Power plan

Firewall forward for your Cardinal

BY JULIE K. BOATMAN

hen we purchased the 1977 Cessna 177B Cardinal that we're refurbishing for this year's AOPA sweepstakes, we knew we had a run-out engine to deal with. And that's the way we planned it. We want our winner to fly away with almost no time on the tach—a unique feeling only a few pilots ever get to savor.

Even so, we faced the same question many owners face as engine time nudges up to, matches, then saunters past the manufacturer's recommended time between overhauls: Do we get the engine overhauled, or do we spring for a new one? There are many choices among overhaul options, too (see "Tools From the Trenches: Field Overhaul, Factory, or New?" page 108).

But first we had to choose what kind of engine we wanted for the airplane. The 177B came out of the Cessna factory with a 180horsepower Lycoming O-360-A1F6D engine. This engine features the Bendix dual magnetos popular with engine manufacturers in the 1970s as a way to save space in tight engine compartments, and money in the ever-competitive general aviation market. The dual magnetos (sometimes called *double magnetos*) have independent distributors but share a single rotating magnet and common drive gear to the engine—and occupy the same housing. The Bendix mags, like many other engine accessories, require periodic maintenance, but because they are somewhat unusual, this is regularly missed or performed inadequately. Failure to maintain these mags properly can lead to premature failure and—because they operate from the same drive gear—this can cause engine stoppage.

To eliminate this potential gotcha, I decided to replace the -A1F6D engine with an -A1F6, which includes a standard "two separate mags" setup. Because the -A1F6 engine is on the 177B's type certificate, there is no supplemental type certificate (STC) associated with the swap. By the way, there are few engine STCs for the Cardinal; although you can install the 200-horsepower IO-360 (the model on the 177RG) on the 177B, it involves an STC with significant changes under the cowl. Plus there have been some cooling issues reported that I felt made the exchange not as good of an option.

This year, we had a fabulous offer from Lycoming that, in the end, answered the overhaul question for us—the company agreed to donate a factory-overhauled -A1F6 complete with the company's new roller-tappet technology. Roller tappets improve on traditional flat tappets by creating greater valve lift and turning the camshaft with less effort, and by minimizing the amount of contact with the cam, resulting in less friction and wear within the engine.



Engine, prop on

Lycoming delivered our fresh engine to Don's Dream Machines, of Griffin, Georgia, at the beginning of February, where engine specialist Jeff Swords would oversee the firewall-forward work package. Field Project Manager Dan Gryder, of The AvNet, had flown the Cardinal's engine mount down to Kosola & Associates in Albany, Georgia, for the company's comprehensive dyepenetrant testing, overhaul, and powder coat to a clean, white finish. The mount came back in just a couple of weeks, looking brand-new. We stuck with white as much as possible in the engine compartment to enhance visibility in its nooks and crannies-Advanced Aircraft Refinishers painted the overhauled engine baffles white, and

The Plane-Power alternator (left) and Sky-Tec starter frame the prop hub. Chuck Case (below left) and Jeff Swords install the overhauled baffles. The prop governor sees its reflection in the firewall (right).



new red baffle seals and silver rivets from Gee-Bee, of Palm Desert, California, will complement the Cardinal's firewall-forward appearance.

We sent in the Cardinal's two-blade McCauley constant-speed propeller and governor to American Propeller in Redding, California. The company provided the project with an overhauled governor, and planned to overhaul the prop. To our surprise, the company de-



termined that the prop couldn't be overhauled—technicians found rust in the hub, as well as blades that were down past the point where they could be dressed out again and remain within specs. So the prop on your Cardinal is brand-new; American Propeller has customized it with its proprietary Designer*Prop coatings and protective leading-edge strip. The prop, like those on other recent sweeps projects,



Lycoming Engines

In 1907, the Demorest Manufacturing Co., of Williamsport, Pennsylvania, was restructured and became Lycoming Foundry and Machine Co.—a name now very familiar to pilots. In 1929, a Lycoming-powered Beech Travel Air biplane first flew, using a 215-horsepower R-680 engine. More than 25,000 R-680s were built.

Fast-forward to the present day, and Lycoming (now a global operating division of Textron's Avco subsidiary) specializes in piston aircraft engines for both certified and experimental applications. The 0-360 engine powering the 1977 Cessna Cardinal comes with Lycoming's roller-tappet technology, which debuted in 2005. One hundred years of innovation and reliability stand behind this year's AOPA sweepstakes airplane. Visit Lycoming's Web site (www. lycoming.com) or call 570/ 323-6181 for more information.

