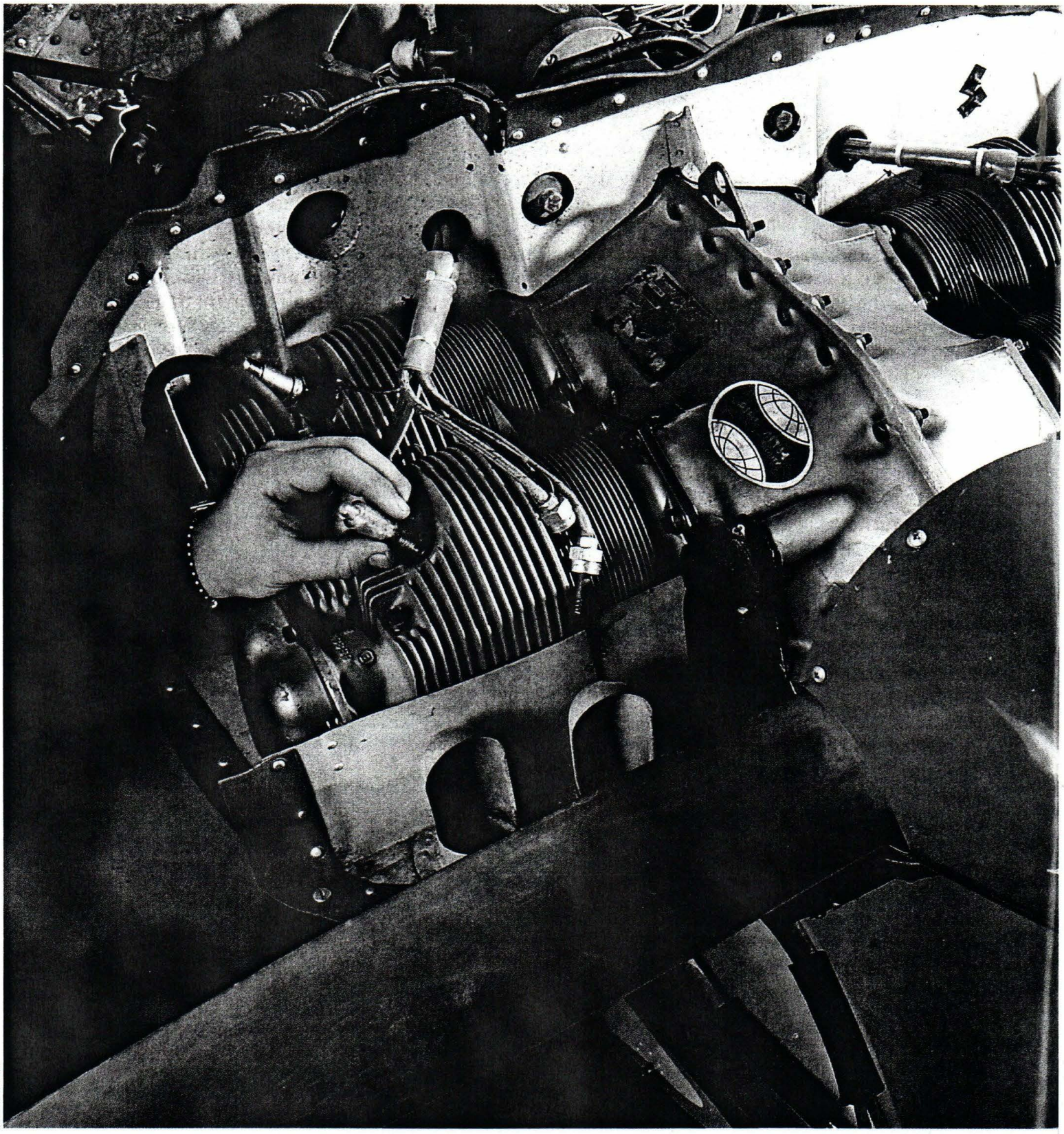


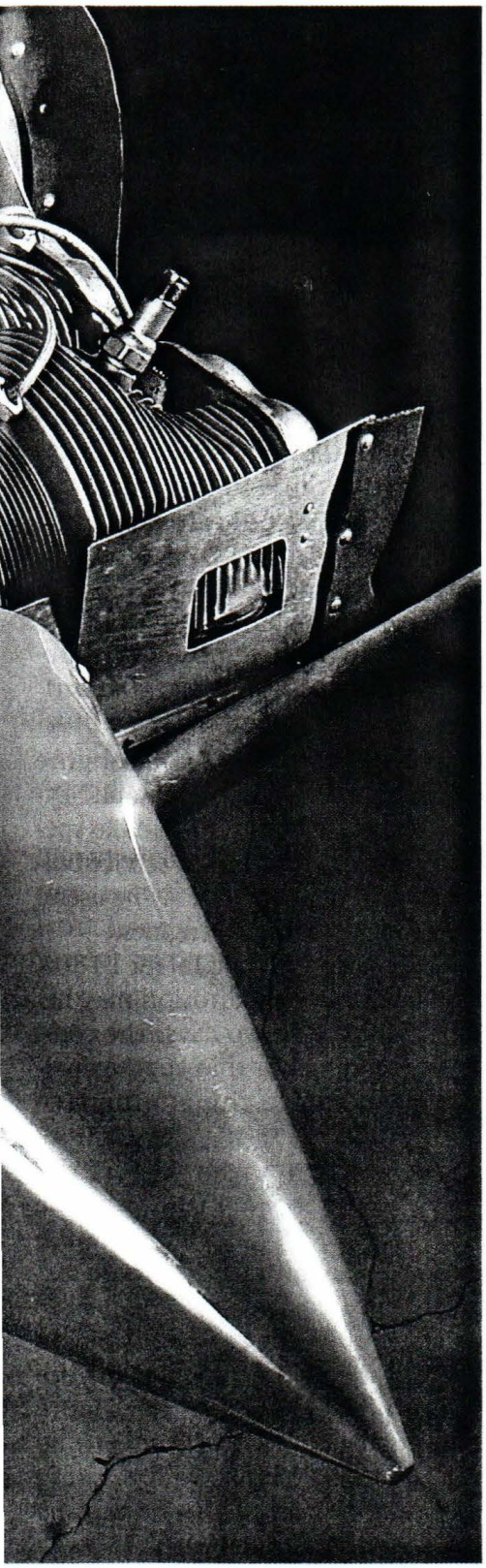
JIM KOEPNICK

"I'll change the oil and check things over this fall when things are less hectic." As we now face the holidays and the coming of a new year, how many of us said this several months ago? And how many of us actually changed the oil and checked those few things on our airplanes?

A show of hands isn't needed, but it would be safe to say that many airplanes sit neglected over the winter. In many cases, the next time these airplanes meet their owners is on a beautiful spring day with calm winds and a fair sky.

Pilots who live down south don't enjoy the same winter weather extremes we do up north, but their engines are just as susceptible as any other to long periods of inactivity. And if they live in a coastal region, their engines are especially vulnerable to humid, salty air.

And let's not forget homebuilders and restorers. Their engines, too, can sit inactive for a long time as they prepare the flying machines for flight. Regardless the reason, engine



RUST DUST & Engine Preservation

How to protect your engine during a prolonged rest

MIKE LEASURE, EAA 218380

inactivity is a breeding ground for corrosion and other maladies—unless the engine's prepared for a rest.

In the coming paragraphs we'll look at what engine manufacturers recommend you do if your engine is going to be taking an extended rest. And we'll discuss special problems that arise in different areas and storage environments.

Demon Corrosion

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Demon Corrosion

Corrosion—good old-fashioned rust and the telltale white deposits of magnesium and aluminum corrosion—is the primary malady that comes with engine inactivity. Corrosion may occur on all internal engine parts, and all of them that are not chrome plated or made of nickel-chrome alloys are particularly at risk.

