

Lycoming Engines MSB 569A, “Crankshaft Retirement Program”: *What’s it all about?*

Many pilots, aircraft owners, and aviation enthusiasts have likely heard of or read about the crankshaft replacement requirement in certain Lycoming 360 and 540 Series engines, and some have even been lucky enough to have to deal with this expensive and incredibly inconvenient issue firsthand. The truth is, though, few actually understand from what events this program originated. While there were indeed specific cases which first spawned the concern over the engine crankshaft and its integrity, it is important to note that this Mandatory Service Bulletin (MSB) and associated Airworthiness Directive (AD) did not appear overnight due to one single fault; it was rather the confirmed failure of several crankshafts over the course of a two to three year period, and several MSBs and ADs preceded what we know today as MSB 569A.

Background and History

As of the date of this writing, more than eleven years have passed since a crankshaft failure in a Lycoming TIO-540-J2B resulted in an engine failure and subsequent fatal accident of a Piper Cheiftain PA-31-350 in South Australia on May 31, 2000. The aircraft was owned and operated by Whyalla Airlines, based out of Whyalla, Australia. This particular flight was a scheduled charter flight and tragically claimed the lives of all eight people on board after ditching in Spencer Gulf, off the southern coast of Australia. Over the next eighteen months, the Australian Transport Safety Bureau (ATSB) collected evidence and released a final report of findings in January of 2002. The report concluded the accident was indirectly attributed to the failure of the crankshaft in the left engine due to a “subsurface flaw”, causing the crankshaft to crack, and inevitably resulted in an engine failure. After the left engine seized, the increased power settings of the right engine—in attempt to keep the aircraft airborne—resulted in higher-than-normal engine temperatures and pressures in the right engine, eventually leading to a failure of this engine as well. While this is indeed based on factual events, it is important to note that this is only a brief summary of the accident and causes; full information is readily available to the general public as the ATSB has made the full 150-page report available online.

Approximately one month after the ATSB released its report in findings, Lycoming Engines released Mandatory Service Bulletin (MSB) Number 550 in February of 2002. MSB No. 550 affected some 400 engines, specifically Lycoming TIO-540 and LTIO-540 engines producing more than 300 horsepower. This MSB essentially grounded the aircraft and required immediate replacement of crankshafts in these select engines. While still a terrible inconvenience, the positive side to this all was that the work was to be covered under warranty from Lycoming Engines. Due to the noticeably sequential timing of the release of the report for Whyalla accident, soon thereafter followed by the release of MSB No. 550, some argue why MSB No. 550 was released when it was—why not sooner, for example, when Lycoming was likely aware there was a widespread issue—but most of these reasons remain to be, and likely always will be, speculation. The fact of the matter is there were other confirmed cases of crankshaft failures in similar engines, but the Whyalla accident just so happened to be more widely publicized, leading many to believe this single accident was the sole reason from which the MSB originated.

But this was only the beginning. After MSB No. 550 was released, it was only a matter of six months before a revised and superseding version was released in August of 2002 as MSB Number 552, adding additional TIO-540 and LTIO-540 engine serial numbers to the “affected” list, as well as specific serial number crankshafts manufactured within a certain timeframe. On the same day MSB No. 552 was released, the FAA issued emergency airworthiness directive AD 2002-17-53, mandating that the work called for under MSB No. 552 be completed under federal regulations.

Generally, in the cases in which Airworthiness Directives are based on the requirements of Service Bulletins, an Airworthiness Directive, which is released by the FAA, federally mandates the work called for by the respective Service Bulletin if, from the FAA’s own research, they find it necessary to incorporate and require the work as an AD. It is important to note that Service Bulletins are released by OEM manufacturers, not the FAA.

Over the four years following the release of MSB No. 552, five subsequent Mandatory Service Bulletins and five respective Airworthiness Directives were issued, with some of them superseding previous versions of an MSB, and others creating entirely new MSBs. The following is a list of these MSBs and ADs, complete with brief descriptions and timeframe of release of the Mandatory Service Bulletins and the respective Airworthiness Directives:

