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## PISTON ENGINE **OVERHAUL TIPS**

Sooner or later, you're going to have to deal with overhauling your aircraft's engine. While you may not enjoy it, with the right information and insights, you can make it much less painful.

**By Dale Smith**

Photography by Airmark Overhaul





“We cannot solve our problems with the same thinking we used when we created them.”

**Albert Einstein**

remember it like it was yesterday. I was in a friend’s office talking about his airplane’s annual when he got the call. After about 30 seconds, the color instantly drained from his face, and his eyes got that look of sheer panic. He put down the phone, and as he lowered himself into his chair, he confirmed my worst possible fear. His beloved Lycoming IO-540 needed an overhaul.

“It was running perfectly last Saturday,” he said, still trying to make sense of it all. “Run-up, pressures, temperatures, oil burn—all perfect. But now this. What should I do?”

Yes, he took meticulous care of his airplane, but he should have seen it coming. The engine had over 1,900 hours. Bad things happen to good engines.

So now, here my friend was, totally unprepared to make the key decisions about his engine. Should he buy a new or rebuilt one from the factory? Or have his engine overhauled? If so, what shop should he use? So many questions.

The good news is it all turned out fine. The engine was overhauled by a reputable shop—albeit for a bit more money than he expected. But, on the bright side, the “new” engine is running smoother and developing more power than he’d seen in a while.

We both learned a lot. Unfortunately, his lessons cost him more than they cost me, but hey, that’s what owning an airplane is all about. Now that the episode is behind us, I’d like to share some of the lessons learned, as well as valuable insights from experts in the overhaul business. I think they’ll help you be prepared when your call comes.

### **Plan ahead**

Unless there’s cylinder detonation, a prop strike, or similar catastrophic event, you can usually see when your overhaul is coming. Heck, most aircraft owners remember their engine’s TBO better than their wedding anniversary.

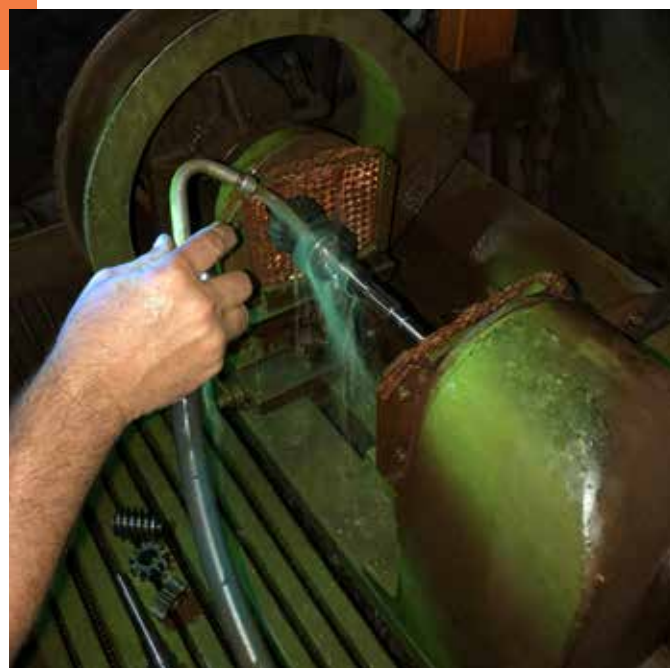
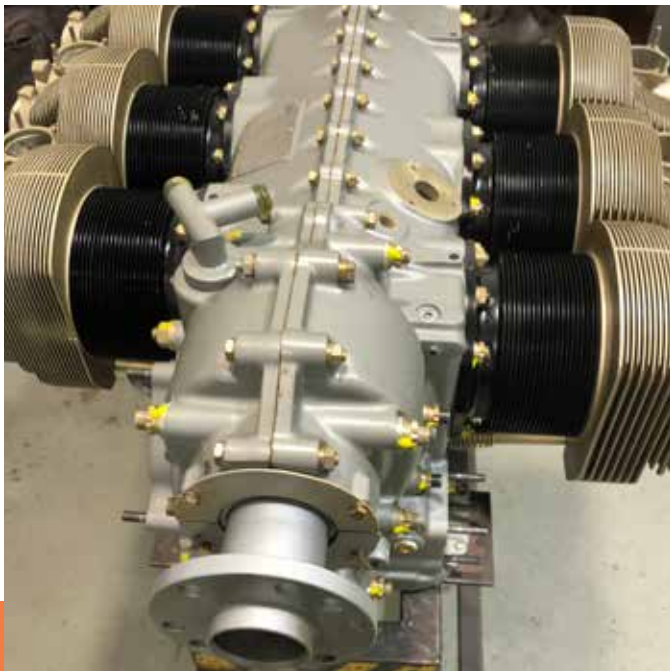
“Not planning for their overhaul far enough in advance is one of the biggest mistakes owners make,” explained Charlotte Saunders, vice president, John Jewell Aircraft. “It takes time to do all the necessary research on shops, get quotes, and such. Don’t wait until you’re ready to pull the engine to start the process.”

