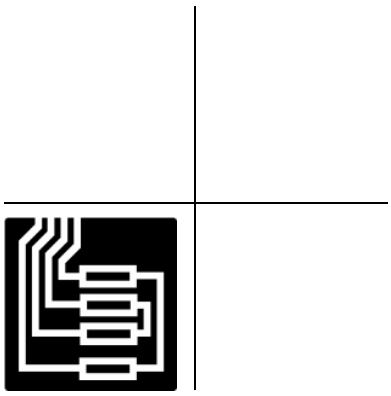
Boeing 727 - Achived 8/2004

Outlook

- Accelerated 727 retirements have all but killed potential for further hushkitting, cargo conversions
- Modest electronics upgrades may continue in short term

Note: Icons indicate area(s) of current retrofit/modernization activity



Orientation

Description. Short- to medium-range, narrowbody trijet transport.

Developer/Primary Manufacturer. Boeing Commercial Airplanes, Seattle, WA, USA.

Current Status. Series production ended in 1985.

Total Produced. Total of 1,832 broken down as follows:

727-100	408
727-100C	164
727-200	1,245
727-200F	15
Total	1,832

Application. Three-engine commercial jet transport accommodating 145-189 passengers depending on configuration and layout.

Price Range. On the used aircraft market, a 727-100 typically sells for $750,000-$1.25 million, while a 727-100C/QC can be bought for $1.35-$2 million. As for other models: 727-200, $1.5-$2.15 million; 727-200 Adv, $3-$5 million (add $5 million for re-engined aircraft).

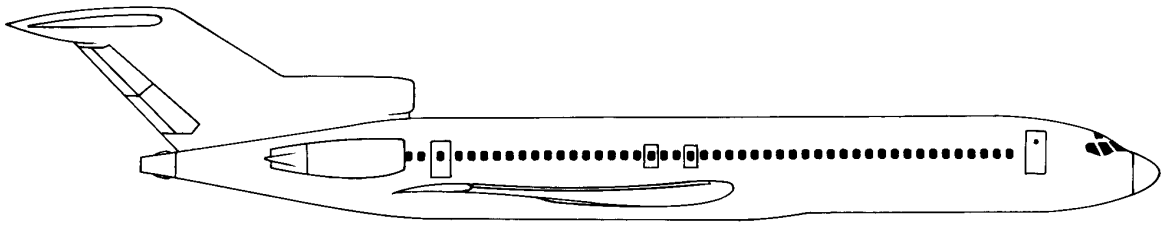
Technical Data

(727-200 ADV)

	Metric	US
Dimensions		
Length overall	46.69 m	153.14 ft
Height overall	10.37 m	34.0 ft
Wingspan	32.93 m	108.0 ft
Wing area, gross	157.9 sq m	1,700.0 sq ft
Weight		
Operating weight empty[(a)]	45,360 kg	100,000 lb
Max T-O weight	95,029 kg	209,500 lb

	Metric	US
Performance		
Max operating speed	Mach 0.90	
Max level speed[(b)]	1,017 kmph	549 kt
Range[(c)]	4,392 km	2,370 nm
Propulsion		
Three Pratt & Whitney JT8D-9A turbofans		
Thrust (each)	64.5 kN	14,500 lbst
or		
Three Pratt & Whitney JT8D-15 turbofans		
Thrust (each)	68.9 kN	15,500 lbst
or		
Three Pratt & Whitney JT8D-17 turbofans		
Thrust (each)	71.2 kN	16,000 lbst
or		
Three Pratt & Whitney JT8D-17R turbofans		
Thrust (each)	77.4 kN	17,400 lbst

[(a)]Typical
[(b)]At 6,585 m (21,600 ft); brake release weight of 83,825 kg (184,800 lb).
[(c)]At long-range cruising speed, with fuel load of 36,831 liters (9,730 US gallons) and payload of 12,474 kg (27,500 lb), ATA domestic reserves; brake release weight of 95,029 kg (209,500 lb).



