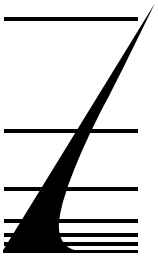
The Market for Large Commercial Jet Transports

Product Code #F611

A Special Focused Market Segment Analysis by:



FORECAST INTERNATIONAL

Analysis 1
The Market for Large Commercial Jet Transports
2011-2020

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PROGRAMS

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The Market for Large Commercial Jet Transports

Executive Summary

The global airline industry returned to profitability in 2010, after two years of net financial losses. Helping to spur the return to black ink was a resumption of growth in passenger and cargo air traffic, which had declined in 2009 and was nearly flat in 2008. The airline recovery has continued into 2011.

While impressive, the recovery has not been consistently strong throughout the world. It has been much more robust in Asia, the Middle East, and Latin America than it has been in North America and especially Europe. European airlines are facing a very difficult business environment characterized by a stalled regional economy, a severe governmental debt crisis, and weak air travel demand.

Orders for Airbus and Boeing commercial airliners had declined dramatically in both 2008 and 2009. This decline in new order activity was accompanied by a wave of order cancellations and delivery deferrals as airlines implemented deep capacity reductions. However, order rates improved significantly in 2010. And, in the first few months of 2011, order rates outpaced the same period in 2010.

Throughout the market downturn, Airbus and Boeing behaved quite aggressively, increasing airliner production by over 15 percent in 2009 and keeping it stable in 2010. The persistence of the two companies was perhaps most impressive in the narrowbody sector. Through 2009 and even into early 2010, a number of customers and suppliers were calling on Airbus and Boeing to significantly reduce narrowbody build rates. However, Boeing kept 737 production steady throughout, while Airbus made only a minor reduction in A320 series production that it quickly reversed. Both companies also continually announced future build rate increases for their narrowbody families.

In late 2010, Airbus launched the A320neo (New Engine Option) series, a family of updated A320 variants featuring new engines and Sharklet wingtip devices. The A320neo represents an attempt by Airbus to protect (and potentially increase) its share of the narrowbody market in the face of emerging new competitors such as the Bombardier CSeries.

The launch of the A320neo placed Boeing on the defensive and the U.S. company is considering whether, and how, to respond. Not enthusiastic about re-engining the 737, Boeing is leaning toward introduction of an all-new narrowbody for service entry in the 2019-2020 timeframe. Boeing expects to make a decision regarding its narrowbody product development path by early 2012.

Embraer is biding its time, waiting for Boeing to announce its plans in order to have a clear view of the competitive landscape before it determines its own strategy. Embraer is considering the launch of a 130-150 seat narrowbody airliner.

The widebody market will continue to be dominated by Airbus and Boeing. The latter's new 787 is slated to enter service by the end of 2011, following a protracted series of schedule delays. Airbus' response to the 787 is the new A350 XWB, which should follow the 787 into service a couple of years later. The A350 also targets Boeing's 777, and Boeing has some decisions to make as to how to protect the 777's market share from encroachment by the A350.

While the recovery in the airliner market is fairly strong, any optimism about the market must be tempered by a number of near-term concerns. These include the still fragile nature of the general economic recovery (especially in Europe and North America), the impact of high fuel and operating costs on airline profits, and the ability (and willingness) of airlines to maintain capacity discipline as air traffic continues to grow.

The Forecast. Forecast International projects that a total of **13,869** large commercial jet transports will be manufactured from 2011 through 2020. In constant 2011 U.S. dollars, the value of this production is estimated at **$1.8 trillion**.

Annual production is forecast to increase each year of the forecast period. However, the rate of annual increase is considerably lower in the second half of the timeframe than in the first half. This slowing of growth in yearly output is most evident in the heavy transport, or widebody, portion of the market as production stabilizes of such new entrants to the segment as the A350 and the 787.

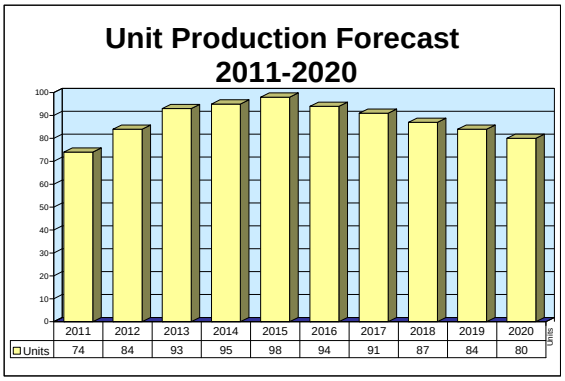
The trend in annual production value is similar to that of annual unit production. Yearly production value is projected to increase throughout the forecast period, though at a slower rate in the second half of the forecast timeframe than in the first. In 2020, the final year of the forecast period, the value of production is estimated at $215 billion.

Our forecast indicates that Airbus and Boeing will produce 13,637 large airliners during the 2011-2020 **Continued….**

Boeing 777

Outlook

- Boeing has announced a significant production rate increase for the 777
- Airbus' new A350 XWB looms as a competitive threat to the 777
- Boeing is considering various options to improve or replace the 777



Orientation

Description. Twin-engine, medium-/long-range widebody commercial transport aircraft.

Sponsor. Development of the 777 was sponsored privately by Boeing with additional support from the Japanese Ministry of International Trade and Industry (MITI), Mitsubishi, Kawasaki, and Fuji. Two more Japanese companies, Japan Aircraft Manufacturing and Shin Maywa, joined the development program for the 777-200LR/-300ER versions.

Status. Production. Orders as of December 31, 2010, totaled 1,163.

