

The Airframe

cause a visibility problem. Even then, light to moderate scratches are usually removable by someone with experience, although if done incorrectly, the result will be irregular glass removal and distortion. Glass does have, of course, some drawbacks.

Glass is very difficult to shape, so flight deck windshields tended to be composed of a series of fairly short, flat sections. Glass is also expensive and is very heavy compared to the primary alternative: acrylic transparencies.

Most pilots use the term Plexiglas, which is actually the trademark for one type of single-ply acrylic manufactured by the Rohm and Haas Company of Philadelphia. The Plexiglas formula was patented during World War II when U.S. fighter aircraft needed contoured canopies. The correct generic name is actually “as-cast” acrylic transparency.

Made of a monolithic polymer, acrylic molecular structure is uniform throughout, so it does not have flaws or discontinuities, and acrylic is molded easily to the contours required by modern aircraft. Even though there is no strengthening treatment, as-cast acrylic is remarkably strong and resilient. It actually has a greater impact resistance than glass.

Scratches in acrylic transparencies usually don't require replacement unless they interfere with vision. Since windshield wipers are not put on acrylic transparencies, the cause of scratches is almost always physical abuse. There are three types of scratches that can be removed relatively easily with the proper equipment and knowledge. The first is the hairline scratch, usually caused by improper cleaning procedures. The second type is the minor scratch that you can feel with a fingernail. The deep scratch you can feel with the tip of your finger is the third type. Cracks and crazing do not fall into any of these categories.

Most light aircraft use single-ply as-cast acrylic transparencies, which eliminates the problem of flaking or delamination—when one ply separates from another. As-cast transparencies are also relatively inexpensive and hold up fairly well for several years in the outdoors before deterioration and discoloration set in. Acrylic can also handle significant temperature changes and is designed to absorb ultraviolet rays, which is especially important in preventing pilot sunburn at higher altitudes.

When it comes to noise suppression, however, the typical light aircraft doesn't do so well, as it has an acrylic transparency ranging from .19 to .25 inches thick. The noise from the props, engine, and wind can be remarkably loud, though it is possible to get thicker transparencies with a bit more sound-deadening capability on the after-market. There are, of course, problems even with as-cast acrylic transparencies.

The biggest disadvantage is that acrylics lack hardness. With approximately the same surface hardness as brass, they are easily scratched. Worse, many cleaning agents and solvents attack, and some literally eat, acrylics. You have to keep a very close eye on who washes your windows.

Stretched acrylic is stronger than as-cast acrylic and as a result is used on many pressurized and some large unpressurized aircraft. The process stretches a sheet of thick acrylic into a thinner, specified shape. The act of stretching makes acrylic more resistant to cracks and less susceptible to crazing and abrasion. *Crazing* refers to those tiny surface cracks that, when the light hits them from certain angles, turn the windshield into a blinding glare. Stretched acrylic is engineered to withstand greater stresses, temperature