

E-Jet family specifications

There are 12 variants of the E-170/-175 and E-190/-195 models available, powered by two main variants of the CF-34. Their specifications are analysed.

The E-170, E-175, E-190 and E-195 are all members of the E-Jet family. Designed from the outset for the regional jet (RJ) market, the four family members provide 70 to 122 seats, with actual numbers depending on cabin configuration. The family is intended to fill the gap between 50-seat RJs and the smallest jetliners, in order to provide airlines with capacity on RJ routes that needed more capacity, or smaller aircraft on jetliner routes at an economic level. The E-Jets family is the first of new generation large RJs or 'right-sized' jets.

The E-Jets have up to 95% commonality in parts and systems across the four main types to reduce rotatable inventories and maintenance costs. The flightdeck has 100% commonality for the four models, so they all have cross-crew-qualification, thereby providing flexibility in fleet planning, since additions to the fleet will incur relatively few costs.

The E-Jet family is sub-divided into the E-170/-175 and E-190/-195, with the

aircraft being certified as two main types and each with two variants. The smaller E-170/-175 are powered by the CF34-8E engine rated at 14,500lbs thrust, while the larger E-190/-195 are powered by the CF34-10E rated at 18,500lbs thrust (see table, page 7). The -10E has a one-inch wider intake fan than the -8E, and also a three-stage low pressure compressor.

Being certified as two main types means that the E-170/-175 and E-190/-195 each have their own maintenance programmes. The two programmes have a high degree of similarity, however.

Basic features

The E-Jet family was launched in 1999, with the E-170 entering service in the first quarter of 2004. The design efficiencies promised 30% more payload per pound of structural weight compared to similar-sized aircraft.

The E-175 first flew in 2003, with the first delivery made in July 2005 to Air Canada.

The E-170/-175 were followed by the longer E-190/-195 models, which have a larger wing and higher-rated engines.

The E-190 entered service in September 2005 with jetBlue, and the E-195 entered service in December 2006 with Flybe.

Each of the four main E-Jet family models has three variants: the standard (STD); long-range (LR); and advanced range (AR). The AR variant was first introduced on the E-190/-195, and has structural reinforcements that provide greater payload-range performance. The AR changes are now offered on the E-170/-175, with some 2008-built -175LR's being delivered structurally ready for conversion to AR variants in 2009.

The maximum cruise speed for all models is 481kts or Mach 0.82 (see table, page 7). The range varies from 1,700nm to 2,400nm, with the payload increasing from 20,062lbs on the E-170 to 30,093lbs on the E-195. The E-170 and E-175 share the same fuel capacity, as do the E-190/-195 models.

Embraer comments that, although the fuel capacity is the same within each model, the range differs due to higher maximum take-off weight (MTOW). The AR models also have a higher maximum zero fuel weight (MZFW) and slightly higher operating empty weight (OEW).

The E-170/-175 have three payload variants, while the E-190/-195 variants have constant payload (see table, page 7). The cargo capacity in two belly holds also increases from 508.18 cubic feet to 906.17 cubic feet.

Passenger comfort is aided by Embraer's double-bubble fuselage design that promises an increased cabin width at passengers' elbows and shoulders, large cabin windows, and a high cabin ceiling. The aircraft is also configured in a four-abreast seat arrangement, which is popular with passengers. It also aids fast passenger loading and unloading.

In terms of seat capacity, the E-170 carries 70 to 80 passengers, the E-175 carries 78 to 88, the E-190 carries 98 to 114 seats, and the E-195 carries 108 to 122.

Actual seat numbers depend on an operator's seat pitch and other cabin configurations, such as number and size of wardrobes, toilets and galleys.

Time on the ground for any aircraft is wasted money for an operator, so the E-Jets are equipped with integral airstairs at the forward passenger door to aid fast



The four members of the E-Jets family have fly-by-wire flight control systems and identical flightdecks, giving them qualification.

E-JETS SPECIFICATIONS

Aircraft	Engine	Take-off thrust -lbs	MTOW -lbs	MLW -lbs	Maximum payload -lbs	Fuel capacity -lbs	Seats	Range with full payload & LRC -nm	Cargo volume -cu.ft.
E-170 STD	CF34-8E	14,200	79,344	72,310	20,062	20,580	70-80	1,800	508.18
E-170 LR	CF34-8E	14,200	82,011	72,310	20,062	20,580	70-80	2,000	508.18
E-170 AR	CF34-8E	14,200	85,098	73,414	21,693	20,580	70-80	2,100	508.18
E-175 STD	CF34-8E	14,200	82,673	74,957	22,223	20,580	78-88	1,700	604.59
E-175 LR	CF34-8E	14,200	85,517	74,957	22,223	20,580	78-88	1,900	604.59
E-175 AR	CF34-8E	14,200	89,000	75,178	22,840	20,580	78-88	2,000	604.59
E-190 STD	CF34-10E	20,000	105,358	94,798	28,836	28,596	98-114	1,800	799.18
E-190 LR	CF34-10E	20,000	110,892	94,798	28,836	28,596	98-114	2,300	799.18
E-190 AR	CF34-10E	20,000	114,199	97,003	28,836	28,596	98-114	2,400	799.18
E-195 STD	CF34-10E	20,000	107,563	99,208	30,093	28,596	108-122	1,500	906.17
E-195 LR	CF34-10E	20,000	111,972	99,208	30,093	28,596	108-122	1,900	906.17
E-195 AR	CF34-10E	20,000	115,279	100,971	30,093	28,596	108-122	2,200	906.17

