There are now more than 300,000 approved PMA parts, and the number grows each year by about 35,000. More airlines are accepting PMAs, and their use can generate substantial savings in expenditure on material and parts. The major suppliers and their products are reviewed.

PMA parts: the market & major suppliers

Parts manufacture approved (PMA) parts and components have become more accepted by airlines over the past 10 years. The main appeal of PMA parts is their list prices, which are up to 65% lower than those of the original equipment manufacturers (OEMs) for the same parts. PMA parts are used during aircraft maintenance, and can potentially make large savings for airlines and independent maintenance, repair & overhaul (MRO) facilities if a wide range of parts are used.

Development of PMA parts and components in large numbers started about 10 years ago, and the total number of approved parts available for all aircraft types exceeds 300,000. This includes PMA parts for corporate, general aviation and military aircraft, and represents a tiny percentage of all the part numbers in existence for all aircraft types.

The number of approved parts grows each year by about 35,000. There are about 2,300 specialist manufacturers of PMA parts in the US alone. This article surveys the major suppliers of PMA parts for regional aircraft and jetliners, and their engines.

PMA acceptance

Significant numbers of PMA parts began becoming available to airlines and independent MROs in the mid-1990s. Besides the problem with unapproved parts, interest in PMA parts was stimulated by the high list prices of OEMs' parts, and the high rate of annual list price inflation these OEMs applied.

PMAs first started to be used by the US majors in the 1980s to combat tightening profit margins. PMAs then gradually became more accepted by European carriers, especially Lufthansa through its maintenance & engineering subsidiary Lufthansa Technik. In fact, Lufthansa Technik encouraged the use and development of further PMA parts, while Lufthansa itself encouraged their use with some of its Star Alliance members. Major airlines in the Asia Pacific, such as Japan Airlines (JAL), also started to accept and use PMA parts.

One sector of the industry that has remained resistant to PMA parts is operating lessors, most of which stipulate the use of OEM parts in the return conditions in their lease contracts, partly because PMA parts reduce the value of the aircraft and engines concerned. Some airlines still have a policy of not using PMA parts, so leased aircraft or engines would need to have PMA parts swapped for OEM parts at high cost when lessors remarket their assets. Some low-cost airlines avoid using PMA parts simply because they have their aircraft on short-term leases with operating lessors.

Aerostrategy values the annual global MRO market for jetliners and regional aircraft at $42-45 billion, depending in the size and activity of the global fleet. Of this, the material and part consumption for the industry was $16.6 billion in 2008, and is forecast to grow to $21.4 billion in 2013. Aerostrategy says that $400 million of the 2008 spend is accounted for by PMAs: only 2.4% of the total. Expenditure on PMAs is forecast to grow to $680 million in 2013: 3.6% of the total spent on materials and parts.

Use of PMAs in components and airframe maintenance has the highest growth rate. Although engine PMAs were among the first to be developed, engine OEMs have developed several defensive measures to limit the rate of PMA use. Moreover, many engines are under maintenance contracts with the OEMs, which will clearly not use PMA parts.

Given the small percentage of total material expenditure that PMAs account for, there is clearly large scope for PMA suppliers to increase the number of approved parts.

PMA potential

The cost of parts and components accounts for the largest portion of engine shop visit events. Interest in engine PMA parts is therefore particularly high with some users. All engine components and structures fall into air transport association (ATA) chapters between 70 and 79. The most complex and expensive parts are engine turbomachinery components: the blades and vanes, which come under ATA Chapter 72. Other parts include: engine cowling, mounts and wiring (ATA Chapter 71); engine fuel and fuel controls (73) ; engine ignition components and power (74); autothrottle and controls, engine instrumentation and condition monitoring indications, and the oil system (76, 77 and 79).

Other parts and components in aircraft with the highest prices are air conditioning (ATA Chapter 21), autoflight and communications (22 and 23), electrical power (24), flight controls (27), fuel system (28), hydraulic system and power (29), instruments and avionics (31), lights and navigation (33 and 34), pneumatic system (36), and the central maintenance system (45). Aircraft interior equipment, fire protection, ice and rain protection, landing gear, crew oxygen, water and waste, and auxiliary power unit (APU) systems and components all have high list prices. ATA Chapter 32 includes the landing gear, tyres, wheels, brakes and steering components.