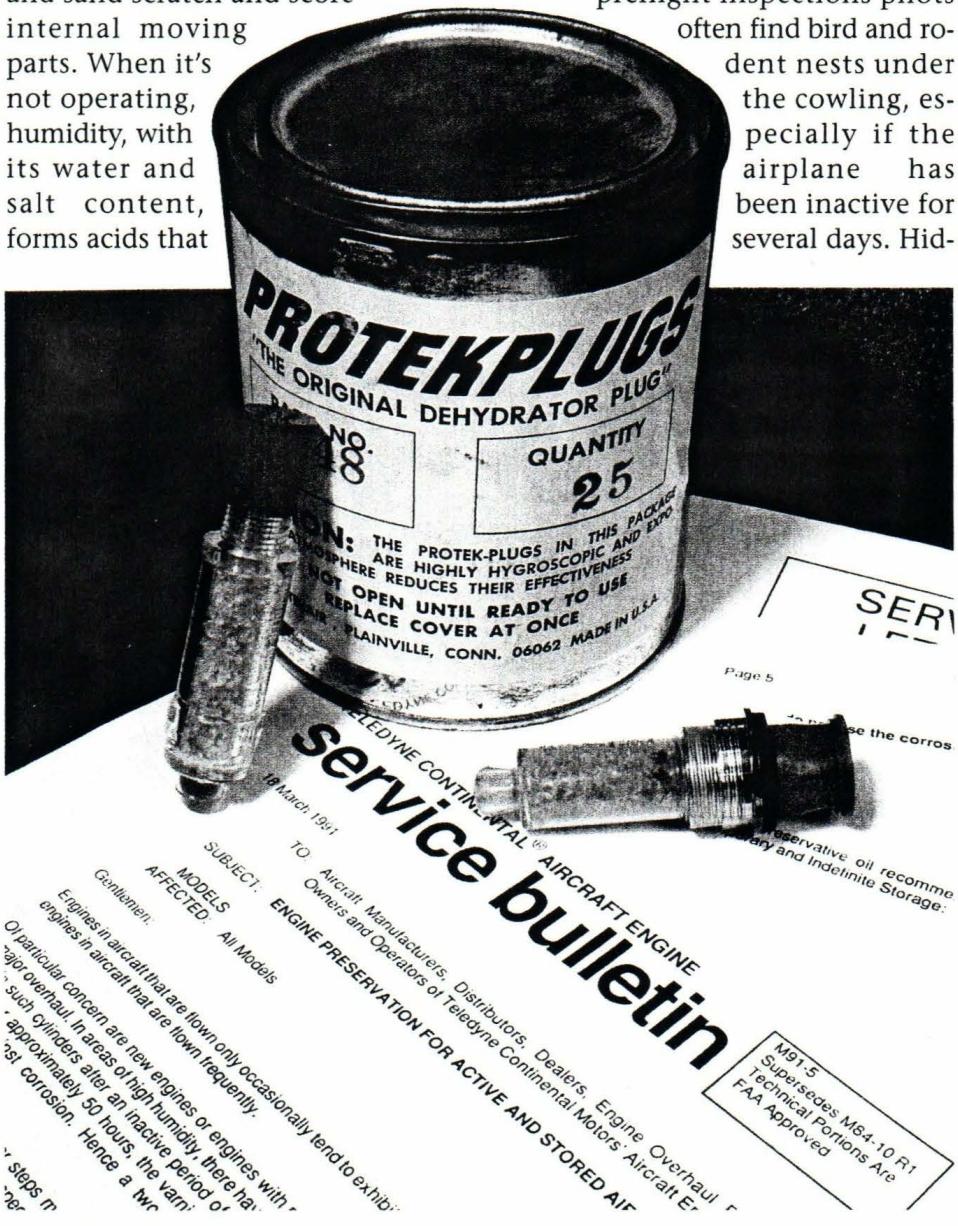
Accessory gears, plain steel cylinder barrels, valve train parts, magnesium alloy oil sumps, and accessory housings are the corrosion leaders. If you or your mechanic removed a magneto for timing or inspection and found the drive gears pitted and discolored, the condition of these gears may indicate corrosion problems throughout your engine.

When an engine is operating, dust and sand scratch and score internal moving parts. When it's not operating, humidity, with its water and salt content, forms acids that pit the surface of engine metals and cause rapid wear. Inside an engine, rust acts much like sand or dirt and causes rapid wear because of its abrasive nature.

Any time an engine sits stationary, several intake and exhaust valves are off their seats, open doors to the cylinders for air and contaminants that migrate through the exhaust stacks or induction system. The crankcase vent tube is another passage for outside air. Because most aircraft engines have little or no barrier to environmental contamination, they are highly susceptible to damage caused by humidity, salts, and dust that enter the engine through these openings.