turnaround times. This can potentially cut five minutes off turnaround time compared to using an air jetty or ground steps.

The various efficiencies mean that turnaround is expected to take an average of 20 minutes. The boarding process is further assisted by the larger overhead lockers that give, on average, 1.75-2.0 cubic feet of stowage space per passenger. This equates to an increase of up to 0.5 cubic feet (or up to 28%) per seat, compared to that available on each of the E-Jet's equivalent-sized competitors. In particular, the E-190 and E-195 models have stowage space equal to, or better than, older Boeing and Airbus aircraft that are similar, or slightly larger, in size. The cabin, seat and aisle width, and cabin height are all some of the largest available for this size of aircraft, if not the widest of all narrowbodies in some cases.

The E-170/-175 have no overwing exits, which allows more cabin configuration options. Due to the size of the E-190/-195, however, there is a need for two overwing exits. All variants have two full-size passenger-entry doors forward and aft on the port side, and two service doors forward and aft on the starboard side. Doors forward and aft of the cabin can speed up turnaround time.

The E-Jet family has many of the advantages of modern mainline jets. This includes a cruising altitude of 41,000ft, full authority digital engine controls (FADEC), and a fly-by-wire flight control system. The flightdecks of all variants are fully equipped with Honeywell Primus Epic digital avionics and a Dark & Quiet cockpit environment to improve awareness and reduce pilot workloads. The E-Jets will also have an onboard central maintenance computer, which reduces line maintenance costs compared to similar-sized aircraft.

CF34-8E & -10E THRUST RATINGS

Thrust ratings	-8E5	-8E5A1	-10E5	-10E5A1	-10E6	-10E6A1	-10E7
Max take-off	14,510	-	18,820	-	-	-	20,360
Normal take-off	13,420	14,050	17,390	18,820	17,390	18,820	18,820
Max continuous	13,520	-	17,040	-	-	-	-
Take-off flat rating deg C	30	-	30	-	35	-	30
Max temperatures - deg C							
Max take-off	1,006	-	983	-	-	-	-
Normal take-off	965	989	945	983	947	983	943
Max continuous	960	-	960	-	-	-	-

The E-190/-195 will find competition in the spacious Bombardier C Series from 2013, and the Bombardier CRJ-1000 from late 2009. The smaller E-170/-175 will shortly be competing with newer RJs and right-sized jets from Mitsubishi and Sukhoi, which promise more spacious cabins. The E-170/-175 also compete with the older CRJ-700 and -900 models.

The E-Jets, however, are the only family that offer a full range of four models covering 70-120 seats. They are also the first of the new generation of RJs to be in operation and, because they have many of the technological advances of larger aircraft, they are already one of the few aircraft certified to fly into difficult airports such as London City Airport.

Environmentally, the E-Jet is fully compliant with all noise regulations, as well as CAEP/6 gaseous emissions. The margins to CAEP/6 are particularly good on the E-170/-175, ranging from 26.4-97.6% for unburned hydrocarbons, carbon dioxide, nitrous oxides and smoke emissions.

There is a business-jet version based on the E-190, called the Embraer Lineage 1000, which has an extended range and

executive seating for 19.

The 12 main airline variants are examined in this guide.

E-170

The E-170 entered service with LOT Polish Airlines in 2005. The STD variant has an MTOW of 79,344lbs, the LR an MTOW of 82,011lbs, and the AR an MTOW of 85,098lbs (see table, this page). While the STD and LR are currently in operation, the AR is not due to be delivered until late 2009/2010. An additional variant, which has the same specifications as other E-170s, but also an increased MTOW of 101,389lbs, will be designated SR as a short-runway variant. This variant is due to be delivered to British Airways CityFlyer in September 2009.

The E-170 will have a maximum fuel capacity of 20,580lbs, which produces a range of 1,800nm on the STD, 2,000nm on the LR and 2,100nm on the AR. This is the case when the aircraft are flown at long-range cruise speed (LRC) and with a full payload.

