Rolls-Royce

Civil aerospace

Rolls-Royce engines are in service with more than 600 airlines around the world.

Rolls-Royce is the world number two in commercial jet engines overall, and holds the number one position in both the high-thrust and business jet sectors.

Just over half of total company earnings are generated by the civil aerospace business, which employs around 20,000 people worldwide. Close to 60 per cent of civil aerospace revenues come from service activities.

Rolls-Royce engines power 41 of the world's top 50 airlines with a fleet of 12,000 modern engines.

Powering over 30 types of major commercial aircraft, the company's portfolio covers a range from business jets to the largest widebody airliners designed to carry over 500 passengers.

At the top of the power scale, with thrusts from 53,000lb to 95,000lb, the Trent family continues to build on its significant presence on the new generation of wide-bodied airliners from Airbus and Boeing on which it has secured the majority share of the available market.

Over 1400 Trents have been delivered with a further order book of 958 engines. In 2006, the Trent family completed more than 21 million hours in service with more than 60 customers.

First to enter service was the Trent 700 on the Airbus A330 in 1995, followed a year later by the Trent 800 on the Boeing 777. In 2002 came the Trent 500, sole powerplant for Airbus A340-500 and -600 aircraft.

Latest development programmes are the Trent 900 for the Airbus A380, due to make its airline debut in 2007, the Trent 1000 on the Boeing 787 Dreamliner, certified in 2007 for entry into service in 2008 and the Trent XWB for the A350 XWB, available for deliveries from mid-2013.

The Trent family has a direct line of heritage to the RB211 engine series which pioneered the three-shaft design philosophy unique to Rolls-Royce. As the Trent has extended its family line, the practical benefits of the three-shaft approach to large engines have become clear – better performance retention, shorter, more rugged powerplants, and lighter engines by significant margins over their two-shaft competitors.

Taking a common design approach to successive Trent variants means a cost-effective solution to development programmes, with compressor and turbine systems scaled to meet requirements. Trent technologies have also been retrofitted to RB211-524 engines, resulting in longer on-wing lives and improved fuel burn.

The V2500, produced by the International Aero Engines (IAE) consortium, in which Rolls-Royce is a senior shareholder, powers Airbus A320 series and MD-90 aircraft. A total of 3,115 V2500s have been delivered since entry into service in 1989 and orders have been placed for a further 2185 engines. IAE has a customer base of 135 airlines and leasing companies.

In the regional jet market, Rolls-Royce is represented by the AE 3007 which powers Embraer 145 series aircraft with passenger capacities from 35 to 50 seats and the BR715 on the Boeing 717. Both are exclusive powerplants for their respective aircraft.

