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BOEING 747-400



Boeing 747-400

TYPE: Wide-bodied airliner

PROGRAMME (original): Announced 13 April 1966 (first ever wide-body jet airliner), with Pan American order for 25; official programme launch 25 July 1966; first flight 9 February 1969; FAA certification 30 December 1969; first delivery (to Pan Am) 12 December 1969; first route service New York - London flown 21 January 1970. 747-400 announced October 1985. In May 1990, Boeing decided to market only the -400; last -200 (a -200F Freighter for Nippon Cargo Air Lines) delivered 19 November 1991.

Production of earlier variants totalled 724 (205 -100, 45 SP, 393 -200 and 81 -300). Nineteen Pan American 747s modified as passenger/cargo C-19As by Boeing Military Airplanes for Civil Reserve Air Fleet. Boeing board approved launch of 747-400IGW in December 1997. By 31 July 2002, 1,308 Boeing 747s (including 584 -400s) had been delivered, of which 1,100 remained in service. The worldwide fleet of 747s (all models) had flown more than 35 billion miles in 12 million flights, carrying 3.6 billion passengers, by January 2002.

PROGRAMME (current): Series 400 announced October 1985 as 747 development with extended capacity and range; design go-ahead July 1985; first order 22 October 1985; roll-out 26 January 1988; first flight 29 April 1988; certified with P&W PW4056 on 10 January 1989; first delivery 26 January 1989; entered service with Northwest Airlines 9 February 1989; certified with GE CF6-80C2B1F on 8 May 1989; R-R RB211-524G on 8 June 1989; R-R RB211-524H on 11 May 1990. Since May 1990, -400 is the only 747 marketed. 1,200th 747 delivered to British Airways on 17 February 1999.

CURRENT VERSIONS: **747-400:** Basic passenger version; standard and three optional gross weights.

Detailed description applies to -400, except where indicated.

747-400M Combi: Passenger/freight version: initial order 9 April 1986; rolled out 23 March 1989; first flight 30 June 1989; certified 1 October 1989; first delivery 1 September 1989 to KLM. Maximum 266 three-class passengers with freight, 413 without; port-side rear freight door; main deck limit is seven pallets at 27,215 kg (60,000 lb); underfloor and fuel capacities as for passenger 747; 49 delivered by 31 December 1996. For all gross weights, maximum landing weight 285,763 kg (630,000 lb) and maximum zero-fuel weight 256,280 kg (565,000 lb). All three engine options available.

747-400F: All-freight version.

747-400 Domestic: Special high-density two-class 568-passenger version; first order 18 December 1988; rolled out 18 February 1991; first flown 18 March 1991; certified 10 October 1991 and delivered same day to Japan Air Lines (first of six) and later to All Nippon (six) and Japan Air System (one). Maximum T-O weight 272,155 kg (600,000 lb) but can be certified to 394,625 kg (870,000 lb). Structurally reinforced; no winglets; lower engine thrust; five more upper deck windows; revised avionics software and cabin pressure schedule; brake cooling fans; five pallets, 14 LD-1 containers and bulk cargo under floor; GE or P&W engines.

747-400 Performance Improvement Package (PIP): Announced April 1993, and first stage implemented in July 1993. Included gross weight increase of 2,268 kg (5,000 lb). Second stage, implemented in December 1993, included longer-chord dorsal fin made of CFRP, and wing spoilers held down more tightly to reduce profile drag and leakage. These improvements were immediately applied to production aircraft and are retrofittable; PIP flight tested in leased United Airlines 747-400 May 1993.

747-400ER: Offered (as 747-400IGW) from December 1997 in response to Qantas requirement, for which the carrier has placed an order for six, with first delivery then scheduled for October 2002. One or two additional fuel tanks in hold. Range 7,500 n miles (13,890 km; 8,630 miles) with one additional tank; 7,700 n miles (14,260 km; 8,861 miles) with two. Structural strengthening around centrebody, wing/fuselage joint, flaps and landing gear.

