There has been regular speculation regarding the potential for an all-new replacement of the 757. The demand for such an aircraft is considered here along with a summary of the alternative types either in service or in development. Some current 757 operators have called for a new replacement with more capacity but narrowbody operating costs.

Is there a market for a 757 replacement?

The 757 is the largest narrowbody in service. The flexibility provided by the 757's payload-range performance has seen it serve a range of requirements from high-density, short-haul leisure services to long, thin, full-service transatlantic sectors. Since the final 757 was delivered in 2005 there has been regular speculation regarding a replacement.

The potential requirement for a completely new 757 replacement is examined here. 757 family specifications, operators and route types are summarised. This analysis considers whether the 757's operational capabilities may be matched by alternative types already in service or in development.

757 family

The 757 family comprises two main series: the 757-200 and -300. This analysis only considers the need to replace passenger-configured 757s.

757-200

In total, 913 757-200 passenger aircraft were delivered from 1982 to 2005. Most of these were ordered by commercial airlines, although a few were acquired for military and other purposes.

The 757-200 is powered by PW2037/40 or RB211-535E4 series engines. It has a fuselage length of 155 feet, 3 inches and an internal cabin width of 11 feet, 7-inches *(see table, page 18)*. The 757's fuselage cross-section was based on Boeing's previously successful six-abreast narrowbody configuration for the 707, 727 and 737 families.

The 757-200 can accommodate up to 196 passengers in a typical two-class cabin configuration *(see table, page 18)*. The maximum single-class capacity for a 757-200 is 224 or 239 seats, depending on the exit-door configuration.

The active 757-200 fleet is configured with a range of different capacity options. Full-service operators, including Delta Air Lines, United Airlines and American Airlines (AA), operate their 757-200s in a variety of multiple-class configurations. These tend to include first- or business-class, premium economy and standard economy seats.

Leisure operators such as Thomson Airways generally configure 757-200s in high-density, all-economy arrangements.

A 757-200 equipped with winglets can operate sectors of up to 2,130-3,995 nautical miles (nm) with a full 196 passenger payload. The maximum range varies according to an individual aircraft's maximum take-off weight (MTOW). The MTOW options for a 757-200 range from 220,000 to 255,000lbs *(see table, page 18)*.

757-300

The first 757-300 was delivered in 1999, and 55 were produced in total.

The 757-300 is a 23-feet fuselage stretch of the -200 series. The -300 has the same fuselage and cabin width as the -200 *(see table, page 18)*.

The 757-300 can have up to 234 seats in a dual-class configuration *(see table, page 18)*. This increases to 280 seats in a single-class configuration. While this makes the -300 the largest narrowbody ever built, the fuselage length led to problems with passenger embarkation and unloading when using a single airport terminal airbridge. This may have limited the aircraft's appeal, and been the main cause of limited sales.

The 757-300's MTOW options vary from 240,000 to 273,000lbs. Its maximum range with a dual-class passenger payload will vary from 1,855-3,490nm depending on the MTOW *(see table, page 18)*. This would be for a winglet-equipped aircraft with 234 seats.

The 757-300 fleet is powered by PW2043 or RB211-535E4 series engines.

757 in service

There were 889 active passenger-configured 757s at the end of 2004. This had fallen to 868 by the end of 2006, and the active fleet has continued to decline.

There are 414 active and 153 parked 757 passenger aircraft. There are still 359 757-200s in passenger service, and a further 153 stored aircraft. All 55 757-300s built remain active. Many 757-200s have now been converted into freighters.

Operators

757-200s remain in service with 36 operators, most of which are commercial and include full-service, low-cost and leisure airlines.

The largest active fleets of 757-200s are operated by Delta (109 aircraft), AA (58) and United (56), accounting for 62% of the in-service fleet. The next largest fleets are operated by Icelandair (25), Thomson Airways (14) and Jet2 (11).

All 55 of the 757-300s produced remain in service with six operators, including full-service and leisure airlines: United (21), Delta (16), Condor (13), Arkia Israeli Airlines (2), Thomas Cook Airlines (2) and Icelandair (1).

Routes

757s will operate 355,020 non-stop scheduled passenger flights worldwide in 2016. This is a 60% reduction compared to 2004, when the passenger-configured 757 fleet was at its peak. 757-200s will

The 757-200 is operated by full service, low-cost and leisure airlines. Its flexible payload-range performance has seen it been used to operate a range of missions from high capacity, short-haul to thin transatlantic services.

account for 85% of all 757 departures in 2016, with the remaining 15% performed by 757-300s.

US domestic services are the largest market for 757s in 2016, and account for more than half of all 757 operations.

