PANEL MODIFICATIONS - PART VIII

# DINOSAURS, DUMPSTERS & DOLLARS

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Last month we thoroughly explained the various glareshield options for Beech instrument panels. Like glareshields, a well-executed panel project can be ruined by poorly done painting and placarding, or the awkward use of wood grain.

Finishing instrument panels actually involves two separate tasks. The first is prepping, priming and painting (or powdercoating) the bare metal panels. And second is the application of placarding. The two procedures are related in that the finishing process chosen for the instrument panel in many ways dictates a decision on the type of placarding that can be used.


ScotchBrite, lacquer thinner, Alumaprep, alodine, primers, placarding materials and clear coating.

## PREPPING, PRIMING & PAINTING

Since aluminum is self-oxidizing, the metal must be thoroughly cleaned with ScotchBrite and lacquer thinner, etched with Alumaprep and alodine. Aircraft zinc chromate or automotive primer can then be applied to create a paint-ready surface. If wood-grain materials are being used, they can be bonded directly over the alodined aluminum.

Before describing how the various finishes are applied, we need to discuss advantages and disadvantages of these different systems. There are three basic systems used to paint instrument panels, and all have their good points. After thorough discussion and careful consideration, we ask our customers to ultimately make the decision on what system is best for them.

**Lacquer paint** - First is lacquer paint, probably the oldest system of the three. Properly done, lacquer finishes are durable, easily repaired or modified, and allow for an infinite range of colors.

The key to lacquer's superior workability lies in its chemistry. When initially applied, lacquer will dry very quickly.

Also, lacquer is very solvent-sensitive, meaning that it will melt into a previously applied lacquer surface, creating a very thorough bond when dry. This creates a totally monolithic coating that allows for easy modification and repair of the finished panel in the future. Another advantage of the fast drying time is that there is very little dust contamination in the finished surface.

The downside of lacquer is that, when dry, it is prone to scratching and chipping, so caution needs to be taken when tightening instrument screws. If over-torqued, the lacquer will yield under the screws, creating chipping. The chips can easily be touched up, but there are two other finishing systems that perform better where scratching and chipping are concerned.

**Catalyzed polyurethane** - The second panel finishing system is catalyzed polyurethane, basically the same stuff used on the outside of your airplane. In the chipping and durability department, urethane is superior to lacquer. That said, urethane paints require 8 to 24 hours to cure, are very susceptible to dust contamination when wet, and require extensive masking since the overspray will stick to everything. This makes painting a panel in place very difficult.

Urethane finishes dry to a very high shine. Good for exterior finishes; bad for panels. If a semigloss finish is desired, a flattening base can be added to the urethane finish. We've found that urethane coatings require a higher quantity of the flattening agents, but unfortunately that can degrade the hardness of the finish. It's all a compromise.

Since urethane finishes cure chemically, there is a very limited time during which they can be top-coated or touched up. This can create some difficulties in the application of graphics or placarding. Also, repairing or touching up a urethane-finished panel can be more difficult since the new paint does not melt into the previously chemically cured coating.

It is important to know that the chemistry of catalyzed urethane paint is very toxic. Don't even think of using this type of finish without all the required personal and environmental protection equipment. I have lost several friends over the past 40 years to cancer, I suspect as a result of them not believing those warnings on the labels.

**Powdercoating** - The third panel-finishing system in common use today is powdercoating, a process of elecrostatically spraying a fine powder on the prepared metal surface. The powdercoated metal is placed into an oven at about 400°. The high heat melts the powder into a liquid that flows to create a smooth, high-gloss surface. Once cured, it becomes a very hard and durable surface that is quite resistant to scratching and chipping.

The downside of powdercoating is that any future changes in the panel or placarding require complete stripping of the

entire panel and a repeat of the powdercoating and placarding process. Also, unlike wet-painting processes, powdercoating requires an oven. Some people have had success using household ovens. The smells associated with this process will definitely test the patience of your spouse. (You've been warned!)

Before moving on to the various ways that graphics can be applied to these painted surfaces, a very important suggestion: We like to build an instrument panel that is mounted to the airplane with structural machine screws and nut plates. This allows us to etch, alodine, paint and placard the panel outside of the airplane. This allows our customers total freedom to select the finish process of their choice.

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One final note on panel finishes: Almost every panel we have painted, modified or built from the ground up will probably be modified or repaired at some future time. There is no ultimate panel design. It's unrealistic to think that your panel will never have to change. With that in mind, it's important to choose a finish system that can be easily changed—and for my money, that's lacquer.

