Flying further for less

Blended Winglets and their benefits

"Just as the automotive industry has transitioned to radial tires, the aviation industry will upgrade to performance-enhancing Blended Winglet technology," predicts Aviation Partners Boeing (APB) chairman Joe Clark. Here, *APB* explains why, if you haven't already upgraded to Blended Winglet technology, your operating costs are higher than they need to be.

It's not easy changing the global airline industry and the economics of flight. Once an aircraft model is designed it's essentially frozen and you're pretty well stuck with the original performance, range and fuel-burn parameters for the life of your asset. Maximising cost efficiency, particularly for today's low-fare airline carriers, typically comes down to managing external factors — hedging on fuel, maximising labour productivity and fine-tuning assorted operating and service costs. Until relatively recently, there really was not much an operator could do to measurably enhance performance, extend range and reduce fuel-burn on existing aircraft, other than through expensive re-engine projects, such as for the ageing 727 fleet. This all changed, however, with the introduction of Aviation Partners' Blended Winglet technology about 10 years ago.

Designed originally for the Gulfstream II business jet in 1991, the 5.5-foot tall wide-sweep Blended Winglets dramatically extended range and reduced fuel burn up to seven per cent via overall

wing drag reduction. Retrofit fuel savings of this magnitude previously required re-designing the entire aircraft or re-fitting new engines. In 1999 Boeing adopted Blended Winglet technology to boost the range and marketability of its Boeing Business Jet. Soon thereafter Aviation Partners Boeing, a joint venture between Aviation Partners and The Boeing Company, began offering Blended Winglet technology to 737 NG operators, both as retrofits and later as buyer-furnished equipment (BFE). The rest, as they say, is history.

Changing the economics of flight

Today, over 1,000 737 NGs are flying with Aviation Partners' Visible Technology, over 50 per cent of the 737-700/800 fleet is Blended Winglet-equipped and more than 85 per cent of all new 737-700s/800s are factory-delivered with this technology. Operators range from Southwest Airlines and Ryanair, with Blended Winglet orders numbering in the hundreds, to smaller operators in far-flung locations on all continents of the world. Blended Winglet systems are also available for 757-200s and 737-300 Classics with a programme in development for the 767-300.

Aviation Partners' Blended Winglet systems improve the performance of any commercial or business aircraft, says Aviation Partners Boeing chairman Joe Clark: ''People often think of Blended Winglets as only for specific aircraft but that's not true. While we tailor Blended Winglet systems to particular aircraft this technology works on any aircraft, from a smaller regional jet to the Airbus A380.''

The primary driver in the mass migration to Blended Winglets among both operators and leasing companies worldwide is quick payback on investment: typically between two and three years on fuel savings alone. Typical 737 NG operators save 95,000-130,000 gallons of fuel per aircraft per year and these fuel savings benefits stay with the operator for the entire economic life of the aircraft. Operators of Blended Winglet-equipped 757-200s save even more: up to 240,000 gallons per aircraft per year. Along with these significant and ongoing fuel savings come a host of important environmental benefits. A Blended Winglet-equipped 737 reduces

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carbon monoxide and nitrous oxide emissions by 4 per cent and 5 per cent respectively while decreasing the take-off noise footprint by 6.5 per cent. Thanks to improved wing efficiency and reduced noise footprints, many Blended Winglet-equipped operators in Europe have been able to decrease operating fees and noise surcharges by opting for lower-thrust engines and lower max take-off weight.

With fuel costs recently as high as $70 per barrel — and not expected to come down dramatically over the foreseeable future — operators are looking for any tools they can use to remain cost-competitive. "While it's the cost-saving attributes of our technology that have made Blended Winglets a necessity for today's progressive low-cost carriers, it's the fuel savings benefits that I'm most proud of," says Clark. "Blended Winglet fuel savings have totalled over 260 million gallons to date and the industry will save another 120 million gallons this year because of our technology. Assuming we deliver 400 Blended Winglet shipsets per year for the rest of the decade, our technology will save approximately 1.5 billion gallons of jet fuel for the decade 2001-2010. At Aviation Partners we're doing our part in a changing world."