The next largest 757 markets include domestic Chinese services, and those between the United Kingdom (UK) and Spain. Most domestic US and Chinese 757 flights are operated by full-service airlines. The UK-Spain market is dominated by low-cost and leisure carriers.

The number of US and Chinese domestic flights operated by 757s has decreased since 2004, but there has been a marked increase in transatlantic 757 services between Europe and North America. Many of these transatlantic sectors are flown by the US majors, but Icelandair and Aer Lingus are also significant 757 operators in this market.

Operators appear to be using their 757s on more long-distance sectors in 2016 than in 2004. More than 16,500 757 flights will operate on sectors of 3,000nm or more in 2016, compared to just 1,964 flights in 2004.

In 2004 55% of all 757 flights were operated on sectors of 1,000nm or less, and 99% were flown on sectors of up to 2,500nm. In 2016 only 37% of 757 flights will operate on sectors shorter than 1,000nm, and 89% of all 757 flights will operate on sectors of up to 2,500nm.

757-200s are operated on routes of 103nm to 3,590nm in 2016. Delta operates a range of mission lengths including the longest 757-200 route from New York (JFK) - Pisa (PSA)

757-300s are similarly operated on varying routes of 147nm to 2,350nm. United operates the longest 757-300 sector between San Francisco (SFO) and Boston (BOS).

OEM outlook

Boeing and Airbus are clearly the main contenders to produce a clean-sheet replacement for the 757 family.

Boeing is non-committal on plans to develop a 757 replacement, although it is clearly considering the possibility. Boeing says that it is talking to its customers about their market needs, while looking at the technology requirements and the business case for any new development.

Boeing says it is studying the segment between the 737-900ER/MAX 9 and 787-8 to identify potential products, but it is too early to speculate over the configuration of any possible design.

Airbus has no plans to develop a clean-sheet alternative to the 757. It claims a combination of its in-service and new engine option (neo) aircraft families will be capable of matching the operational performance of the 757-200.

757 alternatives

The following summary highlights the basic capacity, payload and range capabilities of the main contemporary types likely to be considered as replacement candidates for the 757 family. These include the largest narrowbodies and smallest widebodies in production or in development. The specifications of these aircraft are compared to those of the 757-200 and 757-300 to determine whether suitable replacement candidates already exist.

Boeing

737-900ER

The 737-900ER is the largest Boeing narrowbody in production. The first aircraft was delivered in 2007. There are 396 737-900ERs in service, and 108 on firm order.

The 737-900ER has the same six-abreast fuselage cross-section as the 757 family. The 737-900ER is 17 feet shorter than a 757-200, and 40 feet shorter than a 757-300 *(see table, page 18)*. The 737-900ER can be configured with 178 seats in a typical dual-class arrangement, and up to 220 in a single-class arrangement.

The 737-900ER therefore has 18 fewer seats than a 757-200 in a dual-class configuration, and 56 fewer than a 757-300.

The 737-900ER also has 19 fewer seats than the maximum single-class capacity of the 757-200, and 60 fewer than the 757-300.

The 737-900ER's MTOW is 164,000-187,700lbs. Its range with a typical two-class passenger payload varies from 1,455nm to 2,950nm. A 757-200 therefore has 1,000nm longer range and 18 more seats than a 737-900ER. In a typical dual-class configuration a 757-200 could therefore provide 1,000nm more range than a 737-800ER with 18 extra seats, while a 757-300 has 500nm more range with 56 extra seats.

737 MAX 9

The 737 MAX 9 will be the largest member of the 737 MAX family, and is the largest Boeing narrowbody in development. It is not possible to provide precise order numbers for the 737 MAX 9, since many 737 MAX orders do not specify the variants. At least 222 orders are confirmed for the MAX 9.

The 737 MAX 9 will have near identical fuselage dimensions to its predecessor, the -900ER *(see table, page 18)*, so it will offer the same standard seating configurations of 178 seats in a typical dual-class arrangement, and up to 220 in an all-economy layout.

As with the 737-900ER, the 737 MAX 9's capacity is 18 and 56 seats fewer than that of the 757-200 and -300 in dual-class configurations, and 19 and 60 seats fewer than the 757's in a single-class arrangement.

One of the main developments with

757 FAMILY SPECIFICATIONS

757 family	757-200	757-300
Two-class seating	196	234
Max single-class seating	224/239	279/280
Fuselage length	155ft 3in	178ft 7in
Interior cabin width	11ft 7in	11ft 7in
Engine Type	PW2000/RB211-535	PW2000/RB211-535
MTOW (lbs)	220,000-255,000	240,000-273,000
Range (nm)	2,130-3,995	1,855-3,490
In service	358	55
Order backlog	n/a	n/a

Notes:
1). Seat capacity figures based on standard manufacturer examples and may vary by airline.
2). Range is based on typical two-class passenger payload with baggage, based on aircraft with winglets
3). In-service fleet and order numbers correct as of August 2016. Source: FlightGlobal Fleets Analyzer.