Total Produced. Through 2010, Boeing produced a total of 910 777s.

Application. Medium-/long-range, high-density scheduled passenger transportation. Also available as a dedicated freighter.

Price Range. 777-200ER, $232.3 million; 777-200LR, $262.4 million; 777-300ER, $284.1 million; 777 Freighter, $269.1 million. All in 2010 U.S. dollars.

Boeing 777

Source: Boeing

Boeing 777

Contractors

Prime

Boeing Commercial Airplanes	http://www.boeing.com, 3003 W Casino Rd, Everett, WA 98203 United States, Tel: + 1 (425) 294-2300, Fax: + 1 (425) 294-6200, Prime

Subcontractor

Acme Aerospace Inc	http://www.acme-aero.com, 528 W 21st St, Tempe, AZ 85282 United States, Tel: + 1 (480) 894-6864, Fax: + 1 (480) 921-0470 (Nickel Cadmium Battery)
Air Cruisers Co	http://www.aircruisers.com, PO Box 180, Belmar, NJ 07719 United States, Tel: + 1 (732) 681-3527, Fax: + 1 (732) 681-9163, Email: info@aircruisers.zodiac.com (Escape Slide)
Alenia Aeronautica	http://www.alenia-aeronautica.it, 45, Via Campania, Rome, 00187 Italy, Tel: + 39 06 420881, Fax: + 39 06 42824528, Email: communication@alenia-aeronautica.it (Radome; Outer Wing Flap)
Avtech Corp	http://www.avtcorp.com, 3400 Wallingford Ave N, Seattle, WA 98103-9041 United States, Tel: + 1 (206) 695-8000, Fax: + 1 (206) 695-8011 (Digital Control Audio System)
Embraer - Empresa Brasileira de Aeronáutica SA	http://www.embraer.com, Av Brigadeiro Faria Lima, 2170, São José dos Campos, 12227-901 São Paulo, Brazil, Tel: + 55 12 3927 1000 (Aluminum Wing Tip; Dorsal Fin)
Fuji Heavy Industries Ltd	http://www.fhi.co.jp/english, Subaru Bldg, 1-7-2 Nishishinjuku, Shinjuku-ku, Tokyo, 160-8316 Japan, Tel: + 81 3 3347 2111, Fax: + 81 3 3347 2338 (Main Landing Gear Door; Wing/Body Fairing; Front Center Wing Box)
GE - Aviation	http://www.geae.com, 1 Neumann Way, Cincinnati, OH 45215-6301 United States, Tel: + 1 (513) 243-2000 (GE90 Turbofan)
Goodrich Corp	http://www.goodrich.com, Four Coliseum Centre, 2730 W Tyvola Rd, Charlotte, NC 28217-4578 United States, Tel: + 1 (704) 423-7000, Fax: + 1 (704) 423-7002, Email: corporate.communications@goodrich.com (Wheels)
Goodrich Landing Gear	http://www.lgd.goodrich.com, 8000 Marble Ave, Cleveland, OH 44105 United States, Tel: + 1 (216) 341-1700, Fax: + 1 (216) 429-4800 (Landing Gear)
Hamilton Sundstrand	http://www.hamiltonsundstrand.com, One Hamilton Rd, Windsor Locks, CT 06096-1010 United States, Tel: + 1 (860) 654-6000, Fax: + 1 (860) 654-2621, Email: hs.general@hsd.utc.com (Fuel Metering Unit; Electronic Engine Control System; Engine Starting System)
Hamilton Sundstrand	http://www.hamiltonsundstrand.com, 4747 Harrison Ave, PO Box 7002, Rockford, IL 61125-7002 United States, Tel: + 1 (815) 226-6000 (Backup Electric Power System; Main Electric Generator)
Honeywell Aerospace	http://www51.honeywell.com/aero, 1944 E Sky Harbor Circle, Phoenix, AZ 85034 United States, Tel: + 1 (602) 231-1000, Fax: + 1 (602) 365-2075 (Various Avionics Systems)
Honeywell Aerospace, Aircraft Landing Systems	http://www.honeywell.com/sites/aero/Landing-Systems.htm, 3520 Westmoor St, South Bend, IN 46628 United States, Tel: + 1 (219) 231-2000, Fax: + 1 (219) 231-2020, Email: alscommunications@honeywell.com (Brakes; Wheels)
Honeywell Aerospace, Engines, Systems & Services	http://www.honeywell.com, 111 S 34th St, Phoenix, AZ 85034-2892 United States, Tel: + 1 (602) 231-1000, Fax: + 1 (602) 231-5713 (GTCP 331-500 APU)
Intertechnique	http://www.intertechnique.fr, 61 rue Pierre-Curie, BP 1, Plaisir Cedex, 78373 France, Tel: + 33 1 30 54 82 00, Fax: + 33 1 30 55 71 61 (Windshield Heat Control Unit)
Ipeco Europe Ltd	http://www.ipeco.co.uk/fs_europe.htm, Aviation Way, Southend-On-Sea, SS2 6UN Essex, United Kingdom, Tel: + 44 0 1702 209307, Fax: + 44 0 1702 540782, Email: sales@ipeco.co.uk (Crew Seat)
Kaman Aerospace Corp	http://www.kamanaero.com, Old Windsor Rd, PO Box 2, Bloomfield, CT 06002-0002 United States, Tel: + 1 (860) 242-4461, Fax: + 1 (860) 243-7514 (Wing Fixed Trailing Edge Assembly)