Blended Winglet design

Aviation Partners' Blended Winglets differ in several important ways from the small, angular, wingtip appliances you see on many commercial aircraft today. Blended Winglet technology works as well as it does because the winglet systems are sized for maximum advantage based on available wing structure and are shaped with a patented wide transition chord from wing to winglet to minimise vortex drag. Aviation Partners' chief aerodynamicist Dr Bernie Gratzer created the Blended Winglet back in 1991 by blending the airfoil for maximum performance while ensuring even wing loadings for maximum drag reduction. The end result is a block fuel savings of four to five per cent for 737s and even more for 757-200s, compared to 1-1.5 per cent savings with traditional-style winglets.

Cases studies

Aeromexico, the largest airline in Mexico, has ordered 38 Blended Winglet shipsets for 737-800s and 737-700s. Blended Winglet-equipped 737-800s will be used to replace existing 757-200 routes to the US, including the 1,816nm route from Mexico City to New York. "While 5 per cent block fuel savings were an important benefit to Aeromexico the overriding factor in this purchase decision was the ability to effectively replace 757-200s," says Aviation Partners Boeing's VP sales Patrick LaMoria. "The performance/payload benefit of Blended Winglet technology allows Aeromexico to operate economically, with full passenger loads, out of high/hot Mexico City airport."

For Casablanca, Morocco-based Royal Air Maroc, which recently ordered 29 Blended Winglet shipsets for 737-800s and 737-700s, reduced noise and emissions when operating into Europe helped drive the decision to upgrade. "For Royal Air Moroc, the environmental benefits of our technology were particularly important," says Aviation Partners Boeing's director of sales and marketing Christopher Stafford. "Reduced noise and emissions, made possible with our technology, reduce the carrier's operating fees in Europe. With a more efficient wing, Royal Air Moroc has the potential to lower airframe maximum take-off weight to reduce navigation and landing fees within the European Union."

Icelandair found it had an iron-clad case for investing in Blended Winglet technology when it placed an order for seven 757-200 shipsets with options for an additional 15 shipsets. As Icelandair flies its 757-200s about 4,000 hours annually, with average stage lengths of 1,450nm, the Blended Winglet payback is less than two years thanks to fuel savings — close to 200,000 gallons per aircraft per year — and engine maintenance cost savings of about $4,000 per month.

Leasing companies, traditionally hesitant to invest in out-of-production aircraft, now seem willing to 'bend the rules' when it comes to Blended Winglet-enhanced models such as the 757-200. ILFC recently signed a General Terms Agreement to retrofit with Blended Winglets two 757-200s leased by Antalya, Turkey-based SunExpress. As winglets increase residual value and lease rates for lessors, and represent an immediate cash flow positive proposition for lessees, it's a win-win situation. "Leasing companies have become more aggressive recently in investing in our technology for out-of-production aircraft," says LaMoria. "Operators retrofitting leased 757-200s with Blended Winglets typically save three times the cost of additional monthly

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lease rates based on fuel savings alone. Any time you can achieve this sort of cash flow positive scenario it's very hard to say no!"

In two of the world's fastest growing airline markets — China and India — Blended Winglet technology has become a vital part of running a successful and cost-efficient airline. Over 110 Blended Winglet-enhanced Boeing aircraft are currently in operation in Asia-Pacific with orders for an additional 121 shipsets. In India alone, Jet Airways has ordered 10 shipsets, SpiceJet has ordered 10 shipsets, Air Sahara has ordered one shipset and Air-India Express, India's newest low-cost carrier, has ordered 22 Blended Winglet shipsets. "We've been very successful in India and Australia, with virtually 100 per cent market penetration, and we have very strong relationships in place with air carriers throughout China," says Aviation Partners Boeing sales director Craig McCallum.

Air Senegal was the first operator in Western Africa to order Aviation Partners Boeing's Blended Winglet technology. Primary application for Air Senegal's first Blended Winglet-enhanced 737-700 will be on the daily 2,625-mile Dakar to Paris route. At typical utilisation rates, Air Senegal will save up to 120,000 gallons of fuel per Blended Winglet-equipped aircraft. This saving translates into one in every 25 Dakar to Paris flights being free, in terms of fuel costs, with close to 15 'fuel-cost-free' round trips to Paris each year.

