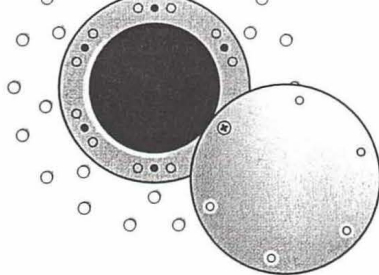


AIRFRAME AND



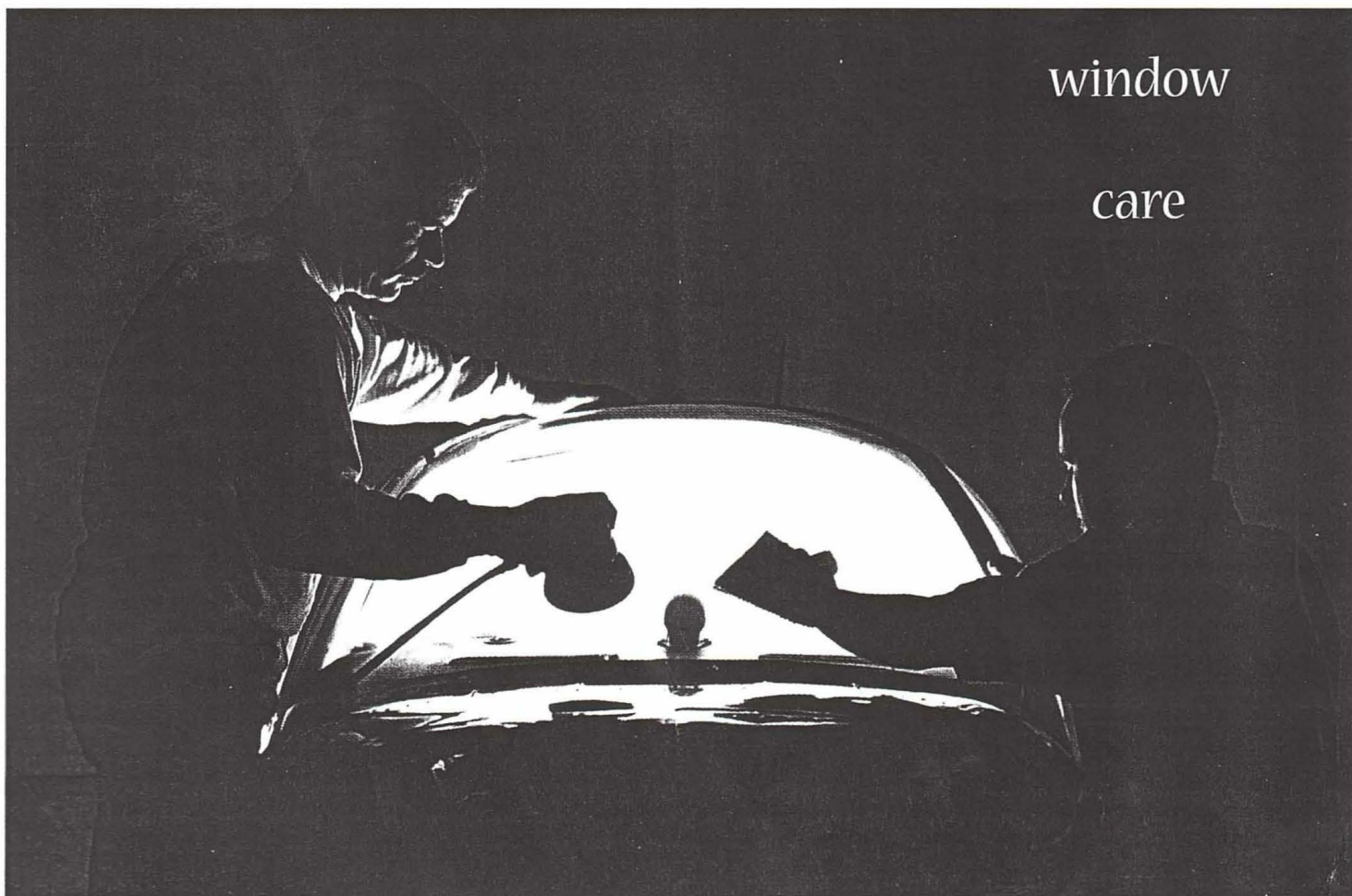
POWERPLANT

Per-plex'd

Like memory loss, thinning hair, and the vague sensation that there hasn't been any good new music in the last 10 years, the deterioration of your aircraft's windows comes on gradually, almost insidiously. One day, much to your consternation, you turn final into the setting sun and see a constellation of scratches, nicks, swirls, and checks—but no airport. This may not be the first indication that you need to swap glass, but it's probably the most obvious. ■ Indeed, for nonpressurized

