

Composites Techniques for the RV Builder

The dos and don'ts
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Description

- Many builders are using antiquated body shop techniques to ready their composite airframes and pieces for paint resulting in unnecessary added weight and potential coating failure.
- Further, builder groups perpetuate the practice of flawed techniques claiming success.
- The dos and don'ts and helpful techniques of readying composite surface for paint application will be presented to provide a lightweight and lasting finish.

Aerodynamic Fairing Putty

- No Bondo directly on epoxy substrate!
 - Suitable on polyurethane primer if needed
- No spot glaze putty (reddish layer)



RV-10 Overhead

- Spot Glaze Putty
 - Is there a need?
 - What is the end goal?
 - Why even use it? Because other builders are...?



SmittysRV.com Fiberglass 101



- What not to use:
 - West System Epoxy (unless nonstructural as epoxy has T_g of only 130F)
 - Acetone / Lacquer thinner (possible 5% recycled = bond breakers)
 - Do not use WEST System 410 Microlight as it is a plastic sphere
 - Expands in solar heat if under a dark color

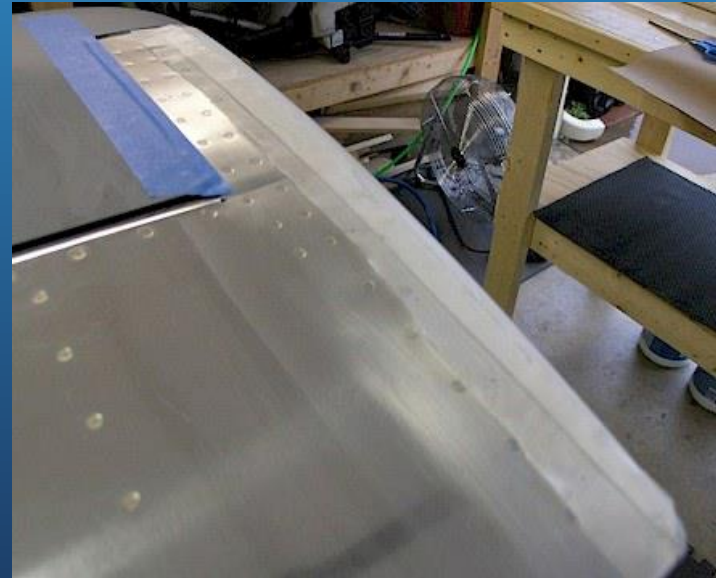
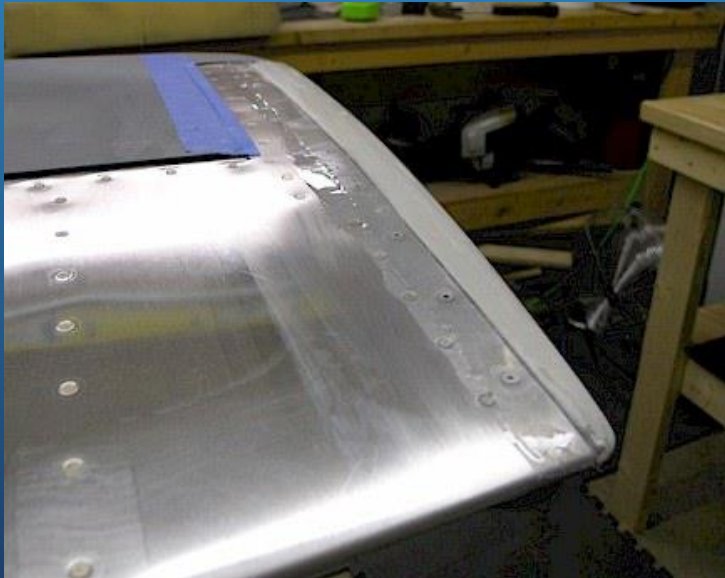
SmittysRV.com Cont.

- What to use:
 - Recommend ProSet, MGS or PTM&W epoxy
 - Higher temperature tolerance (heat distortion temp or T_g)
 - These epoxies have T_g around 180F
 - +95% isopropyl alcohol (medical and laboratory regulated)



SmittysRV.com Cont.

- “First I scuffed up the surface of the aluminum and fiberglass tips with a scotchbrite pad where the fiberglass tip and aluminum meet and then cleaned it off with lacquer thinner. Then I cut a thin strip of 1.5 oz lightweight fiberglass cloth and layered it over the junction between the aluminum and the fiberglass tip.”
- The interface between the fiberglass and the metal will eventually crack



SmittysRV.dot com Cont.

- Do not use polyester or vinyl ester putties /fillers directly over epoxy substrate
 - The amines in the epoxy frustrate the cure
 - Can use over urethane primed surfaces such as PPG K36 or similar
- “Then I used a plastic spreader and put an initial thin coat over the resined area.” Yet the photo on the right shows putty applied over primer.



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- Why build in aluminum and want your plane to look like a composite!?