### **Selecting the right overhaul shop**

Selecting the right shop and pre-planning go hand-in-glove. Researching and selecting the right shop for your overhaul is key to the best outcome. Like most things in aviation, the best place to start is by talking to your friends, FBOs, or flight schools on your home airport. You’ll quickly learn who to stay away from. So, what do you look for in a shop?

“The most important thing is to always go with an FAA-certified, Part 145 repair station,” Saunders said. “Just by coming under that umbrella means we meet the FAA’s requirements for employee drug testing, tool calibration, and having the most current libraries of correct documents and manuals for overhauling the engine and its components.”

“Not everyone doing overhauls meets those requirements. I know that many field overhauls are done by independent (freelance) A&P mechanics who don’t go through the FAA’s requirements,” stated Dave Williams, president, Airmark Overhaul Inc. “Yes, it’s legal for them to do the overhauls. But



there's a chance that their tools are not calibrated, or that they're not using the latest maintenance information from the engine's manufacturer, or that they'll be around a year from now if you have a problem."

### **Make sure the shop is using the correct maintenance manuals**

While you're shopping for an overhaul shop, one of the first things you need to do is confirm that they will be using the most current version of your engine's overhaul manual. Not every overhauler does.

"We've recently found that some engines coming into our shop for overhauls had not been previously overhauled to the proper overhaul manual directions. That's very important," Williams says. "The FAA came out with a memorandum Aug. 13, 2010, that sets guidelines for shops to use the most current overhaul instructions for the particular engine."

Williams speculated that among the reasons that some shops may not want to use the most current information is Continental and Lycoming have recently added steps and processes to their overhaul

instructions that owners won't want to pay for, or that the shops can't accommodate.

For example, in 2016, Continental came out with a new Master Overhaul Manual that is to be used in conjunction with current revised model-specific manuals that call for more extensive non-destructive testing (NDT), and additional parts replacement requirements as part of the overhaul processes on many of their engines.

"A full-service shop can handle all of the NDT and accessory inspection requirements, where other shops can't.



So, they can't do the overhaul legally," Williams said. "If they don't 'know' about the requirements, then they can skip it during the overhaul.

"But it doesn't let the [aircraft] owner off the hook. They are ultimately responsible for the airworthiness of their engine."

Of course, it also comes down to the price. A "non-conforming" overhaul will probably cost you less than one that checks all the FAA's boxes.

#### **Accessories are not an option**

Another question to ask the shop is

if they offer in-house inspections and repairs of critical accessories like magnetos, starters, and alternators. If they do, it will probably save you time and money.

If they have to send them out for work, ask for documentation that shows that whomever is going to do the required inspections and/or repairs is qualified.

#### **Don't choose a shop based on price alone**

I'm sure that no one reading this article would do it, but believe it or not, some aircraft owners would choose their

overhaul shop based solely on the lowest price. Really! But, unfortunately, that's often a bad decision.

"Everything adds up to the price of an overhaul, but it's all necessary to do the job correctly. Calibrating tools is expensive. Documentation and research is expensive. Licensing is expensive. Yes, overhauls are very expensive," Saunders says. "Most reputable Part 145 shops are pretty close to our cost. But, if someone is offering to do one for significantly less than other facilities, you need to know what you are not getting. Too cheap is not good."



Price is often why some owners choose to have their overhaul done by an independent A&P. That's not always a bad choice. Some freelancers are very good at what they do. But, should the unforeseen occur and you need support, will that freelancer be there to provide it or have the business insurance to cover it?

### **PMA's can save you money**

All things being equal, you can save some serious money by selecting to use FAA-approved Parts Manufacturer Approval (PMA) components and piece-parts. And I do mean serious money.

"With a six-cylinder Continental engine, you can see around a \$3,000 savings if you use Superior Air Parts PMA cylinders instead of the factory cylinders," Williams said. "On a four-cylinder Lycoming, you're looking at saving at least \$1,000 on the cylinders alone—and there's absolutely no difference in quality or performance.

"In fact, in many cases, my opinion is that the PMA parts are actually superior to the original equipment parts," he added. "It's not only with the cylinders, but many of the internal parts as well. Because we are independent, we have the flexibility to pick and use the best parts for each customer's application. If the factory overhauls the engine, they can't do that."

"We know what does and does not perform well in the field," Williams says. "It's to our and our customer's benefit to use the best parts we can get. It keeps our warranty issues to a minimum and our customer satisfaction high."

Oh, and while we're on the subject of cylinders, some shops will suggest overhauling your current cylinders. While it's legal, that direction does have its challenges like thinning and eroding of cylinder wall thickness, and other potential issues.

