

# WARRANTY WEEK™

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## Jetliner Warranties:

**In the good old days, the airlines and aviation parts manufacturers already swamped by regulatory paperwork had little time for the additional bother of warranty claims. But in an era of falling revenue and rising costs, warranty has suddenly become very important to both operators and their suppliers.**

As with so many facets of life, in aviation there is the era before Sept. 11, and then there is the downturn and recovery that followed. Commercial airlines have always veered from booms to busts, and the manufacturers have seen tough times too -- Boeing Co. spent 18 months in the early 1970s without taking a single order! But the one-two-three combination punches the aviation industry suffered in the past few years from terrorism, epidemics and war produced the sharpest downturn in the hundred-year history of their industry. Cutting costs became a matter of survival, which put the spotlight on the cost of repairs and spare parts, and ultimately, warranty.

Commercial jet airplanes, which are among the largest and most complex manufactured products in the world, are also blanketed by some of the most complex warranty policies. They're so complex, in fact, that the major airframe manufacturers usually negotiate a package of warranties for the engines, avionics, and other components, which they then hand over in book form to the new owners. In the old days, the airlines would put that book on a shelf and not worry about things as trivial as warranties. They had another book to consider: the log book that follows a plane throughout its life, containing lists of all repairs made down through multiple owners. But now, with spare parts bills consuming up to 40% of airline revenue, they've dusted off those warranty book to see whether they're entitled to any reimbursements for the parts they've replaced.

Jetliners and their spare parts generally are covered by three-year warranties against manufacturing defects. The airframe structure is generally covered for 12 years (pro-rated) against problems such as cracks. But there are two more types of product guarantees peculiar to the aviation industry. One is the performance guarantee, which basically predicts the seat-mile costs over 10 years. Another is the maintenance cost guarantee, which predicts the cost of repairs over five years. For instance, an engine manufacturer will guarantee \$X in maintenance costs per year and \$Y in fuel costs per flight. After five or 10 years, they may have to pay the owner of the plane a penalty if those guarantees are not met. Of course, it's up to the owner to document those costs.

Aviation warranties are sufficiently complicated that some of the smaller airlines have decided to outsource their entire warranty operations to outside experts. Harish Shah, managing director of [Aviation Warranty Solutions Ltd.](#), was until last year working for one of the airlines based at London's Luton Airport. He was working for [Monarch Aircraft Engineering Ltd.](#), an arm of Monarch Airlines, which operates a fleet of scheduled and charter services out of a hub at the airport. Over time, he found himself organizing the warranty claims paperwork for not only Monarch Airlines, but also for some of the other small independent airlines that subcontracted their maintenance and repair services to Monarch.

## Timing Is Everything

One day, he saw an opportunity to leave the company completely, taking this warranty processing skill with him. He set up shop as a warranty expert specializing in processing claims for small airlines with 20 planes or less. One would think that opening an airline service company of any kind in the past year or two would be akin to trying to open a financial service company in 1933. After all, this was the depths of the travel recession, when anybody who didn't absolutely have to fly stayed home. But as with any service that saves money or recovers costs, warranty actually became more important during the downturn. Contacted by phone last week, he said he's never been busier.

"As the industry is buoyant, airlines tend to not worry too much about warranty claims," Shah explained.

"As the times tightened up, more and more airlines looked for savings, and one of those savings was to effectively manage their warranties."

Shah said he doesn't want to name his clients, but they are primarily small charter airlines, although one is a scheduled airline. Most are based in the UK, though one is based in Spain. In all, they fly around 50 airplanes -- mostly Airbus A320 and Boeing 737 jets -- and have designated Shah and his company to essentially become their warranty administrators. They have come to him because they don't have the resources to employ somebody to do nothing but shepherd their warranty claims along, but they still want their claims processed.



"I provide the service in the middle," Shah said. "I represent the airlines themselves. On behalf of the airline customers I have, I review all their defects and maintenance activities, and then I process the items and figure out which are warrantable defects. Then I prepare the claims, put them in to the manufacturers, and then basically do all the negotiating. Once the claim is accepted, the credit then goes back to the airline."

Shah said he started out in engineering, but gradually developed an expertise at paperwork and negotiation. "I've worked for the airlines and gone through the different phases of airline maintenance and operations, right through to contract management. I've been doing it for the last 15 years, working for maintenance and repair organizations," he said. In general, what he finds is that for the scope of the aviation industry and the size of the jets they fly, it really is a small world.

"Basically, warranties within the airline world work on a personal one-to-one basis," he said. "So there are a lot of personal relationships I have with a lot of the vendors. And you generally get one person that you deal with, so you can build a relationship and trust."