The panel in my 172 is more than 20 years old and has been modified and partially refinished and placarded several times. I don't think even the most discriminating nitpicker could identify what parts have been refinished or replacarded, although I do have a scratch caused by a careless technician—a testimony to my laziness since it would take less than an hour to touch it up with a little lacquer and an air brush. But no one's perfect.

## What about color?

No panel-painting discussion would be complete without addressing color. The human-factors types have spent a lot of time and effort analyzing instrument-panel color as it relates to accurately reading and interpreting complex instrument panels. All this effort has produced a few basic rules.

*1. Black is out.* Since instrument faces are white graphics on black backgrounds, a black panel lacks boundary definition, making it seem to be a sea of numbers with little definition as to what each island of information represents.

*2. Neutral colors.* By finishing the panel in a medium beige or grey color, every instrument becomes visually identifiable as a more specific piece of information separated from an adjacent piece of information by a very visible area of contrasting color. Aesthetically, by being finished in a neutral color that complements the interior, the instrument panel becomes an integrated part of the total interior design package. Looks and works better. Win-win!

*3. Wood grain:* I believe that some wood-grain finish adds a degree of elegance and richness to the functional purpose of an instrument panel, especially true of an interior that has some wood accent. But that said, I think that an all-wood panel can be

Wolters' 172 panel after several changes and 27 years in service.

a visual distraction because all that wood texture tends to compete with the complex instruments, pulling a pilot's eyes away from the task at hand — accurately reading the instruments.

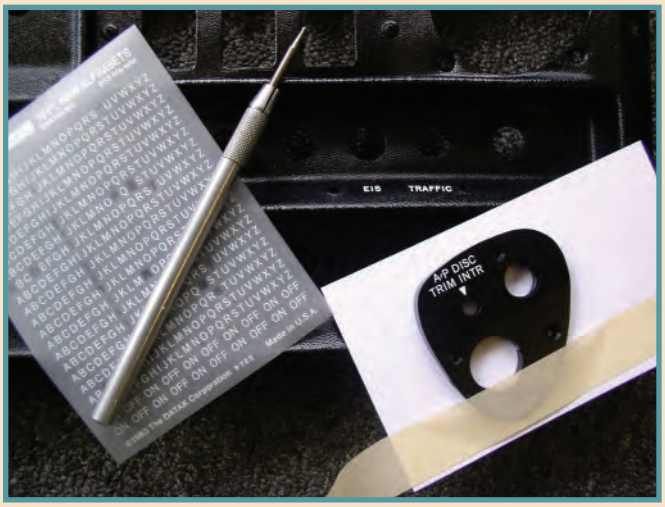
*4. Surface texture:* Three words cover this subject: Shine is bad. Daylight and night-reflected lights compete with seeing the instruments. Enough said.

There are three ways to apply a wood finish to your panel. The first is the infamous heat-sensitive stick-on wood-grain vinyl sheet material used by Beech in the '70s. This is actually the same stuff that was used to apply wood to the sides of station wagons in the '60s and '70s. We've all seen it. I think this stuff imparts about the same quality enhancement to an instrument panel as hanging a velvet painting in the Louvre.

A far more durable and quality-enhancing method of adding a wood finish is to bond a horizontal grade (thicker) laminate to the face of the metal panel, then cut all the instrument panel holes and edge trimming with a small router. Fast, clean, attractive and durable. (I love adjectives!) All of the instrument-mounting screw holes can be drilled from behind the panel and countersunk from the front to get very clean

Routing instrument holes in a laminate-covered .090" panel.

Wood-veneer finished and ready to be mounted to a metal panel.




Press-on type works on almost any flat surface.

holes. Put the whole thing together with black brass countersunk instrument screws and it's about as good as it gets.

The final wood-grain technique is to make a .025" 2024T3 aluminum mask, complete with every instrument and instrument-mounting hole for the area of the panel to have a wood-grain finish. Bond real .025" thick hardwood veneer to the face of the aluminum mask. Then apply six coats of a clear catalyzed epoxy coating. The graphics are applied next and then six more coats of clear coat.

Once finished, the masks are bonded to the panel with contact cement. When all the instruments are mounted and the panel assembled, you have a highly finished, durable, real-wood accent that truly complements the overall panel design.

## PLACARDING

Some of the various placarding techniques and options presented in this article are good for both placarding newly painted panels and replacarding part of an existing panel.

Here at Air Mod, we've found three good ways to placard or label panels. Each system has advantages and limitations, but each one allows for the creation of very crisp, legible and durable graphics. By having a large selection of typefaces and font sizes, we are able to use larger and bolder type, allowing us more senior pilots to actually read the placards at night. Sometimes little things like that can mean a lot.