Bugs, rodents, and birds also threaten an engine's health. During preflight inspections pilots often find bird and rodent nests under the cowling, especially if the airplane has been inactive for several days. Hidden inhabitants are of greater concern. These may include mud wasp nests in the induction system or the fuel vent tubing. Pilots probably won't find the mouse that crawls into a muffler shroud tube and nests on top of the muffler during their preflight inspection. Undetected, the nest is a hazard that may catch fire in flight.

Even with my Citabria living in a hangar and inspected regularly, I have had all of these things happen to it, except I found the mouse nest before it could do any damage. The engine is open to the environment, and if the environment contains these elements, then the risk is present.



Short-Term Protection

How can you protect your engine from this environmental assault? Lycoming and Continental make specific recommendations in service bulletins, and their advice may be useful for all makes of piston engines.

Lycoming service letter L180A says cylinder wall corrosion may begin in as little as two days. The company recommends that engine owners hand rotate the engine five revolutions every five days. Before turning the engine make sure the magneto switch and fuel selector are off, the spark plugs are removed, the propeller area is clear, and the aircraft is securely tied down.

The common practice of starting the engine and running it on the ground for a short time does more harm than good, as the warm engine is a condensation magnet. Lycoming recommends that you fly the airplane for at least 30 minutes every 30 days.

Flying the airplane brings the engine to its operational temperature,

Desiccant spark plugs absorb a limited amount of moisture from within the cylinder barrel and combustion chamber before they become saturated, so you should use them in combination with covers. The desiccant material will turn from blue to pink if moisture contamination has occurred.

which boils the residual water and fuel contaminates out of the oil and reduces the formation of damaging acids. It is important that the oil reach full operating temperature. This may require more than 30 minutes depending on ambient temperature and power settings.

Long-Term Protection

If your engine is going to be inactive for longer periods, you need to protect it using more effective methods, including coating the internal engine parts with preservative oils, covering all external openings, and installing desiccant plugs and bags. Desiccant absorbs moisture by pulling it out and away from your engine. It does the same thing as the little bags of stuff you find in with new electronics equipment, the bags with warnings that say, "Do Not Eat."

If your recently overhauled engine is going to sit for a while before you install it, Lycoming service instruction 1481 tells you how to protect it. Through their first 50 hours of operation engines form a protective varnish on internal parts that helps protect them against corrosion. Newly overhauled engines do not have this varnish—or the protection it provides.

Corrosion—good old-fashioned rust and the telltale white deposits of magnesium and aluminum corrosion—is the primary malady that comes with engine inactivity.

If not placed into service, for up to a year stored engines should be inspected at 60- or 180-day intervals. After one year, the Lycoming service instruction says the engine must be installed on an aircraft and operated or returned to Lycoming for evaluation.

Continental service bulletin M84-10 breaks engine storage into three categories: flyable, temporary, and indefinite. Again, it recommends that owners follow special procedures for newly overhauled engines. Continental also notes that owners should rotate engines by hand rather than running them for short periods on the ground.

Flyable storage includes a 30-minute flight every 30 days. If you can't fulfill this schedule, engine owners should follow the procedures for temporary and indefinite storage, both of which call for preservative oil application and use of desiccant materials and covers.

The procedures outlined by both manufacturers share some common points. Both manufacturers recommend that you fly the airplane for at least 30 minutes every 30 days, and

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For longer storage periods, you'll need to use preservative oils, cover all external openings, and install desiccant plugs and bags. A Remove Before Flight tag will aid in the removal of the bag when it's time to put the engine back into service. A placard with a "Do Not Turn Prop" message is also a good idea.

during that 30-day period you hand rotate the engine every five days.

If the engine will be inactive for more than 30 days, the companies recommend more extensive preservation methods. If the engine is a newly overhauled engine (less than 50 hours), then it is especially susceptible to damage from inactivity.

Eight-Step Preservation

To preserve an inactive engine, follow these eight basic steps:

1. Drain the engine oil
2. Fill the engine with preservative oil mixture
3. Run the engine with the preservative oil to distribute it
4. Let the engine cool, remove spark plugs, and spray preservative oil in the cylinders
5. Insert desiccant bags and nonporous covers over all openings
6. Install desiccant plugs in place of removed spark plugs
7. Placard the propeller "DO NOT TURN"
8. Inspect integrity of covers and color of desiccant during storage

This eight-step process requires planning and an investment of time and money. But this investment is minute compared to replacing a pitted camshaft or making an early trip to the overhaul shop.