NARROWBODY ALTERNATIVES TO THE 757 FAMILY

In-service narrowbodies		737-900ER	A321-200ceo
Two-class seating		178	199
Max single-class seating		220	230
Fuselage length		138ft 2in	146ft
Interior cabin width		11ft 7in	12ft 1 in
Engine Type		CFM56-7B	CFM56-5B/V2500-A5
MTOW (lbs)		164,000-187,700	206,100
Range (nm)		1,455-2,950	3,100
In service		396	1,235
Order backlog	-	108	369

New gen narrowbodies	737 MAX 9	A321neo (basic)	A321LR
Two-class seating	178	199	206
Max single-class seating	220	230	240
Fuselage length	138ft 4in	146ft	146ft
Interior cabin width	11ft 7in	12ft 1in	12ft 1in
Engine Type	LEAP-1B	PW1100G-JM/LEAP-1A	PW1100G-JM/LEAP-1A
MTOW (lbs)	168,200-194,700	206,100	213,800
Range (nm)	1,560-3,515	3,675	4,000
In service	n/a	n/a	n/a
Order backlog	222*	n/a*	n/a*

Notes:
1). Seat capacity figures based on standard manufacturer examples and may vary by airline.
2). Range is based on typical two-class passenger payload with baggage, based on aircraft with winglets/sharklets.
3). In-service fleet and order numbers correct as of August 2016. Source: FlightGlobal Fleets Analyzer.
4). MTOW and range for Airbus aircraft based on max available.
5). Additional 898 orders booked for 737 MAX aircraft where precise variant cannot be established.
6). There are 1,190 A321neo on order but it is not possible to establish split between basic and LR variants.

WIDEBODY ALTERNATIVES TO THE 757 FAMILY

In-service/new-gen widebodies	787-8	A330-200	A330-800neo
Three-class seating		247	257
Two-class seating	242		
Max single-class seating	359	406	406
Fuselage length	186ft 1in	193ft	193ft
Interior cabin width	18ft	17ft 3in	17ft 3in
MTOW (lbs)	502,500	533,500	533,500
Range (nm)	7,355	7,250	7,500
In service	302	502	n/a
Order backlog	117	43	10

Notes:
1). Seat capacity figures based on standard manufacturer examples and may vary by airline.
2). Range is based on typical two or three-class passenger payload with baggage.
3). In-service fleet and order numbers correct as of August 2016. Source: FlightGlobal Fleets Analyzer.
4). MTOW and range for Airbus aircraft based on max available.

the 737 MAX 9 is the use of more fuel-efficient, new generation CFM LEAP-1B engines. The 737 MAX 9 also offers higher MTOWs and longer range than a 737-900ER. The MTOW of a 737 MAX 9 could be 168,200-194,700lbs. Its range with a 178-seat, dual-class passenger payload will be 1,560-3,515nm.

The 757-200 and -300 still have a payload-range advantage over the 737 MAX 9. The 757-200 provides nearly 500nm longer range and 18 more seats than a 737 MAX 9. The 737 MAX 9 will match the maximum range of a 757-300, but with 56 fewer seats.

787-8

The 787-8 is the smallest Boeing widebody in production. The first aircraft was delivered in 2011, and there are 302 in service and a further 117 on firm order.

The 787-8's payload-range performance exceeds the 757 family's.

The 787-8's internal cabin is six and a half feet wider than that of the 757 family, giving it an eight- or nine-abreast economy-class configuration *(see table, this page)*.

The 787-8 is nearly 31 feet longer than a 757-200, and seven and a half feet longer than a 757-300, giving the 787-8 a higher seat capacity than the 757-200 and -300.

In a typical dual-class layout Boeing claims the 787-8 will accommodate 242 seats. This is 46 more than a 757-200, and eight more than a 757-300. In a high-density, single-class arrangement the 787-8 can hold up to 359 seats; 120 more than a 757-200 and 79 more than a -300. The 787-8 clearly has about 25% more seats than a 757-200.

The 787-8 has a range of up to 7,355nm with a 242-seat, dual-class passenger load *(see table, this page)*. The 787-8 therefore has a 3,350nm longer range than a 757-200 with 46 extra seats. It would offer more than twice the range of the 757-300 with eight extra seats.

Airbus

A321ceo/A321neo

The first A321ceo (current engine option) was delivered in 1994 and 1,325 have been delivered. Most of these are A321-200 series. The -200 series superseded early -100 series aircraft, which had lower certified weights and shorter range. There are a further 374 A321ceos on firm order.