Kawasaki Heavy Industries Ltd (KHI)	http://www.khi.co.jp, 6-5 Minamisuna 2-chome, Koto-ku, Tokyo, 136-8588 Japan, Tel: + 81 3 3615 5195, Fax: + 81 3 3615 5206 (Forward & Center Fuselage; Rear Center Wing Box; Rear Pressure Bulkhead; Wing Rib)
Korean Air Aerospace Division	http://www.kal-asd.co.kr, 41-3 Seosomun-Dong, Chung-Gu, Seoul, Korea, South, Tel: + 82 2751 7311, Fax: + 82 2751 7347 (Flap Support Fairing)
Messier-Bugatti	http://www.messier-bugatti.com, Zone Aéronautique Louis Breguet, BP40, Velizy-Villacoublay, 78140 France, Tel: + 33 1 4629 8100, Fax: + 33 1 4629 8700 (Landing Gear)
Mitsubishi Heavy Industries Ltd (MHI)	http://www.mhi.co.jp/en/, 16-5 Konan 2-chome, Minato-ku, Tokyo, 108-8215 Japan, Tel: + 81 3 6716 3111, Fax: + 81 3 6716 5800 (Rear Fuselage Body Panel; Rear Fuselage Door)
Parker Aerospace Stratoflex Products Division	http://www.parker.com, 220 Roberts Cut-Off Rd, Fort Worth, TX 76114 United States, Tel: + 1 (949) 809-8267, Email: spdmarketing@parker.com (Hydraulic Hose)
Pratt & Whitney	http://www.pratt-whitney.com, 400 Main St, East Hartford, CT 06108 United States, Tel: + 1 (860) 565-4321, Email: info@pw.utc.com (PW4000 Turbofan)
Rockwell Collins Inc	http://www.rockwellcollins.com, 400 Collins Rd NE, Cedar Rapids, IA 52498-0001 United States, Tel: + 1 (319) 295-1000, Fax: + 1 (319) 295-5429 (Electronic Library System Maintenance Access Terminal; Flat Panel LCD Standby Indicator; Autopilot)
Rolls-Royce plc	http://www.rolls-royce.com, 65 Buckingham Gate, London, SW1E 6AT United Kingdom, Tel: + 44 20 7222 9020, Fax: + 44 20 7227 9170 (Trent Turbofan)
Sierracin Corp	http://www.sierracin.com, 12780 San Fernando Rd, Sylmar, CA 91342-3796 United States, Tel: + 1 (818) 362-6711, Fax: + 1 (818) 362-0603 (Heated Side Panel; Passenger Window)
Thales Aerospace	http://www.thalesgroup.com/aerospace, 45, Rue de Villiers, Neuilly-sur-Seine, 92526 France, Tel: + 33 1 57 77 80 00, Fax: + 33 1 57 77 87 70 (Full-Format Printer)
Toray Industries Inc	http://www.toray.com, 1-1 Nihonbashi-Muromachi, 2-Chome, Chuo-Ku, Tokyo, 103-8666 Japan, Tel: + 81 03 3245 5111, Fax: + 81 03 3245 5054 (Carbon Material)
Triumph Aerostructures, Vought Aircraft Division	http://www.triumphgroup.com/companies/triumph-aerostructures-vought-aircraft-division, 90 Hwy 22 W, Milledgeville, GA 31061-9699 United States, Tel: + 1 (478) 454-4200 (Wing Spoiler; Inboard Flaps; Nacelle Panels)

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Technical Data

(777-200ER/-200LR/-300ER)

Design Features. Cantilever low-swept-wing monoplane. Materials include aluminum alloy and carbon/carbon composites. The aircraft has a cockpit based on the 747, allowing for a common type rating for pilots.

The 777's tail unit has an all-moving carbon composite horizontal stabilizer. The vertical fin is also constructed of carbon composites. Carbon composites are used in the floor beams and wing trailing edge flaps. Overall, composite materials represent 10 percent of the aircraft's structural weight. The horizontal tail contains fuel.

The wing of the 777 employs optional folding tips to allow utilization of existing DC-10/L-1011/A300/767 gates. Airlines can order the 777 with no wing fold or with the wingtip hinges and fold joints less the actuation system, which can be retrofitted at a later date. Landing gear are tricycle type with dual six-wheel trucks and a single dual-wheel nose unit.

Boeing is responsible for the manufacture of vertical and horizontal stabilizers, fixed trailing edges, the rudder, elevators, the Section 41 nose fuselage, struts and fairings, wings, ailerons, composite floor beams, and engine pylons and nacelles.

Boeing 777

Honeywell supplies various avionics for the 777, including six 8-inch x 8-inch LCD flat panel display units, a two-display Engine Indication and Crew Alerting System (EICAS), the integrated Aircraft Information Management System (AIMS), and the Air Data Inertial Reference System (ADIRS). BAE Systems supplies the primary flight control system computer.

	Metric	U.S.
Dimensions		
Overall length		
777-200ER/-200LR	63.73 m	209.08 ft
777-300ER	73.86 m	242.33 ft
Overall height		
777-200ER	18.52 m	60.75 ft
777-200LR	18.62 m	61.08 ft
777-300ER	18.49 m	60.67 ft
Wingspan		
777-200ER	60.93 m	199.92 ft
777-200LR/-300ER	64.80 m	212.58 ft
Cabin width	5.87 m	19.25 ft
Weight		
Max takeoff weight		
777-200ER	297,560 kg	656,000 lb
777-200LR	347,450 kg	766,000 lb
777-300ER	351,530 kg	775,000 lb
Capacities		
Max fuel capacity		
777-200ER	171,170 liters	45,220 U.S. gal
777-200LR (standard)	181,280 liters	47,890 U.S. gal
777-200LR (with three optional fuel tanks)	202,570 liters	53,515 U.S. gal
777-300ER	181,280 liters	47,890 U.S. gal
Cargo volume		
777-200ER/-200LR	150.9 cu m	5,330 cu ft
777-300ER	201.6 cu m	7,120 cu ft
Performance		
Typical cruise speed at 35,000 ft	Mach 0.84	Mach 0.84
Max range		
777-200ER	14,305 km	7,725 nm
777-200LR	17,395 km	9,395 nm
777-300ER	14,685 km	7,930 nm