Over in the sultanate of Oman, Oman Air recently adopted Blended Winglet technology for dramatic range/payload benefits in addition to expected fuel savings of 100,000 gallons per aircraft per year. "The Blended Winglet business case was particularly compelling for Oman Air," says Stafford. "Our technology allows Oman Air 737-800s to depart Muscat 4,400 pounds heavier thanks to a more efficient wing. This translates to 22 additional revenue passengers being boarded, per flight, during hot summer months."

On the mega-order front Southwest Airlines is looking to upgrade as many as 542 737-700s through 2012, Ryanair has committed to 229 737-800 Blended Winglet shipsets and Continental Airlines plans to performance-upgrade up to 51 of its 757-200s with Blended Winglet technology.

"The significance of these orders is huge," says Aviation Partners Boeing's senior VP Marketing Dick Friel. "It really pushes us over the top as far as critical mass goes. There was a time when airlines were asking the question 'Why do we need Blended Winglet technology?' but this question has now changed to 'Why don't we have Blended Winglets?' Today, carriers not taking advantage of Blended Winglet technology are the exception and their operating costs are higher than they need to be."

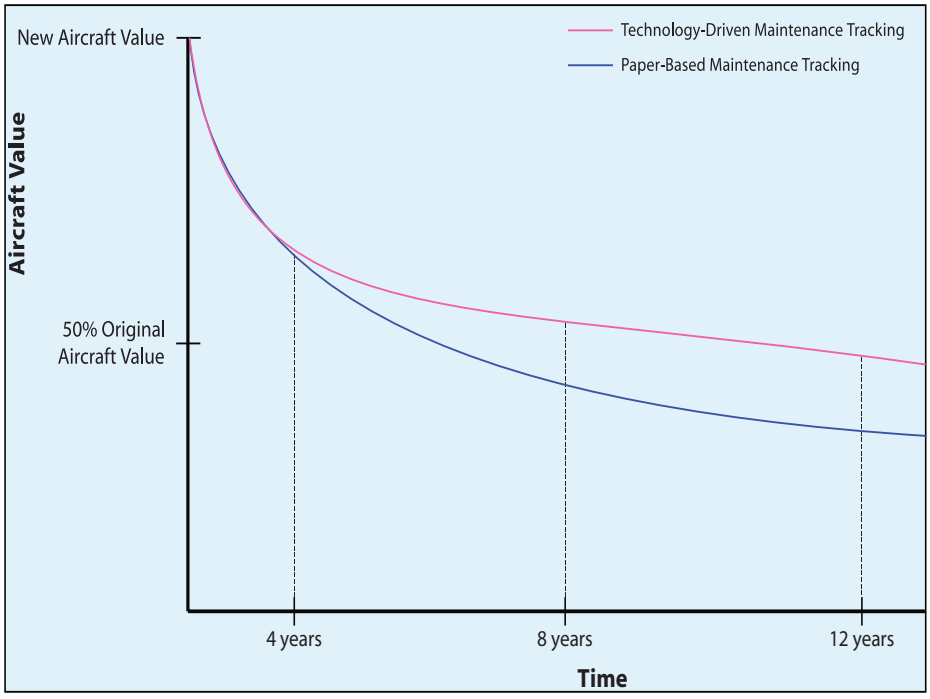
The future is 'on the wing'

Today, with critical mass achieved, the standard configuration for most of the world's 737-800s and 700s is as a Blended Winglet-equipped aircraft. As Aviation Partners Boeing launches new programmes, an even greater percentage of the global airline fleet will benefit from significant fuel savings, performance advantages and the environmental attributes of Blended Winglet technology.

Looking 10 to 20 years out, Clark envisions many exciting opportunities for the industry: "New commercial transports will become more fuel efficient and aerodynamically fine-tuned, and we're looking into a new generation of uniquely effective drag-reducing wingtip treatments for these future generation transports. I anticipate the emergence of a successful second-generation of supersonic airline transports within the not too distant future, as well as well as new categories of unmanned air vehicles (UAVs) in military, cargo and perhaps even airline transport configurations. We look forward to significantly enhancing the economics and operating efficiency of all of these new transports with our performance enhancing technology. The beauty of Blended Winglets technology is that it's effective for any make or model of aircraft."