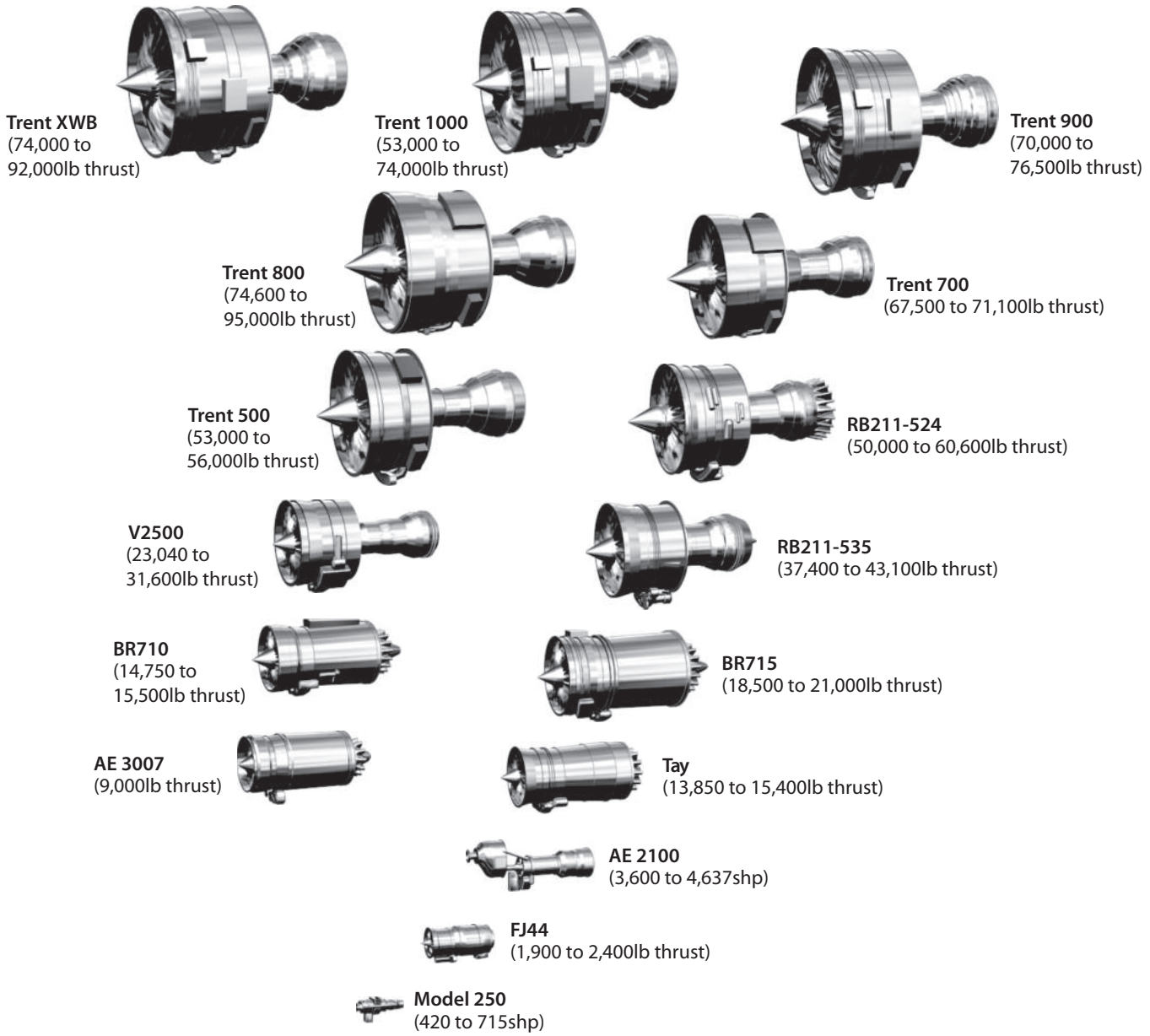
The AE 3007 is also sole engine for the Cessna Citation X corporate jet, while the BR710 holds a similar position on the G500, G550, Bombardier Global Express, Bombardier Global 5000 and the Global Express XRS which was launched in October 2003. The Tay turbofan also holds an exclusive position on the G300, G350, G400, and G450 business jets.

The three-shaft concept

The three-shaft system means that the large diameter fan is isolated on its own shaft. This allows the rest of the engine to be scaled in a variety of proportions to give different bypass and pressure ratios to suit the specific aircraft on which the engine is installed. Advances in computer-aided design mean this is a relatively simple process.

In this way, the Trent family is capable of efficiently providing thrusts from 50,000lb to over 100,000lb. Three-shaft efficiency, which allows low, intermediate and high-pressure systems to run close to their optimum speeds, actually results in fewer stages of compressors and turbines.

Civil engine product range



Risk and Revenue Sharing Partners (RRSPs)

Engine	Partners	*Financial RRSPs only
Trent 500	KHI, IHI, ITP, Goodrich, Hamilton Sundstrand, Avio, Marubeni, Fokker Elmo, TechJet, Turbomeca Africa, Volvo Aero	
Trent 700	KHI, IHI, ITP, Goodrich, Turbomeca Africa, Marubeni*, Rolls-Royce Deutschland*	
Trent 800	KHI, IHI, ITP, Goodrich, Turbomeca Africa, Marubeni*, Rolls-Royce Deutschland*	
Trent 900	ITP, Hamilton Sundstrand, Avio, Marubeni, Volvo Aero, Goodrich, Honeywell (Samsung, KHI and IHI are programme associates)	
Trent 1000	Goodrich, Hamilton Sundstrand, KHI, MHI, Carlton Forge Works	
RB211-524G/H-T	KHI, IHI	