Propulsion

777-200ER	(2)	Pratt & Whitney PW4084/PW4090, Rolls-Royce Trent 884/890/892/895, or General Electric GE90-85B/90B/92B/94B turbofan engines rated 374-423 kN (84,000-95,000 lbst) each.
777-200LR	(2)	General Electric GE90-110B1 turbofan engines rated 489 kN (110,100 lbst) each, or General Electric GE90-115BL turbofan engines rated 512 kN (115,300 lbst) each.
777-300ER	(2)	General Electric GE90-115B turbofan engines rated 512 kN (115,300 lbst) each.

Seating

777-200ER – Seats 301 in a three-class, twin-aisle passenger arrangement; 400 in two classes; or up to 440 in a single, all-tourist configuration.
777-200LR – Typical three-class seating for 301 passengers.
777-300ER – Typical three-class seating for 365 passengers.

Variants/Upgrades

777-200. Previously known as the 777-200 A Market version. This basic model was first ordered by United Airlines in October 1990. It was marketed in four configurations: 506,000 pounds maximum takeoff weight (MTOW), 515,000 pounds MTOW, 535,000 pounds MTOW, and 545,000 pounds MTOW.

Maximum range of the 777-200 was 5,240 nautical miles.

The 777-200 could handle all LD containers as well as 96-inch-wide and 88-inch-wide pallets. Up to 32 LD-3 containers could be carried, plus 600 cubic feet of bulk-loaded cargo. An optional crew rest area had four bunks and two business-class seats below the main deck. Aircraft powerplants were rated approximately 74,000-77,200 lbst, and included the Pratt & Whitney PW4074/PW4077, the Rolls-Royce Trent 875/877, and the General Electric GE90.

The 777-200 is no longer in production.

777-200ER. Previously known as the 777-200IGW and, prior to that, the 777-200 B Market version. The 777-200ER is an increased gross weight (IGW), extended-range version of the 777-200. It has been marketed in five configurations with MTOWs of 580,000 pounds, 590,000 pounds, 632,500 pounds, 648,000 pounds, and 656,000 pounds. It has essentially the same passenger capacity as the -200 model. Maximum range is 7,725 nautical miles. The Pratt & Whitney PW4084/PW4090, the General Electric GE90, and the Rolls-Royce Trent 884/890/892/895 are the powerplants.

First flight of the 777-200ER took place in October 1996.

777-300. Previously known as the 777 Stretch. This version had a maximum takeoff weight of 660,000 pounds and carried 368 passengers in a three-class configuration, 451 in two classes, or up to 550 in one tourist class. Range was 6,005 nautical miles. It had a fuselage stretch of over 10 meters.

The 777-300 program was launched in mid-1995. The -300 provided airlines with an economical replacement for older 747-100s and 747-200s. First flight of the -300 occurred in October 1997. Initial delivery, to Cathay Pacific, occurred in May 1998.

The 777-300 is no longer in production.

777-200LR. The 777-200LR, also called the longer range 777-200, is a new version of the 777-200. It was previously called the 777-200X. The 777-200LR can carry 301 passengers in a three-class configuration. Maximum takeoff weight of the new derivative is 347,450 kilograms (766,000 lb). The maximum range of the -200LR is 17,395 kilometers (9,395 nm). Initially, the exclusive powerplant for the -200LR was the General Electric GE90-110B1, rated at 489 kN (110,100 lbst). Customers now have a choice of two engines, either the GE90-110B1 or a higher thrust variant, the 512-kN (115,300-lbst) GE90-115BL.

Boeing temporarily suspended preliminary design work on the -200LR in October 2001 due to uncertain demand for the new version, though it continued to market the aircraft. Work on the -200LR resumed in March 2003.

Boeing rolled out the initial 777-200LR in February 2005. This aircraft made its first flight in March 2005. It was joined in flight testing by a second -200LR in May 2005.

The initial delivery of a 777-200LR occurred in February 2006, to launch customer Pakistan International Airlines. The carrier received a second 777-200LR in March 2006. These two aircraft were the flight test aircraft that were refurbished prior to delivery to the airline.

777F. Following a launch order from Air France, Boeing officially launched a freighter version of the 777-200LR in May 2005. Dubbed the 777 Freighter (777F), the aircraft is capable of flying 9,070 kilometers (4,900 nm) with a full payload. Maximum revenue payload is 102 metric tons (224,868 lb). The 777F entered service in February 2009.

Initially, the 777F was powered exclusively by the 489-kN (110,100-lbst) General Electric GE90-110B1L turbofan engine. Customers now have a choice of two engines, either the GE90-110B1L or the 512-kN (115,300-lbst) GE90-115BL.

777-300ER. The 777-300ER, also called the longer range 777-300, is a new version of the 777-300. It was formerly known as the 777-300X. The 777-300ER carries 365 passengers in a three-class configuration. Maximum takeoff weight is 351,530 kilograms (775,000 lb). The maximum range of the -300ER is 14,685 kilometers (7,930 nm). The engine for the -300ER is the General Electric GE90-115B, rated at 512 kN (115,300 lbst).