Prototype N747ER (1,308th B747) rolled out 10 June 2002 (official ceremony on 17th); maiden flight 31 July 2002; became VH-OEE of Qantas.

747-400 ERF: See following entry.

747-400X QLR: Study, since superseded, for developed, Quiet Longer Range version, initially designated 747-400X. Based on 747-400 airframe, but with revised (B777-style) flight deck, crew rest/passenger sleeping area in upper aft fuselage, increased provision for carry-on baggage in cabin, 747-400F's thicker gauge outboard wing with B767-400ER-style raked wingtips (span 68.66 m; 225 ft 3 in) instead of winglets, MD-11-type trailing-edge wedges (of which flight tests began in October 1998), strengthened fuselage sections and landing gear, and modifications to cargo and fuel systems to permit installation of additional fuselage tank forward of centre wing tank, with second additional tank of same capacity optional. Max ramp weight 418,665 kg (923,000 lb); max T-O weight 417,760 kg (921,000 lb); operating weight empty 186,425 kg (411,000 lb), max structural payload 65,315 kg (144,000 lb); fuel load 248,714 litres (65,705 US gallons; 54,710 Imp gallons), giving max range, with 416 passengers in three classes, of 7,980 n miles (14,779 km; 9,183 miles); alternative 396,900 kg (875,000 lb) MTOW and 7,500 n mile (13,890 km; 8,630 mile) range to comply with QC2 noise regulations. Alternative seating up to 524 (including 42 first class). Cruising Mach No is 0.86. By late 2002, QLR had generated little airline interest and Boeing had developed the proposal with greater range and payload, provisionally designating it **747-800X**.

Initial engine planned to be GE CF6-80C2B9F of 282 kN (63,300 lb st). New 'chevron' engine nacelles with serrated rear edges on core and fan nozzles promote mixing of bypass and core flows, and mixing of bypass flow and ambient air; combined with acoustic engine liners, these make QLR some 6 dB quieter (20 per cent on T-O; 40 per cent on approach), enabling it to meet QC2 noise standards.

QLR announced at Asian Aerospace, Singapore, 26 February 2002 (when 'chevron' design revealed). Studies replaced by 747 Advanced.

747-400XF QLR: Study for cargo version of Quiet Longer Range, with simplified and lightened handling system. Launched (then as Longer-Range 747-400 Freighter) April 2001 with order from ILFC. MTOW 417,760 kg (921,000 lb); range 5,150 n miles (9,537 km; 5,926 miles) with 112,810 kg (248,700 lb) payload. Cargo volumes (upper, lower and bulk) as for 747-400F. No extra fuel; capacity as for basic 747-400, GE-engined variant (203,325 litres; 53,765 US gallons; 44,769 Imp gallons). Typical cruising speed M0.845 on CF6-80C2B9F engines.

747X and 747X Stretch: Boeing cancelled development of its proposed 747X and 747X Stretch in March 2001.

747-800X: Under consideration by late 2002. Evolved from 747-400X QLR, with 1.98 m (6 ft 6 in) forward fuselage stretch; some 3,785 litres (1,000 US gallons; 833 Imp gallons) of additional fuel in tailplane tanks; between 20 and 40 more seats; and range increased to 8,000 n miles (14,816 km; 9,206 miles). Candidate engines in 276 to 285 kN (62,000 to 64,000 lb st) class. Developed into 747 Advanced.

747 Advanced: Revealed mid-2003 as further development of 747X QLR (and 747XF QLR) theme, drawing on [Boeing 787 Dreamliner](#) technology, including new engines. Service entry possible in 2009. Raked wingtips with overall span of 68.66 m (225 ft 3 in); trailing-edge wedge and fuselage plugs carried forward from previous studies, although last-mentioned to comprise 2.03 m (6 ft 8 in) ahead of wing and 1.52 m (5 ft 0 in) behind. Length 74.22 m (243 ft 6 in), height overall 19.38 m (63 ft 7 in). Weight empty 198,660 kg (437,975 lb), max T-O 421,840 kg (930,000 lb), zero-fuel 269,430 kg (594,000 lb), max structural payload 70,770 kg (156,020 lb). Fuel capacity 225,705 litres (59,625 US gallons; 49,648 Imp gallons); max operating speed M0.86 with 448 passengers (24/85/339) over 8,090 n miles (14,982 km; 9,309 miles).