## Airline Warranty Group

Shah and around 30 others recently formed an association of airline warranty professionals called the International Aviation Warranty Association. Membership in the IAWA is open to airline and MRO warranty representatives, but not to manufacturers, he said, although OEMs are frequently invited to make presentations to the group. The Alitalia Group is a member, and the next meeting is scheduled to be held in Rome. Details are available from [Neil.Greenlees@firstchoice.co.uk](mailto:Neil.Greenlees@firstchoice.co.uk).

The components and systems aboard just one airplane can have multiple hundreds of warranties. First there is the basic airframe warranty, which in the commercial airline world is likely to come from either Boeing or Airbus. Then there are the turbine engines, which are likely made by General Electric's [GE Aircraft Engines](#) unit, United

Technology's [Pratt & Whitney](#) unit, or perhaps by [Rolls-Royce plc](#). But don't let the name fool you. This Rolls is the aerospace manufacturer, while [Rolls-Royce Motor Cars Ltd.](#) is the automotive manufacturer.

Then there are all the avionics, the cabin interiors, seating, carpeting, food galleys, in-flight entertainment systems, and dozens of other systems, components, and parts. While there could be hundreds of manufacturers involved from nose to tail, market leaders include [Honeywell International Inc.](#), [Rockwell Collins Inc.](#), [Hamilton Sundstrand Corp.](#), another unit of United Technologies, [L-3 Communications Holdings Inc.](#), makers of security items such as the "black box" recorders, and [Goodrich Corp.](#), the rubber manufacturer turned aerospace company which owns neither a blimp nor the tire company that gave the company its name.

Each of these manufacturers is first going to try to nail down a long-term supply contract with either Boeing or Airbus, making sure that their engines, avionics, or cabin systems are part of the new plane package. But the corresponding warranty will be issued by each manufacturer directly to the buyer, somewhat akin to how it's done in the trucking industry. It's not the same in the passenger car industry, where the OEM issues the "bumper to bumper" warranty and deals with its suppliers itself. Usually, the airframe manufacturer has negotiated the warranty for each manufactured item to an industry-standard length of three years, and also has assembled all the warranty documentation and paperwork into one thick book for the buyer. But if the engine or avionics needs fixing, Boeing or Airbus doesn't want to be the first ones called. It's not their engine.

Also somewhat akin to the trucking industry, the major airlines are essentially fleet managers, so they try to keep their fleets as uniform as possible. Therefore, given a choice, they will prefer if all their new planes have engines, cabins and avionics similar to what they already own. They don't want to fly with too many types of systems on their fleets, if they have to stock spare parts for each of them. So, for instance, if they have a choice of engines on an aircraft, they will choose the one they already have the most of already in service. Nothing is sole-source in theory, but it ends up being that way in practice.

The spare parts business is a huge part of the airline industry. Some say spare parts consumes up to 40% of a typical airline's revenue. The aftermarket also is hugely important to the manufacturers, because they make most of their money selling spare parts to the jetliner operators. The parts used to build the new jetliners are sold to Boeing or Airbus at much lower prices than they fetch in the aftermarket. With the best-selling platforms such as the A320 or the 737, they're just happy to be on board the new plane, because they'll automatically be part of the "as new" package for years to come.

This gives some manufacturers an incumbency that is hard to overcome. Everything from the engines to the wheels have to conform to standards of quality and airworthiness, which results in stories of the \$200 flashlight and its \$40 batteries. It's not that the batteries cost \$40. They cost \$2, but the paperwork needed to put them on board costs \$38. Before parts can be shipped and installed, each manufacturer has to pay an expert to fill out an [FAA 8130 form](#), a piece of paperwork that seemingly only retired FAA officials can navigate, with hourly consulting fees that would make most lawyers envious. But without an 8130 certificate of airworthiness, the parts cannot be used on commercial flights.

## **Turbine Engine Manufacturers**

Airlines selecting engines for the planes they buy usually have a choice among two or three vendors. For instance, if they were buying a fleet of Boeing 757 jets, they could choose between the Rolls-Royce [RB211](#) engine or the Pratt & Whitney [PW2000](#). Other times just one manufacturer's engines have qualified for a given airplane, especially if it's a large two-engine model expected to travel over long distances across remote regions of the world.

Sometimes the new plane pushes the envelope so far that the engine manufacturers partner, as with the [GP7000](#) engine for the next-generation Airbus A380. Pratt & Whitney and General Electric teamed up to produce engines big enough for the mammoth A380, a double-decker jumbo jet planned to have 49% more floor space and 35% more seats than the largest 747. The companies are working together as the [GE-PW Engine Alliance](#) because otherwise they each would have spent \$1 billion on development without any guarantees of market share. This way, they share the development cost and then the risk and revenue.