Note: Turbomeca Africa formerly known as Denel

Engine	Power	Application
Trent	53,000 to 95,000lb	Boeing 787 Dreamliner (-8, -9, -3) Boeing 777-300 Boeing 777-200ER Boeing 777-200 Airbus A330-200, -200F Airbus A330-300 Airbus A340-500/600 Airbus A350 XWB (-800, -900, -1000) Airbus A380-800, A380F
RB211-524	58,000 to 60,600lb	Boeing 747-400 Lockheed L-1011 Boeing 767-300 Boeing 747-200 Boeing 747SP
RB211-535	37,400 to 43,100lb	Boeing 757-200 Boeing 757-300 Boeing 757-200SF Tupolev Tu-204
V2500	22,000 to 33,000lb	Airbus A319 Airbus A320 Airbus A321 Airbus Corporate Jetliner Boeing MD-90
BR710	14,750 to 15,500lb	G500 G550 GV GV-SP Bombardier Global Express and Global Express XRS Bombardier Global 5000
BR715	18,500 to 21,000lb	Boeing 717-200
Tay	13,850 to 15,400lb	G300 / G350 G400 /G450 GIV GIV-SP Fokker 70 Fokker 100 Boeing 727-100 (re-engined)
AE 3007	6,000 to 9,000lb	Embraer ERJ 135 Embraer ERJ 140 Embraer ERJ 145 Embraer Legacy Cessna Citation X
FJ44	1,900 to 2,400lb	Cessna CitationJet CJ1/CJ2 Sino Swearingen SJ30-2 Raytheon Premier I
AE 2100	4,152 to 4,637shp	L-100 Saab 2000
Model 250	420 to 450shp 420 to 715shp	Civil turboprops Civil helicopters

Trent

Key facts

- Trent 900 is the most environmentally friendly engine on the A380
- Trent 500 powering the longest scheduled operations
- Trent 800 continues as the market leading engine on the Boeing 777 with the most consistent reliability record
- Trent 700 gives the A330 its best payload capability
- Trent 1000 is the launch engine for the Boeing 787-3, -8, -9, and will enter service with ANA in 2008
- Trent engines have achieved over 21 million hours in service

Trent 500

In 1997, Airbus announced the selection of the Trent 500 as the sole engine for its next generation A340-500 and -600 ultra long range aircraft. Prior to first engine run in its development programme, over 500 Trent 500s had been sold – a record for any Rolls-Royce programme at that stage.

Cleared to a rating of 60,000lb but operated with a thrust range of 53,000 – 56,000lb, the Trent 500 has further growth potential for possible increased weight versions of the aircraft.

The Trent 500 has the same fan diameter as the Trent 700 on the A330, and a core scaled from the Trent 800, the engine in service on the Boeing 777. This combination produces an engine with the highest bypass ratio in its class, resulting in significant improvements in fuel efficiency and lower noise.

Although destined for a four-engined aircraft, the Trent 500 was developed to meet the same stringent reliability standards as those required for a twin-engine ETOPS programme.

Customers include Lufthansa, Singapore Airlines, Virgin Atlantic, Iberia, Emirates, Thai Airways International and South African Airways.

Thrust (ISA, SLS)	53,000 – 56,000lb
Flat rating	ISA +15˚C
Overall pressure ratio	*36.3
Bypass ratio	*7.5
Fan diameter	97.4 inches
Length	155 inches
Service entry	August 2002

* 56,000lb version

Trent 700

The Trent 700 is the market leader on the A330 with over 40 per cent of the customer base and order book.

With the best take off and climb performance, the Trent 700 delivers the greatest capability for the A330. The Trent 700 delivers this capability with margin resulting in high on-wing time, even in the most arduous operating regions.

The Trent 700 is the most environmentally friendly engine on the A330 with the lowest noise and lowest emissions.

The Trent 700 entered service with Cathay Pacific Airways in 1995 and now has 35 customers worldwide, including all three major airline groups in mainland China – Air China, China Southern and China Eastern.

Other Trent 700 customers include Cathay Pacific, Emirates, Singapore Airlines, Lufthansa, Dragonair, ILFC, and CIT Aerospace.

Thrust (ISA SLS)	67,500 – 71,100lb
Flat rating	ISA +22˚C
Overall pressure ratio	33.7 – 35.5
Bypass ratio	5.0
Fan diameter	97.4 inches
Length	154 inches
Service entry	March 1995
ETOPS approval (180 minutes)	May 1996

Trent 800

Available in thrusts ranging from 75,000 to 95,000lb, the Trent 800 is the most powerful civil engine produced by Rolls-Royce. It is the market leader on the Boeing 777 with a share of 40 per cent on versions of the aircraft where it competes.

Its three-shaft configuration and second generation hollow, titanium wide-chord fan blades give the Trent-powered Boeing 777 a weight advantage of up to 3.5 tons over the same aircraft using competitors' engines.