The initial 777-300ER flight test aircraft was rolled out in November 2002. It made its first flight in February 2003. A second -300ER flight test aircraft made its initial flight in April 2003. These two flight test aircraft were later refurbished and reconfigured, and were

delivered to a customer in mid-2004. The initial production -300ER flew for the first time in January 2004.

The 777-300ER was awarded certification in March 2004 by the U.S. Federal Aviation Administration (FAA) and the European Aviation Safety Agency (EASA). Initial delivery of the -300ER occurred the following month.

777-100X. Boeing once considered development of a shortened version of the 777, called the 777-100X. This effort was eventually shelved, but Boeing later began examining a revised -100X concept.

The original -100X concept had a maximum takeoff weight of 287,150 kilograms (633,047 lb). Range was to have been 16,700 kilometers (9,003 nm).

The revised -100X has a maximum takeoff weight of 276,696 kilograms (610,000 lb) and a range of approximately 13,541 kilometers (7,300 nm).

777-250ERX. A new version of the 777, called the 777-250ERX, has also been studied by Boeing. The 777-250ERX would have a range similar to that of the 777-300ER and more capacity than the 777-200LR.

Program Review

Background. During the course of three years of intense market research and concept definition studies, Boeing determined that development of an all-new aircraft was necessary, well beyond the company's earlier consideration of a simple 767 stretch and re-wing. Boeing knew that the fuselage cross-section of the 767 was a limiting factor, with carriers wanting an aircraft at least the width of the Airbus A300 and more nearly that of Boeing's own 747. This would provide the flexibility of six- to 10-abreast seating. Boeing also considered a double-deck design, harking back to the early 1950s Stratocruiser concept. Here, too, the 767's fuselage design meant difficulties if a dual-deck layout were to be seriously considered. Finally, and with the help of significant airline consultation, Boeing opted for what was essentially an all-new design, incorporating flight deck commonality with the 747-400 and little, if any, commonality with the 767.

767X/777 Gestation. In the fall of 1989, Boeing revealed diagrams of a preliminary 767X. It had an all-new fuselage, nose section, and tail, and a wing that would eventually grow to a span of more than 190 feet. This wingspan actually presented some minor problems to Boeing and its potential customers. Ground handling requirements became a real issue for the aircraft. Several airlines considering the 777 as a direct replacement for the DC-10 and the L-1011 were shown technical data by Boeing. These airlines said that they would prefer a wingspan of approximately 52 meters (171 ft), roughly the same as that of the DC-10. However, Boeing eventually opted for a 199.9-foot wingspan as its maximum (which was later exceeded on the 777-200LR/-300ER), using optional folding wingtips.

Carriers selecting the folding wing pay only a slight penalty in weight but are able to use existing widebody trijet gates. Other carriers that have more gate flexibility can select either the straight wing with no provision for folding tips, or a wing with the wingtip separation and locking mechanism in place but no actuation system. (If required, an E-Systems designed hydraulic actuation mechanism can be retrofitted at a later date.)

In late 1989, Boeing established a new division to handle design, engineering, and marketing of the 767X. Throughout the following year, Boeing worked closely with major target airline customers, including United, American, Delta, British Airways, Cathay Pacific, and All Nippon, to define interior configurations, passenger complements, galley and lavatory locations, and maintenance requirements.

On October 15, 1990, United placed firm orders for 34 777s and optioned 34 additional 777s. The aircraft would be powered by Pratt & Whitney PW4000 turbofans. Boeing launched the 777 program two weeks later on October 29. All Nippon followed with 15 firm orders and 10 options for the 777 in December 1990.

Market-Spanning Range of Models

Three Versions. When it launched the 777, Boeing announced that at least three different versions would be available within two years of each other. These versions would span the widebody market from short-haul, high-density travel to very long-range, high-density transoceanic route systems. This derivative plan placed the 777 in competition with the A330 at the low end of the range chart and the MD-11 and the A340 at the high end.

The first model, known as the 777-200, was specifically designed as a replacement for aging DC-10s and L-1011s. The second model, now known as the 777-200ER, represented the first extended-range derivative. Seating capacity was essentially the same as that of the -200 but with a range that initially exceeded 5,950 nautical miles.

The third model, the C market aircraft, was a potential ultra-long-range version capable of 7,000-nautical-mile segments. It would thus have formed part of the replacement market for early-model 747-100s and 747-200s. However, growth in the range of the 777-200ER (which currently exceeds 7,700 nautical miles) left the future of the C market aircraft uncertain, and, ultimately, the C market model was never built.

A 777-300 stretched version was later developed that accommodated up to 550 passengers.

Engine Battle. In the years prior to the final 777 definition phase, it had been assumed that all three engine builders would offer derivatives of their big turbofans: the GE CF6-80, the P&W PW4000, and the Rolls-Royce Trent. However, in January 1990, GE announced that it was going to develop an all-new engine, the GE90. This engine has a 120-inch fan. Initially, it was to be certificated at 80,000 lbst, but this was subsequently increased to 84,700 lbst, with derating in service for the 777 at 75,000-80,000 lbst.

In early 1989, Pratt & Whitney had been planning a 72,000-lbst version of the PW4000, with a 104-inch fan, for the 777. But, as 777 thrust requirements grew, Pratt continued to evolve its product. United launched the PW4073 in October with its order for 34 777s. However, the PW4074 and PW4077 derated variants of the PW4084 were used on the basic 777-200. The 777-200ER uses either the PW4090 rated at 90,000 lbst or the PW4084 rated at approximately 84,000 lbst.