- 1- **September 16, 2002, Mandatory Service Bulletin Number 553:** Additional TIO-540 and LTIO-540 engines rated at 300 HP or higher and certain crankshafts are included, as well as IO-540 engines with aftermarket turbochargers installed. This MSB required the affected engines in this MSB to have material samples taken to evaluate if a crankshaft should be replaced or remain in service. These factory-authorized inspections were at no charge to the owner; in other words, covered under warranty. **AD 2002-19-03** is released.
- 2- **July 11, 2005, Mandatory Service Bulletin Number 566:** Several 540-Series engines at 300 HP or less were added, as well as some counterweighted 360-Series engines. This MSB required owner/operators to verify if their engine or crankshaft was within a set range of models and serial numbers. If within the range set forth by this MSB, owner/operators had to replace crankshafts. If not within the range set forth, a logbook entry had to be made stating it was not affected. Factory replacement of crankshafts were accomplished at no cost to the owner. Due to reports of 12 crankshaft failures in Lycoming 360 and 540 series engines rated at 300 HP or lower, **AD 2005-19-11** is released by the FAA.
- 3- **November 30, 2005, Supplement Number 1 to Service Bulletin 566:** Due to a confirmed failure in a Lycoming LO-360-A1H6, additional counterweighted 360-Series engines are added, as well as additional crankshafts as set forth by select serial numbers. As with the original MSB No. 566, this supplement required owner/operators to verify if their engine or crankshaft was within a set range of models and serial numbers. If within the range set forth by this MSB, owner/operators had to replace crankshafts. If not within the range set forth, a logbook entry had to be made stating it was not affected. Factory replacement of crankshafts were accomplished at no cost to the owner. **AD 2006-06-16** is released to incorporate the additional terms.
- 4- **February 21, 2006, Mandatory Service Bulletin Number 569:** As Lycoming Engines continued to investigate potentially affected models of engines and crankshafts, it was discovered that other models and crankshafts shared the same material flaws as those crankshafts addressed by earlier MSBs and ADs. For this reason, Lycoming Engines released MSB No. 569, officially starting the “crankshaft retirement program” for various engine models, including 390-, 540-, 580-, and 720-Series engines. The program called for the replacement, or retirement, of the crankshafts in the affected engines at first crankcase separation or next overhaul, whichever occurred first. A crankshaft kit was made available to owners of affected aircraft for \$2,000 USD.
- 5- **April 11, 2006, Mandatory Service Bulletin Number 569A:** Additional engine models, serial numbers and crankshafts were added to the original MSB No. 569, the most notable of which were certain counterweighted 360-Series engines. MSB No. 569A retained the originally mandated time-of-compliance as first crankcase separation or next overhaul, whichever occurred first, but further added that the work must be completed no later than February 21, 2009. The crankshaft kit was still made available for \$2,000 USD. The FAA investigated MSB Numbers 569 and 569A, and, after reviewing 23 confirmed cases of crankshaft failures, they instate **AD 2006-20-09** which mandates the retirement program under federal regulations. However, there is a key difference between the AD and the MSB, specifically in the required time of compliance (further discussed below).
- 6- **May 27th, 2009, Supplement Number 1 to Service Bulletin 569A:** After further review of MSB No. 569A, a relatively minor change is incorporated into the original MSB by correcting the start date (of manufacture) of affected engine models from March 1, 1997 to January 1, 1997. *(As of the date of this writing, AD 2006-20-09 is still in effect with the original dates from MSB No. 569A, though in August of 2011, a proposal was made to amend the AD to incorporate the corrected starting date for affected engine models to January 1, 1997.)*

Present Day: MSB No. 569A and AD 2006-20-09

As of the date of this writing, Lycoming Engines MSB No. 569A (technically 569A-1, but hereinafter referred to as MSB 569A) is still in force, as is the associated Airworthiness Directive, AD 2006-20-09, which mandates compliance under federal regulations. However, there is a key difference between the MSB and the AD, and this is to the advantage of an aircraft owner with an affected engine: the MSB calls for time of compliance to be at *“first crankcase separation or at the next overhaul, whichever occurs first, but not later than February 21, 2009”*; the AD differs by removing the February 21, 2009 deadline and replaces it with the terminology that replacement must occur *“...at the earliest of the following: (1) The time of the next engine overhaul as specified in Lycoming Engines Service Instruction No. 1009AS, dated May 25, 2006; or (2) The next separation of the crankcase; or (3) No later than 12 years from the time the crankshaft first entered service or was last overhauled, whichever is later.”* The FAA found that the February 21, 2009 deadline was irrelevant and that crankshaft removal at overhaul would reduce the risk of failure “to an acceptable level”. So, while compliance is still required, the AD actually provided owners and operators an extension of sorts by allowing them a longer time-to-comply.