The Trent 800 is also environmentally friendly, being over 15dB quieter than Stage 3 international legislative limits and having the lowest NOx levels for this aircraft.

Maintenance advantages include its unique ability to be transported whole in the hold of a Boeing 747 freighter.

Customers include Thai Airways International – launch airline for the engine – British Airways, Emirates, American Airlines, Delta Air Lines, Cathay Pacific, Singapore Airlines and Malaysian Airlines.

Thrust (ISA SLS)	74,600 – 95,000lb
Flat rating	ISA +15˚C
Overall pressure ratio	34.5 – 41.9
Bypass ratio	6.2 – 5.7
Fan diameter	110 inches
Length	172 inches
Service entry	April 1996
ETOPS approval (180 minutes)	October 1996

Trent 900

The Trent 900 is the lead engine on the A380 programme and will power the launch customer, Singapore Airlines, into service in 2007.

The engine first ran, on schedule, in March 2003, and made its maiden flight, also on time, on the Airbus flying testbed in May 2004. Engine certification was achieved on schedule in October 2004, ahead of first flight on the A380 in April 2005.

With a core scaled from the Trent 500, the Trent 900 has the lowest levels of emissions on the A380 and is also the quietest engine available for the aircraft.

It features the first production use by Rolls-Royce of the 'swept' fan design – a scimitar-shaped blade which improves aerodynamic efficiency and also results in better resistance to foreign object damage. The engine is also the first Rolls-Royce civil engine to feature a counter-rotating high-pressure shaft. This improves efficiency, reduces weight, and improves fuel burn.

It was certified at 80,000lb thrust, well above requirements for entry into service (70,000lb thrust), allowing potential for future growth.

In addition to Singapore Airlines, Qantas, Lufthansa, Virgin Atlantic, Malaysian Airlines, Etihad Airways and China Southern have selected the Trent 900.

Thrust (ISA SLA)	70,000 – 76,500 – 80,000lb
Flat rating	ISA +15˚C
Overall pressure ratio	36.5 – 39
Bypass ratio	7.7 – 8.5
Fan diameter	116 inches
Length	179 inches
Service entry	2007

Trent

Trent 1000

The Trent 1000 is the lead engine for the Boeing 787 Dreamliner programme, and will be the fifth member of the Trent family to enter service when it begins commercial operations with ANA of Japan in 2008.

A single version of the Trent 1000 will power all variants of the Boeing 787. The engine is optimised for long-range missions performance while also supplying the required economics for short-range operations.

The Boeing 787 Dreamliner will use electrical power rather than high pressure air from its engines to supply cabin air. Trent 1000 innovations include power extraction from the intermediate pressure system to produce the required electricity via a gearbox-mounted generator. This solution, unique to three-shaft engines, will result in lower fuel burn.

The Trent 1000 will feature latest developments in intelligent engine controls – including new-generation predictive maintenance tools, which will help the drive to new, low cost of ownership levels for operators.

The eight-engine development testing programme started in Spring 2006 and is on target for engine certification in 2007.

The Trent 1000 is the launch engine for the 787-3, -8 and –9. Air New Zealand was the first customer to choose the Trent 1000.

Thrust (ISA SLS)	53,000lb – 74,000lb
Flat rating	ISA +20˚C
Bypass ratio	11.0
Fan diameter	112 inches
Certification	2007
Service entry	2008

Trent XWB

The Trent XWB is a single engine being designed specifically for the A350 XWB Family of aircraft. It will evolve as the iterative design process between Airbus and Rolls-Royce converges on the aircraft solution to meet the needs of the operator. It will be the sixth generation of Trent engine and benefit from over 75 million hours of Trent experience.

The three-shaft architecture enables each component to be scaled to give the optimum design solution. The engine will be matched to the airframe, leading to optimised fuel burn; the engine will have a thrust range that will ensure the operator can benefit from using a single engine type across the entire family.

The Trent XWB will use the latest service-ready technologies appropriate for it Entry into Service. These will be developed through the Rolls-Royce Vision process in order to provide low risk performance advances coupled with excellent environmental attributes.

Trent family experience, the latest technologies and world-class service provision will ensure that the Trent XWB offers the operator the ultimate combination of performance, reliability and value.