CUSTOMERS: Launch customer Northwest Orient Airlines ordered 10 -400s with PW4000s and 420-passenger interior October 1985; first delivery 26 January 1989.

COSTS: US\$185 million to US\$211 million (2002); Combi version US\$196 million to US\$215 million (2002). Prices unchanged by mid-2003.

DESIGN FEATURES: Wide-bodied extrapolation of Boeing intercontinental jet configuration of low wing and four podded engines, optimised for greater passenger numbers and increased efficiency. Twin-deck forward fuselage; four mainwheel bogies for weight distribution.

According to engine type, fuel burn per seat over 3,000n mile (5,556 km; 3,452 mile) sector varies between 135.8 kg (299.3 lb) and 138.5 kg (305.4 lb).

Sweepback at quarter-chord 37° 3'; thickness/chord ratio 13.44 per cent inboard, 7.8 per cent at mid-span, 8 per cent outboard; dihedral at rest 7°; incidence 2°; winglets, canted 22° outward and swept 60°, increase range by 3 per cent; upper deck extended rearward by 7.11 m (23 ft 4 in).

FLYING CONTROLS: Conventional and powered.

Elevators: Four elevator sections mechanically linked with breakable shear devices; each elevator has dual hydraulic-powered control units; control feel and three individual autopilot input servos mounted on central elevator quadrant; all surfaces have position transmitters; feel computer-operated by pitot pressure and tailplane angle.

Rudder: Upper rudder surface operated by three hydraulic actuators served by two hydraulic systems, lower surface by two actuators fed by remaining two hydraulic systems; no balance weights; each rudder has separate yaw damper module; left and right digital air data computers provide signals for controlling rudder ratio changer on each rudder surface according to air data and tailplane angle; combined feel actuator, rudder centring and trim actuator in rear servo area; mechanical cable linkage between rudder pedals and aft actuator area; rudder trim control switches on centre console. Maximum rudder deflection ±30°.

Tailplane: Tailplane angle set by hydraulic motor-driven shaft and ball screw with primary and secondary hydraulic brakes; flight control unit and air data computer signals sent to tailplane through dual stabiliser, trim and rudder ratio modules, which automatically apply Mach trim, and by dual-stabiliser control modules; tailplane trim limits computed according to flap positions.

Lateral control: Pilot and co-pilot aileron linkage can be physically separated if necessary; all four ailerons operate at low speeds; outboard ailerons are locked out at cruising speed; the inboard spoiler panel on each wing used on ground only; remainder have variable ratio response and spoiler mixer units; there are trim, centring and feel units.

Leading-edge and trailing-edge devices: Three-section Krueger flaps inboard of engines; variable camber slats between (five-section) and outboard (six-section) of engines lie flat when retracted and adopt camber curvature when extended. Two flap assemblies on each wing, one inboard of engines and the other between engines; three sections, fore flap, mid-flap and aft flap, move rearwards as single flat panel up to 5° deflection; thereafter, three sections separate progressively to form three slots, and camber angles relative to each other increase progressively.

Automatic flight control system: Combines autopilot, flight director and automatic tailplane trim and sends commands through triple independent flight control computers; system automates all flight phases except take-off; dual digital air data computers; pilots' primary flight and navigation displays are large-size cathode-ray tubes; two engine indicating and crew alerting screens, one on main panels, one on console; three multifunction control and display panels control flight management system, navigation and communications; flight control computers (autopilot) and inertial reference units are triplicated; new features include full-time autothrottle and dual-thrust management system included in flight management computer; integrated radio control panels and automatic start and shutdown of APU.