The first A321neo (new engine option) is due for certification by the end of 2016.

The basic A321neo will have the same fuselage dimensions and capacity options as the A321ceo *(see table, this page)*. Both variants feature a fuselage length of 146 feet, and a maximum interior cabin width of just over 12 feet. The A321 is nine feet shorter than a 757-200, and 32.5 feet shorter than a 757-300. Like the 757, the A321 is configured with six-abreast seating in economy, but with 18-inch wide seats compared to the 757's 17-inch wide seats.

According to Airbus, the A321ceo

and the basic A321neo can accommodate 199 seats in a dual-class layout. This is three more seats than Boeing's typical two-class layout for the 757-200, but 35 fewer seats than a dual-class 757-300.

Airbus suggests the A321ceo and basic A321neo can accommodate up to 230 seats in a high-density, single-class arrangement. This is nine fewer seats than the maximum permitted for a 757-200 and 50 fewer than a 757-300.

A number of factors allow the A321ceo and A321neo to offer similar seating capacities to the 757-200, despite the shorter fuselage of the Airbus variants. Firstly, Boeing's typical dual-class configuration for the 757-200 assumes an economy seat pitch of 32-inches compared to 30-inches for the Airbus aircraft. It can be assumed that similar seat pitch assumptions apply to the two manufacturer's standard single-class configurations. The A321ceo and A321neo also benefit from what Airbus describes as 'cabin efficiency enablers'. These include slim-line seats, plus the new 'Space-Flex' and 'Smart-Lav' rear-galley and lavatory designs.

In January 2015 Airbus launched the A321LR, a new longer-range variant of the A321neo series with greater seat capacities that could potentially exceed those of the 757-200.

The A321ceo and basic A321neo can both have an MTOW of up to 206,100lbs *(see table, page 18)*. The main difference between the two variants is the A321neo's new PW1100G-JM and CFM LEAP-1A engine options that will provide fuel burn savings of 15%, and 575nm longer range.

The A321ceo has a range of up to 3,100nm with 199 passengers, compared to 3,675nm for the basic A321neo. In dual-class configurations the A321ceo and basic A321neo would have three more seats than a 757-200, but the 757 will have 900nm or 320nm longer range.

The 757-300 would provide 35 more seats than the A321s. The 757-300 has a range advantage of 400nm over the A321ceo, but nearly 200nm shorter range than the basic A321neo.

Airbus believes that the A321ceo and basic A321neo are suitable replacements for most 757-200 operations, despite their inferior range. It highlights how most 757 operations are on US domestic routes shorter than 2,500nm. According to Airbus the A321ceo's range makes it suitable for US domestic services, including popular routes between the West Coast and Hawaii. As an example, AA replaced 757s with A321s between Los Angeles and Hawaii in 2015. Airbus adds that airlines have already ordered as many A321s as they did 757s, including 384 A321ceos and 176 A321neos.

European charter or leisure airlines have also been significant 757 operators. Monarch and Thomas Cook have since become important A321 operators.

Airbus claims current A321ceo variants save 15% fuel consumption per seat compared to the older 757-200, while the A321neo will save more than 30%. Its says that the A321ceo is one generation ahead of the 757, and the A321neo is two generations ahead. This performance comparison is based on aircraft with basic design weights, operating an 800nm sector with maximum two-class passenger payloads.

A321LR

The A321LR will be the closest new alternative to the 757-200 in terms of payload-range performance. The first A321LRs will be delivered in 2019.

The A321LR will have the same fuselage dimensions and engine options as the basic A321neo but will offer more range and higher capacity options.

The A321LR will have a typical dual-class capacity of 206 seats *(see table, page 18)*. This is 10 more than Boeing's dual-class arrangement for the 757-200, but 28 fewer than the 757-300. Airbus claims

the A321LR will accommodate up to 240 seats in a high-density, single-class configuration. This is one more than the maximum capacity of a 757-200, but 40 fewer than the 757-300's.

The A321LR will have a range of up to 4,000nm with a dual-class passenger load. In typical manufacturer's dual-class configurations, the A321LR will have the same range but 10 more seats than the 757-200. The A321LR has 500nm longer range than a 757-300, but with 28 fewer seats.

Like the A321ceo and basic A321neo, the A321LR's typical dual-class capacity is based on an economy seat pitch of 30 inches, compared to 32 inches for the 757s. There is likely to be a similar disparity in seat pitch assumptions for the standard single-class configurations. The A321LR will also benefit from slim-line seats, the Space-Flex and Smart-Lav galley and lavatory designs.

The A321LR will feature several design differences to the basic neo variant to achieve its extended range performance and additional capacity.