Thrust (ISA SLS)	74,000 to 92,000lb
Flat rating	ISA +15˚C
Certification	2011
Service entry	2013

Engine	EIS	Power		Aircraft applications	Seats	Range (nm)
Trent 556	2002	56,000lb	(249.1kN)	Airbus A340-600	380	7,690
Trent 553	2003	53,000lb	(236kN)	Airbus A340-500	313	8,735
Trent 768	1995	67,500lb	(300kN)	Airbus A330-300	295	5,600
Trent 772	1995	71,100lb	(316kN)	Airbus A330-300	295	5,600
Trent 772B	1999	71,100lb	(316kN)	Airbus A330-300, -200, -200F	295 / 253	5,600 / 6,650
Trent 875	1996	74,600lb	(332kN)	Boeing 777-200 (545,000lb)	375 (2 class)	5,065
Trent 877	1996	77,200lb	(343kN)	Boeing 777-200, -200 ER (545,000lb)	375 (2 class)	5,065
Trent 884	1996	84,950lb	(378kN)	Boeing 777-200 ER, -200, -300 (590,000lb)	301 (3 class)	5,910
Trent 892	1996	91,600lb	(407kN)	Boeing 777-200 ER, -300 (656,000lb / 660,000lb)	301 / 368 (3 class)	7,730 / 5,954
Trent 895	2000	95,000lb	(423kN)	Boeing 777-200ER, -300 (656,000lb / 660,000lb)	301 / 368	7,730 / 5,954
Trent 970	2007	70,000lb	(311kN)	Airbus A380-800	555	8,000
Trent 972	2007	72,000lb	(320kN)	Airbus A380-800	555	8,000
Trent 977	2010	76,000lb	(340kN)	Airbus A380-F	Payload 150 tonnes	56,000
Trent 1000	2008	53,000lb-74,000lb	(236kN-329kN)	Boeing 787 Dreamliner Family (-3, -8, -9)	242-317	2,965-8,305
Trent XWB	2013	74,000lb -92,000lb	(334kN-423kN)	Airbus A350 XWB Family	270-350	8,300-8,500

RB211-524 & -22B

Key facts

- 1,300 engines in service powering the L-1011 and all variants of the Boeing 747
- RB211-524 and -22B engines have logged more than 100 million flying hours
- Latest engines achieved lives over 27,500 hours

The RB211 engine series pioneered the unique Rolls-Royce three-shaft design and provides a direct lineage through to today's world-leading Trent family.

Typically shorter and more rigid than their two-shaft competitors, RB211s were introduced in 1972 when the -22B entered service as the exclusive engine on the Lockheed TriStar.

Variants of the RB211-524 then followed on the Boeing 747 and Boeing 767, culminating in the 60,600lb thrust -524G/H-T in 1998 for the Boeing 747-400 and Boeing 767-300. This version is retrofitted with a Trent high pressure system and combustor.

Thrust (ISA SLS)	*60,600lb
Flat rate	ISA +15°C
Overall pressure ratio	34.5
Bypass ratio	4.1
Fan diameter	86.3 inches
Length	125 inches
Service entry	*1998

* –524G/H-T

Engine	EIS	Power		Aircraft applications	Seats	Range (nm)
-22B	1972	42,000lb	(187kN)	Lockheed L-1001-1	270	3,000
				Lockheed L-1011-100	270	3,750
-524B & B2	1977	50,000lb	(222kN)	Boeing 747-200	366	6,230
				Boeing 747SP	280	6,174
				Lockheed L-1011-200		
				Lockheed L-1011-500		
-524B4	1981	50,000lb	(222kN)	Lockheed L-1011-250	270	4,750
				Lockheed L-1011-500	218	5,330
-524C2	1980	51,500lb	(227kN)	Boeing 747-220	366	6,230
				Boeing 747SP	280	6,169
-524D4	1981	53,000lb	(236kN)	Boeing 747-200	366	6,550
				Boeing 747SP	280	6,479
-524G	1989	58,000lb	(258kN)	Boeing 747-400	416	7,325
-524H	1990	60,600lb	(270kN)	Boeing 747-400	416	7,325
				Boeing 767-300ER	218	6,105
-524G/H-T	1998	60,600lb	(270kN)	Boeing 747-400	416	7,325
				Boeing 747-400F	–	4,445
				Boeing 767-300	218	6,105

-535

Key facts

- 1,400 engines and over 620 aircraft delivered since 1983
- 59 per cent market share of 757 at time of line closure in 2004
- First non-US engine to launch a Boeing civil aircraft
- First western powerplant certified for use on a Russian airframe (Tu-204)
- First engine to achieve more than 40,000 hours time on wing when it set the world record of 40,531 hours with Icelandair in 2000
- Over 46 million hours of highly reliable service

A lower thrust member of the family, the RB211-535, was launch engine on the Boeing 757, with the 535C. The 535C entered service in 1983 and was succeeded by the 40,100lb thrust 535E4 in 1984. Although the 757 build line closed in 2004 the 535E4B is still in production powering the Tupolev Tu-204.