STRUCTURE: Wing and tail surfaces are aluminium alloy dual-path fail-safe structures; advanced aluminium alloys in wing torsion box save 2,721 kg (6,000 lb); advanced aluminium honeycomb spoiler panels; CFRP winglets and main deck floor panels; advanced graphite/phenolic and Kevlar/graphite in cabin fittings and engine nacelles; frame/stringer/stressed skin fuselage with some bonding. Improved corrosion protection and further coverage with compound introduced from 1993.

LANDING GEAR: Twin-wheel nose unit retracts forward; main gear consists of four four-wheel bogies; two, mounted side by side under fuselage at wing trailing-edge, retract forward; two, mounted under wings, retract inward; nosewheel steerable up to 70° left or right from tillers; full rudder pedal travel gives up to 7° for use at high speed; two centre main legs steer up to 13° when nosewheels are steered more than 20° and speed is less than 20 kt (37 km/h; 23 mph); carbon disc brakes on all mainwheels, with individually controlled digital anti-skid units; one of three brake pressure supplies automatically selected; main and nose tyres H49x19.0-20 or -22 (32 ply). Minimum ground turning radius, with body gear steering, is 48.46 m (159 ft 0 in) at wingtip and 27.73 m (91 ft 0 in) at nosewheels.

POWER PLANT: Four turbofans for baseline 747-400, these comprise: 252 kN (56,750 lb st) Pratt & Whitney PW4056; 258 kN (57,900 lb st) General Electric CF6-80C2B1F or 276 kN (62,100 lb st) CF6-80C2B5F; or 258 kN (58,000 lb st) Rolls-Royce RB211-524G or 270 kN (60,600 lb st) RB211-524H. Further optional engines (subject to certification) are 267 kN (60,000 lb st) PW4060, 276 kN (62,000 lb st) PW4062 and 274 kN (61,500 lb st) CF6-80C2B1F1. For 747-400ER, initial engine choices are CF6-80C2B5F, PW4062 and RB211-524H8T.

Fuel in four main tanks in wings can feed to any engine; in addition there are a centre-wing tank and reserve tanks in outer wing; optional tailplane tank; vent and surge tanks in outer wings and starboard tailplane; jettison pumps in inner main tanks; APU fed from port inner tank; automatic refuelling through two receptacles under each wing leading-edge between engines; automatic condensate scavenging and flame arresters in vent outlets.

Basic fuel capacity 204,355 litres (53,985 US gallons; 44,952 Imp gallons) with P&W and R-R engines; 203,523 litres (53,765 US gallons; 44,769 Imp gallons) with GE engines. At alternative higher T-O weights above 394,625 kg (870,000 lb) use of 12,492 litre (3,300 US gallon; 2,748 Imp gallon) tailplane/centre section tank is mandatory; fuel capacity including tailplane tank is therefore 216,846 litres (57,285 US gallons; 47,700 Imp gallons) with P&W and R-R engines and 216,013 litres (57,065 US gallons; 47,516 Imp gallons) with GE engines.

Usable fuel in 747-400ER comprises 239,389 litres (63,240 US gallons; 52,658 Imp gallons) with GE engines; 240,222 litres (63,460 US gallons; 52,841 Imp gallons) with P&W and R-R engines. Volumes include two tanks in cargo hold each of 11,583 litres (3,060 US gallons; 2,548 Imp gallons).

Nitrogen-based flammability reduction system (FRS) trials with 747-400 tanks undertaken in 2003 with Honeywell/Parker Aerospace OBNGS; available from late 2006 or early 2007.