Isolating the metal inside the engine from potentially damaging substances is the goal of all preservation. Condensation, humidity, fuel, salt, and airborne debris are the most damaging elements, and you foil them by sealing the engine's entry points, coating the interior components with a corrosion barrier, or both.

How thoroughly you preserve your engine essentially determines the degree of protection. If you plan to store the engine more than 30 days, you should use all of the preservative techniques to the extent possible.

To cover all the entry points into the engine, like exhaust pipes and breathers, use a nonporous material like plastic bags. You can secure these covers with wire, tie wraps, or tape—whatever method will secure the cover and prevent air from entering the engine.

Use bags of moisture-absorbing desiccant in conjunction with the covers to capture any moisture that sneaks past the barrier and to absorb any moisture present in the engine when you preserve it. Desiccant bags and desiccant spark plug inserts are available from aviation parts suppliers.

A major concern when using covers and desiccant bags is ensuring that you remove all of them when you return the engine to service. One good way to make sure you remove all of them is to attach bright-colored streamers to the desiccant bags and/or covers as applicable.

When you preserve the engine you might even want to create a checklist that tells where you applied each cover, desiccant bag, and other preservative aid. Then check each of them off as you prepare the engine for installation. In either case, a thorough preflight and ground run are important whenever an engine has been stored for a period of time.

Replacing spark plugs with desiccant spark plugs absorbs moisture from within the cylinder barrel and combustion chamber. These plugs absorb a limited amount of moisture before they become saturated, so you should use them in combination with covers. The plug's desiccant material will turn from blue to pink if moisture contamination has occurred. This is an effective method of determining the moisture exposure of the cylinder in storage.

Spraying preservative oil inside the engine and/or filling the engine with a preservative oil mixture and running the engine to distribute the mixture is another way to protect the engine's internal parts from contaminates.

Spray the preservative oil in the cylinder through the spark plug hole using a siphon gun of the type commonly used for engine cleaning. The gun atomizes the oil and allows it to distribute throughout the less accessible parts of the engine.

The preservative oil mixture is one part MIL-C-6529C, type 1, concentrated corrosion preservative compound and three parts MIL-L-6082C, aircraft mineral oil. You can operate the engine using this mixture as the lubricating oil until the engine reaches its normal operating temperatures. This is a Lycoming recommendation and may be done on the ground or in flight.

During storage you should inspect the engine periodically. Examine the security of the airtight covers and the color of the desiccant plugs and remove the rocker box covers and look for rust. Also look for any critters that have set up housekeeping in the engine's various nooks and crannies. If any of your protective measures appear to have deteriorated or been damaged, then a complete re-treatment is recommended.

Restoring Power

One of the concerns with preserving an engine for storage is the procedure required to return the powerplant to service. Before you run the engine for the first time, remove all the air-barrier covers, service the spark plugs and reinstall them, and hand rotate the engine several times to clear the preservative oil. Hydraulic lock of the cylinders from residual oil is a possibility, and the engine may be damaged if not cleared of this danger.

Drain the preservative oil and fill the crankcase with the proper grade and quantity of oil. To pre-oil the engine, create oil pressure without running the engine by turning the engine with the starter, the ignition, and the fuel off. Engine overhaul shops do this when they've finished their work, and it distributes the oil to critical points within the engine.

When your engine returns to the air after storage, closely monitor oil pressure, temperature, and CHT readings for any signs of trouble. For peace of mind, do a compression test, change the oil, and inspect the oil screen (and filter, if your engine has one) after a few hours of operation.

Flying your airplane is the best way to preserve its engine because it needs heated, clean, lubricating oil distributed evenly and thoroughly on a regular basis. I can't think of a better way to spend a Sunday afternoon. You will be preserving the life of your engine and enjoying the time spent doing it.

Mike Leasure is an airframe and powerplant mechanic with an inspection authorization (A&P-IA) and an assistant professor at Purdue University's aviation degree program. A private pilot who now owns a Cessna 170A, he's an EAA Technical Counselor and annual volunteer at EAA AirVenture Oshkosh's emergency aircraft repair.