Engine Overhaul Fundamentals, Part Three: PREPARING THE ENGINE BAY

A firewall-forward overhaul can offer a great opportunity to "partner up" with your A&P. Design a two-part plan that divides the workload based on what's allowable as well as what's realistic for the owner. This approach gives both parties the ability to move the project forward, plus, you'll be proud of the high-quality work you accomplish together.

By DENNIS WOLTER

Aviation, like many specialty fields, has its own technical language, including commonly-used abbreviations and acronyms. TBO (time between overhauls), FAR (Federal Aviation Regulation), ELT (emergency locator transmitter), ATC (air traffic control), FBO (fixed-base operator)... the list goes on and on.

In looking at ads for pre-owned airplanes, you will often see a reference to an engine overhaul as being firewall-forward, meaning that everything forward of the firewall is reconditioned to as close to new as possible.

Ads and promotions will often read something like "150 hrs SMO [since major overhaul], FWF [firewall forward]." It's important to know that a comprehensive, high-quality engine overhaul involves more than just the engine itself.

As with many things in aviation, an optimum outcome for any engine overhaul effort begins with, you guessed it, a good plan.

The planning process should begin with engaging your licensed maintenance technician to create a list of the specific tasks you as an owner can perform, and those items which require the expertise of a licensed A&P mechanic.

Many of the tasks involved in completing a thorough firewall-forward overhaul can be performed by an aircraft owner under the preventive maintenance provisions of the Federal Aviation Regulations 43.13, Appendix A, Paragraph (c). In future articles, I will elaborate on procedures that must be followed under the provisions of owner-performed maintenance. *(See "Further reading" in Resources at the end of this article for a list of additional owner-performed maintenance articles. —Ed.)*

It's been my experience that most A&Ps are quite busy and would welcome your willingness to clean, repair and detail certain components in preparing the engine bay for installation of the newly-overhauled engine. Who likes to work in a dirty place?

Due to the varying time commitments and skill levels of individual aircraft owners, not all of these "two-part" plans will be identical. That said, I think the following two lists are inclusive enough to help you and your mechanic develop a realistic

plan. The result will be a thorough and safe firewall-forward overhaul project that you and your mechanic can be proud of.

In an upcoming article, I will write about how to properly execute each of these tasks. Oh yes, there will be lots of pictures, too.

LIST 1 (FOR AN OWNER)

This first project list covers the things an owner can legally do to the engine bay to help create a high-quality firewall-forward overhaul.

GENERAL CLEANUP
- Firewall
- Cowl
- Exhaust components
- Engine mount

COWLING
- Remove corrosion and paint inside surfaces
- Repair minor cracks
- Correct chafing issues
- Replace damaged fasteners, or upgrade to stainless cam locks
- Repair or replace latches
- Replace worn or missing bumpers
- Replace degraded mounting hardware and clamps

BAFFLES
- Repair cracks and out-of-spec holes in existing baffles
- Install approved aftermarket baffle kits
- Repair soft material baffle seals, or upgrade to silicone rubber seals
- Secure new baffle seals with stainless screws vs. staples or rivets

ELECTRICAL
- Remove corrosion from battery terminals, clean spark plugs
- Detail and clean up wire insulation to remove grease and grime
- Replace aging grommets
- Replace worn clamps and tie wraps

DUCTING
- Evaluate the condition of all duct hoses and clamps
- Upgrade to new orange silicone SCAT ducting
- Check for proper routing and security of ducting
- Correct improper use of clamps and tie wraps
- Replace old clamps with new stainless screw clamps

SILICONE CAULKING
- Remove poorly-applied and old silicone caulking
- Apply new caulk using masking tape for a neat seal

As you work through the owner-performed list, it's important to keep your mechanic involved. The guidance of an experienced technician can go a long way in avoiding mistakes.

LIST 2 (FOR AN A&P)

The second list is an outline of the tasks that require the skill, experience, documentation and logbook entry of a licensed technician.

