Engine Values Book

2007 Edition

Engine Values Book

IBA is pleased to announce the first issue of the Engine Values Book (albeit the fifth version of a more comprehensive Aero Engine Guide)

Last year has seen virtually all engines' values rise, with a few exceptions, obviously driven by the continued demand for both narrow-body and wide-body aircraft. Who would have thought that 6 ex-United B747-400s would have moved so quickly from the desert to operations?

This type of transaction shows how the demand for the engine type can be created - combined with the need to perform mandatory RCC modifications - the operator is likely to need 3 to 4 spare engines to adequately support worldwide operations. Increased demand for B757-200s with either Roll-Royce RB211-535E4 or PW2000 series engines has also depleted the limited stocks of spare engines.

Strong current market demands for aero engines to be treated as unique assets and therefore supporting journals, guides, data and information are multiplying. More financial opportunities have attracted new parties with funds and intentions to be players in the market. IBA has contributed in providing support for the growing market demand for information and has also consistently fine tuned its figures as a result of better information from manufacturers and maintenance facilities.

An aspect of the business that IBA has been involved with is the potential added value of manufacturer support programmes such as Rolls Royce TotalCare (please contact us if you have questions about such matters). Also, the threat/opportunity of PMA parts (or Non Type Certificate Holder Parts) is attracting much of our attention in relation to the impact on residual values and marketability of engines.

We hope that airlines and lessors make use of the data in our Engine Values Book and we would appreciate any feedback you may have. If you would like to give us your comments or get more information about our other Engine Management products, please feel free to contact us by telephone, fax or through our central email address (marketing@ibagroup.com).

Phil Seymour
Managing Director
Senior Certified ISTAT Appraiser
IBA Group Ltd.

Contents

Engine Values Book

Engine Valuation Methodology

Whilst the techniques used and the judgements made do not isolate every single influence and reduce it to a numerical value that impacts on the overall model, it is our view that the complexity of a purely mathematical approach would produce values that were overly sensitive to minor changes in the parameters feeding it. Consequently, IBA feels that, when making an assessment of engine value, there is still no substitute, for the blend of market research and intelligence, mathematics, and judgement based on the experience of the appraiser in this highly dynamic market.

The Engine Values Book has therefore been constructed around the following criteria:

Scope: Engine variants associated with current production “modern technology western-built passenger and cargo aircraft” with an entry into service date of post-1980 and with a minimum population of 200 engines and/or 100 delivered aircraft.

Method: Determination of values includes account of replacement price, age, market condition, depreciation based on resale history and useful economic life. Engines are considered within the market segment to which they belong and compared with the competitor engines in the segment.

Engine values, rental rates and maintenance indicators are based on IBA’s own engine databases which have been built on information for various engine types routinely gathered and stored as part of IBA’s daily business.

Assumptions: (a) current / balanced market condition with balance achieved at levels perceived appropriate for today’s market (b) "standard / mid-time maintenance condition" (c) good /average physical condition (d) typical utilisation (e) standard / average specification unless otherwise indicated.

Value Definitions

Market Value is IBA’s opinion of the most likely trading price that may be generated for an engine under the market circumstances that are perceived to exist at the time in question. Market Value assumes that the engine is valued for its “highest, best use”, that the parties to the hypothetical sale transaction are willing, able, prudent and knowledgeable, and under no unusual pressure for a prompt sale, and that the transaction would be negotiated in an open and unrestricted market on an arm's-length basis, for cash or equivalent consideration, and given an adequate amount of time for effective exposure to prospective buyers.

Base Value is IBA's opinion of the underlying economic value of an engine in an open, unrestricted, stable market environment with a reasonable balance of supply and demand, and assumes full consideration of its "highest, best use". An engine's Base Value is founded in the historical trend of values and in the projection of value trends and presumes an arm's-length, cash transaction between willing, able and knowledgeable parties, acting prudently, with an absence of duress and with a reasonable period of time available for marketing.

In most cases, the Base Value of an engine assumes its physical condition is average for an engine of its type and age, and its maintenance time status is at mid-life, mid-time (or benefiting from an above-average maintenance status if it is new or nearly new, as the case may be).

Quick Engine Change (QEC) kit is defined as a collection of components and accessories installed into a bare engine to reduce the time required for installation of the entire powerplant onto an aircraft.