The extended range will be a result of higher design weights and additional fuel tanks. The A321LR will have a higher MTOW of 213,800lbs.

To achieve this, A321LR airframes will feature some structural changes to the wings and fuselage. The A321LR will be able to install up to three extra fuel tanks, known as additional centre tanks (ACTs) in the fuselage. It is only possible to install two ACTs on the A321ceo and basic A321neo. The A321LR's ACTs will also have a larger capacity of 824 US gallons (USG) each versus a capacity of 790 USG each for the ACTs installed in A321ceos or the basic A321neo.

The capability to install a third ACT, thereby increasing fuel capacity, will be incorporated into the Airbus Cabin Flex (ACF) aircraft build standard.

ACF includes a new door configuration and the option for wider escape slides. ACF will be certified in 2018, and will be delivered as the build standard for all A321neos from 2020. ACF will allow the A321LR to accommodate 10 more seats than the A321ceo and the basic A321neo when configured in a high-density arrangement. Once ACF becomes the build standard, airlines will still be able to select aircraft with the basic A321neo certified weights.

Airbus believes the A321LR will perform any mission operated by 757-200s, including long-thin routes. Airbus claims that under the same operational rules, the A321LR with 206 passengers has 200nm longer range than a 757-200 configured with 198 seats (two more than Boeing standard dual-class configuration). Airbus claims the A321LR will burn 30% less fuel than a winglet-equipped 757-200, and that the additional 200nm range means that the A321LR will face fewer operational restrictions than the 757 does under specific airline rules.

Airbus believes that with a range of 4,000nm, the A321LR can address the 757's transatlantic capability, and unlock the potential for other long, thin routes.

There are 1,190 A321neos on order. One of the largest outstanding backlogs is for current 757 operator AA, which has 100 A321neos on order.

There is no hard figure for the number of A321LRs on order, because many of the A321neos on order could end up being configured as –LRs, with airlines being given the opportunity to decide the final configuration closer to the delivery date.

The only confirmed A321LR orders are for Norwegian, TAP Portugal and Air Astana, which will lease its aircraft from Air Lease Corporation.

A330-200/A330-800neo

Current 757 operators might consider replacing their aircraft with a combination of A321s and A330s.

An airline can use one pool of pilots for A321 and A330 operations due to the Airbus cross-crew qualification (CCQ) concept. The CCQ permits A320 family pilots to transition to Airbus widebodies without the need for a new full type rating training. Pilots can transition from the A320 to the A330 family in just seven days. Airbus notes that some airlines like Finnair have introduced mixed-fleet flying where pilots can be current on more than one type at once, and regularly transition between the A320 family and Airbus widebodies.

Airbus highlights how the A321 and A330 could complement one another. The A321 would be a good low risk option for opening new routes, while the A330 could open new higher demand markets or operate from slot-constrained airports. According to Airbus the A321 and A330 have 650 routes in common, while the 737-900 and 787-8 have just 25 routes.

The A330-200 and A330-800neo are the most probable A330 variants to replace 757s. There are 502 A330-200s in service, and 43 on order. The first A330-800neo is due for delivery by the end of 2018, and there are 10 on order.

The A330-200 and -800neo variants both have a fuselage length of 406 feet, an MTOW of up to 533,500lbs, and typically seat eight abreast in economy. The A330-200 typically seats 247 passengers in a three-class arrangement, while the A330-800neo seats 257. The A330 variants are up to 278,000lbs heavier than the 757-200; making the A330 more than twice as heavy.

Both A330 variants also have a maximum high-density capacity of 406 seats *(see table, page 18)*.

The main difference between the A330-200 and -800neo is the latter's new Trent 7000 engines, extra wingspan and enhanced winglet aerodynamics. These combine to reduce fuel burn per passenger by 14% and provide it with 250nm more range. The A330-200 has a range of up to 7,250nm with a typical tri-class passenger payload compared with 7,500nm for the A330-800neo.

A typical tri-class A330-200 will offer 51 more seats and have a 3,250nm range advantage over a dual-class 757-200. It will also provide 13 more seats and double the range of a dual-class 757-300.

A tri-class A330-800 would provide 61 more seats and 3,500nm longer range than a dual-class 757-200. The A330-800neo would offer more than double the range of a typical two-class 757-300 while also providing 23 more seats.

Comparison considerations

The above summary offers a rough guide to the comparative capabilities of potential 757 replacement candidates, but it does not represent a comprehensive performance analysis. There are a number of limitations to the analysis, including a reliance on standard manufacturer's specifications. It is likely that there will be some minor variations in the assumptions used by Boeing and Airbus to calculate their figures.