American Propeller

In 1976, Kerry and Kathleen Dawes launched Ameritech Industries, of Redding, California. Two divisions, Eagle Engines and American Propeller, specialize in general aviation powerplants. The Screaming Eagle modification for Beechcraft Barons and Bonanzas is a great example, installing a custom Continental IO-550 to replace the IO-520.

American Propeller produces the Designer*Prop service for many makes and models of propellers, including the McCauley prop on this year's AOPA sweepstakes airplane. The Designer*Prop process can be applied to new props or when it's time for a prop overhaul. The company's propeller and governor shops also provide repair and overhaul services for props and prop governors. Visit Ameritech's Web site (www. americanpropeller.com) or call 530/221-4470. matches the airplane's paint scheme for a true show-plane look.

More under the hood

Looking to get more utility and tweak performance from the engine, we took the opportunity to upgrade many of the accessories. A primary but often overlooked performance (and speed) enhancer is saving weight where possible, and the Cardinal—though not as nose heavy as larger Cessna singles benefits from a lighter load up front.

Plane-Power, creator of lightweight alternators, and Sky-Tec, which produces lightweight starters, (both of Granbury, Texas) made important contributions to the project in this area. The Plane-Power AL12-60 alternator replaces the 60-amp Ford alternator original to the Cardinal. The Plane-Power alternator can deliver up to 70 amps in certain installations, and it weighs 9.8 pounds—about 2.5 pounds less than the original alternator—and produces more amps at a lower rpm while running cooler than stock alternators.

The Sky-Tec NL high-torque, inline starter weighs roughly 9.4 pounds, just a little more than half the weight of the Prestolite starter it replaces, and puts

CONTACT

Advanced Aircraft Refinishers www.advancedaircraftrefinishers.com

Air Wrench www.airwrenchinc.com

Atlanta Air Recovery & Storage www.atlantaairrecovery.com

The AvNet www.theaviatornetwork.com

Classic Aircraft Maintenance n522dr@hotmail.com

Donaldson Co. www.donaldson.com

Herpa Miniaturmodelle GmbH www.herpa.de

Kosola & Associates www.kosola.com

Maple Leaf Aviation www.aircraftspeedmods.ca

Plane-Power www.plane-power.com

Power Flow Systems www.powerflowsystems.com

Precision Avionics www.precision-avionics.com

Rapco International www.rapco.com

Skybolt Aerospace Fasteners www.skybolt.com

Sky-Tec www.skytecair.com

Tanis Aircraft www.tanisaircraft.com

Who's behind us?

Don's Dream Machines' Don and Jeff Swords

From early memories, Don Swords recalls a fascination with airplanes: "I could see those things up in the sky, and I'd just go batty." In his 20s, in the mid-1960s, he learned to fly—and worked on aircraft as a hobby to his day job as a mechanic on tank engines. Soon he opened Swords Aviation, and then Don's Dream Machines. Originally based at South Expressway Airport in Jonesboro, Georgia, Don's Dream Machines moved to Griffin-Spalding County Airport when the Jonesboro airport closed in 1998.

Don's son Jeff officially began working with his father in 1996, though he grew up immersed in aviation. Don's Dream Machines is known for its mastery of small Continental engines; Don holds several STCs within this realm. The shop also specializes in owner assistance to Van's Aircraft RV-series builders. We're thrilled to tap Don's and Jeff's experience with all kinds of engines for the Catch-A-Cardinal project. Call 770/412-8885 or visit the Web site (www.donsdreammachines.com).

out more power sooner than other starters. It utilizes Sky-Tec's Kickback Protection System shear pin to minimize damage to the ring gear and starter in the event of a premature ignition misfire (called *kickback*). Both Sky-Tec and Plane-Power hold parts manufacturing approval on their respective components.

We swapped out the worn vacuum pump for a new one from Rapco. Rapco recently improved upon its Smart Stick wear indicator to help users better identify when a vacuum pump requires replacement. The Smart Stick was a dipstick-style measuring device. New pumps will soon have a caliper-style device instead, which the company expects will be useful in other applications around the maintenance hangar as well. We've also taken the Donaldson Co. up on its offer of a new engine intake air filter. The new filter is an updated version of

Tools from the trenches

Field overhaul, factory, or new?

When it comes time for an engine change, you have a number of options from which to choose. Whether you select an overhaul done by a reputable shop or a factory-new engine depends on your budget, your timeline—and the engine you have now.

Field overhaul. Many maintenance shops can overhaul an engine—which essentially means opening the case and assessing each part to determine if it is within tolerances, known as *service limits*, and replacing with new or serviceable parts or returning the original part to the engine. A field overhaul can range from a bare-bones service-limits overhaul to a custom job where the majority of components get replaced with new parts.