Nevertheless, the FAA-implemented 12-year deadline described in AD 2006-20-09 was met with much opposition from owners and operators. Many complained it was a seemingly arbitrary number. However, contrary to what these people believed, the 12-year rule cited in AD 2006-20-09 is, in fact, clearly stated in Lycoming Engine’s Service Instruction No. 1009AS, though the most current revision is No. 1009AU (available for download online on Lycoming’s website: www.lycoming.textron.com). The Service Instruction provides details on recommended time between overhaul periods, and in addition to the specific engine hour recommendations, it also goes on to state that, due to deterioration of engine parts in engines accumulating hours at a low rate per calendar year, “all engines that do not accumulate the hourly period of time between overhauls specified in this publication are recommended to be overhauled in the twelfth year”.

Here’s an example: an engine was first placed into service on January 1st, 2001—the easiest way to determine when an engine was first placed in service is the date-of-manufacture entry in the engine logbook—and this engine has a 2,000 hour TBO. The crankshaft has yet to be replaced and the engine will only have 1,000 hours total time since new by the end of the twelfth year. In this case, AD 2006-20-09 would require this particular engine to have the crankshaft replaced by January 1st, 2013, regardless of the fact that it will only have 1/2 the TBO time in hours.

Retiring a Crankshaft and Associated Costs

Even though the February 21, 2009 deadline to comply with MSB 569A is not applicable in AD 2006-20-09, this date is still an important one to remember. As mentioned above, Lycoming Engines had been providing a crankshaft kit to the owners of affected engines, as part of MSB 569A, for a price of \$2,000 USD. *The key word in that last sentence was “had”*. As of February 21, 2009, Lycoming stopped offering this discounted pricing for the kit, and the kit now costs over \$18,000 USD (as of late 2011). The kit includes the crankshaft along with main bearings, piston pin plugs, crankshaft gear bolt, piston ring sets, connecting rod bolts and nuts, counterweight snap rings, lockwashers, connecting rod bearings, counterweight washers, and seal and gasket set.

Unfortunately, there were numerous owners who did not take advantage of this discounted pricing for any number of reasons, and now these owners, or new owners to whom the aircraft were sold, have to face the expensive reality of purchasing the kit at full price. Many people question why, if these owners of affected engines had nearly three years to buy the discounted kit, would they not have just paid the \$2,000 and buy the crankshaft kit before the February, 2009 deadline. Quite frankly, it is a valid question, and one which still haunts those owners today who never bought the discounted kit. However, in these individuals’ defense, one who criticizes must also consider some valid reasons which are most often cited:

- 1- The aircraft was owned by a different party when the discounted kit was available, and previous owner never bought the kit.
- 2- Owners assumed they would likely run the engine to TBO in hours before the 12-year deadline, and would deal with the crankshaft replacement at engine overhaul.
- 3- Owners assumed they would not own the aircraft for much longer, so they would simply deal with the loss in value upon selling.
- 4- Owners assumed the discounted price for the kit would be available indefinitely.
- 5- Owners simply did not want to pay the money at the time for something which was neither immediately mandatory nor threatening to the airworthiness of the aircraft.

For the owners who figured they would deal with the crankshaft replacement at overhaul often forgot, or were never aware of one crucial piece of information: in a typical field overhaul, the crankshaft is rarely replaced unless there is a serious issue warranting its replacement. One must remember that MSB 569A doesn't call for an *overhaul* of the crankshaft, it requires complete *replacement*. So, unless a crankshaft replacement is specifically requested in a field overhaul, it is typically an added expense in addition to a standard overhaul quote. However, if, at engine overhaul, an owner opts for a factory remanufactured or factory new engine, these engines are delivered with a new crankshaft not affected by the MSB and the problem is solved. The obvious catch is that, on average, a factory remanufactured engine costs more than a standard field overhaul.