The E-170, like all of the E-175



variants, is equipped with the CF34-8E rated at 14,500lbs of thrust and has a bypass ratio of 5:1.

In a single-class layout, the E-170 can seat 70 passengers with a 32-inch pitch, 78 passengers with a 31-inch pitch, and 80 with a 29-30-inch pitch. One dual-class configuration can accommodate six first- or business-class seats with a 36-inch pitch and 64 economy seats with a 32-inch pitch, making a total of 70 seats.

Cabin configurations vary according to operator. There is the option of having two galleys, with one at the front and one at the rear, or having one galley at the rear only. There are two toilets, one at the front and one at the rear with the optional addition of one wardrobe. This would be an essential addition for operators that regularly transport business travellers who require space to hang their suit jackets, as a matter of course.

E-175

The E-175 was certified in late 2004, and Air Canada served as the launch customer in 2005. The AR variant recently entered service with some converted from LRs, and some directly from the factory. Although no STD models are in current operation, the STD has an MTOW of 82,673lbs while the LR has an MTOW of 85,517lbs and the AR an MTOW of 89,000lbs (see table, page 7). The maximum fuel capacity is again 20,580lbs with the operating range, under the same conditions as for the E-170, standing at 1,700nm for the STD, 1,900nm for the LR and 2,000nm for the AR. This is a slightly shorter range compared to the E-170, due to an increase in payload and MTOW. The E-

175 has the same engine variant as the E-170, which produces the same thrust but with higher MTOW, maximum landing weight (MLW) and maximum payload.

In a single-class layout, the E-175 can carry 78 passengers with a 32-inch pitch, 86 passengers with a 31-inch pitch, and 88 with a 30-inch pitch. A possible dual-class configuration could accommodate six first- or business-class seats with a 38-inch pitch and 72 economy seats with a 31-inch pitch, making a total of 78 seats. Apart from the length, and therefore the additional passenger capacity, the cabin interior is exactly the same as for the E-170.

E-190

JetBlue was the launch customer for the E-190 in 2005 after it was certified in August 2005. Only the LR and AR variants are currently operated, with the AR being the launch customer for the E-190 generally. The MTOW for the STD model is 105,358lbs, while the LR and AR have MTOWs of 110,892lbs and 114,199lbs respectively. This equates to at least a third extra capability compared to the E-170, which is also true for the take-off thrust, MLW, maximum payload and fuel capacity. This is required when it is considered that the E-190 carries at least a third more extra passengers in all configuration options.

The maximum fuel capacity is 28,596lbs, which equates to ranges of 1,800nm, 2,300nm and 2,401nm for the STD, LR and AR (see table, page 7). The range again is calculated with LRC speed and a full payload. This would mean that the E-190 not only carries more passengers, but that the LR and AR can also fly further than the smaller E-170/-

The E-Jets provide a combination of attractive cabin layout, short take-off performance and adequate range capability to meet most operator's short- & medium-haul requirements.

175.

The E-190 is powered by a more powerful version of the engine on the E-170. This is the CF34-10E with a take-off thrust rating of 18,500lbs, and a bypass ratio of 5.4:1.

In a single-class configuration, the E-190 can accommodate 98 passengers with a 32- to 33-inch seat pitch, 106 with a 31- to 32-inch seat pitch, and 114 with a 29- to 30-inch seat pitch. If a two-class configuration is required, one option is for eight premium seats with a 38-inch pitch and 86 economy seats with a 31-inch pitch, which totals 94. The E-190 is again very similar to the standard layout of the E-170, but with the addition of more fuselage length, and two overwing exits mid-cabin. A third cabin-crew member would need to be carried in most layouts.

E-195

The E-195 was certified in June 2006 and launched by Flybe. Only the AR and LR variants are currently operated. The MTOW for the STD is 107,563lbs, and 111,972lbs for the LR. The AR's MTOW is 115,279lbs (see table, page 7). The maximum payload is 30,093lbs, with the fuel capacity the same as the E-190's. This results in lower LRC ranges than the E-190, with the STD variant reaching just 1,500nm. The LR has a range of 1,900nm (same as the E-175LR), and the AR can fly for 2,200nm. The engine is the same as on the E-190 and with the same take-off thrust. The cargo capacity is increased to just over 906 cubic feet, which Embraer believes to be more per passenger than available with the 737-600 and A318.

In a one-class layout the E-195 can seat 108 passengers with a 32- to 33-inch pitch, 118 with 31-inch pitch and 122 seats in a high-density layout with 30- to 31-inch pitch. A possible two-class layout could involve eight premium seats with a 38-inch pitch, and 98 economy seats with a 31-inch pitch, making a total of 106 passengers. As expected, the E-195 cabin layout is the same as the E-190, but with additional length. The additional length accommodates a third cabin-crew jumpseat, the option of a second wardrobe and extra passenger seats. **AC**

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