Integrated aviation solutions

In an increasingly dynamic operating environment, application of new technologies can make it easier for lessors to track the maintenance and configuration status of their assets. US-based aviation software provider *Avexus* explains how.



The cost to provide the technology infrastructure to lessees is balanced against the benefit received when the time comes to recover and re-lease the aircraft.

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The value proposition associated with investment in and leasing of a high-value aviation asset has inherent assumptions embedded within it. The two largest assumptions relate to the useful life of the asset and the number of lease-revenue days that can be achieved within that useful life. Multiple factors affect each variable, including environmental, macroeconomic and other intangibles. While there are levers that a lessor can pull to affect these variables, this article will focus on how better utilisation of commercially-available technologies can facilitate extended useful life and expedite an asset's 'return to service'.

The operating environment

The business model for leasing aviation assets has remained fairly static over the last twenty years. What has changed is the environment and operational models of the companies that are consuming those assets. As legacy carriers are increasingly being challenged by new low-cost carriers and other start-up operations, they have been forced to leverage leased aircraft that allow them to flexibly supplement capacity requirements while extending capital and expense budgets.

For many of the new low-cost carriers, the ability to lease aircraft has provided rapid access to markets they want to quickly penetrate with specific types of aircrafts. By leasing aircraft, these start-ups are also able to acquire newer models that allow them to build the type of brand equity they need to be able to compete and acquire market share from legacy carriers. This alternative to large up-front capital expenditures removes one of the largest barriers to entry for a start-up operator.

As demand for leased aircraft continues to rise, prospective lessors need to continuously provide new services to their lessees in order to maintain the highest margin on their leased assets. Lessors also need to

ensure that they are minimising the downtime of their aircraft when they are between contracted lease periods.

As a leased asset is utilised, its maintenance and configuration status are paramount to determining its market value and how quickly it can be returned to service. Commercially-available technology solutions can help manage the life-cycle value of leased assets by providing complete visibility into configuration and maintenance records, allowing for quick asset analysis, lease-end compliance and asset turnaround.

Utilising technology to better control the long-term value of an aviation asset has a profound effect the further out in time you look. Within the first phase (years one to four) of an aircraft's lifecycle, the rate of decline in its value will remain fairly steady regardless of the maintenance operations technologies deployed to manage asset information. It is as the aircraft gets deeper into its lifecycle (year eight and on) that there starts to be significant divergence between the value of a focused asset management technology strategy and a more manual, paper-based methodology (see Figure 1).

To illustrate how technology can allow a lessor to better manage its investments within this environment, we will walk through a case study that focuses on the complete lifecycle of a leased aircraft.

Stage 1: new aircraft

Our fictional leasing company, LeaseCo, has just purchased a new narrowbody jet and already has a lease contract in place with BMXAir, a new low-cost, US-based operator. As part of the contract, LeaseCo provides access for BMXAir to obtain all configuration information and required maintenance programme information for the aircraft in a digital format.

BMXAir has two options at the time of contracting with LeaseCo. It can either download the data for incorporation into its maintenance operations system, or access and manage its new leased asset directly

within the LeaseCo application environment through the internet. In this case, BMXAir, being a young company seeking to minimise its owned information technology environment, chooses to use the LeaseCo system to track and keep current maintenance configuration and status information.

Once in operation, BMXAir updates actual flight information (cycles, hours, and landings) for its leased aircraft on a daily basis into the LeaseCo application. As these results are added, the solution tracks current flight hours and cycles against upcoming required maintenance activities. BMXAir has instant visibility into the maintenance horizon on its aircraft, and is able to plan flight schedules around required maintenance downtime. As maintenance is actually performed, the data for the aircraft is updated accordingly and operational counts reset. BMXAir is able to efficiently manage the maintenance costs over the life-cycle of its lease by utilising the LeaseCo maintenance application.

For LeaseCo, the cost to provide this technology infrastructure to lessees is balanced against the benefit received when the time comes to recover and re-lease the aircraft. That

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benefit arises from an ability to efficiently conduct mid-lease auditing of maintenance reserve status and BMXAir contract compliance; an ability to keep close tabs on the actual versus forecast maintenance activities on the leased aircraft, allowing LeaseCo to perform detail trend analysis; and visibility into aircraft status for rapid and accurate planning for end-of-term maintenance and overhaul requirements.