The structural components of the aircraft come under ATA Chapters 51 to 57. These include fuselage, wing, engine nacelles and pylons.

The PMA parts currently available for each aircraft type only total a few hundred, and are a small number for each ATA Chapter. Moreover, there are few or no PMA parts for some ATA Chapters for some aircraft types, because most PMA manufacturers and providers have

Chromalloy is the specialist provider of engine turbomachinery parts, and the only one to manufacture HPT blades and vanes for the major commercial engines. Savings made by using these blades are in the order of several hundred thousand dollars.

focused on developing parts that are consumed in large quantities, or have been relatively cheap or easy to engineer and approve.

Some of the suppliers with the largest numbers of approved PMA parts have lists of 20,000-40,000 part numbers. GM Nameplate of Seattle, Washington has about 40,000 approved parts, and says it expects to have another 20,000 parts approved by the end of 2010. All of these parts are placards, labels and nameplates used in the interior and on mechanical parts of the aircraft. All models of all Boeing airliners are supported.

The Triumph Group is a leading supplier of PMAs. Its Mexmil Company has up to 70,000 PMA approvals. One of its specialities is insulation materials for Airbus and Boeing types. Another company in the Triumph Group is Triumph Composite Systems, with approval for about 22,000 PMAs.

C&D Zodiac specialises in a wide range of interior products and parts. It currently has approvals for about 18,000 parts for jetliner interiors, including all types of interior parts and equipment.

Kapco (Kirkhill Aircraft Parts Company) is one of the 10 largest PMA suppliers and holds about 13,000 approvals. It specialises in three main areas of machined parts and assemblies, electrical connectors and components, and seals and couplings.

Engine turbomachinery

The OEM list prices of engine blades and vanes represent some of the most expensive parts in an aircraft. The cost of new parts in engine shop visits is 60-70% of a total shop visit. Taking a heavy visit for a CFM56-5B or -7B as an example, of the total cost of $2.0-2.2 million, $1.2-1.7 million comes from the cost of parts and materials. A larger engine, such as the CF6-80C2, has a heavy shop visit cost of $2.6-2.8 million, $1.7 million of which is for the cost of new parts and materials.

The high cost of OEM parts is illustrated by the cost of high pressure turbine (HPT) blades. “A shipset of HPT blades typically totals about 60 blades, and costs more than $600,000, or about $10,000 per blade,” explains Peter Howard, vice president of technology and quality assurance at Chromalloy. “The cost of a full shipset of two HPT stages in the CF6-80C2 has an OEM list price of $1.3 million. High pressure compressor (HPC) blades are less sophisticated, but a complete shipset has an OEM list price of more than $150,000.”

Chromalloy started about 50 years ago making protective coatings for HPT blades, and then developed into the blade and vane repair business. It now has repair capability for about three-quarters of all commercial engine types. “In the past 10 years we went into developing PMAs, and also bought Belac. Between us we have approvals for 370 PMA part numbers. Belac focuses on HPT blades, while Chromalloy focuses on all other blades and vanes in the HPT, the HPC, low pressure compressor (LPC) and low pressure turbine (LPT).

“Belac is a joint venture between Chromalloy, Lufthansa Technik and United Airlines,” continues Howard. “It manufactures HPT blades, and provides for nine different engine types. The first was the CFM56-3, which was approved in 2002. The PW4000-94 Stage 1 HPT blades were approved in 2009, and are working on new programmes for other General Electric and Pratt & Whitney (PW) engines. Over the past seven years we have manufactured more than 400 shipsets of HPT blades.”

Chromalloy and Belac make blades and vanes for the CFM56-3, -5 and -7 series; the CF6-50C2 and -80C2 series; the PW2000; and the PW4000-94. They are also working on about 50 new PMAs for the V2500 and other parts in the CFM56-7B, and have a possible interest in developing parts for the PW4000-112 and GE90. Chromalloy also has some PMA parts on the JT8D.