STEEL ENGINE MOUNT
- Old steel tubing-type mounts can be cracked or corroded. It's a good idea to send them to a specialty shop for testing and inspection
- Once stripped, a steel tubing mount should be painted with light paint to make any future cracking more easily visible
- Thoroughly inspect any engine mount that also serves as a mounting for the nosewheel
- Check the condition and security of heat shields

CRADLE-TYPE ENGINE MOUNT
- Clean thoroughly
- Inspect all rivets for corrosion and security
- Inspect entire mount area for cracks or signs of deformation; some of these systems also serve as nosegear mounts
- Check the condition of all bolts and their mounting holes
- Replace rubber vibration isolators of Dynafocal mounts at overhaul time
- If the aluminum cradle-type mounting structure is uncorroded, leave it unpainted

ELECTRICAL
- Replace degraded wiring with silicone-insulated Mil-Spec wire
- Check for unapproved electrical connectors
- Evaluate the condition and compliance of any previous repairs
- Check the condition of the battery box

Engine overhaul time is a good time to evaluate (and potentially replace) your exhaust system.

HOSES
- Inspect hoses for time-in-service life limits, condition, routing and security
- Check for torque markings

MUFFLER AND EXHAUST
- Inspect all exhaust pipes, clamps and flanges
- Inspect and test the muffler for condition and function
- Evaluate the advantages of upgraded exhaust systems, especially for turbocharged engines

TURBOCHARGER
- Always overhaul the turbo and related components at engine overhaul time

INDUCTION SYSTEM
- Carburetors should be overhauled at engine TBO
- Air boxes require thorough inspection for condition and function
- Consider air filter upgrades
- Inspect and evaluate engine controls; a stiff throttle cable can be a warning that a serious problem is lurking
- Fuel-injected engines have multiple components that must be evaluated
- Evaluate the age and condition of the fuel boost pump

CABIN HEAT SYSTEM
- Firewall-forward cabin heat system components are often in need of repair; for example, hot and cold air mixing plenums and related ducting are common problem areas
- Check for proper function of cabin emergency shut-off

PROPELLER - FIXED
- Older fixed-pitch props can be sent to the manufacturer or a field propeller shop for inspection, balancing and refinishing

PROPELLER - CONSTANT-SPEED
- Confirm the inspection, AD status and condition of constant-speed propellers
- Check ADs and Service Bulletins

ENGINE INSTRUMENTS
- All related components should be inspected for condition and accuracy
- Mechanical tachometers are often inaccurate—check against an optical tachometer

Does this seem like a lot of work? Well, it is.

Not everything on these two lists will apply to every airplane. Often, many of these items are in good condition and require no improvement. Also, many of these tasks do not require a lot of time to complete.

I can assure you that all of the time, elbow grease, money and even a little frustration will produce the reward of owner's pride in being part of preserving their plane for the next generation. Equally as important, the knowledge an owner will gain after being engaged in the care of their airplane will make them a better pilot.

Until next time, fly safe! PF

Know your FAR/AIM and check with your mechanic before starting any work.

Industrial designer and aviation enthusiast Dennis Wolter is well-known for giving countless seminars and contributing his expertise about all phases of aircraft renovation in various publications. Wolter founded Air Mod in 1973 in order to offer private aircraft owners the same professional, high-quality work then only offered to corporate jet operators. Send questions or comments to editor@piperflyer.org.

RESOURCES >>>>>

FURTHER READING

"Engine Overhaul Fundamentals: Part Two"
by Dennis Wolter, February 2019

"Engine Overhaul Fundamentals: Part One"
by Dennis Wolter, January 2019

"Keep Those Manuals Handy: Rules for Owner-Performed Maintenance"
by Steve Ells, January 2019

"Engine Mounts Explained"
by Steve Ells, November 2018

"Exhaust System 101: Inspection and Maintenance"
by Jacqueline Shipe, June 2018

"Pre- and Post-Overhaul: Engine Removal and Installation"
by Jacqueline Shipe, April 2018

"A Step-by-Step Guide to Overhauls"
by Jacqueline Shipe, February 2018

"Engine Management 101: Understanding Cylinder Baffling"
by Bill Ross, December 2017

"The Right Mix: An Aircraft Carburetor Overview"
by Jacqueline Shipe, February 2017

All of these articles—and many more—are available at PiperFlyer.org