Hot and high performance

The specific payload and range figures used in the comparison will almost certainly be based on standard operating conditions. These are likely to include the assumption that the aircraft are operating from airports at sea level with an ambient temperature based on the international standard of 15 degrees centigrade (59°F).

Any increase in the departure airport's elevation and/or the ambient temperature can affect an aircraft's payload-range performance. The air density is lower at higher altitudes and/or higher

The 757-300 can accommodate up to 280 seats in a single class configuration. A small production run meant only 55 aircraft were delivered. Practical problems relating to embarking and disembarking passengers may have led to a lack of demand.

temperatures. At lower air densities the efficiency of aircraft engines is reduced. At an airport with a high elevation and/or higher ambient temperatures, an aircraft will need a longer take-off run than it would from an airport at sea level with standard temperatures. In some cases the take-off distance required to operate at MTOW from hot and high airports might not be available, and a payload and/or range restriction will apply.

An aircraft's take-off performance determines the extent to which differences in airport elevation and ambient temperature can affect its payload-range characteristics. It was not possible to compare the hot and high performance of the 757 variants with the potential alternative types analysed here. However, a basic calculation of approximate thrust-to-weight ratios provides a rough guide to potential take-off performance.

PW2040 and RB211-535E4-B engines have a Boeing-equivalent thrust (BET) rating of up to 40,100lbs and 43,500lbs each. A 757-200 equipped with these engines would have a total take-off thrust of 80,200lbs or 87,000lbs respectively.

When this take-off thrust is compared to the maximum available MTOW of 255,000lbs, the resulting thrust to weight ratios are 0.315:1 and 0.341:1.

A 757-300 has a thrust-to-weight ratio of 0.312:1 or 0.319:1 with PW2043 or RB211-535E4-B engines, slightly less than the 757-200. 757s equipped with other engine variants may have lower thrust-to-weight ratios.

A 737-900ER and 737 MAX 9 operating at the highest possible MTOWs and with CFM56-7B27/B1 and LEAP-1B28B1 engines have thrust-to-weight ratios of 0.303:1 and 0.287:1. These are less than the 757-200 and -300.

Comparative thrust-to-weight ratios for the A321ceo, basic A321neo and A321LR would be 0.311:1, 0.319:1 and 0.308:1, based on the highest available MTOWs and thrust-rated engines.

In certain configurations, the 757 will have higher thrust-to-weight ratios than the alternative narrowbodies, and offer superior take-off performance, which could lead to fewer payload-range restrictions when operating from airports with above-average elevations and ambient temperatures, or shorter runways.

Cargo

The maximum range specifications quoted in the analysis only account for a maximum passenger plus baggage payload, so it would not be possible to carry any cargo in addition to passenger baggage over these distances. The aircraft would have additional payload available for cargo on shorter missions.

One notable difference between the 757 family and the A321ceo and A321neo is that the Airbus aircraft can accommodate half-size containers in their lower holds. The Boeing aircraft can only be bulk-loaded with cargo. This would only be relevant on shorter sectors where there is payload remaining for cargo.

Other factors

The latest generation of large narrowbodies including the 737-900ER, 737 MAX 9, A321ceo and A321neo may not all be able to match the 757's capacity and range, but they will burn less fuel per sector. This advantage in fuel burn performance could give them competitive or superior operating economics over certain sector lengths, even when they are configured with fewer seats than a 757.

The smallest contemporary widebodies including the 787-8, A330-200 and A330-800neo would all provide superior capacity and range to a 757. It should be noted that this will come with widebody operating costs that may make them unsuitable candidates for some current 757 operators. Widebody unit costs are higher than narrowbody ones.

Larger, heavier and more complex widebodies with larger and more powerful engines have higher acquisition- or lease-, maintenance-, fuel- and weight-related operating costs.

Airline opinion

Delta

Delta is the largest 757 operator. "Delta's merger with Northwest created the largest 757 fleet in the world," says Greg May, senior vice president of supply chain management and fleet at Delta. "At the time, the merged fleet included nearly 200 aircraft, accounting for almost 20% of all the 757s built."

Delta's current fleet includes 109 active and 34 stored 757-200s. It also operates 16 757-300s.

In the past these aircraft have been configured with a wide range of seat capacities. "Deliveries over 20 years, US airline industry turbulence, and the 757's flexible performance characteristics resulted in diverse cabin seating configurations and passenger amenities at the time of the merger," says May. "Delta is now fully refurbishing its younger 757s with new amenities such as in-seat audio-video on demand, and personal electrical outlets. The refurbishment will streamline Delta's 757s into three sub-fleets, including two high-capacity configurations to mainly serve high-demand domestic and Hawaii services. The high-capacity configurations will see 757-200s fitted with 199 seats, and 757-300s with 234. There will also be a long-range transatlantic sub-fleet of 757-200s configured with 168 seats that include flat-bed seats in the Delta One cabin."