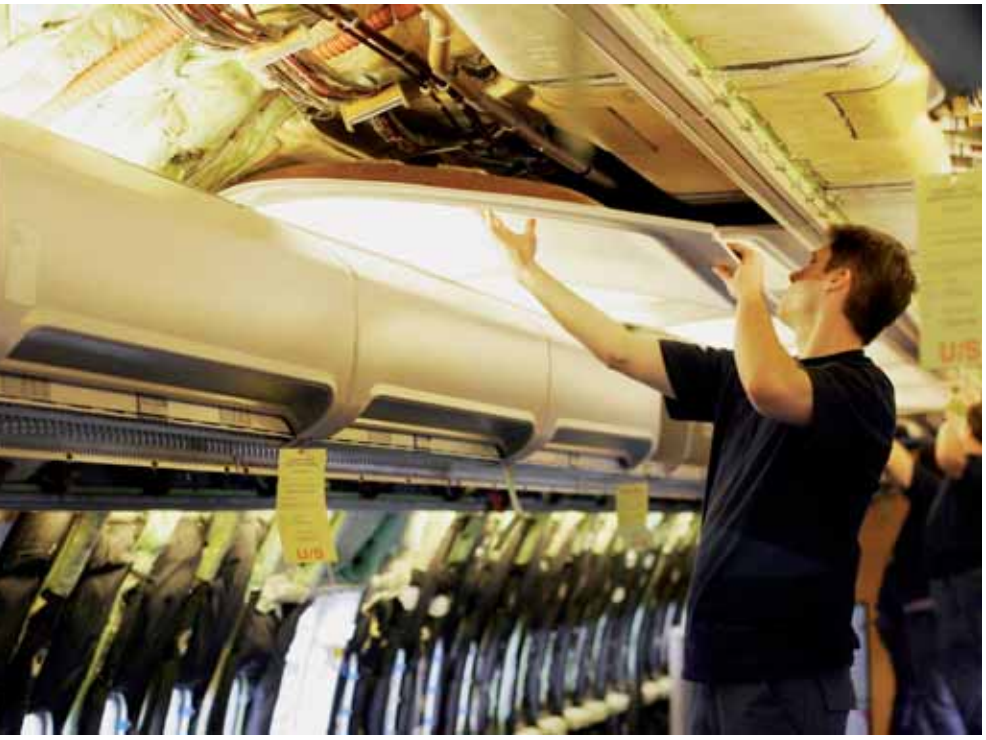
Howard illustrates the benefits of using PMA parts. “Our list prices are 40-75% of the OEMs, so we have discounts of up to 60%,” says Howard. “A 30% discount on HPT blades is typical, which means a saving of about $200,000 per engine is possible when replacing a single stage of HPT blades. For the CF6-80C2 with two stages of HPT blades, we can generate a saving of up to $600,000.”

Some of Chromalloy’s customers include Korean Air, United Airlines, American Airlines and Delta Airlines.

Another provider of engine PMA parts is HEICO. “Engine parts were the first PMAs we developed,” says Kate Schaeffer, senior vice president, sales & marketing at HEICO. “We provide HPC blades for the CFM56 family and CF6-80C2 engines. We also manufacture fuel pump gears, bearings and shafts, and expendables on HPT and LPT shrouds for the CFM56 family and CF6-80C2, as well as all major engine types between the GE CF34 up to the PW4000-112. We have four or five partners that decide which parts they want us to develop. These include British Airways, Lufthansa, United, American, Delta and JAL.

“There is no reason why we could not manufacture engine discs and other life limited parts (LLPs) in the future,” adds Schaeffer. “We would consider most parts for the CFM56 family except for fan blades. We already make HPC blades, so we could also do LPT blades and vanes.”

While HEICO has seen some resistance to PMA use, Schaeffer says this has gradually eased. “Even lessors are softening due to the incentive to save money,” says Schaeffer. “It is possible to save $400,000-500,000 per engine event using PMAs. All major airlines now accept them. Most engine PMAs come from HEICO and Chromalloy, but there



More recent years have seen several PMA providers get into the area of aircraft interior parts. Some of the largest PMA providers already hold approvals for large number of interior parts.

is little overlap between the two companies' parts. We have list prices that are 20-30% lower than the OEMs, but it is possible for major customers to save up to 40% if they can give us a long-term commitment."

One interesting development in the PMA market is OEMs making PMAs for other OEMs' products. PW developed a Global Material Solutions (GMS) programme for the CFM56-3. This includes 19 LLPs and 11 gas path components for the engine, making PW the only alternative supplier of LLPs for the engine.