BOEING 727-200

Source: Forecast International

Program Review

Background. One of the most successful transports in modern times, the Boeing 727 is in service with more than 100 carriers throughout the world. The aircraft was developed primarily to meet a United Airlines requirement and was unique at the time in that it was the first US transport featuring rear-mounted engines.

The initial design, the 727-100, was announced in December 1960, although design work had begun in mid-1959. First deliveries were made in October 1963. This first model was powered by JT8D-1 turbofans, had a gross weight of 72,576 kilograms (160,000 lb), and carried up to 131 passengers. It later became available with optional -9 engines which permitted a weight increase to 76,658 kilograms (169,000 lb). Boeing has since offered several developed versions of the -100 series and also introduced the stretched -200 series.

Variants/Upgrades

727-100. Initial production version.

727-100C. This convertible cargo/passenger version is similar to the 727-100 except for a heavier flooring and supporting structure, plus a large forward-loading cargo door. It handles the same cargo pallets as Boeing's 707-320C, and has removable galleys and seats. In all passenger configurations it accommodates 92-96 mixed class seats, and in passenger/freight combination a typical layout accommodates 50-54 passengers, plus up to 17,237 kilograms (38,000 lb) of

cargo on eight pallets. In the latter configuration, it has a range of about 2,300 nautical miles.

727-100QC. This is basically similar to the above, except that it incorporates a "quick change" kit consisting of palletized seats and galleys, and can be converted for either freight or passengers in about half an hour.

727-200. In 1965, Boeing introduced this stretched version, with a 20 foot fuselage plug, a revised center engine intake, and other structural modifications to accommodate the additional loads. Passenger capacities range from 134 to 189 in various class arrangements and seat pitches. Standard engines were the JT8D-9, but customers could also order the -11, 66.7 kN (15,000 lbst) or -15, 68.9 kN (15,500 lbst).

Advanced 727-200. In 1971, Boeing introduced an extended-range airplane with take-off weights between 78,472 kilograms (173,000 lb) and 95,029 kilograms (209,500 lb), depending upon engines selected. This aircraft is the same size as the basic 727-200 but is fitted with extra fuel tanks, increasing the range to 2,500 nautical miles. It also features a redesigned interior for a widebody look, plus advanced sound suppression equipment. In all-tourist class, this model carries 189 passengers at 30-inch pitch or 155 at 34-inch pitch. In typical mixed class it accommodates 20 first-class travelers in 38-inch pitch seats, plus 114 tourists in 40-inch seats. Besides the JT8D-9A, the Advanced 727-200 is also available with the JT8D-15, -17, or -17R engines. The latter incorporates the Boeing Automatic Performance Reserve (APR) system which, when sensing a loss of thrust in an engine during take-off and initial climb, automatically increases thrust on the other two. This option is particularly attractive to carriers operating under hot/high conditions. Lloyd Aereo Boliviano (LAB), Kuwait, Hughes Airwest, Avianca, and Mexicana specified these powerplants.

727-200F. This is an all-cargo model that was ordered by Federal Express Corp. Basically, it is a -200C with a large cargo door. The aircraft is powered by Pratt & Whitney JT8D-17A engines and allows Federal Express to carry 25,855 kilograms (57,000 lb) of cargo. Deliveries began in June 1983 and were completed in September 1984.

Milestones

Month	Year	Major Development
	1959	Design work begun
Dec	1960	727 announced
Oct	1963	Initial 727-100 deliveries begun
Nov	1967	727-200 certificated
Jun	1972	Advanced 727-200 initial deliveries begun
Jul	1979	1,500th 727 delivered
	1987	Flight tests of Valsan re-engined 727
Late	1992	First flight of Tay-powered 727-100