The E4 set new standards in engine reliability setting an expectation for all future engines. It has achieved this position through its technology such as being the first engine to use hollow, titanium wide chord fan blades, pioneering today's new engine fan system technology.

Thrust	*43,100lb
Flat rating	ISA +14°C
Overall pressure ratio	25.8 – 28.0
Bypass ratio	4.3
Fan diameter	74.1 inches
Length	117.9 inches
Service entry	*1984

* –535E4

Engine	EIS	Power		Aircraft applications	Seats	Range (nm)
-535C	1983	37,400lb	(166kN)	Boeing 757-200	201	3,040
-535E4	1984	40,100lb	(178kN)	Boeing 757-200	201	3,900
				Boeing 757-300	243	3,395
				Tupolev Tu-204	214	2,390
-535E4B	1989	43,100lb	(192kN)	Boeing 757-200	201	3,900
				Boeing 757-300	243	3,395
				Tupolev Tu-204	214	2,390

V2500

Key facts

- Current order book stands at more than 5,100 engines worth US$35 billion
- More than 5,000 V2500 engines have been delivered or are on order
- Powering aircraft for 125 customers in more than 35 countries, the V2500 fleet has logged more than 36 million hours
- United Airlines, British Airways and JetBlue are amongst IAE's largest airline customers
- Over 35 new customers in the last three years
- 56 per cent market share since 1998
- In 2006, Spirit Airlines chose the V2500 to power 30 A319 aircraft in a deal valued at more than US$600 million to IAE. This will bring the total V2500 powered fleet of Spirit Airlines to a total number of 70 powered aircraft

The V2500 is the Rolls-Royce offering in the 22,000 to 33,000lb thrust class. The product of IAE International Aero Engines AG, a successful multi-national consortium led by senior shareholders Rolls-Royce and Pratt & Whitney together with JAEC and MTU Aero Engines, the engine powers the Airbus A319, A320, A321 and Boeing MD-90, as well as the Airbus Corporate Jetliner aircraft.

Offering up to four per cent better fuel-burn performance than alternatives, the V2500 achieves improved payload and range while reducing airline fuel bills. Superior performance retention leading to longer on-wing life is also a characteristic of the engine.

The V2500's noise and emissions levels are well within both current limits and proposed future limits, offering an operation that is less damaging to the environment as well as being less expensive to airlines.

In 1999, the first V2500-A1 Phoenix Standard engine entered service. The Phoenix Standard updates the original -A1 engine with the latest 'hot section' technology from today's -A5 engine to extend the on-wing life of the -A1 and reduce maintenance costs.

In addition to standard ratings, IAE also offers the V2527E and V2527M ratings. The V2527E is an enhanced rating, which provides additional total thrust at high altitude airports for the A320. The V2527M rating is available for the Airbus Corporate Jetliner and A319 to enhance its payload and range capabilities.

Thrust	22,000 – 33,000lb
Overall pressure ratio	29.4
Bypass ratio	5.4
Fan diameter	63 inches
Length	126 inches
Service entry	1989

Engine	EIS	Power		Aircraft applications	Seats	Range (nm)
Baseline engine:						
V2500-A1	1989	25,000lb	(111kN)	Airbus A320	150	2,700
V2500-A5 for Airbus:						
V2500-A5	1997	22,000lb	(98kN)	Airbus A319	124	1,900
V2500-A5	1997	24,000lb	(107kN)	Airbus A319	124	3,000
V2500-A5	1993	26,500lb	(118kN)	Airbus A320	150	2,900
V2500-A5	1994	31,400lb	(140kN)	Airbus A321	185	2,250
V2500-A5	1997	33,000lb	(147kN)	Airbus A321	185	2,700
V2500-D5 for Boeing:						
V2525-D5	1995	25,000lb	(111kN)	Boeing MD-90-30	153	2,045
V2528-D5	1995	28,000lb	(124kN)	Boeing MD-90-30	153	2,045

Tay

Key facts

- Over 870 Tay-powered aircraft have accumulated over 24 million hours in service
- The most reliable entry into service of any aero engine
- Tay unplanned removal and shutdown rates well below industry average

The Tay provides the quietest operation in its class and has levels of emissions well below those required for future regulations.