The 19 LLPs have been developed with a supplemental type certificate (STC), which means that PW owns the design. The parts comprise a full set of LLPs.

The 11 gas path components are PMAs, so they are identical to the OEM's parts. They comprise four stages of LPT blades, four stages of LPT vanes, the HPT blade, HPT vane and HPT shroud. PW says it is exploring opportunities for other GMS programmes.

Aviation Component Solutions (ACS) manufactures non-core parts for a range of engines, including the CFM56-5A/B, PW4000-94, CF6-50C2 and CF6-80C2. "These are mainly accessory parts that include fuel controls, starters, integrated drive generators (IDGs), constant speed drives (CSDs) and several other accessory and quick engine change (QEC) components," says Gordon Harker, sales director at ACS. "Most of our engine PMA parts relate to ATA Chapters 73 and 75: engine fuel distribution and control and fuel flow and pressure, and engine accessories and cooling.

"When developing parts we need to test them to get Federal Aviation Administration (FAA) approval, so we test them with Lufthansa Technik, United Airlines and American Airlines," says Harker. "We originally entered the PMA market because Lufthansa Technik asked us to start producing PMAs for various engine parts. The testing with these airlines means we automatically have a market ready once the part is approved.

"Most PMA providers have list prices that are 30-40% less than the OEMs, but our prices are 25-65% lower than the OEMs, depending on the type of part," continues Harker.

AAR is another provider of engine PMAs. "We started in the engine PMA business, and we manufacture class 3 hardware," says Chris Willingham, director of technology at AAR PMA Products. "These are parts such as spools, bushings, bearings, airseals, and other simple metallic parts. All are high-volume consumable products. We have stuck with these because the development costs for turbomachinery parts are prohibitive. We make parts for the JT8D, JT9D, PW2000, the three variants of the PW4000 family, and a few for the V2500.

"The PMA parts industry standard is to be about 30% cheaper than the OEMs, but our prices can be as low as 45-50% in some cases, although we do provide airframe parts as well," continues Willingham.

Wencor is another provider of engine PMA parts, and it avoids gas path components. "Since we started manufacturing PMAs in 1985, our range of part numbers has grown to cover most jetliners and regional aircraft," says Jason Caldwell, vice president of North American sales at Wencor. "We provide some parts for virtually every engine type. We have a small number of part numbers for Rolls-Royce engines, and have a larger number of parts for GE and PW engines, including seals, attachment points, harnesses, various types of hardware, links and bearings.

"We so far have approvals for 2,500 part numbers, and are currently receiving approval for about 500 new parts each year," continues Caldwell. "Our list prices are typically 25-30% lower than OEMs'."

Airframe system components

Some of the most complex airframe components are those rotable components in the hydraulic, pneumatic, air conditioning, electrical, fuel and flight control systems. The piece parts that make these high-price rotable units have high list prices, and consequently many PMA providers have developed large numbers of these to supply the component repair business.

ACS makes piece-part PMAs for mainly hydraulic and pneumatic system components. "We have focused on all current Boeings and Airbuses from the A300 to the A340," says Harker. "We also have some parts for the Fokker 70/100, Saab 340, Embraer ERJ family, and Bombardier CRJ family.

"Our parts relate to air conditioning (ATA Chapter 21); the hydraulic system (29); ice and rain protection (30); and the pneumatic system (36)," continues Harker. "The parts we supply are those that are consumed during the repair and overhaul of the larger rotable units in these systems, which are also some of the more expensive components. We are now also developing parts for the ATR."

HEICO also manufactures a range of airframe system parts and components. "We manufacture parts for every large commercial jet type, especially the A320 and A340. These include parts relating to the APU and thrust reversers. We also produce a large range of airframe parts, such as expendables, impeller wheels and other complex parts in rotable components. Including engine parts, we manufacture about 5,000 different part numbers."