Worldwide Distribution

Region	Country	Total	Type	Avg. Age (Yrs)
Commercial Operators				
Africa				
	Algeria			
	Air Algerie	11	727-200	22
	Angola			
	Air Gemini	7	727-100C	36
	Angola Air Charter	10	727-100F	37
	Sonair Sarl	4	727-100C/F	33
	Transafrik	5	727-100F	37
		4	727-100C	36
		3	727-200	33

Region	Country	Total	Type	Avg. Age (Yrs)
Commercial Operators (continued)				
Africa (continued)				
	Cameroon			
	Cameroon Airlines	2	727-200 Adv	25
	Congo			
	Scibe Airlift	2	727-100	38
	Hewa Bora Airways	2	727-100	38
		3	727-200	32
	Gabon			
	Air Gabon	1	727-200	23
	Kenya			
	African Airlines Int'l	2	727-200	32
	Libya			
	Libyan Arab			
	Airlines	10	727-200 Adv	28
	Nigeria			
	Albarka Air	3	727-200	31
	Chanchangi Airlines	5	727-200	23
	Kabo Air	2	727-100	39
		6	727-200	33
	ADC Airlines	3	727-200F	34
	Okada Air	3	727-200	32
	Triax Airlines	2	727-100	37
	South Africa			
	Airworld	2	727-200/F	30
	Comair	6	727-200	27
	Million Air Charter	2	727-100	38
	Nationwide Air Charter	2	727-100	36
		3	727-200	30
	Safair	2	727-200	31
	Sudan			
	Sudan Airways	1	727-200	34
	Tunisia			
	Tunis Air	2	727-200 Adv	27
Asia				
	Afghanistan			
	Ariana	9	727-200	27
	Indonesia			
	Bouraq Indonesia	3	727-200 Adv	27
	Malaysia			
	Transmile	5	727-200/F	24
	Mongolia			
	Miat Mongolian	1	727-200	34
Australia/New Zealand				
	Australia			
	Australia Air Express	5	727-200/F	25
		1	727-200F	32
Central America				
	Dominican Republic			
	Dominicana de Aviacion	2	727-200 Adv	29
	Panama			
	Panavia	1	727-100F	38
	DHL Aero	3	727-200 Adv	30

Region	Country	Total	Type	Avg. Age (Yrs)
Commercial Operators (continued)				
Europe				
	Belgium			
	European Air Transport	1	727-100F	32
		6	727-200/F	36
	Denmark			
	Star Air	4	727-100F	36
	Sterling Airways	1	727-200 Adv	30
	France			
	Corsair	2	727-100	38
	Greece			
	Olympic Airways	7	727-200	34
	Ireland			
	Air Contractors	5	727-200F	32
	Spain			
	Iberia	19	727-200	30
	Swiftair	8	727-200F	29
	Sweden			
	Air Operations	8	727-200	34
	Switzerland			
	Jet Aviation Management	2	727-200	22
	Turkey			
	Noble Air	2	727-200	34
	Turk Hava Yollari	1	727-200 Adv	24
	United Kingdom			
	Aerospace Finance	3	727-200 Adv	28
	Yugoslavia			
	Aviogenex	1	727-200	24
	JAT	6	727-200 Adv	28
Middle East				
	Iran			
	Iran Air	3	727-100	34
		5	727-200 Adv	27
	Iran Asseman	4	727-200 Adv	23
	Iraq			
	Iraqi Airways	6	727-200 Adv	20
	Libya			
	Libyan Arab	12	727-200 Adv	27
	Syria			
	Syrian Arab	5	727-200 Adv	24
	UAE			
	Sky Aviation	4	727-200 Adv	26
	Yemen			
	Yemen Airways	5	727-200 Adv	25
North America				
	Canada			
	All Canada Express	1	727-100C	36
		9	727-200/F	24
	Skyservice	1	727-200	34
	First Air	4	727-100/C	37
		2	727-200F	31
	Kelowna Flightcraft	4	727-100C/F	33
		13	727-200/F	29