QEC kits can be categorised into three types: basic, neutral & full. A basic QEC includes all prime parts and accessories required for an engine test. A neutral QEC can be considered to comprise the basic kit plus sufficient specialist parts and accessories that will allow installation on an airframe but excludes any items relating to a specific aircraft or application. A full QEC comprises the neutral kit plus those items required for varying aircraft applications. In the case of basic and neutral, neither the thrust reverser nor the nose cowl is included. Each engine type should be considered unique in its QEC configuration and installation.

Values are shown as a range to bracket IBA's view of neutral and full QEC kits and to reflect the different make-up of each kit as the components and accessories vary depending on the type of aircraft the engine will eventually power.

Typical Current Rental Rate (TCRR) is IBA's opinion of the monthly lease rental as it relates to an arm's length transaction between a willing lessor and a willing lessee for a single engine transaction. Values are shown as a range to bracket IBA's view of short-term (18 months) to long-term (5 years) duration of rental.

Maintenance Definitions

Life Limited Part (LLP) Cost refers to IBA's opinion of the basic cost of all of the engine's life-limited parts (LLPs), assuming all-new parts.

Mean Time Between Overhauls (MTBO) represents IBA's opinion of the average time, in flight hours, between major engine shop visits. This does not include unscheduled removals for reasons such as foreign object damage but it does include removals due to exhaust gas temperature (EGT) deterioration or LLP life expiry.

Basic Overhaul Cost is IBA's estimated figure for an average workshop visit carried out under a "time & materials" basis. This includes labour for teardown, inspection, repair costs, material replacement and a degree of LLP replacement.

Airworthiness Directive (AD)

Airworthiness Directives (ADs) have been included at the end of each section of the Aero Engine Guide. Recurring ADs are noted with a bullet and key ADs are further noted by the use of bold, red lettering. Key ADs, as defined by IBA, fall into one or more of the following categories:

- ADs resulting from an uncontained failure.
- ADs that reduces the life of components, LLPs and primary components.
- ADs requiring a correction of operational problems.
- ADs requiring piece part inspection programs of LLPs and usually resulting in a restricted operational life and/or driving components out of the engine at shop level.

These key ADs are usually associated with high costs in terms of operational disruption, higher material investment, or higher shop visit rates with possible increases in cost of each shop visit. Wherever possible, IBA has provided a dollar value of key ADs for each engine.

Disclaimer

This Engine Value Book represents the opinion of the International Bureau of Aviation (IBA), and is intended to be advisory only. Therefore, IBA assumes no responsibility or legal liability for any action taken, or not taken, by the user, or by any other party. In using this guide, the consumer agrees that IBA shall bear no such responsibility or legal liability.

Honeywell

Engine Values Book

Honeywell ALF502

The ALF502 engine was launched in 1970 for use on commercial and corporate aircraft though did not enter service until a decade later after a series of delays. Hawker Siddeley (UK) was planning the HS-146 short haul airliner and in 1972 the ALF502 engine was selected to power this aircraft type. In 1977 Hawker Siddeley merged into British Aerospace (BAe) and by 1978 the BAe 146 was launched. In September 1981, the prototype BAe 146-100 made its first flight with four ALF502s installed.

The ALF502 is a high bypass ratio, two-shaft turbofan engine providing a bypass ratio of 5.6:1 for the R-5 variant, typically between 3.5 to 5 times more than the lower bypass engines such as the Rolls Royce Spey and Pratt & Whitney JT8D. In dry configuration, the ALF502R-5 weighs 1,336 pounds and specific fuel consumption is 0.406 lb/h/lb at take-off. Major ALF502 engine overhaul and refurbishment is carried out “on-condition” though a typical Hot Section Inspection (HSI) occurs every 5,000 flight cycles.

When the ALF502 entered commercial service on the BAe 146 aircraft, the engine/airframe combination was noted for its operational quietness. The BAe 146 remains a very quiet aircraft today, easily meeting the latest current noise standards of ICAO Annexe 16 Chapter 3 and the corresponding FAR Part 36 Stage 3.

The manufacture and marketing of the ALF502 changed from Allied Signal Inc as it merged with Honeywell Inc in June 1999. The ALF502R-3 was certificated in January 1981. The R-3 engine was quickly improved to R-3A (or R-5) standard. It entered service with Dan-Air in April 1983. The ALF502R-5 is rated at 6,970 pounds.