"You can overhaul your current cylinders in some instances, but we don't recommend it," Saunders says. "By the time you replace all the parts, the cost difference [to installing new cylinders] is almost nothing, and with the new Superior PMA cylinder, you get a full warranty."

*(Continental Aerospace Technologies has PMA cylinders for Lycoming engines. —Ed.)*

### **Explore your options**

Along with the availability of PMA



parts, another thing to consider at overhaul time is any engine upgrade options that may be available for your aircraft. When you consider the performance increase they offer, the cost may be a good investment.

"The owner may really want to upgrade their engine, but it's just not cost-effective to perform the upgrade on a mid-life engine, so TBO is the best time," Saunders explained. "In our case, we have an STC to upgrade a [Continental] O-470-U series on Cessna 182s that increases the horsepower and raises the TBO to 2,200 hours. We also have an STC to upgrade the engine on K- through N-model Cessna 210s from a [Continental] IO-520 to a 300 hp IO-550."

*(Air Plains Services, Northpoint Aviation, P. Ponk Aviation, and Texas Skyways also offer engine upgrades. —Ed.)*

While swapping for a more powerful engine is attractive, it's not a viable option for most aircraft owners. But that doesn't mean you don't have other options at overhaul time.

"Dynamic balancing of the rotational parts is an excellent option that isn't available from the original equipment

manufacturer," Williams said. "We offer it with every engine we overhaul here."

"Common static balancing is just balancing the weights of the pistons and pins," he says. "Dynamic balancing is especially beneficial on counterweighted engines, lets us install precisely balanced weights and pins on the rotational parts. By experimenting with various counterweight and pin weight combinations, we can achieve the optimal balance of the critical parts."

"The result is a very smooth-running engine across the power ranges. Smoother operations reduce vibrational fatigue on the engine, airframe, and the pilot," Williams added. "It's an option most owners want."

### **May I quote you on that?**

Collecting and comparing the quotes is one of the most challenging parts of the overhaul process. No two shops do it the same way. One key part of the process that owners often forget to provide, and a surprisingly large number of shops don't ask for, are the current logbooks. Their contents can save you a lot of money.

"Logbooks with correct and up-to-date entries are a major part of the process," Williams says. "We take the time to look through the entries to make sure that all the required inspections have been completed. It saves a lot of time and money if we don't have to redo any of them."

"For example, Continental had an AD on a crankshaft a while back that required taking a sample for analysis. If that's already been done; and documented in the logbook, we don't have to do it again," he said. That will save the owner a lot of money."

In addition, both Saunders and Williams stressed the need to make a line-by-line comparison of each quote. Along with the bottom-line price, a proper quote needs to list every component and part that will be inspected and/or changed, and whether or not they will use original equipment, PMA, or rebuilt/refurbished parts.

"I'd have my mechanic run an AD list for that engine to see if there are any outstanding ADs or service bulletins. The overhauler will probably do that, but again, it's good to know that before you

ask for the quote,” Saunders said. “Don’t wait until the engine is at the shop and in pieces before you learn about it.”

“Remember to have the shop list which overhaul manuals and revision numbers they will be using as part of their written quote,” Williams stressed. “Saying, ‘The right ones,’ is not the correct response. The owner can’t be afraid to ask the questions and expect the right answers. If they’re unsure, then they need to get their own mechanic involved.”

“Also require they give you copies of all of the various work orders, fits and clearances, serial numbers of all the components they remove and install,” he added. “It’s a lot of work, but it’s essential if there’s ever a problem. Any question could leave you with having to tear down the engine again. Nobody wants that.”

 **DALE SMITH** has been an aviation journalist for 30 years. When he’s not writing aviation articles, Smith does commission aircraft illustrations specializing in seaplanes and flying boats. Smith has been a certificated pilot since 1974 and has flown 35 different types of General Aviation, business, and World War II vintage aircraft. Send questions or comments to [editor@cessnaflyer.org](mailto:editor@cessnaflyer.org).

## RESOURCES

### **AIRMARK OVERHAUL INC.**

[airmarkoverhaul.com](http://airmarkoverhaul.com)

### **AIR PLAINS SERVICES**

[airplains.com](http://airplains.com)

### **JOHN JEWELL AIRCRAFT**

[johnjewellaircraft.com](http://johnjewellaircraft.com)

### **NORTHPOINT AVIATION**

[northpointaviation.net](http://northpointaviation.net)

### **POPLAR GROVE AIRMOTIVE**

[poplargroveairmotive.com](http://poplargroveairmotive.com)

### **P.PONK AVIATION**

[pponk.com](http://pponk.com)

### **SUPERIOR AIR PARTS**

[superiorairparts.com](http://superiorairparts.com)

### **TEXAS SKYWAYS**

[txskyways.com](http://txskyways.com)