As for Rolls-Royce engines, the 777-200 was marketed with either the Trent 875 or the Trent 877, both rated in the 74,000-77,000 lbst class. The -200ER has been sold with uprated versions of the Trent 800: the Trent 884, the Trent 890, the Trent 892, and the Trent 895.

Program Schedule. Joint FAA/JAA certification for the Pratt-powered 777 was received in April 1995. Initial delivery, to United Airlines, occurred in May 1995, followed by service entry the following month.

The first five 777s were powered by PW4000 engines. The sixth aircraft, powered by GE90 powerplants, flew for the first time in February 1995. Initial delivery of a GE90-powered 777, to British Airways, was originally scheduled for September 1995. This was delayed, though, for several weeks in order to complete certification testing. Modifications had been made to the GE90 engine, which had become necessary based on earlier flight testing. Delivery eventually occurred in November, and three GE90-powered 777s were delivered by the end of 1995.

Meanwhile, the initial Trent-powered 777 flew for the first time in May 1995. Certification and initial delivery occurred in April 1996.

ETOPS. In May 1995, the Pratt-powered 777 became the first aircraft ever to receive FAA approval to fly using Extended-range Twin-engine Operational Performance Standards (ETOPS) at service entry. That month, the aircraft was presented with 180-minute ETOPS approval.

As noted above, the 777 is also marketed with General Electric and Rolls-Royce engines; each of these versions had to receive separate ETOPS approval. Both the GE-powered aircraft and the Rolls-powered aircraft received 180-minute ETOPS approval from the FAA in October 1996.

Related News

Boeing Plans to Increase 777 Production Rate – In December 2010, Boeing announced plans to increase the production rate for the 777 to 8.3 aircraft per month in the first quarter of 2013. This was the second production increase announced in 2010 for the 777 program. In March, the company had said that it would increase production from five to seven aircraft per month starting in mid-2011.

"In response to strong customer demand globally, we are increasing our yearly production to 100 777s," said Boeing Commercial Airplanes President and CEO Jim Albaugh.

Boeing said that its suppliers are prepared to support the rate increase. (Boeing, 12/10)

Funding

Boeing estimated the total cost of 777 certification at $4.0 billion (in 1990 U.S. dollars).

Boeing 777

Contracts/Orders & Options

(As of February 2011)

Operator	Designation	Quantity	Phase
Air Austral	777-200LR	2	On Order
Air China	777-300ER	19	On Order
Air France	777-300ER	11	On Order
Air France	777F	1	On Order
Air France	777F	3	Option
Air India Ltd	777-300ER	3	On Order
Air New Zealand Ltd	777-300ER	4	On Order
Air New Zealand Ltd	777-300ER	3	Option
All Nippon Airways (ANA)	777-200ER	5	On Order
American Airlines	777-200ER	7	On Order
American Airlines	777-200ER	34	Option
American Airlines	777-300ER	2	On Order
Arik Air Ltd	777-300ER	2	On Order
Asiana Airlines Inc	777-200ER	2	On Order
Biman Bangladesh Airlines	777-300ER	4	On Order
Biman Bangladesh Airlines	777-300ER	4	Option
BOC Aviation	777-300ER	8	On Order
British Airways	777-300ER	1	On Order
British Airways	777-300ER	4	Option
Cathay Pacific Airways	777-300ER	18	On Order
China Southern Airlines	777F	1	On Order
Delta Air Lines Inc	777-200LR	23	Option
Dubai Aerospace Enterprise	777F	6	On Order
El Al Israel Airlines Ltd	777-200ER	2	Option
Emirates	777-300ER	48	On Order
Emirates	777-300ER	20	Option
Ethiopian Airlines	777-200LR	2	On Order
Etihad Airways	777-300ER	9	On Order
Etihad Airways	777F	1	On Order
FedEx	777F	14	On Order
FedEx	777F	15	Option
Garuda Indonesian Airways	777-300ER	10	On Order
Garuda Indonesian Airways	777-300ER	10	Option
GECAS	777-300ER	4	On Order
GECAS	777F	2	On Order
Guggenheim Aviation Partners	777F	3	On Order

Operator	Designation	Quantity	Phase
Jet Airways (India) Ltd	777-300ER	2	On Order
Jet Airways (India) Ltd	777-300ER	7	Option
KLM - Royal Dutch Airlines	777-300ER	2	On Order
KLM - Royal Dutch Airlines	777-300ER	2	Option
Korean Air	777-300ER	6	On Order
Korean Air	777-300ER	3	Option
Korean Air	777F	5	On Order
LAN Airlines SA	777F	2	On Order
Oak Hill Capital Management LLC	777F	2	On Order
Philippine Airlines Inc	777-300ER	4	On Order
Qatar Airways	777-200LR	2	On Order
Qatar Airways	777-200LR	13	Option
Qatar Airways	777-300ER	3	On Order
Qatar Airways	777F	1	On Order
Saudi Arabian Airlines	777-300ER	12	On Order
Saudi Arabian Airlines	777-300ER	10	Option
TAAG Angola Airlines	777-300ER	2	On Order
TAAG Angola Airlines	777-300ER	2	Option
TAM Linhas Aereas SA	777-300ER	4	On Order
THY Turkish Airlines	777-300ER	6	On Order
Unidentified	777-200LR	1	On Order
Unidentified	777-300ER	6	On Order
Unidentified	777F	3	On Order
Virgin Blue Airlines Pty Ltd	777-300ER	6	Option