Honeywell ALF502 & LF507

Engine Variants Available					
Variant	**Thrust**	**Flat Rating**	**SFC***	**Aircraft Type(s)**	**Engines in Service**
ALF502R-3	6,970 lbf	21.0°C	0.411 lb/h/lb	BAe 146-100	20 engines
ALF502R-5	6,970 lbf	15.0°C	0.406 lb/h/lb	BAe 146-100, -100F, -200, -200F, -300, -300F	528 engines
LF507-1F	7,000 lbf	28.0°C	0.397 lb/h/lb	RJ70, RJ85, RJ100	144 engines
LF507-1H	7,000 lbf	28.0°C	0.397 lb/h/lb	BAe 146-300	440 engines

** Specific Fuel Consumption (SFC) at take-off thrust*

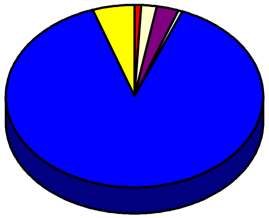
Airframe/Engine Combinations			
Aircraft Manufacturer	**Aircraft**	**Engine**	**Worldwide Population**
BAE Systems	BAe 146-100	ALF502R-3	5 aircraft
		ALF502R-5	11 aircraft
	BAe 146-200	ALF502R-5	55 aircraft
	BAe 146-200F	ALF502R-5	18 aircraft
	BAe 146-300	ALF502R-5	40 aircraft
		LF507-1H	4 aircraft
	BAe 146-300F	ALF502R-5	8 aircraft
	RJ70	LF507-1F	6 aircraft
	RJ85	LF507-1F	72 aircraft
	RJ100	LF507-1F	64 aircraft

IBA Group Limited, Meadowcroft House
180 Balcombe Road, Horley
Surrey RH6 9AE, UK

Honeywell ALF502 & LF507

Worldwide Distribution of Installed Engine Population

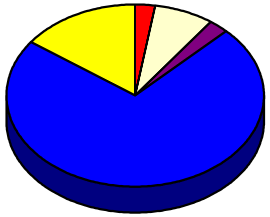
Total installed population 1,132 engines



Africa	8 engines	*0.7%*
Southern Pacific	24 engines	*2.1%*
North America	32 engines	*2.8%*
South & Central America	4 engines	*0.4%*
Europe & CIS	1,004 engines	*88.7%*
Asia & Middle East	60 engines	*5.3%*

Worldwide Distribution of ALF502 & LF507 Operators

Total operators of ALF502 & LF507 engines 40 operators



Africa	1 operators	*2.5%*
Southern Pacific	3 operators	*7.5%*
North America	1 operators	*2.5%*
South & Central America	-	-
Europe & CIS	29 operators	*72.5%*
Asia & Middle East	6 operators	*15.0%*

Current Market Value, Base Value, Typical Current Rental Rate (TCRR) & QEC

ALF502R-3A/5

Market Value	*Bare Engine*	$285,000
Base Value	*Bare Engine*	$285,000
Typical Current Rental Rate		Low $13,800 per month High $24,200 per month
QEC		$235,000

All amounts in US$

Engine Maintenance Indicators

ALF502R-3A/5

Life Limited Part (LLP) Cost	$567,840
Average Cost of Overhaul	$863,870
Mean Time Between Overhauls (MTBO)	7,000 Flight Hours
Fleet Average Flight Hour/Cycle Ratio	1.15 FH/Cycle

All amounts in US$

IBA Group Limited, Meadowcroft House
180 Balcombe Road, Horley
Surrey RH6 9AE, UK

Honeywell ALF502 & LF507

Current Market Value & Base Values

Values in US Dollars (millions)
Annual inflation of 2.5% assumed

Type	CMV	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
ALF502L	0.225	0.23	0.23	0.22	0.21	0.21	0.20	0.19	0.19	0.19	0.19	0.19
ALF502R-3A/5	0.285	0.29	0.29	0.29	0.29	0.29	0.28	0.27	0.26	0.25	0.24	0.24
LF507-1F	1.076	1.08	1.10	1.13	1.16	1.19	1.22	1.25	1.25	1.25	1.25	1.25
LF507-1H	0.958	0.96	0.98	1.01	1.03	1.06	1.08	1.11	1.11	1.11	1.11	1.11

IBA Group Limited, Meadowcroft House
180 Balcombe Road, Horley
Surrey RH6 9AE, UK

Listing of Airworthiness Directives (AD)