BY MARC E. COOK

The ins
and outs
of
window
care



PHOTOGRAPHY BY MIKE FIZER

aircraft, the main time that windows come under scrutiny is when they're too crazed or hazy to see through. There are generally no life limits put on windows—placing them in that free-for-all category of on-condition replacement—so it's up to you to decide when enough is enough. There may be other factors, of course, including cracking at the mounts or in tight corners—some mechanics are loathe to stop-drill more than the most minor cracks.

What causes windows to turn? More often than not the culprit is just old age—and we're talking 20 or 30 years, depending upon how the airplane has been cared for and whether it lives in a hangar. Over time, the transparencies can develop myriad small cracks or start what's called *crazing*—this is, essentially, a multitude of tiny cracks below the surface of the acrylic sheet that is the material's way of relieving stress. Win-

allowing the accumulated bug residue to soak." He adds that if you need to use force to remove the bug remains, use your bare hand. Adding a small amount of mild dishwashing detergent to the water will help to get the worst of it.

Follow up with a commercial polish or wax. Pfister is adamant on one point—never use any cleaner that isn't specifically designed for acrylic. Anything containing solvent will quickly destroy the window, and this includes most common glass cleaners, which contain ammonia. Many pilots swear by the furniture wax Pledge, but LP Aero isn't convinced. The company says that while the wax appears to work well, there's no data on long-term compatibility. Moreover, LP's literature points out, Pledge is designed for use indoors on furniture, not in a 170-knot breeze in the great outdoors. Still, many pilots have been using Pledge for years with-



Window repair facilities such as Lee Aerospace in Wichita use high-power optical instruments to determine the depth of scratches and cracks.

out problems, although they admit that the product does ablate quickly, requiring frequent reapplication.

Commercial products for acrylic windows generally fall into one of three categories—simple cleaners, cleaners with a wax-like additive that is intended to fill small scratches,

and cleaners/polishes containing mild abrasives. For everyday use on new or good, clean windows, use the simple cleaner or one with a mild wax. Pfister doesn't like to see people use too much wax because it can build up over time and discolor. Read the label on the can or bottle carefully to determine whether the product is intended to just clean or to clean and wax.

dows can also haze up with age, partly the result of the depletion of the plasticizers in the material and a chemical reaction to ultraviolet light. It seems to be an additive process: As a window ages, it not only begins to haze from exposure to the sun but also picks up more and more scratches that reduce its transparency.

Although there's little you can do to stop the basic aging process, hangaring helps, as do canopy covers if you follow a few basic rules. You can, however, prolong your windows' life with proper care. Window manufacturers are agreed that the most harm comes to the transparencies when you attempt to clean them improperly. Says Jeff Pfister, marketing director for LP Aeroplastics, "We want you to remove as much abrasive dirt as possible without touching the surface. Ideally, this would involve flushing the surface with water and

Window treatments with mild abrasives should be used sparingly. At the appropriate time, these products are useful for taking out the smallest of surface imperfections, but they should not be used in lieu of a conventional cleaner/polish. Because the abrasive constituent removes any protective wax, you'll have to follow application of this product with a cleaner containing a wax or scratch-filling material.

Never use paper to wipe the windows, even in the presence of a wax or

polish. Always use a cotton cloth; a cotton flannel is best. A second choice is the ubiquitous plain T-shirt.

Virtually all general-aviation windows are made from cast acrylic plastic. Rare installations use Lexan, a General Electric-trademarked name of a type of extruded polycarbonate plastic. Lexan is used most often in the homebuilt arena, where its comparatively light weight and toughness are desirable. However, according to LP Aeroplastics, acrylic is a much easier material to work with. "We can mold it with much better optical quality, and acrylic is not nearly as soft and easily scratched as polycarbonate," says Pfister.