Wencor has a wide range of airframe system and rotable components. "Besides engine components, our catalogue of PMAs includes a lot of airframe mechanical components. These are engine

Many PMAs are parts that are components and materials used in high volumes on a range of structures and components throughout the aircraft and engines. An example is bearings. The difference in list price between those provided by PMA providers and the OEMs can be as much as 70%.

starters, hydraulic and fuel pumps, IDGs and actuators," explains Caldwell. "We provide these mainly for Boeing and McDonnell Douglas aircraft, every Airbus type except the A320, and the Bombardier CRJ series. While we are strongest on airframe components, we also have attaching parts and some components related to flight controls."

Avio-Diepen owns ADpma, based in Memphis, Tennessee. It manufactures piece parts for interiors, landing gears and wheels/brakes, an APU waste blower, filter kits and some batteries for most Boeing and Airbus types, as well as the MD-80 and some regional aircraft.

Many PMA providers have opted to produce smaller, cheaper high-volume parts. Able Engineering manufactures washers, bolts, gears, bearings, rollers, sleeves and bushings for the 737, 747, 757 and 767, as well as PW engines and various Honeywell products.

Some manufacturers specialise in particular types of components. AirGroup America makes bearings for all types of engine accessories and airframe rotables for most narrowbody and widebody commercial jetliner types, as well as regional jet and turboprops. The company makes about 70 different part numbers and says its list prices are typically 25-35% lower than the OEMs', but up to 70% lower in some cases.

Structural components

While many PMA providers have been producing parts for engines, airframe rotables and expendables, recent years have seen the development of components in other areas of the aircraft.

"In the past few years we have developed parts for interior equipment and furnishings, due to market demand," says Willingham. "Interior parts form the bulk of our airframe-related components. We added these from 2005. They comprise mainly tray tables, cockpit-crew seat covers and a variety of small piece parts used in all areas on the interior."

HEICO now also provides interior components and parts, and its catalogue is becoming more diverse as it has more parts approved. Wencor is another supplier of interior components. Caldwell explains that this has been a trend in recent years. "In the future we will be developing parts for aircraft that are reaching maturity in maintenance terms. The 737NG falls into this category, and interiors for the aircraft are going to be in high demand as large numbers go through their first heavy checks."

Other areas of the aircraft include structural components and heavy components, such as landing gears, wheels and brakes. AAR is also now manufacturing a lot of A320 landing gear components. This complements the activity at its landing gear shop. "Our area of future development is mainly interior and landing gear parts," says Willingham. "We also have customers asking us to develop structural components for use during heavy checks."

Aerobrake specialises in producing hardware parts for wheels and brakes. "These include wheel rim o-rings between the two halves of wheel hubs. While they are not expensive items, they are used in high numbers because of all the wheel rims being inspected," explains Scott McNew, president at Aerobrake. "We also make polymers, nuts, bolts, screws and washers. These are all high-replacement parts used in repairing wheels and brakes. We are now looking to develop other seals in other parts of the aircraft. The parts we currently produce are used on the 727, 737, 747, 767, Dash 8 family, CRJ family and ERJ family. We are now looking at developing parts for the 777 and 787. We also make a small amount of parts for some Airbus types. Basically, we manufacture all types of parts used in brakes other than those in the heat section.

"To give an example of how our prices compare to OEMs, you can pay $50-83 for a wheel seal, while our prices are $30-50. This adds up to a large saving for an airline using 500 seals each year," continues McNew.

Another major issue is the supply of components for major structural parts. Spirit AeroSystems in Wichita, Kansas was a division of Boeing until it was sold in 2005. It manufactures fuselage sections, engine pylons, engine nacelles and some wing components for the 737, 747, 757, 767, 777 and 787. Spirit AeroSystems sells components for these structures as PMA parts, and has about 15,000 part numbers. These can be bought via Boeing at the OEM list price, or direct from Spirit AeroSystems at a discounted PMA price. These would be acquired during the aircraft's life for maintenance.

Sourcing PMAs

Finding PMA parts is complicated because they are not listed in the illustrated parts catalogues for aircraft and engines that are published by the OEMs. Aviation Data Research of Oregon supplies a database of PMA parts via its PMA Parts Finder software for airlines and MROs to locate individual parts and holders of PMA approvals.

The system works by a series of tabs. The first tab gives the user the method of searching for the part. The choices include: part name, PMA part number, PMA part holder, aircraft or engine type, and OEM part number. Once parts are found, lists can be saved so they do not have to be searched for again. The database has more than 265,000 parts, and is continually updated. AC