In essence, an owner of an affected engine has two options in dealing with the crankshaft retirement at this point in time: (1) have a full engine overhaul completed and replace the crankshaft at the same time, or (2) only replace the crankshaft only with no engine overhaul. Technically, as with all Airworthiness Directives, there are alternate methods of compliance (AMOCs), but these are approved on a case-by-case basis and should generally only be pursued as a last resort. Opting to overhaul an engine is, in most cases, the most expensive option, but it may also be the most cost-effective. When one considers the time and labor required to simply open the engine crankcase and gain access to the crankshaft, it almost seems like a waste of time and money *not* to have the engine completely overhauled at the same time. Though, in all fairness, nearly all owners are always working with some sort of budget, so a full overhaul may not be manageable. Additionally, if an engine still has very low hours on it, then perhaps an overhaul would not be the best decision. Each case is unique, though, and deciding on the appropriate option depends on several factors; this is where a thorough evaluation and some creativity may be necessary. For instance, if an owner has contacts in salvage parts, perhaps he or she could find an airworthy crankshaft not affected by MSB 569A. Sometimes manufacturers or parts departments run specials and an owner can get a deal on a new crankshaft kit. Perhaps another owner has a "good" crankshaft which he or she wants to sell in parting out an aircraft. Bottom line: a smart owner shops around.

My engine is affected by MSB 569A. What do I do now?

If, by reading this article, you are learning about MSB 569A for the first time, and you have an engine which you suspect might be affected, then your first step should be to read the details of MSB 569A and search to see if your engine's serial number is in the tables listed in the MSB text. The full text of MSB 569A can be found on Lycoming's website, www.lycoming.textron.com. Keep in mind that the airworthiness date of your aircraft may not be the same date your engine first entered service—it rarely ever is—so be sure to check your *engine* maintenance logbook. You may find it necessary to incorporate the help of your mechanic in order to search for the necessary serial numbers and information on your specific equipment, so do not be shy about requesting the assistance.

After determining whether or not your engine is affected by the MSB, you have options to consider, and honestly, they may take some time to properly evaluate. If your engine is not affected, then have your mechanic endorse your engine logbook as necessary to indicate MSB 569A is not applicable for whatever reason (e.g. "previously complied with" or "N/A by serial number"). If you discover your engine is affected, then it would probably be wise to start shopping for your most cost-effective option.

Unfortunately, for some owners, time is not on their side, and the “un-airworthy clock” is ticking down due to TBO in hours or calendar time. If you fall into this category and you plan to keep your aircraft, not sell it (see details further on pertaining to selling an aircraft affected by MSB 569A), the best suggestion is to team up with your mechanic and start shopping around to evaluate prices for either a standalone crankshaft replacement or full engine overhaul with crankshaft replacement. It is strongly suggested to obtain pricing for both options so you can compare the cost-effectivity of both options. In other words if the standalone crankshaft replacement costs \$25,000, and a full overhaul with new crankshaft costs \$35,000, is spending the extra \$10,000 worth spending right now? In addition to cost, one has to consider many variables, including, but not limited to resale value, aircraft and engine total time, and engine condition.

For those owners with time on their side: your options remain essentially the same as those owners on a time crunch, but it would be smart to take advantage of this time to carefully evaluate how you want to handle the situation. Procrastinating and naively hoping that the price of the crankshaft is going to be reduced in the near future is, quite frankly, irresponsible, and is only delaying the inevitable, which is that you will have to face the expense or lost value sooner or later. However, if it seems plausible that you may be flying the aircraft to TBO by or before your calendar deadline for crankshaft replacement, then it would be reasonable to assume you can handle the crankshaft issue upon engine overhaul. Though again, you have to factor in the cost of replacing the crankshaft *in addition to* the standard overhaul cost. Regardless, it would be wise to at least consider purchasing the crankshaft kit now so as to avoid any further price increase on the kit, which is also inevitable.

If you are among the group of individuals who bought the crankshaft kit when it was offered for the lower price, then your options are also essentially the same, and presumably, you already have a plan of action in place. Nonetheless, if you have time to spare and have not done so already, it would be wise to consider all the options discussed above.

Selling an Aircraft with MSB 569A Not Completed

Another option for any owner with an aircraft affected by MSB 569A is to consider selling the aircraft before the crankshaft retirement is due, which is actually quite common. However, there is an obvious drawback to this approach: a seller immediately loses some negotiating power the instant he or she places the aircraft for sale due to this known maintenance-deferred discrepancy. This loss in negotiating power goes beyond the tangible cost of the crankshaft, though; it also results from a loss of seller integrity. This may seem a like a bit of an exaggeration, but consider this: the fact that an aircraft has deferred, known maintenance discrepancies can potentially suggest to buyers the idea that the aircraft has had poor maintenance history in general. In other words, some buyers may wonder, if this work (crankshaft replacement) hasn't been completed, who is to say there are not other hidden mysteries in the maintenance? It could also lead buyers to believe a seller is strapped for cash and is desperate to sell. Understandably, this may not be remotely true for a majority of owners for any number of reasons—see reasons 1 through 5 earlier in the article for a few examples—but the point remains that many sellers do not often consider this point of view when selling an aircraft with known issues.