Delta's long-range, transatlantic 757-

The A321neo is due to be certified before the end of 2016. The A321LR variant will be the closest match to the 757-200 in terms of payload-range performance. It will be able to perform the majority of missions operated by 757-200s.

200 sub-fleet features business, premium economy and economy seats. The domestic sub-fleet features first-class, premium and standard economy seats.

"The 757 has the highest seat capacity of any single-aisle aircraft in Delta's fleet and serves distinct roles in our network," continues May. "The largest proportion of 757 operations serves high-demand markets, including a few very short domestic sectors such as Atlanta (ATL) to Jacksonville (JAX), which is only 235nm. At the other end of the scale, the 757-200's range capability is highlighted by transatlantic routes like Paris Charles de Gaulle (CDG) to Raleigh Durham (RDU) with a sector length of 3,521nm. The 757's take–off performance also allows it to operate economically from airports with challenging hot and high conditions, such as Bogota (BOG) in Colombia."

According to FlightGlobal Data, Delta will operate 757-200s on sectors ranging from 104nm to 3,590nm in 2016. Most of these will be domestic US services, including links between ATL and Florida, and cross-continental sectors from JFK to Los Angeles (LAX) and SFO.

Delta also uses 757-200s on 14 transatlantic routes, including Philadelphia (PHL) to London Heathrow (LHR), JFK to Reykjavík-Keflavík (KEF) and RDU-CDG. The 757-300s are mainly used on US domestic services. The longest 757-300 sector is Seattle (SEA) to Honolulu (HNL) in Hawaii.

Delta's total narrowbody fleet includes 679 active aircraft. In addition to the 757s, it operates 717-200s, 737-700s, 737-800s, 737-900ERs, A319s, A320s, A321s, MD-80s and MD-90s. Its order backlog includes 56 737-900ERs, 73 A321s and 75 smaller CS100s.

"The combination of winglets and more efficient cabin layouts put the fuel efficiency of the 757 in the same tier as Delta's current 737-900ER and A321 deliveries," claims May.

Delta has been replacing 757 frequencies with younger types on some routes. The sectors from ATL to Orlando (MCO) and Fort Lauderdale (FLL) both used to be operated exclusively by 757s. Some of these flights are now operated by A321s. The ATL-SEA route was also primarily served by 757s, but now has a number of daily 737-900ER flights.

"Delta strongly believes there is a need for a 200-240 seat aircraft with a range of 4,000-5,000 statute miles (3,475-4,345nm) and narrowbody-like unit costs that would efficiently bridge the gap between the largest narrowbodies and smallest widebodies," says May. "The 757 is the only aircraft in this space today, and the youngest aircraft are more than 10 years old. Indicative of the potential market size for such an aircraft, both the 757 and 767 sold more than 1,000 units each when the global airline industry was a fraction of the size it is today."

United

United's 757 fleet includes 56 active and five stored 757-200s. It is the largest 757-300 operator, with 21 aircraft in service.

"The 757-200 is a unique aircraft that allows us to operate to and from many markets that would otherwise not be served," explains Ron Baur, vice president fleet at United.

FlightGlobal Data indicates that United will deploy 757-200s on sector lengths of 174nm to 3,415nm in 2016, and many of its 757-200 operations are transcontinental and transatlantic services. The routes with the most 757-200 capacity are the transcontinental sectors between New York, Newark (EWR) and LAX and EWR-SFO.

United has introduced a Premium Service (p.s.®) product on these transcontinental 757 sectors. It also uses 757-200s on services between North and South America and on transatlantic routes from EWR, Washington Dulles (IAD) and Chicago O'Hare (ORD) to Europe. United's longest 757-200 sector is between EWR and Stockholm-Arlanda (ARN).

"We use the 757-200's unique capabilities and economics to serve smaller European cities from our East Coast hubs," explains Baur. "We believe it is the right size aircraft for a number of markets, including transatlantic services to other UK airports such as Glasgow (GLA), Edinburgh (EDI), Manchester (MAN), Birmingham (BHX) and Belfast (BFS).

"The 757-200s that operate transatlantic services are configured with 169 seats including 16 flat-bed seats in BusinessFirst and 153 in economy, including 45 Economy Plus seats," adds Baur. When United moved p.s. transcontinental services to EWR, some of the 757-200s being used for transatlantic flights were re-deployed to the EWR-LAX and EWR-SFO markets.

FlightGlobal Data indicates that United will operate 757-300s on sector lengths of 360nm to 2,350nm in 2016. These aircraft are configured with 216 seats. Most 757-300 operations are concentrated on domestic operations. The route with the most 757-300 flights is Denver (DEN) to SFO.