**Transfer press-type** - The first choice one must make is, depending on the background color and texture, whether the placards should be black or white. If we are not sure which is best, we simply placard a test piece of each and make our choice.

The easiest to use, most versatile, least expensive, changeable and durable graphics application system is the rub-off dry-transfer press-type method. These rub-off letters can be applied to both painted and laminated surfaces and then coated with clear lacquer to make them permanent.

These sheets of letters used to be available at art supply stores in countless fonts, styles, sizes and colors. No expensive equipment to buy, just a sheet of press-on type, a burnishing tool, some clear lacquer and you're in business! The problem is that with the onset of the computer and digital age, these rub-on letters are becoming increasing difficult to obtain.

Here's the best part of this system: If the need arises to change a placard, all you need to do is carefully sand through the clear coat and the graphics using 400-grit sandpaper, stopping at the base coat. Apply the new lettering and airbrush two or three coats of clear protective lacquer; no one will be able to tell that the placard was changed.


Can you tell which two placards on this panel have been changed?

**Silkscreening** - In some situations where the same placard is to be used repeatedly, we employ a silkscreen system. We either press-type or computer-generate an original placard and send the image to a photo screen company to create a framed silkscreen of the placard.

We use a rubber brayer and epoxy ink to transfer the placard to the finish panel surface. This process can be used on any type of panel finish—as long as the surface is almost flat.

Silkscreen graphics have long been used by manufacturers for repetitive production work. But considering the cost of having a screen made, and the set-up and clean-up time, we

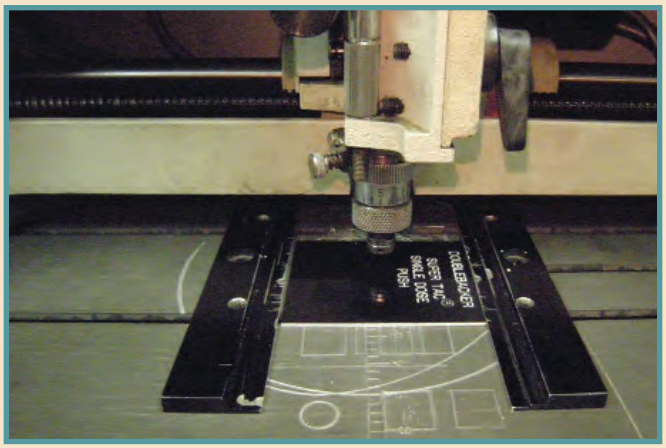

A nicely screened subpanel from D'Shannon Aviation.

High-dollar laser engraving set up.

feel silkscreening has rather limited application in custom panel placarding.

**Engraving** - Two basic methods of engraving are in use today. The first is the old router type where a fine cutting bit is mounted into a computer-controlled router tool. This tool can cut very clean graphics into either a painted surface or a bi-color plastic sheet that can be bonded to the instrument panel surface.

Many shops will first paint the panel with a coat of either white or black paint and then add a second coat of the finish color. The router is set at a very precise depth to cut through the top finish coat, but not through the white or black first coat. *Voila!* A crisp and legible image is created.



A computer-controlled cutting router.

**Laser engraver** - Moving into the 21st century, we come to the *crème de la crème* of graphics systems: the digitally controlled computer-driven laser engraver. This bad boy works much the same as the old router system mentioned above. However, the precision cutting is done by a laser and can be used on almost any surface with a great deal of control. The final product is an extremely clean image.

Guess which system costs the most? You get what you pay for. And cost isn't the only disadvantage of the engraving-based systems. The other is permanence. The only way to make a change is to strip and refinish the panel. It's all about compromise.

For those doing this work themselves, press type makes the most sense (if you can find it). I like silkscreening or press type because it's changeable. There is so much talk lately about change, and when it comes to light airplanes, most of it is happening in the panel.

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That's it on building custom instrument panels. I do hope all this techno-speak of the past several months helps ABS members with decisions when it comes to making changes in their panels. It's all about making *informed* choices.

Fly safe!

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Dennis Wolter is an A&P, IA and a 3,000-hour instrument pilot who started Air Mod in 1973 to bring innovative design and high-quality renovations to the general aviation market. Dennis has a degree in industrial design from the University of Cincinnati.


## New Life Members

ABS would like to recognize new Life Member:

Frank S. Kimmel, III, Greenwood, Mississippi
(Member since 1994; he flies a 1980 A36TC)