Once again, creativity comes into play if the objective is to sell an aircraft and receive maximum value, especially if the aircraft has known (and expensive), outstanding discrepancies like MSB 569A. For instance, one suggestion is to sell the aircraft at a certain price which includes the crankshaft kit only, but the crankshaft is not installed. Another option might be to offer a sale that includes installation of the crankshaft kit once a non-refundable deposit is obtained from the buyer. These are just two ideas, but if seller and buyer are flexible in terms, there are numerous ways how the sale can be successfully handled and brought to an agreement satisfactory for both parties.

Buying an Aircraft with MSB 569A Not Completed

It is important to understand that sales of previously-owned aircraft with known discrepancies happen every day. Buyers of such aircraft cannot expect to have them completely perfect, nor should sellers feel like they have to have a perfect aircraft before they can sell. Even brand new aircraft rolling off factory lines have discrepancies; it is simply the norm for man-made machines in general. However, the nature of each known discrepancy, and how each one affects the resale value of an aircraft varies widely and has to be determined on a case-by-case basis.

If a buyer wants to buy an aircraft which is affected by MSB 569A, and the seller has yet to have it completed, this should not be a sole deterrent from buying that particular aircraft. There are numerous aircraft available for sale in excellent condition which have yet to have the crankshaft replaced. Again, creativity and willingness to be flexible in terms is key to striking a deal, and there is motivation on both sides of the negotiation, chances are both buyer and seller will find a mutually agreeable solution.

MSB 569A is arguably one of the most widespread and costly “recalls” in recent modern-era general aviation aircraft, but that does not mean that buyers should steer clear of aircraft affected by this MSB. In fact, many of the affected aircraft models are among the most popular in general aviation, and they remain to be, despite the impact of MSB 569A. Buyers in the market for an aircraft equipped with the various affected Lycoming engine models owe it to themselves to at least look through MSB 569A to see if their dream aircraft might be affected. Solely for reference purposes only, the following is an abbreviated list of some popular aircraft affected by MSB 569A / AD 2006-20-09*:

-Beech Duchess	-Mooney TLS M20M	-Piper Dakota
-Cessna 172RG	-Piper Arrow PA-28-200R	-Piper Mirage
-Cessna Cardinal	-Piper Seneca I	-Piper Aerostar 600, 601, 602P,
-Cessna TR/R182	-Piper Seminole	700P
-Cessna 182S, 182T, T182T	-Piper Apache, Cherokee 235	-Piper Aztec, Comanche
-Cessna 206H, T206H	-Piper Cherokee Six	-Robinson R44
-Extra 300	-Piper Saratoga, Turbo Saratoga	-Commander 114, 112TC
-Maule MX-7 Series	-Piper Lance	-Socata TB-20, TB-21
-Mooney M20J-201	-Piper Navajo	

**A full listing of affected aircraft and respective engine models can be found in the text of AD 2006-20-09.*

Important note: an aircraft on this list above does not automatically mean it is an aircraft in which a buyer is going to have to replace the crankshaft, as it may have already been complied with for any number of reasons. A prudent buyer should, however, verify with the seller in the initial round of inquiries that the aircraft in question has had the work completed. A well-educated buyer is a smart buyer, and a smart buyer will become a happy owner, so ask as many questions as possible.

*This article was written by **Andrew Gallagher**, Director of Aircraft Sales at Tom’s Aircraft Sales & Service. Andrew can be reach via email: andrew@tomsaircraft.com. The information in this article is meant to provide an overview of the history and current status of MSB 569A and FAA AD 2006-20-09, which can be a useful resource for anyone, including pilots, aircraft owners, operators, sellers, buyers, or anyone curious to learn what this MSB is all about. However, it is important to understand that, while the information provided herein can provide a great general knowledge of the various pieces of information behind MSB 569A and associated ADs, it should not be used as a sole source of information. All the documents to which references are made throughout this article are available to the public, and can be easily accessed on the Internet or from your local aircraft maintenance facility.*