Timetable

Month	Year	Major Development
	1987	Boeing begins studies of stretched 767
	1988	Boeing reveals several new 767 configurations
	1989	767X program announced; concept definition studies begun
Late	1989	Boeing concludes 767X concept definition studies; establishes new division for 777
Oct	1990	United orders 34 777s; Boeing launches project
Dec	1990	All Nippon becomes second 777 customer
Jun	1994	First flight
Apr	1995	Joint FAA/JAA certification of Pratt-powered aircraft
May	1995	Pratt-powered 777 receives 180-minute ETOPS approval from FAA
Jun	1995	Initial delivery

Boeing 777

Worldwide Distribution/Inventories

(As of February 2011)

Operator	Designation	Quantity
AeroLogic GmbH	777F	8
Aeromexico	777-200ER	4
Air Austral	777-200ER	3
Air Austral	777-300ER	2
Air Canada	777-200LR	6
Air Canada	777-300ER	12
Air China	777-200	10
Air France	777-200ER	24
Air France	777-300ER	31
Air France	777F	2
Air India Ltd	777-200LR	8
Air India Ltd	777-300ER	12
Air New Zealand Ltd	777-200ER	8
Air New Zealand Ltd	777-300ER	1
Alitalia	777-200ER	10
All Nippon Airways (ANA)	777-200	17
All Nippon Airways (ANA)	777-200ER	6
All Nippon Airways (ANA)	777-300	7
All Nippon Airways (ANA)	777-300ER	19
American Airlines	777-200ER	47
Asiana Airlines Inc	777-200ER	11
Austrian Airlines	777-200ER	4
Biman Bangladesh Airlines	777-200ER	1
British Airways	777-200	3
British Airways	777-200ER	42
British Airways	777-300ER	3
Cathay Pacific Airways	777-200	5
Cathay Pacific Airways	777-300	12
Cathay Pacific Airways	777-300ER	18
China Cargo Airlines	777F	4
China Southern Airlines	777-200	2
China Southern Airlines	777-200ER	7
China Southern Airlines	777F	5
Continental Airlines	777-200ER	21
Delta Air Lines Inc	777-200ER	7
Delta Air Lines Inc	777-200LR	10

Operator	Designation	Quantity
EgyptAir	777-200ER	4
EgyptAir	777-300ER	4
El Al Israel Airlines Ltd	777-200ER	6
Emirates	777-200	3
Emirates	777-200ER	6
Emirates	777-200LR	10
Emirates	777-300	12
Emirates	777-300ER	53
Emirates	777F	2
Ethiopian Airlines	777-200LR	2
Etihad Airways	777-300ER	6
EVA Air	777-300ER	13
FedEx	777F	11
JAL Domestic	777-200	1
JAL International	777-200	14
JAL International	777-200ER	10
JAL International	777-300	8
JAL International	777-300ER	13
Jet Airways (India) Ltd	777-300ER	3
Kenya Airways Ltd	777-200ER	4
KLM - Royal Dutch Airlines	777-200ER	15
KLM - Royal Dutch Airlines	777-300ER	4
Korean Air	777-200ER	18
Korean Air	777-300	3
Korean Air	777-300ER	6
Kuwait Airways Corp	777-200ER	2
LAN Airlines SA	777F	1
LAN Cargo SA	777F	1
Malaysia Airlines	777-200	1
Malaysia Airlines	777-200ER	16
Mid East Jet Inc	777-200ER	1
Pakistan International Airlines Corp	777-200ER	4
Pakistan International Airlines Corp	777-200LR	2
Pakistan International Airlines Corp	777-300ER	3
Philippine Airlines Inc	777-300ER	2
Qatar Airways	777-200LR	8
Qatar Airways	777-300ER	13
Qatar Airways	777F	2
Royal Brunei Airlines Ltd	777-200ER	6

Boeing 777

Operator	Designation	Quantity
Saudi Arabian Airlines	777-200ER	23
Singapore Airlines Ltd	777-200ER	35
Singapore Airlines Ltd	777-300	6
Singapore Airlines Ltd	777-300ER	21
TAAG Angola Airlines	777-200ER	3
TAM Linhas Aereas SA	777-300ER	4
Thai Airways International	777-200	8
Thai Airways International	777-200ER	6
Thai Airways International	777-300	6
Thai Airways International	777-300ER	3
Thai Airways International	777F	2
THY Turkish Airlines	777-300ER	9
Transaero Airlines	777-200	1
Transaero Airlines	777-200ER	8
Transaero Airlines	777-300	4
Turkmenistan Airlines	777-200LR	1
United Airlines	777-200	19
United Airlines	777-200ER	34
V Australia	777-300ER	5
Vietnam Airlines Corp	777-200ER	10

Market Intelligence Service Subscribers: The Airline Inventories, Orders and Options appendix provides instructions on how to access an online database of up-to-date listings. Use this database to obtain detailed, current information.

Forecast Rationale

Production to Increase

In December 2010, Boeing announced plans for another production increase for the 777, saying that it intended to increase the build rate to 8.3 aircraft per month in the first quarter of 2013. This was the second planned 777 production increase announced by the company in 2010. In March, Boeing said that it intended to raise 777 production to seven aircraft per month in mid-2011 (from the then-current rate of five per month).

A build rate of 8.3 aircraft per month translates into production of 100 aircraft per year. Boeing officials indicated that its decision to ramp up to such a rate was spurred by strong global demand. Nevertheless, customer demand may not be the sole motivating factor behind this bold move, particularly as it would come on the heels of the earlier build rate increase to seven 777s per month. Boeing ended 2010 with an order backlog for 253 777s, only about three years worth of production at the seven-per-month rate.