ACCOMMODATION: Two-crew flight deck, with seats for two observers; two-bunk crew rest cabin accessible from flight deck. Optional (but currently available on 90 per cent of B747-400 fleet) overhead cabin crew rest compartments above rear of main deck cabin (four bunks, four seats; eight bunks, two seats; two bunks, two seats, five sleeper seats). Typical 416-seat, three-class, long-range configuration accommodates 40 business class on upper deck; 23 first class in front cabin, 38 business class in middle cabin and 315 economy class in rear cabin on main deck. Maximum upper deck capacity 69 economy class. First class seating six abreast with two 86 cm (34 in) aisles, each twin-seat unit 1.45 m (4 ft 9 in) wide. Business passengers four abreast with 72 cm (28 1/2 in) aisle and 1.37 m (4 ft 6 in) wide seat pairs on upper deck or two-three-two on lower deck with two 63 cm (24 3/4 in) aisles and 2.08 m (6 ft 10 in) triple seat. Economy seating three-four-three, with 49.5 cm (19 1/2 in) aisles, two 1.51 m (4 ft 11 1/2 in) triple seats and 2.07 m (6 ft 9 1/2 in) quad seat. Five passenger doors on each side; upper deck emergency door each side. 747-400ER accommodates, typically, 500 in two-class arrangement (42 first, 458 economy or 416 three-class (as above).

Centre overhead stowage bins 0.16 m³ (5.7 cu ft) volume per 1.02 m (40 in) long bin; outboard bins 0.45 m³ (15.9 cu ft) volume per 1.52 m (60 in) long bin; 0.083 m³ (2.95 cu ft) bin volume per passenger (three-class). Two modular upper deck lavatories, 14 on main deck, relocatable (six upper deck optional locations; 33 on lower deck) and vacuum-drained into four waste tanks with combined volume of 1,136 litres (300 US gallons; 250 Imp gallons). Single-point drainage. Basic galley configuration, one on upper deck, seven centreline and two sidewall on main deck; lavatories and galleys can be quickly relocated if required fittings are installed; advanced integrated audio/video/announcement system.

Underfloor freight: forward compartment, five 2.44 m (96 in) x 3.18 m (125 in) pallets (totalling 58.8 m³, 2,075 cu ft) or 16 LD-1 containers (totalling 78.4 m³; 2,768 cu ft); aft compartment, 14 LD-1 containers (totalling 68.6 m³; 2,422 cu ft) or four pallets (totalling 47.0 m³; 1,660 cu ft); and bulk storage behind aft compartment 23.6 m³ (835 cu ft). Max capacity of 747-400 (16 LD-1s forward, 14 LD-1s aft and bulk storage in extreme rear) 170.6 m³ (6,025 cu ft). Door to each of three areas, all starboard side. Optional cargo door, port rear, on Combi version. 747-400ER lower deck accommodates 129 m³ (4,550 cu ft) within LD-1 containers, plus 22.3 m³ (789 cu ft) of bulk cargo, when two fuel tanks fitted. Capacity of 747-400X QLR reduced by up to six containers when both additional fuel tanks fitted; capacity 158.5 m³ (5,599 cu ft) with basic fuel; 137.0 m³ (4,837 cu ft) with max fuel.

SYSTEMS: Each engine drives a hydraulic pump feeding an independent system; services are connected to supplies in such a way that loss of one supply cannot disable one system: two hydraulic systems also have air-driven pumps to maintain pressure and two have electric pumps; one electric pump can be run to provide braking when the aircraft is being towed on the ground; all four hydraulic reservoirs can be filled from a single location in the port main landing gear bay.

Hot air bled from the low-pressure and high-pressure compressors of all four engines is precooled by fan exit air and fed via a manifold to the cabin pressurisation and air conditioning system and to provide de-icing of wing leading-edge and engine nose cowling and to pressurise hydraulic tanks. Three conditioning packs in wing/ fuselage fairing provide cabin air; five cabin zones, each with digital temperature control.

Each engine drives an integrated drive generator supplying 90 kVA power to respective AC busses; three generators are a dispatch item, but one will supply essential loads; APU drives two further generators; automatic start-up, load transfers and load shedding reduce crew workload; power systems may be isolated from each other for triple-channel Cat. III autoland.