Acrylic plastic is light and simple to form, a significant consideration given the nature of aircraft windows. You have probably already noticed that most windshields are complicated, compound-curve affairs, while side and rear windows are more often sections of flat glass. Did you know that, as part of the preventive maintenance regulations, you as a pilot can legally cut and install side windows, as long as doing so does not require disassembling any structural part of the airplane?



When window thickness is critical—or a minimum thickness is specified by the manufacturer—technicians may use a highly accurate ultrasonic tool.

Most single-engine Cessnas, for example, have treacherously difficult compound curves in the upper corners of the windshields that take much effort to reproduce. The original manufacturers most often design and build their window molds as the airplane is being certified—although it's common for this to be done out of house—but aftermarket companies must reverse-engineer the pieces. In order to obtain an FAA parts manufacturer approval, firms such as LP Aeroplastics must prove identicality to the original part. A sure sign that a

window maker knows its stuff is how closely the supplied window fits the aircraft aperture. Some aircraft are built to wide tolerances, so a company like LP Aero must provide sufficient material to fit the worst cases. But it's desirable to have less cutting to do rather than more, if for no other reason than to limit the chances of ruining the acrylic during installation. Check with your local shop for its list of favorite window providers.

Windows also come in a variety of thicknesses. Typically, the original size was chosen with the dual mandates of low cost and light weight higher on the list than low noise and good optical quality. The aftermarket blossoms with thicker replacements. There are compelling reasons for a move up in thickness. The windshields will be stronger and better able to handle bird strikes—although this is not always a definitive improvement. Sometimes the weak link in the window is not the glass itself but the mounting scheme—particularly if the window has to be thinned or milled at the edges to fit into the aircraft structure.

There's little question, though, that thicker windows make for a quieter

cabin. We don't have an interior in the AOPA Aero SUV sweepstakes airplane yet, so this Cessna 206 is still quite loud; but we expect to beat the stock readings of more than 95 dBA in cruise when it's finished. In all windows but the aftmost panels, we upped the thickness to one-

quarter inch, which doubles the thickness of most of the panes. In addition, various tests with a sound meter in singles show that the noisiest part of the aircraft is the area immediately behind the windshield. It's common to see a 2- to 4-dBA drop from the glareshield

to the pilot's seat.

This transmission of noise comes from the window's actually flexing to the prop beat; thicker windows are less prone to this flexing and therefore transmit less noise into the cabin. Many an interior guru has said that he could get a GA airplane to be much, much quieter if only we could live without the windows.

You may be limited by the airframe in the total thickness of windshield you can install. Some windows are placed in removable channels that can be shimmed to accommodate the additional thickness. Other installations—the Cessna 206 is a good example—have fixed-width channels that limit your choices. Milling the edges—taking a quarter-inch window and making its edges just one-eighth-inch thick—is a common tactic.

The next time you fly, take a close look at your windows. See whether old age has caught up with them insidiously. And consider treatment or replacement—clear, clean windows will give you a whole new outlook on flying. □

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Putting on the fix

Sooner or later, you'll get a scratch in one of your windows that's too big to ignore, yet too small to require replacement of the glass. Good news: Available to you is a variety of products intended to fix scratches in acrylic windows the old-fashioned way—with lots of elbow grease.

Among the most popular kits are Micromesh, Clearfix, and Polysand. The components vary among the different kits, but the underlying concept is the same—apply a controlled amount of abrasive material to the window to grind down to the bottom of the crack, and then polish back up to a smooth, clear surface.

Sound scary, this sanding of your precious windshield? Don't worry. These kits make it relatively easy to understand the system and to be successful in smoothing out the defect. But be realistic. If the scratch extends a significant distance into the material—say, one-third or more—you aren't going to have enough acrylic left once you've smoothed the crack to retain sufficient panel strength. Nor are you likely to have good optical transparency when you're finished.

In addition, it's a good idea to walk up your refinishing learning curve on a piece of scrap acrylic, not on that big, mean scratch in the pilot's-side windshield. Finally, expect to take your time. Sanding and polishing acrylic is a tedious job that rewards patience above all. —MEC