ALF502R-3						
	Issuing Authority				**Description**	**Cost Estimate**
	EASA	CAA	DGAC	FAA		(US$)
●	-	-	-	82-25-10	First stage compressor stator vane	-
	-	-	-	83-03-51	Fourth stage turbine rotor assembly	-
●	-	-	-	87-06-52 R1	Engine chip detectors (Superseded by 97-05-11)	-
	-	-	-	87-15-03	Gas producer turbine (GPT) spacer	-
●	-	-	-	89-13-52	Uncontained disk failure (Superseded by 90-24-01)	-
●	-	-	-	90-24-01	Disk failure	-
●	-	-	-	90-25-02	Third stg. turbine bld release (Superseded by 95-04-11)	-
	-	-	-	92-08-51	Uncommanded power reduction	-
	-	-	-	93-10-07	Compressor disks	-
	-	-	-	93-14-13	Turbine disk failure	-
	-	-	-	95-03-15	Turbine disk	-
●	-	-	-	95-04-11	Third stage turbine disks	-
●	-	-	-	97-05-11	Engine chip detectors	-
●	-	-	-	97-05-11 R1	Engine chip detectors	-
●	-	-	-	97-11-05	Fuel manifold assemblies	-
●	-	-	-	**2000-05-14**	**LPT failure**	**$31,800**
	-	-	-	**2000-11-15**	**Critical life-limited rotating engine part failure**	**$3,360**
	-	-	-	**2002-12-08**	**Prevent gas producer turbine (GPT) component failure**	**$7,980**
●	-	-	-	**2002-22-06**	**Prevent separation of the combustion chamber liner assembly**	-
	-	-	-	2003-02-01	Prevent fire in the engine nacelle	-

● Indicates recurring AD; **Bold red indicates key AD**

IBA Group Limited, Meadowcroft House
180 Balcombe Road, Horley
Surrey RH6 9AE, UK

Listing of Airworthiness Directives (AD)

ALF502R-5						
	Issuing Authority				Description	Cost Estimate (US$)
	EASA	CAA	DGAC	FAA		
	-	-	-	83-03-51	Fourth stage turbine rotor assembly	-
●	-	-	-	87-06-52 R1	Engine chip detectors (Superseded by 97-05-11)	-
	-	-	-	87-15-03	Gas producer turbine (GPT) spacer	-
●	-	-	-	89-13-52	Uncontained disk failure (Superseded by 90-24-01)	-
●	-	-	-	90-24-01	Disk failure	-
●	-	-	-	90-25-02	Third stg. turbine bld release (Superseded by 95-04-11)	-
	-	-	-	92-08-51	Uncommanded power reduction	-
	-	-	-	93-10-07	Compressor disks	-
	-	-	-	93-14-13	Turbine disk failure	-
	-	-	-	95-03-15	Turbine disk	-
●	-	-	-	95-04-11	Third stage turbine disks	-
●	-	-	-	97-05-11	Engine chip detectors	-
●	-	-	-	97-05-11 R1	Engine chip detectors	-
●	-	-	-	97-11-05	Fuel manifold assemblies	-
	-	-	-	**99-15-06**	**Reduction of engine thrust**	**$78,000 - $88,000**
●	-	-	-	**2000-05-14**	**LPT failure**	**$31,800**
	-	-	-	**2000-11-15**	**Critical life-limited rotating engine part failure**	**$3,360**
	-	-	-	**2002-12-08**	**Prevent gas producer turbine (GPT) component failure**	**$7,980**
●	-	-	-	**2002-22-06**	**Prevent separation of the combustion chamber liner assembly**	-

● Indicates recurring AD; **Bold red indicates key AD**

IBA Group Limited, Meadowcroft House
180 Balcombe Road, Horley
Surrey RH6 9AE, UK

Listing of Airworthiness Directives (AD)

LF507-1F & LF507-1H						
	Issuing Authority				Description	Cost Estimate (US$)
	EASA	CAA	DGAC	FAA		
●	-	-	-	97-05-11	Engine chip detectors	-
●	-	-	-	97-05-11 R1	Engine chip detectors	-
●	-	-	-	97-11-05	Fuel manifold assemblies	-
●	-	-	-	**2000-05-14**	**LPT failure**	**$31,800**
	-	-	-	**2000-11-15**	**Critical life-limited rotating engine part failure**	**$3,360**
	-	-	-	**2002-12-08**	**Prevent gas producer turbine (GPT) component failure**	**$7,980**
●	-	-	-	**2002-22-06**	**Prevent separation of the combustion chamber liner assembly**	-

● Indicates recurring AD; **Bold red indicates key AD**

IBA Group Limited, Meadowcroft House
180 Balcombe Road, Horley
Surrey RH6 9AE, UK