Completely self-contained 1,081 kW (1,450 shp) P&WC PW901A APU, mounted clear of all flight-critical structure and flight controls in the extreme tail, drives two 90kVA generators that can supply electrical power for whole aircraft; also supplies compressed air to operate pneumatic components; can run at up to 6,100 m (20,000 ft) and supply compressed air below 4,575 m (15,000 ft). Capabilities include maintenance of 24°C (75°F) ground cabin temperature in 38°C (100°F) ambient conditions.

Forward underfloor cargo compartment heated to 5°C by hot air exhausted from flight deck cooling equipment and avionics in main equipment centre, boosted as necessary by two electrical heaters; rear underfloor hold heated to minimum 5°C or 18°C (selected by crew) by engine bleed.

Overheat detection and automatic extinguishing provided in all lavatories; APU automatically shut down and fire extinguisher bottles initiated on detection of fire; each engine has three dual fire detectors in series and a fourth detector for overheating. Underfloor freight compartments and upper deck hold of Combi have smoke detectors and extinguisher systems; wheel wells have overheat detectors.

AVIONICS: Boeing launched development of new Flight Management Computer software in January 1993 to match existing aircraft to international Future Air Navigation System (FANS-1) during 1995. Standard avionics fit as follows:

Comms: Dual VHF and HF transceivers with Selcal; dual transponders; flight intercom with air-to-ground facility, connectable also to satcom system; cabin entertainment and passenger address and service units.

Radar: Colour weather radar transmitting in I- and G-bands.

Flight: Dual VOR; triple ILS receivers with single marker beacon receiver; dual ADF; dual DME; all nav radios automatically tuned by flight management computer system (FMCS). Automatic flight control system (AFCS) integrates autopilot, flight director and automatic stabiliser trim functions; dual digital air data computers with dual selectable pressure sensors, angle of attack sensors and total air temperature probes; FMCS allows crew to preselect flight plan using standard air traffic control language; FMCS incorporates database, updated every 28 days, which includes data on waypoints, airports, standard instrument departures (SIDs), standard terminal arrival routes (STARs), airline routes and information on specific geographic areas; triple ring laser gyro inertial reference units provide navigation input on EFIS, flight management displays or radio magnetic indicators; other systems include ground proximity warning, triple low-range radio altimeters and TCAS.

Central maintenance computer monitors over 75 electrical and electromechanical systems, performs tests and centralises maintenance data; failures are indicated in EICAS displays and stored for future reference for in-flight use or line or hangar maintenance. Satcom datalink allows ground crews to interrogate system for additional information while aircraft in flight.

Instrumentation: Electronic flight instrument system (EFIS) comprising six (left/right inboard/outboard and central upper/lower) 20.3 x 20.3 cm (8 x 8 in) integrated display units (IDU), two each for primary flight display (PFD), navigation display (ND) and engine indicating and crew alerting (EICAS) functions; all IDUs receive data from all three EFIS/EICAS interface units (EIU), updated via software data loader; PFD and EICAS primary formats automatically switch to inboard and lower IDUs respectively, with facility for manual selection of formats on different IDUs as required. B747-400 has 181 switches, 171 lights and 13 gauges, compared with 284, 555 and 132 of earlier variants; total 365 is below average 450 for typical two-crew jet transport.