Specialty-shop overhaul. A handful of companies around the country have made a business out of overhauling engines. In addition to replacing components with new parts, many offer custom or upgraded components.

A "new to you" overhaul. If your engine already has been overhauled more than once, you might consider swapping your engine for another overhauled engine off the shelf. This option also makes for less downtime, since the shop can essentially pull your old engine off and bolt the overhauled one on.

the old-style paper induction filters, and the 500-hour replacement airworthiness directive for the original paper filters does not affect it.

Capping off the upgrades under the cowl is a brand-new tuned exhaust system from Power Flow Systems, of Daytona Beach, Florida. The system replaces the stock exhaust headers, collector, and muffler with corrosion-resistant stainless-steel parts. The original exhaust system on the Cardinal not only looked like it had been in the air for better than 4,400 hours, but also performed like it. The Power Flow system increases performance significantly, making for a great update to the airplane. I'll report back on how this improves our climb performance, cruise speed, and fuel burn per horsepower when we've flown the airplane for a few hours.

We went with Power Flow's Short Stack system, and added a special fairing produced by Maple Leaf Aviation, of Brandon, Manitoba, Canada. The fairing is STCed to work in conjunction with Factory overhaul. Engine manufacturers also offer overhauled engines for sale. The benefits of having an engine that was overhauled in the plant may be obvious, but they include access to a full gamut of tools and parts inventories, plus factory oversight and warranties. Factory overhauls can be overhauls using either your supplied engine or one obtained via the factory. The engine is still a "time-continued" engine, which means it retains the same logbook and total time continues to accrue.

Zero-time rebuilt engine. A true zerotime engine can be purchased only from the factory. During the rebuild process, certain components are automatically replaced with new factory parts, and reused parts must meet "new" tolerances. The engine gets a fresh start on total time (including a new logbook) to reflect the allnew cylinder assemblies and testing to "new" factory specifications.

New engine. It may be that you determine the best course is starting fresh with a new engine. Though this is the most expensive route, considerations include the latest technology for your engine along with the fact that technicians trained to the most recent standards will build it. You get a first-run engine, typically the best warranty, and the full lifetime of service—and several overhauls down the road—to enjoy. —JKB

the Power Flow system, and it enhances the cowl's appearance while reducing drag from the exhaust pipe and opening in the cowl. We've added a couple of other fairings from this Cardinal specialist that we'll cover later this year.

Protecting the investment

You may be familiar with the Tanis name, since the company's aircraft engine pre-heaters have been popular on the GA market for many years. Tanis Aircraft graciously donated a preheating system for the Cardinal-handy for long winters and cold climates. Tanis also provided us with engine and propeller blankets that protected the airplane's powerplant during our trip by trailer to the Sun 'n Fun Fly-In in Lakeland, Florida, and during the show. We'll pass these on to the winner as well-the covers can maintain engine temperatures after shutdown for a few valuable hours.

Speaking of Sun 'n Fun, we did something different this year. As we disassembled the airplane, we were amazed with



the incredible look at the airplane's structure and systems—and we wanted to share that behind-the-scenes element with everyone that we could. Since the project entailed working on so much of the airplane simultaneously, it also made sense to keep that work in progress right up until the time of the show. So we made plans to transport the airplane down to Lakeland rather than fly it. Talented hands from Air Wrench install the new Skybolt adjustable cowl fasteners.

We enlisted the help of two special contributors for this project. For ground logistics, we called upon our Griffin neighbors at Atlanta Air Recovery & Storage to trailer the airplane, with the wings off, to the show and back. Atlanta Air does this kind of thing every day, so your Cardinal was in excellent hands. To move the wings, control surfaces, and other com-

ponents quickly and safely, we utilized the Douglas DC–3 sponsored by Herpa Miniaturmodelle GmbH, a manufacturer of high-quality aircraft models.

We figured that the DC–3 actually could have transported the entire Cardinal—but in a lot more pieces than we wanted to have it in. We were also unsure just how to get the fuselage into the cargo door.

We just keep going

Once back from Sun 'n Fun, the team of shops in Griffin went right to work on the airplane, with the technicians from Precision Avionics, Air Wrench, and Classic Aircraft Maintenance delving back into the airplane's reassembly, and Swords getting deep into the heart of the firewall-forward work. Soon we'll be ready to fly.

E-mail the author at julie.boatman@ aopa.org.



There's a wealth of information plus a gallery of photos—on the sweeps project Web site. Check out the photos from the Cardinal's trip (by trailer and DC–3) to the Sun 'n Fun Fly-In, as well as video and the latest information on contributors to the project. www.aopa.org/pilot/sweeps0707