Stage 2: return to service

As the end-date of the BMXAir lease term nears, LeaseCo becomes actively engaged in the process of re-leasing the now eight-year-old aircraft. BMXAir has decided to lease another new aircraft, so LeaseCo quickly jumps into sales mode. One key marketing strategy that LeaseCo can use is to advertise the fact that the aircraft has been managed and tracked since its first flight by the LeaseCo maintenance operations application. Across the leasing industry, which over the eight-year period increasingly deployed leading technologies to manage the aircraft, the LeaseCo programme is highly regarded as being a market leader.

With six months to go before the aircraft is due to be returned, LeaseCo has complete visibility into what maintenance is going to be required to have the aircraft re-leased to a new customer with the minimum amount of downtime. This allows LeaseCo to plan and locate inventory properly, line up maintenance services and capacity, and provide a reliable date to the marketplace on when the aircraft will be ready for re-lease.

When the term of the BMXAir lease ends, the aircraft goes directly to LeaseCo's preferred maintenance facility, AvHangar, for its return-to-service overhaul. AvHangar has direct access to all of the maintenance activities performed on the aircraft, including detailed records of what regulatory items have been completed or remain open (service bulletins, air worthiness directives); and when and where all maintenance checks were done, as well as any other historical maintenance information that is relevant.

Several factors allow LeaseCo to minimise the downtime of its leased aircraft and increase overall revenue dollars. For example, AvHangar has advanced visibility to the maintenance history of the aircraft, and hence is able to accurately forecast the likely maintenance required and to plan capacity and resourcing with an efficient process. What's more, managing the aircraft through its entire life with an integrated maintenance operations system gives confidence to prospective lessees as to the quality of the asset they will be putting into operation. LeaseCo, meanwhile, does not have to spend time updating maintenance information from paper maintenance records, an activity that often spans several months; and it is able to rapidly gain the required return-to-service certification for the aircraft.

Stage 3: same aircraft, new lessee

With clean historical information and a well-maintained aircraft,

LeaseCo is able to quickly come to terms with AirSouth, a national Latin America-based operator. AirSouth has been operating for the last 30 years, starting off as a regional carrier and then evolving into a larger national operation. The leased aircraft fits well into the AirSouth fleet, as they have 10 other aircraft of the same model of varying ages.

AirSouth chooses to integrate the management of the leased aircraft into its own on-site maintenance operation system. LeaseCo provides all of the historical maintenance information to AirSouth directly out of its maintenance application, which rapidly allows AirSouth to get the new aircraft into operation. As part of the negotiation before the lease was signed, LeaseCo was able to extract substantial revenue from AirSouth as the two sides agreed on the cost avoidance that AirSouth would be able to obtain by not having to manually update historical and current maintenance activity information on the new leased aircraft.

Even though AirSouth chose not to use LeaseCo's maintenance operations solution to manage the aircraft on a day-to-day basis, LeaseCo is still able to track and gain visibility into the status of the aircraft. In the contract, AirSouth agreed to provide automated weekly operations updates to the LeaseCo application. This helps preserve the residual value of the asset by allowing LeaseCo to monitor contracted maintenance compliance and visibility into future maintenance requirements. This will allow LeaseCo to pull the levers in the right direction when it comes time to re-start the leasing process at the end of AirSouth's term.

Maximising value in a diverse environment

LeaseCo has now made it through two lease cycles and has been able to maintain a high level of integrity of the maintenance and operating information of its asset. It was able to accomplish this across two very different operating models: one lessee that invested very little in information technology infrastructure and utilised the LeaseCo application, and one that integrated data from LeaseCo into its maintenance operations application.

The operational environment for aircraft lessors is only going to become more complex and competitive as operators focus their efforts on business strategies that generate positive cash flow. Being able to provide value-added services to their customers will not only allow lessors to drive better top-line return on their investments, but it will inevitably lead to better utilisation of aviation assets through the extended value chain.

Value benefits for the lease network

Ultimately, the network relationship between leasing organisations and lessees creates a significant business value benefit for each organisation, arising from reductions in operating cost, turn-time, manual processes and contracting costs, and from increases in revenue opportunities, asset availability, residual values and asset reliability. Confirming the attractiveness of networking to all parties, the entire process is compliance-driven.