DIMENSIONS. EXTERNAL:	
Wing span: normal	64.44 m (211 ft 5 in)
with winglets	64.92 m (213 ft 0 in)
Wing span, fully fuelled	64.92 m (213 ft 0 in)
Wing chord: at root	14.63 m (48 ft 0 in)
at tip	4.06 m (13 ft 4 in)
Winglet height	0.89 m (2 ft 11 in)
Wing aspect ratio	7.7
Length: overall	70.67 m (231 ft 10 1/4 in)
fuselage	68.63 m (225 ft 2 in)
Max width of fuselage	6.50 m (21 ft 4 in)
Height overall:	
at OWE: -400	19.51 m (64 ft 0 in)
-400ER	19.58 m (64 ft 3 in)
at MTOW: -400	18.77 m (61 ft 7 in)
-400ER	19.05 m (62 ft 6 in)
Tailplane span	22.17 m (72 ft 9 in)
Wheel track (c/l shock-struts):	
outer pair	11.00 m (36 ft 1 in)
inner pair	3.84 m (12 ft 7 in)
Wheelbase: mean	25.60 m (84 ft 0 in)
to forward main bogie	24.07 m (78 ft 1 1/2 in)
to rear main bogie	27.14 m (89 ft 0 1/2 in)
Distance between engine centrelines:	
outboard	41.66 m (136 ft 8 in)
inboard	23.37 m (76 ft 8 in)
Passenger doors (10, each):	
Height: door, clear access	1.93 m (6 ft 4 in)
Width: door	1.19 m (3 ft 11 in)
clear access	1.07 m (3 ft 6 in)
Height to sill: at OWE:	
front: -400	5.16 m (16 ft 11 in)
-400ER	5.21 m (17 ft 1 in)
rear: -400	5.31 m (17 ft 5 in)
-400ER	5.38 m (17 ft 8 in)
at MTOW:	
front: -400	4.72 m (15 ft 6 in)
-400ER	4.75 m (15 ft 7 in)
rear: 400	4.80 m (15 ft 9 in)
-400ER	4.98 m (16 ft 4 in)
Upper deck emergency door (two):	
Height: door	2.01 m (6 ft 7 1/4 in)
clear access	1.83 m (6 ft 0 in)
Width	1.07 m (3 ft 6 in)
Height to sill:	
at OWE: -400	7.90 m (25 ft 11 in)
-400ER	7.95 m (26 ft 1 in)
at MTOW: -400	7.52 m (24 ft 8 in)
-400ER	7.54 m (24 ft 9 in)
Baggage door (front hold): Height	1.68 m (5 ft 6 in)
Width	2.64 m (8 ft 8 in)
Height to sill: at OWE	3.10 m (10 ft 2 in)
at MTOW	2.69 m (8 ft 10 in)
Baggage door (rear hold): Height	1.68 m (5 ft 6 in)
Width	2.64 m (8 ft 8 in)
Height to sill: at OWE	3.17 m (10 ft 5 in)
at MTOW	2.82 m (9 ft 3 in)
Bulk loading door:	

