

AIRLINE MAINTENANCE PROGRAMS A CHALLENGE FOR THE APPRAISER

PART I

TRENDS IN AIRLINE MAINTENANCE PRACTICES WILL REQUIRE APPRAISERS TO ALTER THEIR METHODS.

By: L. Nick Lacey and Andy Stein

Traditional airline maintenance programs are based on the concept that every item has a “right age” at which complete overhaul is necessary to ensure safety and operating reliability. The aircraft manufacturers developed design features that mitigated failure consequences such as replication of system function and the design of damage-tolerant structures. However, airline maintenance departments noticed early on that many types of failures could not be prevented or effectively reduced by maintenance schedules that were based on time between overhauls – they saw many “problem free” engines pulled off the wing for a 2,000-hour overhaul, only to see the recently overhauled engine fail in service a short time later.

In the early 1960’s a FAA/Industry working group was established to evaluate the apparent lack of correlation between preventative maintenance programs and engine life – the outcome was the first maintenance programs that used reliability data to drive maintenance priorities and actions. Up until this time, it was widely believed that the length of time (or number of cycles) between successive overhauls was an important factor in controlling failure rate. This Maintenance Steering Group (MSG) found that scheduled overhauls have little effect on overall reliability of most aircraft components.

The next step was to take what was learned from various reliability programs and design a preventative maintenance program centered on reliability information. This document is known as MSG-1, and became the basis for the Boeing 747 maintenance program, a highly successful program.

The use of the decision-diagram techniques in aircraft maintenance, pioneered by McDonnell Douglas, led to further improvements that resulted in a refined document two years later, known as MSG-2.

How does a failure occur?

What are the consequences?

What can maintenance do?



What maintenance tasks must be done?

What maintenance tasks should be done?

MSG-2 became the basis for the maintenance programs for next generation of tri-jets, the DC-10 and L1011. A similar document prepared in Europe was the basis for the initial maintenance programs for the Airbus A300 and the Concorde.

Under traditional maintenance policies the initial program for the DC-8 required scheduled overhaul for 339 items, in contrast to seven such items in the DC-10 program - a good example of the economic benefits of MSG-1 and MSG-2 approach. One complex item no longer subject to overhaul limits was the turbine engine.

The MSG concepts of Reliability Centered Maintenance (RCM) continued to evolve as more effective statistical methods were developed and the manufacturers added improved system monitoring equipment into the next generation of aircraft such as the A320, 747-400, and MD-11.

In a drive to further reduce maintenance costs and reliability, the steering group issued the third iteration of the concept in 1980 (MSG-3) which led the industry to a whole new approach to maintenance planning. Under MSG-3 maintenance logic separates maintenance activities into safety and economic results, and these activities are assessed at the system level rather than the component level. In other words, if it can be demonstrated that the functional failure of a particular system had no effect on operational safety or that the economic repercussions were not significant, there was no need for a routine maintenance activity. Otherwise, does the cost of maintenance exceed the cost of failure?

For failures evident to flight crews, pilot reports could be used as the point for initiating corrective maintenance action. Where a failure was not obvious to the flight crews, specific maintenance tasks would have to be defined - servicing/lubrication, operational functional check, detailed inspection, or even overhaul or replacement.

The savings in maintenance man-hours under MSG-3 maintenance was dramatic - between 10 and 30 percent depending on the effectiveness of the base program. Consequently, some major U.S. airlines even began to view MSG-3 based maintenance as a competitive advantage.

At this time, 80 percent of widebody and 40 percent of narrowbody aircraft are under MSG programs. Boeing has been expanding its capability to convert Boeing MSG-2 models. Boeing currently offers conversions for the DC-8, DC-9, DC-10, MD-80, 747 and 727. This spring they will add a conversion program for the 737-200/-300/-400/-500. Boeing expects 100 percent of the widebody and 80 of the narrowbody fleet to transition to MSG-3 programs in the near future.

Our next article will address the following: 1.) How the valuations of aircraft on these programs differ? 2.) The impact of MSG-3 based maintenance programs on market value? Residual value? ➔



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PART II

MAINTENANCE PROGRAMS AND AIRCRAFT VALUE

By: L. Nick Lacey and Andy Stein

Our April article on aircraft maintenance discussed the evolution of maintenance programs based on economics and safety. The third iteration of this maintenance philosophy is guided by a joint industry-regulator group known as the Maintenance Steering Group-3 (MSG-3). Under MSG-3, logic separates maintenance activities into safety and economic results, and these activities are assessed at the system level rather than the component level. In other words, if it can be demonstrated that the functional failure of a particular system has no effect on operational safety or that the economic repercussions are not significant, there was no need for a routine maintenance activity.

Aircraft maintained under MSG-3 programs do not see overhaul facilities as often as aircraft in traditional B-C-D check programs. Basically, there is one major structural inspection program that looks for both fatigue and corrosion. While it is clear that MSG-3 maintenance programs enable the operator to maintain airworthiness at a lower cost and reduced man-hours, the impact on the valuation of the aircraft can be significant.

When changing maintenance programs, aircraft must undergo a complex transition (bridging) process. In other words, an MSG-3 program cannot migrate with the aircraft from one airline to another. For a leasing company, a Boeing 767 aircraft coming off an MSG-3 program at airline "A" with a vast experience in operating B767s will need to be bridged back to the manufacture's recommended intervals before entering service with airline "B". For example, Delta primarily uses the data collected in their continuing analysis and surveillance program to justify the time between maintenance tasks. This data is not valid for any maintenance program other than Delta Airlines. The cost of transitioning an aircraft back to basic manufacturers' requirements can be expensive.

Appraisers must give special treatment to aircraft under MSG-3. The traditional aircraft appraisal method of relying on the "D" checks to "zero-life" the airframe until the next "D" check does not work for MSG-3 aircraft. Each aircraft under an MSG-3 program becomes a unique "collection of parts" in different stages of their useful life. The best the appraiser can do is to make an educated guess at the adjustments necessary for an aircraft on an MSG-3 aircraft, or he can spend hours researching the maintenance records in order to determine the status of major components - then try to correlate his findings with the value of aircraft on a traditional maintenance program with the same number of hours and cycles - a time consuming process.



The residual value of an aircraft maintained under MSG-3 should theoretically be higher, because the overall condition of an MSG-3 maintained aircraft should be significantly greater than one that is “run out” approaching the cycle/hour limits in a traditional program. However, the market does not recognize the increase in residual value until there is an efficient way to transition between maintenance programs and airlines

We expect to see more aircraft transitioning to MSG-3 programs. Any program that can maximize the availability of an aircraft to make revenue, decrease maintenance man-hours and increase the mechanical reliability is a winner for the operator. If they haven't already, leasing companies and appraisers will have to adapt. At this time, 80 percent of widebody and 40 percent of narrowbody aircraft are under MSG-3 programs. ➔