So, more seems to be involved here than a simple response to market demand. It is surely no coincidence that increasing 777 output to 8.3 aircraft per month in 2013 would bring Boeing added revenue after having spent considerable resources in bringing the new 787 and 747-8 to market. And this additional revenue would prove quite useful in helping Boeing fund such potential new projects as a possible upgrade of or replacement for its 737 narrowbody family.

In addition, the 777 is now facing its first true direct sales competition in the form of Airbus' new A350 XWB. Ramping up the 777 build rate will help Boeing guard against the possibility of losing customers

to the XWB solely because of a lack of 777 delivery slots.

Family Improvements

A family of three aircraft models, the A350 XWB series poses a significant competitive threat to the 777. Airbus has positioned the A350-900 variant, which is scheduled to enter service in 2013, as nearly a direct competitor to the 777-200ER. Already, the A350-900 appears to be eroding sales of the 777-200ER. From 2008 through 2010, Airbus garnered 179 orders for the A350-900, while Boeing recorded only 18 for the 777-200ER. In 2010 alone, the results were 70 orders for the A350-900 and none at all for the 777-200ER.

Even without the advent of the A350-900, the market for the 777-200ER would likely have been dwindling by this point in time. The Airbus model is simply accelerating the process. A different situation and, for Boeing, a more critical situation exists in regard to the 777-300ER. The -300ER faces competition from the A350-1000. The -300ER has proven to be quite popular and, in the absence of the A350-1000, would probably continue to dominate its segment of the market for years to come. However, the presence of the A350-1000 changes the competitive dynamics considerably. And, as the 777-300ER is the production mainstay of the 777 series, the battle between the -300ER and the A350-1000 is a crucial one for Boeing and its future position in the widebody market. The A350-1000 is scheduled to enter service in late 2015. As of the end of 2010, Airbus had 75 orders for this model.

In the face of the XWB competition, Boeing is already implementing certain incremental improvements to the 777, while mulling the possibility of instituting further improvements in the longer term. The incremental improvements include an Enhanced Thrust Management package for the GE90 engines of new-build and existing 777-300ERs. This package increases engine thrust by 1.0 to 2.5 percent, and enables greater takeoff weight at higher altitude airports. Another improvement being implemented for the 777-300ER is a 2,270-kilogram (5,000-lb) increase in the aircraft's maximum zero fuel weight, which provides a payload increase equivalent to 20-25 passengers.

Meanwhile, Boeing is considering an extension to the wingspan of the 777, with late 2012 being posited as a service entry date for this increased-span wing.

More comprehensive changes are being considered for the 777 for the longer term. These include a new engine and a composite wing. Alternatively, Boeing could opt to develop a clean-sheet design to replace the 777 series. At least publicly, Boeing claims that it can afford to wait to see how the A350-1000 program shapes up before it embarks on major changes to the 777-300ER. Complicating the situation is the fact that, due to Airbus' late 2010 launch of the re-engined A320neo, Boeing may now have to address the future of its 737 narrowbody family much sooner than it would have preferred, either by re-engining the 737 or developing an all-new replacement. In February 2011, Boeing Commercial Airplanes CEO Jim Albaugh said that his company will not attempt to develop a 737 replacement and make major changes to the 777 at the same time.

Pending a crystallization of Boeing's plans, our forecast does not include a re-engined 777 variant or a 777 replacement aircraft.

Order Backlog

At the end of 2010, the order backlog for the 777 totaled 253 aircraft, including 14 777-200ERs, 8 777-200LRs, 190 777-300ERs, and 41 777Fs. As can be seen by these figures, the versatile -300ER is by far the most popular of the current 777 production models. The -300ER benefits from ongoing route fragmentation and a quest on the part of airlines for ever more point-to-point services.

Meanwhile, it is possible that the 777-200ER will no longer be in production by the end of the 10-year forecast period. Boeing might soon launch a stretched version of the 787 (the so-called 787-10) in order to stave off competition from the A350-900. It is true that the 787-10 would probably cannibalize 777-200ER demand, and perhaps even kill off the -200ER entirely, but this is a trade-off that Boeing would likely be willing to make.

The 777F dedicated freighter entered service in February 2009, with launch customer Air France. By the end of 2010, Boeing had delivered 38 777Fs to various customers, out of an order book for 79 of the type. Sales of the 777F can be expected to improve significantly as the air cargo market continues to grow.

The 777F was derived from the ultra-long-range 777-200LR passenger model. The -200LR is very much of a niche product, underscored by the fact that the 777F has outsold the -200LR (79 orders to 56) despite being available for sale for a shorter period of time. The 777-200LR can connect almost any two cities in the world nonstop, and appeals primarily to airlines that fly long, thin routes.

Note: *Historical production (through 2010) does not include 60 777-300s.*

Boeing 777

Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program		**High Confidence**				**Good Confidence**			**Speculative**			
	Thru 2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**Total**
Boeing Commercial Airplanes												
777 -200 LR <> GE90												
	48	5	2	2	3	5	4	4	3	3	3	34
777 -200/-200 ER <> GE90												
	170	0	0	0	0	2	1	0	1	0	0	4
777 -200/-200 ER <> PW4000												
	150	1	2	3	1	0	1	0	1	1	0	10
777 -200/-200 ER <> Trent 800												
	183	0	0	4	3	0	1	1	1	1	0	11
777 -300 ER <> GE90 -115												
	261	52	62	65	66	68	64	63	59	58	56	613
777 F <> GE90												
	38	16	18	19	22	23	23	23	22	21	21	208
Subtotal	850	74	84	93	95	98	94	91	87	84	80	880
Total	850	74	84	93	95	98	94	91	87	84	80	880

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