Height: max (front)	1.42 m (4 ft 8 in)
min (rear)	1.24 m (4 ft 1 in)
Width	1.12 m (3 ft 8in)
Mean height to sill: at OWE	3.40 m (11 ft 2 in)
at MTOW	3.00 m (9 ft 10 in)
Combi cargo door (port):	
Height (clear access)	3.05 m (10 ft 0 in)
Width	3.40 m (11 ft 2 in)
Height to sill: at OWE	5.26 m (17 ft 3 in)
at MTOW	4.87 m (16 ft 0 in)
<i>747-400ER baggage door heights to sill: add 50 to 75 mm (2 to 3 in)</i>	
DIMENSIONS, INTERNAL:	
Cabin (main): Max height	2.41 m (7 ft 11 in)
Passenger cabin volume	885.9 m ³ (31,285 cu ft)
AREAS:	
Wings, gross	541.16 m ² (5,825.0 sq ft)
Ailerons (total)	20.90 m ² (225.00 sq ft)
Trailing-edge flaps (total)	78.69 m ² (847.00 sq ft)
Leading-edge flaps (total)	43.85 m ² (472.00 sq ft)
Inboard spoilers (total)	12.78 m ² (137.60 sq ft)
Outboard spoilers (total)	15.46 m ² (166.40 sq ft)
Fin	77.11 m ² (830.00 sq ft)
Rudder	21.37 m ² (230.00 sq ft)
Tailplane	136.57 m ² (1,470.00 sq ft)
Elevators (total, incl tabs)	30.38 m ² (327.00 sq ft)
WEIGHTS AND LOADINGS (747-400: GB: CF6-80C2B1F, GM: CF6-80C2B5F, PB: PW4056, PM: PW4062, RB: RB211-524G, RM: 211-524M engines; all 416 passengers, five cargo pallets and 14 containers, 747-400ER: ER GM CF6- 80C2B5F, ER PM: PW4062, ER RM: RB211-524H-8T with passengers/cargo as above):	
Operating weight empty: GB	180,485 kg (397,900 lb)
GM	180,895 kg (398,800 lb)
PB	180,845 kg (398,700 lb)
PM	181,255 kg (399,600 lb)
RB	181,435 kg (400,000 lb)
RM	181,845 kg (400,900 lb)
ER GM/PM/RM	184,565 kg (406,900 lb)
Baggage/freight capacity, all:	
forward compartment	26,490 kg (58,400 lb)
aft compartment	22,938 kg (50,570 lb)
bulk compartment	6,749 kg (14,880 lb)
Max structural payload:	
ER GM, PM, RM	67,175 kg (148,100 lb)
Max fuel weight: GB	162,580 kg (358,425 lb)
GM	172,560 kg (380,425 lb)
PB, RB	163,250 kg (359,900 lb)
PM, RM	173,225 kg (381,900 lb)
ER, GM	192,190 kg (423,700 lb)
ER, PM, ER, RM	192,855 kg (425,175 lb)
Max T-O weight:	
GB, PB, RB	362,875 kg (800,000 lb)
GM, PM, RM	396,895 kg (875,000 lb)
ER GM, PM, RM	412,770 kg (910,000 lb)
Max ramp weight:	
GB, PB, RB	364,235 kg (803,000 lb)
GM, PM, RM	398,255 kg (878,000 lb)
ER, GM, PM, RM	414,130 kg (913,000 lb)
Max landing weight:	
GB, PB, RB	260,360 kg (574,000 lb)
GM, PM, RM	295,745 kg (652,000 lb)
ER, GM, PM, RM	295,745 kg (652,000 lb)
Max zero-fuel weight:	
GB, PB, RB	242,670 kg (535,000 lb)
GM, PM, RM	251,745 kg (555,000 lb)
ER, GM, PM, RM	251,745 kg (555,000 lb)
Max wing loading:	
GB, PB, RB	670.5 kg/m ² (137.34 lb/sq ft)
GM, PM, RM	733.4 kg/m ² (150.21 lb/sq ft)
Max power loading:	
GB, RB	352 kg/kN (3.45 lb/lb st)
GM, PB	359 kg/kN (3.52 lb/lb st)
PM	360 kg/kN (3.53 lb/lb st)
RM	368 kg/kN (3.61 lb/lb st)
PERFORMANCE (as above; landing at MLW):	
Cruising Mach No.	0.85
Approach speed:	
GB, PB, RB	146 kt (270 km/h; 168 mph)
GM, PM, RM	157 kt (291 km/h; 181 mph)
Initial cruising altitude:	

GB, PB, RB	10,575 m (34,700 ft)
GM, PM, RM	10,000 m (32,800 ft)
T-O field length, 30°C (86°F): GB	2,820 m (9,250 ft)
GM	3,033 m (9,950 ft)
PB	2,820 m (9,250 ft)
PM	2,990 m (9,800 ft)
RB	2,850 m (9,350 ft)
RM	3,215 m (10,550 ft)
Landing field length:	
GB, PB, RB	1,905 m (6,250 ft)
GM, PM, RM	2,180 m (7,150 ft)
Design range:	
GB	6,185 n miles (11,454 km; 7,117 miles)
GM	7,260 n miles (13,445 km; 8,354 miles)*
PB	6,195 n miles (11,473 km; 7,129 miles)
PM	7,325 n miles (13,565 km; 8,429 miles)*
RB	6,040 n miles (11,186 km; 6,950 miles)
RM	7,170 n miles (13,278 km; 8,251 miles)*
<i>*Fuel volume limited</i>	



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