Meanwhile, Rolls-Royce also is developing an engine for the A380. Its much-anticipated [Trent 900](#) engine will compete with the GP7000. Who will buy which engine? And which airlines will buy a plane this big? Those are multi-billion-dollar questions whose answers are still uncertain. First flights of the A380 are expected by year's end, with the first commercial services expected in 2006. [Click here](#) to see artists' drawings of the new A380 interiors. [Click here](#) to see photographs of all the world's jumbo jets currently in service.

[William Edward Boeing](#) started his airplane manufacturing company in a Seattle boathouse in 1915. In the years since it has grown both through the success of products such as the 747, the B-52, and the [Space Shuttle](#), as well as through acquisitions of the Douglas, McDonnell, and North American Aviation companies. The Jet Age began 50 years ago this summer when Boeing's first commercial jet airliner, the [Model 707-120](#), took its first test flight on July 15, 1954. Commercial flights began three years later.

All told, the Boeing Company has built 14,000 jetliners since then. It remains a publicly traded U.S. company, with sales of commercial airplanes topping \$16.5 billion through the first nine months of 2003. Warranty Claims were \$193 million and accruals were \$125 million. The current big seller is the [737](#), followed by the 777 and the 767. But neither production volumes nor revenue are what they used to be. Jetliner sales are down 36% since 2001.



Airbus, officially the Airbus Société par Actions Simplifiée, is owned by the [European Aeronautic Defence and Space Company](#) and [BAE Systems plc](#). EADS is itself a joint venture, 34% publicly traded and 66% owned by a consortium of Aerospatiale Matra S.A., Construcciones Aeronáuticas S.A., and DaimlerChrysler Aerospace AG. Somewhere in that shareholding structure, the French and Spanish governments ultimately own a good chunk of Airbus stock. Airbus has not reported upon its warranty accounting methodology. Its best-selling A320 series has tallied deliveries of more than 2,000 units so far, with another 1,000 on order.

Airbus equipment has a more troublesome maintenance rep in North America because so many of the manufacturers are in Europe. Boeing has a better maintenance and warranty rep on its home turf, but also seems to have an edge in Europe. Boeing has a rep for being somewhat inflexible about its pricing, while Airbus has a rep for selling aggressively on low prices and favorable financing terms. Some say Airbus prices are so low that it can't possibly be making any money for its owners.

## No Warranties in the Military

Both Boeing and BAE Systems also have significant interests in the defense aircraft industry. Boeing and EADS are suppliers of space vehicles as well. But while commercial airliners are usually covered from nose to tail by warranties of three years, military jets are not. Even in cases where a commercial jet with commercial engines is sold as a military freighter, tanker, or troop carrier, it is sold with maintenance guarantees and service contracts, but not warranties.

The Pentagon seeks performance guarantees and reliability guarantees, but even these are specified by contract, not by a warranty policy. Aircraft are tested before they're accepted, and must conform to specifications. Spare parts for military jets might even be [ordered online](#), as is common with the commercial OEMs. But the parts they sell to the military are not usually under warranty in the commercial sense of the term. While this may change as the military shops for more commercial off the shelf products such as communications and navigation systems that are sold with standard warranties in the box, by and large the military does not seek nor does it hold any product warranties on its aircraft.


When a jetliner breaks down, it has to be fixed immediately. Usually, the offending part is taken out of the aircraft -- sometimes at the gate or in the hangar before a flight -- and immediately a spare is inserted and the plane is off again with passengers. If it can't be fixed immediately right then and there, in some cases it will be flown to another repair facility with no passengers on board. Such a non-revenue flight costs between \$5,000 and \$10,000 to make, however. But it's cheaper than taking a plane out of service. An aircraft on the ground (AOG) can cost from \$10,000 to \$25,000 per hour, so there's no time to waste.

Many of the parts in today's jetliners are line replaceable units, meaning they are modules that can be swapped out at the gate, causing no delays or cancelled flights. Sometimes they'll taxi the jet over to a hangar for the work. The airlines either have their own mechanics or they have contracted with someone else's mechanics at each of the airports they serve. The big carriers do around two-thirds of their own maintenance, and contract around one-third out to others. Sometimes they swap or trade or barter repairs or spares, doing someone a favor and expecting it to be returned in time. Some carriers do all their own engine work and contract out most of their airframe and component work. Others contract it all away to outside firms.