United's total narrowbody fleet comprises545 aircraft. As well as 757s this includes 737-700s, 737-800s 737-900s 737-900ERs, A319s and A320s. It has 737-700s 737-800s, 737-900ERs and 737 MAX 9s on order backlog.

"Our remaining 757s are relatively young and mainly owned by the airline," explains Baur. "They have mostly been used on long-haul international routes, so they have not accumulated many cycles. We plan to operate the fleet for the next several years. Other 757s that were operating shorter domestic flights have

Icelandair operates 757s on all 43 routes in its network. It claims that there are no suitable replacement candidates for the 757 on some of its routes due to its superior operating performance.

been retired and replaced with new 737-900ERs that are more efficient and reliable.

"As our 757 fleet ages, there is a need for an aircraft to replace it," adds Baur. "The ideal replacement will have slightly more range and capacity than the 757-200, while providing similar economics."

American Airlines

AA has 58 active and 38 stored 757-200s in its fleet. It operates the 757-200 on routes ranging from 168nm to 3,372nm in length.

AA uses 757s for domestic flights within the continental US and on services to Hawaii, as well as on transatlantic routes and services to South America.

According to FlightGlobal Data, 63% of AA's 757 flights will be operated on domestic US routes in 2016. The domestic routes with the most 757 flights include Miami (MIA) to JFK and Phoenix (PHX) to HNL.

AA also operates 757-200s on 16 transatlantic services in 2016. Most of these are operated from JFK and PHL. Its transatlantic routes with the most 757 flights in 2016 are PHL to Amsterdam (AMS), and JFK to CDG and BHX.

AA has been reducing the size of its 757 fleet, but does not plan to remove the type altogether. AA says the 757 is a great aircraft for medium-length routes that are not big enough to support a larger type. AA expects to have 51 757s at the end of year, 13 fewer than at the start.

AA says that it is adding new business-class seats to 757s that fly internationally. AA's 757-200s will soon be configured with 176 business, premium and standard economy seats, or 188 first-class, premium economy and standard economy seats.

AA's total narrowbody fleet includes 782 active aircraft. In addition to 757-200s, it operates 737-800s, A319s, A320s, A321s and MD-80s. AA has 737-800s, 737 MAX 8s, A321s and A321neos on order.

Icelandair

757s account for most of Icelandair's fleet. It operates 25 passenger-configured 757-200s, a single 757-300 and two 757-200 freighters.

Icelandair's 757s feature business-class, premium economy and economy sections. The 757-200s are configured with 183 seats and the 757-300 has 222.

Icelandair connects European and North American destinations via its hub at KEF. It uses the 757 on all 43 routes in its network in North America and Europe.

757-200s are used on routes ranging from 730nm to 3,248nm in length. The shortest sector is KEF-GLA, while the longest is KEF-Portland (PDX). According to FlightGlobal Data the airline's 757-300 is scheduled to operate route lengths of 1,026-2,260nm in 2016.

The 757 is the only narrowbody operated by Icelandair, but it has nine 737 MAX 8s and seven 737 MAX 9s on order. Some 757s will be replaced by 737 MAX aircraft beginning in 2018. Other 757s will remain in the fleet until a suitable replacement becomes available.

Icelandair believes that for certain operational scenarios, there are no suitable 757 replacement candidates in service or in development. The airline says the 757 has a unique combination of payload and range, and has proven to be highly suitable for routes between Iceland, and Europe and North America. The aircraft with the closest payload-range combination to the 757 is the A321LR, but according to Icelandair, the 757 will outperform the Airbus aircraft on certain routes. As an example, Icelandair has daily 757-200 departures on DEN-KEF. The airline says the A321LR could not operate to DEN during the summer due to its inferior performance in hot and high conditions.

Summary

No in-service narrowbodies can equal the 757's payload-range capabilities, but the 737-900ER and A321ceo can operate many sectors currently served by 757s.

The A321LR will be the closest narrowbody replacement option for 757s when it enters service later in the decade. It will offer similar capacity and range capabilities to the 757-200, including the ability to operate transatlantic services and lower fuel burn per seat.

The A321LR will not match the 757-300s' capacity, but demand for the larger 757 variant has been small, which indicates there is no need to replace it.

There may still be circumstances in which the A321LR does not match the 757's payload-range performance when operating in hot and high environments. This issue is only likely to arise in a small number of niche operational scenarios.

Some airlines may use a combination of narrowbodies and medium-sized widebodies to replace 757 operations. The smallest available medium widebodies exceed the payload-range performance of the 757 family, but this comes with higher operating costs.

Some 757 operators believe there is a market for an all-new 757 replacement, with more capacity and range than the current 757. AC