Region	Country	Total	Type	Avg. Age (Yrs)	
Commercial Operators (continued)					
North America (continued)					
	Canada (continued)				
	Morningstar Air	3	727-100	36	
	Mexico				34
	Aeroejecutivo	1	727-100	39	
		6	727-200	33	33
	Aerolineas Int'l	1	727-100	36	39
		5	727-200	33	35
	Aerosur	3	727-200 Adv	23	35
	Allegro Air	11	727-200	29	23
	Aviacsa	9	727-200	32	27
	Mexicana	10	727-200 Adv	23	28
	TAESA	2	727-100C	38	37
	United States				
	Aviation Capital Group	2	727-200	24	
	Aviation Systems Int'l	5	727-200	35	
	Boeing Capital Corp.	4	727-100	37	
	Capital Cargo	17	727-200/F	27	
	Champion Air	14	727-200	23	
	Continental Airlines	1	727-200	28	
	Custom Air Tpt	3	727-100C	27	
		7	727-200F	29	
	Dallas Aerospace	6	727-200	32	
	DHL Airways	18	727-200F Adv	24	
	DHL Worldwide Courier	11	727-100/C/F	38	
		6	727-200	34	
	Evergreen Int'l Airlines	7	727-100/C/F	38	
	Express Net Airlines	2	727-100F	37	
		3	727-200	28	
	Express One Int'l	5	727-100F	32	
		14	727-200F	34	
	Falcon Air Express	3	727-200	25	
	Federal Express	41	727-100C/F	36	
		94	727-200	29	
	Finova	13	727-200/F	26	
	GECAS	6	727-200	33	
	ILFC	4	727-200	34	
	International Air Leases	6	727-200	33	
	International Capital Eqpmt	6	727-100	38	
	Kitty Hawk	23	727-200/F/Adv	29	
	Miami Air Int'l	6	727-200/F	24	
	Northern Air Cargo	4	727-100F	37	
	Pacific Aviation Holding	5	727-200/F	25	
	Pan American	22	727-200	25	
	Pegasus Aviation	15	727-200/F	28	
	Planet Airways	1	727-100	37	
		5	727-200	25	
	Polaris Leasing	3	727-100	38	
		15	727-200	36	
	Quest Air Parts	7	727-200/Adv	29	
	Ram Air Sales	5	727-200	25	
	RD Aviation LLC	3	727-100	36	

Region	Country	Total	Type	Avg. Age (Yrs)
Commercial Operators (continued)				
North America (continued)				
	United States (continued)			
	Republic Air Freighter	7	727-200 Adv	27
	Republic Financial Corp.	9	727-200/F	30
	Ryan Int'l	8	727-100F	36
		17	727-200	33
	Transmeridian	5	727-200	24
	UPS	44	727-100C/F	34
		8	727-200F	25
	Wells Fargo Bank	13	727-200	34
South America				
	Bolivia			
	Aerosur	2	727-100	37
		2	727-200 Adv	25
	Fly Linhas Aereas	6	727-200 Adv	26
	Lloyd Aereo Boliviano	3	727-100/C	35
		5	727-200	25
	Brazil			
	Total Linhas Aereas	3	727-200F Adv	23
	Varig	5	727-100/C/F	34
		4	727-200F	26
	VASP	3	727-200F	25
	Colombia			
	ACES Colombia	1	727-100	38
	Aerosucre	3	727-100F	36
		1	727-200F	31
	Lineas Aereas Suramericas	2	727-100/C/F	35
	SAM	8	727-100/C	37
	Satena	1	727-100	37
		1	727-200	33
	Ecuador			
	SAETA	2	727-100	37
	TAME	3	727-100	35
		6	727-200 Adv	26
	Peru			
	Aero Continente	6	727-100	36
	Aero Peru	1	727-200 Adv	30
		3	727-100	36
	Aviandina	2	727-100	39
	Venezuela			
	Aeropostal	6	727-200	24
	AVENSA	7	727-100	37
		7	727-200	30