Proper Aluminum Prep

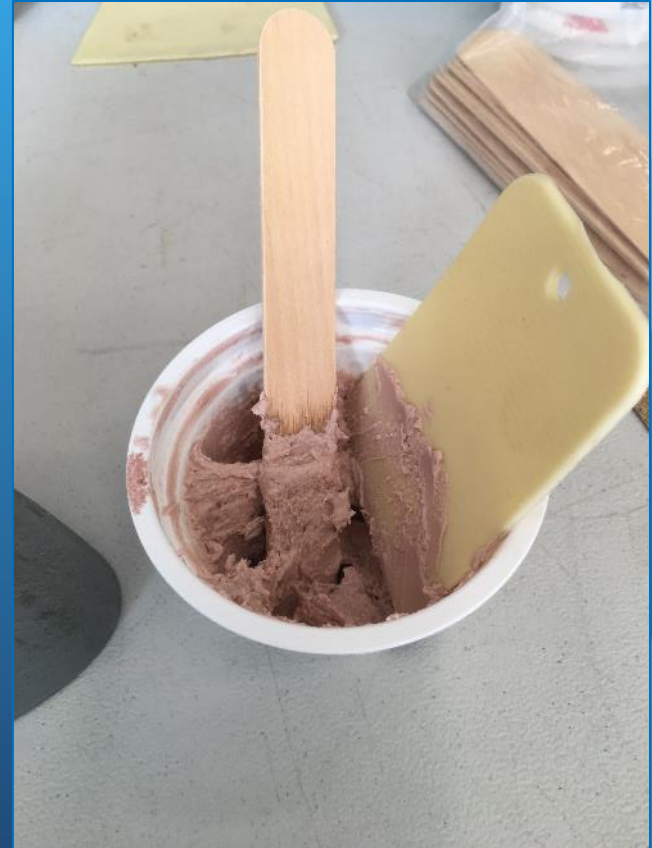
- Abrade surface with 80 grit sandpaper
- Etch with Phosphoric Acid (KleanStrip concrete & metal prep at Home Depot)
 - Dilute 10:1 water for aluminum surfaces
 - 4 minutes with plastic bristle brush (Scotch pad not suitable as it knocks off the edge of the abraded surface)
- Rinse well with fresh water and dry quickly
 - Use paper towels not cloth rags (bond breaker)
- Apply 3M AC-130 (Sky Geek has it in stock) or wet sand surface with mixed epoxy resin
- Let AC-130 air dry in accordance with instructions
 - Go to lunch or dinner
- Apply resin and fiberglass using common practices

Dry Micro Mix

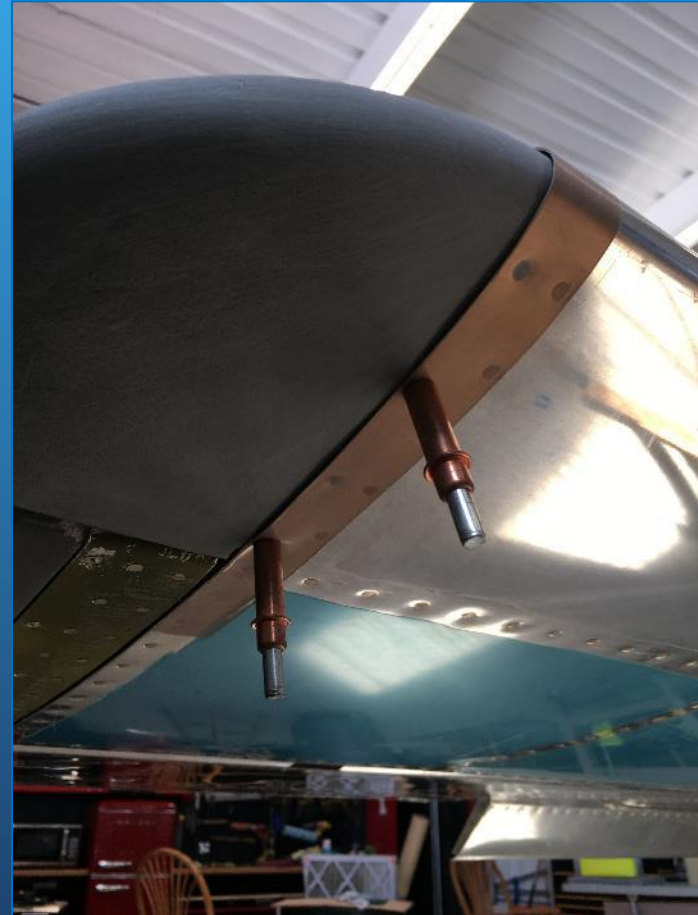
- Need materials:
 - Epoxy resin and
 - Glass microspheres
 - Mixing cups
 - Tongue depressor(s)
- Mix small quantity of epoxy resin (mix thoroughly for ≥ 2 min)
- Add micro-balloon a little at a time with tongue depressor and keep stirring
- Continue adding balloons until peanut butter consistency

Dry Micro Mix Cont.