## Extended Warranties for Engines

Many of the engine manufacturers are now providing service contracts that are referred to as "Power by the Hour" agreements. Somewhat akin to extended warranties in the automotive market, airlines that sign up for these programs pay a fixed fee based on the age of the engine no matter what repairs are needed. [Power by the Hour](#) originated as a trademarked service decades ago at Rolls-Royce, but its popularity has spread throughout the industry, and like Xerox, Kool-Aid and Kleenex, its use has gone somewhat generic. The service contracts makes warranty claims unnecessary, since from day one every repair is covered by the OEM. It also makes it unnecessary for the airline to ever again have to do its own engine repairs, because labor is included. Plus, it makes it much simpler for the airlines to forecast their repair budgets, because costs are fixed.

Service contracts also makes the third party aftermarket less necessary, because all the replacement parts will be provided by the OEM and all the labor will be performed by its representatives. This may keep prices higher in the aftermarket -- the so-called [PMA](#) market (for parts manufacturing authority, an FAA term). If engine repairs become extended warranty jobs, the airlines will no longer have an incentive to buy PMA parts. Aftermarket parts usually get the same warranty as the OEM parts, and perform the same. But the trend towards fixed fee service contracts cuts them off from their prime customers, the airlines.

 [British Airways Avionic Engineering](#), a subsidiary of British Airways located in South Wales, UK, has since 1993 provided repair services to both its corporate parent and to others. BAAE specializes in repairs of avionics, in-flight entertainment systems, and galleys. It makes the repairs and then processes any warranty claims with the OEMs on behalf of the plane's owner. Most of its work is done on behalf of BA itself, but the company also does work for Lufthansa, Quantas, and others.

Kim Lawless, contract and warranty manager at BAAE, said she has personally seen warranty become more important across the whole British Airways organization in recent years, as cost cutting and cost recovery became priorities. "In the last three years at this facility, we've really said hang on a minute, there's an opportunity here that's been missed," she said. "So I've been managing warranty for the past three years. It was recovered previously, but not to the scale that it is now. A process was put in place, and now there are procedures -- how we manage it. We've written some good software programs that allow us to collect the information out of our systems efficiently and accurately. So we can define quite quickly whether there is a warranty claim or not."

Lawless also said that procedures have now been put in place to recover the cost of labor for failed replacement parts, which was not done very well before. For instance, in the old days when warranty was an afterthought, a mechanic could spend eight hours installing a spare part, only to find that it doesn't work. Back then, the company might have made a claim just for the rejected spare part. Now, they'll make a claim for the wasted labor as well.

"In the current situation that the airline industry and the OEMs are in, everyone is trying to recap costs, and if they don't have to give you the money they won't," Lawless said. "I think you have to push everybody to give you money, because that's just the way the industry is. Over the last three years, it's taken a particularly long time to get the OEMs to understand that we're not going to 'drop it.'"

## More Differences from Other Industries

Warranty in aviation is quite different from the situation in automotive or appliances not only because of regulation, but also because of the increased cost of compliance with those regulations. A part is not just replaced. The whole episode has to be documented, whether it's a claimable part or not. But the biggest difference is that in aviation, the owner is likely to perform the replacement, and then bill the manufacturer for the labor at standard rates.

An airline will first replace a part and then make a warranty claim. So before there even is a claim, there is the cost of the labor and the spare part. Then there is the cost of preparing the paperwork for the claim, and the cost of shipping the defective part back to the manufacturer. If the claim is deemed to be valid, the part may be repaired and shipped back to the airline, which has no use for it until another spare is needed.

If the removed parts are still under warranty, they usually are sent back to the manufacturer to be fixed and returned. If there are simply no spares, an airline can put in a priority request to get one manufactured. But the price will be astronomical. As with other sectors, it helps to know somebody who can get it done quicker. Alternatively, the OEM might have a rotatable pool of spares, which means the airline will get back a different remanufactured part from the one they sent in.

Shah at Aviation Warranty Solutions said even the large airlines are not making all the claims they could. "From my experience, the majority of airlines, including the very large ones, recover only about 65% of what there is to recover," he said. The larger airlines typically handle their own warranties in-house. But he sees that as an opportunity. Even in cases where the airline wants its warranty recovery operations to remain in-house, he can train them to do their jobs better.

At the same time, however, the manufacturers and vendors also tightened up their warranty processing operations, making it tougher for the airlines to successfully submit claims. "The processes are becoming harder," Shah said. "You have to provide more and more paperwork, more and more information, in order to get your money back."

## Windows Operating System

[GKN Aerospace Transparency Systems](#) in Garden Grove, Calif., is one of the largest suppliers of windows for jet aircraft, both military and commercial. The windshields it sells for the Airbus A320 family carry industry-standard product warranties of three years, but the cabin windows are warranted for even longer periods.