Region	Country	Total	Type	Avg. Age (Yrs)
Government/Military				
Africa				
	Congo			
	Congo Gov't	2	727-100	37
	Nigeria			
	Nigeria Gov't	1	727-200	24
	Senegal			
	Senegal Govt	1	727-200	25
Asia				
	Taiwan			
	Taiwan Air Force	5	727-100	36
Australia/New Zealand				
	New Zealand			
	New Zealand Gov't	2	727-100C	35
Middle East				
	Jordan			
	Air Force	1	727-200	34
	Saudi Arabia			
	Gov't	3	727-100	35
	Mexico			
	Mexico Air Force	3	727-100QC	27
	Gov't	8	727-200	23
	United States			
	US Air Force	2	C-22	23
	US Marshals Service	1	727-200	29

Opportunities

Several of the largest 727 operators, among them Delta and United, have retired or are in the process of retiring their remaining 727s. As a result of the slump in passenger traffic, increasing numbers of the Boeing trijet have been placed in desert storage, thereby diluting demand for additional cargo conversions, hushkit installations, or other upgrades.

Many non-Stage 3 727s will remain in service in some of the lesser industrialized regions for years to come, but as these aircraft are often not required to meet the same noise/emission standards implemented by the US and Europe, they would appear to offer few opportunities for upgrade/modification business.

As a candidate for retrofit work, the 727 has clearly seen its day, and few additional opportunities are anticipated.

AIRFRAME

Cargo Conversions. Page Avjet, Dee Howard, MAE (Mobile Aerospace), Stambaugh, Hamilton Aviation, and Pemco Aeroplex have all offered conversions of 727-100 and -200 aircraft from passenger to cargo configuration. Approximately 500 of the Boeing trijets have been converted for all-cargo operations.

The recent slump in cargo traffic has accelerated the retirements of many older freighters such as the 727. We believe that any future demand for 727Fs will be met with cargo variants currently in desert storage.

Noise Abatement System. In early 1997, Raisbeck Engineering obtained FAA certification for its Noise Abatement System (NAS) which enables 727-200 models to comply with Stage 3 standards without hushkitting or engine modification.

The NAS design reduces drag during approach and landing by limiting the extension of the aircraft's trailing-edge flaps. The landing flaps are set at 25 degrees, rather than 30-40 degrees, which is maintained by a mechanical stop fitted to the flap quadrant. Take-off flap settings remain unchanged. This new landing configuration lowers perceived noise levels to within Stage 3 standards.

A complete 727-100 shipset costs $695,000 or, according to Raisbeck, "about 40 percent of the initial

cost of the current hushkits available." The NAS refit can be installed during a heavy maintenance C check or in three days downtime. The -200 kit sells for $1.1 million, while the -200 Heavyweight kit (max gross weight of 201,300 pounds) carries a $1.3 million price tag.

Raisbeck modified more than 150 aircraft, but future demand appears minimal, at best.

Quiet Wing System. DuganAir Technologies developed a Quiet Wing System, consisting of winglets, a flap/aileron droop system, and the removal of the No. 3 engine thrust reverser, enabling the 727-100 and lighter weight -200 versions to meet Stage 3 requirements. The system costs about $1.5 million and can be installed in seven working days. DuganAir sold about 100 Quiet Wing System kits by early 2002.

We are not anticipating further demand as most cargo operators are retiring their 727s at accelerated rates.

PROPULSION

Hushkits. Hushkits to bring JT8D engines of most 727 variants into conformity with FAA Stage III noise regulations are available to operators seeking the lowest-cost compliance option.

Pratt & Whitney and Federal Express Aviation Services Inc (FEASI), Memphis, Tennessee, offered a noise reduction kit for the 727-100 consisting of an exhaust gas mixer assembly installed with a series of airframe cowl and thrust reverser modifications. These kits cost about $1.75 million for 727-100s powered by JT8D-7s or -9s. The kit was first flown in late 1990.