It has proven to be an extremely reliable engine and is very durable in demanding short-haul operations.

The Tay 611-8 on the G400 aircraft is renowned for its reliability. An improved version of the engine – the Tay 611-8C – has been selected to power the next generation of G400 aircraft. Changes include the incorporation of a FADEC (Full Authority Digital Engine Control) system.

The Tay 650 on the Fokker 100 aircraft and the 651 on the re-engined Boeing 727, provide increased maximum thrust for take-off, climb and cruise, plus efficiency improvements through small increases in fan diameter and an advanced high-pressure turbine.

Thrust	13,850 – 15,400lb
Overall pressure ratio	15.8 – 16.6
Bypass ratio	3.04 – 3.07
Fan diameter	44 and 45 inches
Length	94.7 inches
Service entry	1987

Engine	EIS	Power		Aircraft applications	Seats	Range (nm)
Tay 611-8	1987	13,850lb	(62kN)	G300 / G400	4	4,100
Tay 611-8C	2004	13,850lb	(62kN)	G350	12	3,800
				G450	12	4,350
Tay 620	1988	13,850lb	(62kN)	Fokker 100, Fokker 70	79	1,400
Tay 650	1989	15,100lb	(67kN)	Fokker 100	107	1,460
Tay 651	1992	15,400lb	(69kN)	Boeing 727-100	–	–

BR700 Series

Key facts

- 500th BR710 delivered to Bombardier in March 2007
- BR700 designed for up to 20 per cent improved fuel burn relative to current engines in its thrust class
- BR700 emissions and noise levels are far below current regulations with capability to meet even future, tougher rules
- First flight of the BR710 in November 1995, in service since December 1996
- BR710 selected for BAE SYSTEMS Nimrod MRA4 in October 1996, first flight August 2004
- Over 500 BR710-powered corporate jets in service
- The BR715 has achieved four million flight hours

The BR710 is capable of delivering 14,750 to 15,500lb (62.7-76.2kN) of thrust and dominates the market in the ultra-long range business jet sector.

First certificated in 1996 the BR710 powers the Gulfstream V and V-SP and their newer versions 500 and 550, Bombardier's Global Express and, as of 2004, the Global 5000 large cabin business jet aircraft.

These aircraft have set many world records in the fields of range, speed and altitude. The BR710 also offers low noise and excellent emission characteristics. Service experience is proving the BR710 to be a very reliable performer, while its Specific Fuel Consumption (SFC) levels are the lowest in its thrust class.

Another application of the BR710 is the BAE SYSTEMS Nimrod MRA4 maritime reconnaissance aircraft for which 88 engines have been ordered. Other military applications of the BR710 include the C-37A (military version of the Gulfstream V) and the Raytheon ASTOR.

The BR715 for the Boeing 717 regional airliners, is a two-shaft engine delivering 18,500 to 21,000lb (82.1-93.2kN) of thrust and was specifically designed for the high-frequency, short-haul market.

The BR715 offers the lowest SFC in its class reducing airlines' operating costs – and minimising the effects on the environment.

Thrust	14,750 – 21,000lb
Overall pressure ratio	24 – 32
Bypass ratio	4.2 – 4.55
Fan diameter	48 – 58 inches
Length	134 / 147 inches
Service entry	1997

Engine	EIS	Power		Aircraft applications	Seats	Range (nm)
BR710	1997	15,000lb	(66kN)	GV, G500, G550	12	5,800
BR710	1999	14,690lb	(66kN)	Bombardier Global Express	8	6,500
BR710	2001	15,500lb	(69kN)	BAE SYSTEMS Nimrod MRA4		
BR710	2003	16,000lb	(71kN)	Gulfstream V-SP	12	6,750
	2004			Bombardier Global 5000	8	4,800
BR715	1999	18,500lb to 21,000lb	(82.1kN) (93.2kN)	Boeing 717	106	2,060