"A cabin window has a very long warranty because the air resistance isn't as strong as on the front windshield," noted Jessica Chester, a GKN sales administrator. "We can go up to eight years, ten years if it's coated," she said. The mean time between unscheduled removals is upwards of 20,000 flight-hours, which translates to several multiples of the warranty period, depending on usage.

One would think there are no warranty claims for the glass in pressurized aircraft, because of the calamity a broken window would become at 10,000 meters. But that's precisely the point. The defects or damage are detected *before* there is a catastrophic failure, and the plane flies with a replacement pane in place.

An airline making a warranty claim to GKN would first send the glass back to the company for inspection. If it looks to GKN's engineers as if the glass cracked or de-laminated, they're going to want to know why it happened, because they're going to have pay to replace it. But if it looks like something hit it, or it overheated because of operator error, the company is going to want to document this as the cause, because the claim will be turned down.

Chester said it's going to take around 30 to 45 days from the time the window is removed until GKN approves or denies the warranty claim. Usually, the airlines like to keep a certain level of stock, so the question of shipping out a replacement window or issuing a credit is dependent on other factors. The airline is more interested in making sure a spare is always immediately available when and where it's needed. Lately, though, they've been paying more attention to the status of their claims.

"I get a lot more warranty claims now," Chester said, because the airlines follow through more frequently with their claims since business declined three years ago. It's not that the windows fail more frequently now. It's just that the airlines want their money back now -- even for a window -- while before they wouldn't bother.

"They're looking at all the possibilities at this point," she said. "It doesn't matter if it's a window or something else inside the aircraft, because of the financial situation they're in. So they are paying more attention [to warranty]. Now they're being very careful."

## **Manufacturing Re-Engineering**

Dan Sokol and Bob Morris, CEO and president, respectively, of Renaissance Services in Springfield, Ohio, work closely with original equipment manufacturers in the aerospace and defense industries. Their company is a consulting service and systems integrator specializing in business process re-engineering. Lately, he too has been seeing more demand for warranty process re-engineering. Most of the company's clients are involved in the manufacture of engines and airframes, so they're well-known names that Sokol unfortunately was not at liberty to share.

"We're working to help these companies reduce their cost of warranty," he said. "A lot of that cost originates from quality escapes that originated in the supply chain. They've done everything else they can to cut costs -- cutting heads out of the company, for instance. Now they're looking more aggressively at how they can reduce warranty costs."

The place to start, Sokol tells them, is with product design -- preventing warranty claims from ever leaving the factory. Something as simple as failing to heat-treat a shaft before an engine is assembled can lead to major expenses down the road as planes that should have been flying are instead idled and retrofitted. The next thing to attack is the manufacturing process -- detecting and reducing the number of rejects while the parts are in production. If there used to be one bad part for every four, that has to go down to one defect in every eight, and meanwhile all seven "good" parts have to be 100% good, with no returns.

Sokol said he doesn't really get into the claims processing end of the business. "That's between the airlines and the manufacturers," he said. "We're a little more upstream from that, from the design to manufacturing to finished product."

Morris said he thinks that many times, the guarantees in aerospace are geared more towards performance metrics than they are for simply break-fix episodes. For instance, an engine manufacturer might specify fuel consumption targets, or noise and emissions levels, and might have to pay compensation if those targets are not met. When there is a break-fix episode, meanwhile, the priority is to get the plane back in the air quickly, and worry later about who's at fault and who's paying.

Morris said he is not sure that the cost of missing performance targets is always reported as a warranty expense. "Two things fall into this bucket: One is the cost of quality, and the other is the actual warranty expense. Some people may view their cost of quality expenses as being in the same bucket as warranty. But I think warranty means something very specific to the people who deal with warranties. And I think ultimately, there may be expenses that are book-kept in some other way," he said.

All told, U.S.-based aerospace vendors have reported warranty claims of around \$1.0 billion for the first nine months of 2004, accounting for roughly 6% of all manufacturing product claims. This amount represents less than 1% of total product revenue for the companies involved. However, keep in mind that some of the manufacturers such as United Technologies and GE are quite diversified, so not all that revenue comes from air, space, and defense lines of business. Also, some of the manufacturers with both warranted civilian lines of business and non-warranted defense lines of business readily mix the two together.

In other words, perhaps Morris is onto something when he says the \$1.0 billion and 1% of revenue figures are not representative of the whole warranty picture. There are both guarantees being made that are not accounted for as warranties, and there are military products being sold without warranties at all. Next time, we'll take a look at some of the warranty claims and accruals passing through the accounts of the top OEMs in the aerospace industry.