Pratt and FEASI also developed a hushkit for 727-200s with JT8D-7B engines that costs about $2.2 million per shipset. The companies also developed a hushkit configuration for JT9D-9/15/17-powered 727-200s with max gross weights up to 199,000 pounds. The price of the heavyweight kit is about $2.45 million and does not include installation. FedEx has accrued orders and options for about 800 727 Stage 3 kits and has delivered about 750 Stage 3 kits.

The recent availability of Raisbeck Engineering's Noise Abatement System and the DuganAir Quiet Wing System (see entries in Airframe section, above) began impacting demand for 727 hushkits even before September 11, 2001, and the sharp slump in cargo traffic that followed.

Super 27 Re-engining. Valsan Partners developed an extensive 727-200 re-engining program to meet US FAA Stage III noise regulations; the program further provided substantial performance improvements. The effort focused on replacing the aircraft's two outboard engines with Pratt & Whitney JT8D-217C or JT8D-219 turbofan engines, while hushkitting the center engine. Valsan completed 21 conversions before it ceased trading in 1994.

In the summer of 1996, California-based Rohr (since acquired by BFGoodrich) relaunched the Valsan project, now known as the Super 27. Aside from bringing the aircraft into Stage 3 compliance, the project provides a 6 to 7 percent reduction in fuel consumption, equating to a 300-nautical-mile range increase. The mod costs $12-$15 million per aircraft, and approximately 70 aircraft had received the upgrade by the end of 2002.

ELECTRONICS

TCAS II. Since December 31, 1993, all civil transport aircraft of 31 seats or more flying in US airspace have been operating with a traffic alert/collision avoidance system (TCAS II) per FAA mandate. TCAS is a family of airborne systems operating independently of ground-based ATC systems. According to FAA officials, current TCAS II devices feature state-of-the-art Version 6.04A software which significantly reduces the false alarm rate.

Manufacturers of TCAS II systems, which cost approximately $120,000-$145,000 each, include Rockwell Collins, AlliedSignal Commercial Avionics, and Honeywell. TCAS II manufacturers will continue to refine and upgrade this equipment in the years ahead.

The US FAA recently mandated TCAS II retrofits of US-registered freighters and set a December 31, 2004, deadline for compliance.

This ruling is not expected to have a significant impact on 727 freighters, as most operators have accelerated their retirement schedules in the past 24 months due to slumping cargo demand.

HUD. Flight Dynamics Inc has been granted an FAA supplemental-type certificate (STC) for a Head-Up Guidance System (HGS) offering safety features not typically available with conventional Category II/III packages. These include a stall warning system and a windshield warning system. The HGS has been refitted to 20 727s operated by Emery, to 17 Ryan International 727s, and to 59 UPS trijets. FedEx was considering head-up display (HUD) refits for 95 727-200s, but no contract announcement has been made.

The Flight Dynamics HUD costs approximately $200,000 for the basic display and related equipment. This, however, is only about half the expense of the installation. The company also supplies a prefabricated installation kit for an additional $30,000.

NAVSTAR GPS. In 1994, the US FAA approved the satellite-based Global Positioning System (GPS) for en route operations over oceanic and remote areas with some restrictions. However, during 1997-98 concerns

about over-reliance on the GPS as the sole means of navigation surfaced in the United States, with the threat of signal-jamming receiving particular attention.

In late 1998 the FAA said it would not approve GPS for sole-use navigation, and it now appears that the agency will extend and expand the existing Loran-C system as an economical backup to GPS, at least until 2008.

Nonetheless, approximately 150 727s have already been refitted with GPS receivers, and there may be a modest number of additional modifications. Due to the stepped-up 727 retirement rates implemented by most major operators of the trijet, however, the outlook for further 727 GPS retrofits has dimmed considerably in the past 24 months.

FI's Opportunity Outlook

Program	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
ELECTRONICS															
TCAS II															
In Progress	+=> 10 (US)														
HGS															
In Progress	+=> 10-15 (US)														
Program	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17