Also see page 38 in the defence aerospace section

AE 3007

Key facts

- Single-stage, direct drive, wide-chord fan gives high efficiency and low noise
- Engine FAA / JAA certification in 1995
- First flight of Global Hawk in February 1998
- AE 3007 engines received CIS certification in March 1998
- Over 925 Embraer ERJ 135s, ERJ 140s and ERJ 145s in service
- 25 million engine hours on corporate and regional aircraft applications since entry into service
- Over 270 Cessna Citation X business jets in service; 500th AE 3007 delivered in early 2005 to Cessna
- 100th Embraer Legacy business jet entered into service in early 2007
- 2,000th AE 3007 engine delivered to Embraer in March 2007

The core of the 8,000lb thrust AE 3007 turbofan is derived from the AE1107 turboshaft engine. It was developed to provide a turbofan member of the AE common core family for the growing regional jet and medium / large business jet markets.

The AE 3007 powers the Cessna Citation X, the world's fastest business jet, for which the engine was certificated in early 1996. It also powers the 50-seat Embraer ERJ 145, 44-seat ERJ 140 and 37-seat ERJ 135 regional jets, as well as the Embraer Legacy corporate aircraft (a modified ERJ 135). In July 2000, Embraer launched the ERJ 145XR programme, with power provided by the newly developed AE 3007A1E. The engine offers a seven per cent increased thrust to the ERJ 145XR, which provides up to a 35 per cent increase in range over existing ERJ 145 aircraft.

A growth version, the AE 3007H was developed for the Northrop Grumman Ryan Aeronautical Centre Global Hawk unmanned surveillance aircraft and is in flight test with the US Air Force.

Thrust	6,495 – 9,000lb
Overall pressure ratio	18 – 20
Bypass ratio	4.8
Fan diameter	38.5 inches
Length	106.5 inches
Service entry	1995

Engine	EIS	Power		Aircraft applications	Seats	Range (nm)
AE 3007A	1997	7,580lb	(34kN)	Embraer ERJ 145ER	50	1,060
AE 3007A1	1998	7,580lb	(34kN)	Embraer ERJ 145LR	50	1,550
AE 3007A1/1	1998	7,580lb	(34kN)	Embraer ERJ 145LR	50	1,550
AE 3007A1P	1999	7,580lb	(34kN)	Embraer ERJ 145LR	50	1,550
	2002			Embraer Legacy	12-19	3,256
AE 3007A1E	2002	8,110lb	(36kN)	Embraer ERJ 145XR	50	2,000
				Embraer Legacy	12-19	3,256
AE 3007A1/3	2001	7,201lb	(32kN)	Embraer ERJ 140	44	1,630
AE 3007A1/3	1999	7,201lb	(32kN)	Embraer ERJ 135LR	37	1,700
AE 3007A1/3	2001	7,201lb	(32kN)	Embraer Legacy	12-19	3,256
AE 3007A3	1999	7,201lb	(32kN)	Embraer ERJ 135	37	1,400
AE 3007C	1996	6,442lb	(30kN)	Cessna Citation X	10	3,300
AE 3007C1	2002	6,764lb	(31kN)	Cessna Citation X	10	3,300
AE 3007H		8,290lb	(37kN)	Global Hawk	–	–

Also see page 37 in the defence aerospace section

Olympus 593

Key facts

- From 1976 to 2003, the Olympus 593 was the world's only civil supersonic engine in airline service
- Engines logged more than 930,000 flying hours, of which over half a million were at supersonic speed
- Concordes flew faster than most of today's combat aircraft and cruised supersonically for longer distances than any military aircraft yet developed
- Fastest crossing – New York to London in 2 hours 52 minutes 59 seconds

The Olympus 593 engine, which powered Concorde, the world's only supersonic passenger aircraft, was derived from a family of engines that powered the long-serving Vulcan bomber. Enlarged and uprated for its civil role, the 593 represented a unique technical challenge for a civil aircraft engine, requiring the use of maximum power for a large proportion of each flight.

Development of the Olympus 593, by Rolls-Royce and its French partner SNECMA, brought significant innovations, among which was the early use of a FADEC (Full Authority Digital Engine Control) system. The Olympus 593 powered the Concorde fleets of British Airways and Air France.

Thrust	38,000lb
Overall pressure ratio	11.3
Bypass ratio	
Fan diameter	47.5 inches
Length	150 inches
Service entry	1976

Engine	EIS	Power	Aircraft applications	Seats	Range (nm)
Olympus 593	1976	31,350lb dry (139kN) 37,090 with reheat	BAE SYSTEMS / SNIAS Concorde	100	4,025