- Mix check consistency:
 - Make peaks of micro by pulling up with tongue depressor
 - Tip of peak should stand up and not curl over
 - When getting close to this consistency add very little balloons at a time as it stiffens quickly
 - Don't want to have dry mix and have to add more epoxy



Micro Putty Approach



Micro Putty Approach



Multiple Steps Required

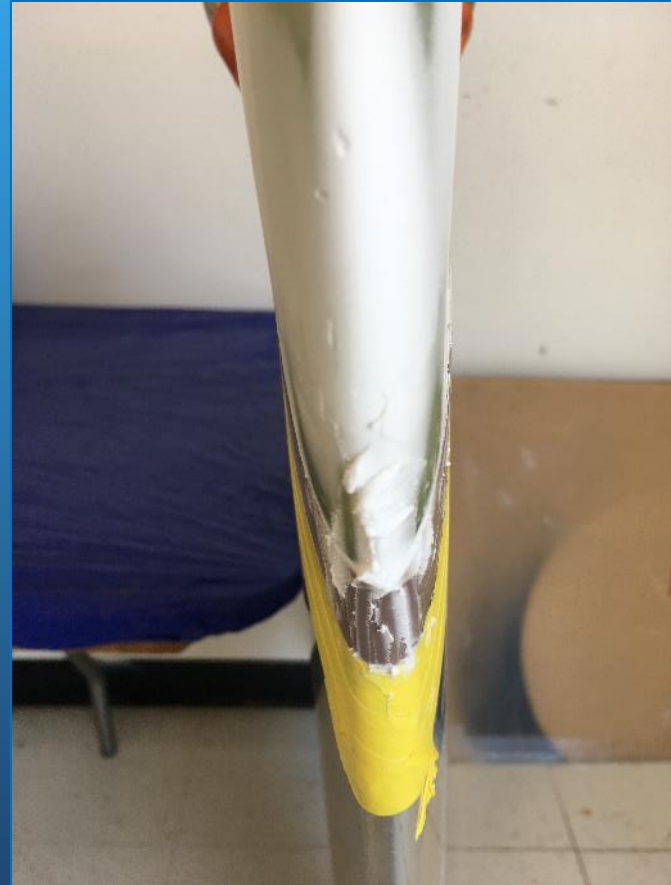
- 2nd Coat



Brad Berry's RV-7



Brad Berry's RV-7 Cont.



Preparing the Seam on Wing Tips

- Common for seam to be raised
 - Need to sand flush
 - There is a technique for this (see below)
 - Assured you will go through gel coat; not a problem
 - Voids will be exposed as a result
- Sand with 80 grit paper & flexible sanding pad
 - Sand to the edges
 - Sand at plus-minus 45°
 - Don't hesitate to expose voids
 - Pick off the 'skin' over hidden void (could blister later)

Sanding on Seam $\pm 45^\circ$



Sand to the edge using a proper sanding pad.

RV-10 Wingtip Bubble Buster

Voids



Pick



'Popped Bubbles'



Picked open voids
have sharp edges the
need to be dressed

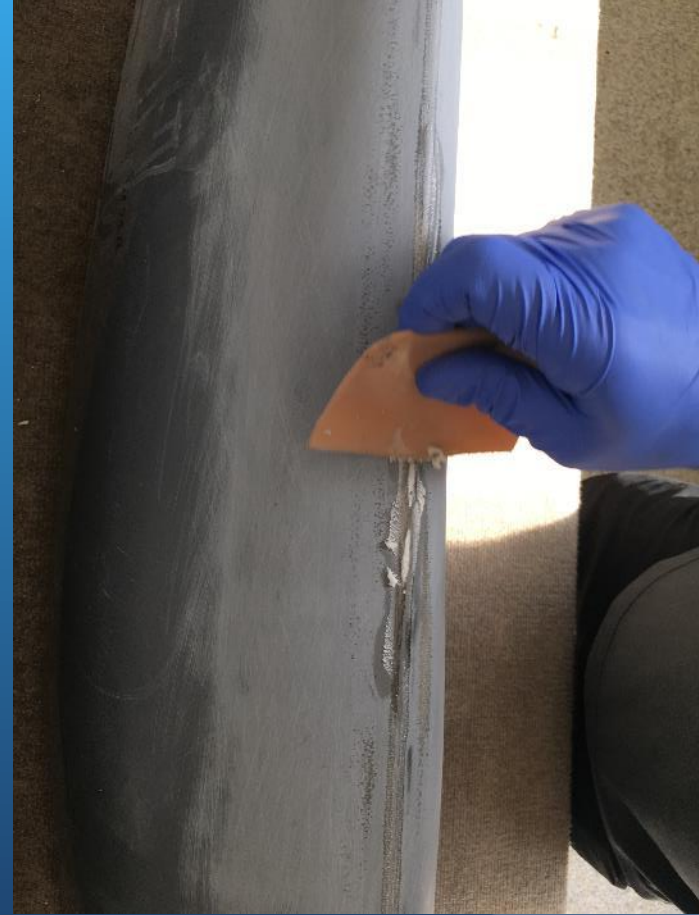
Bubble Busters Continued

Die Grinder
Or
Dremel Tool

GO EASY!!



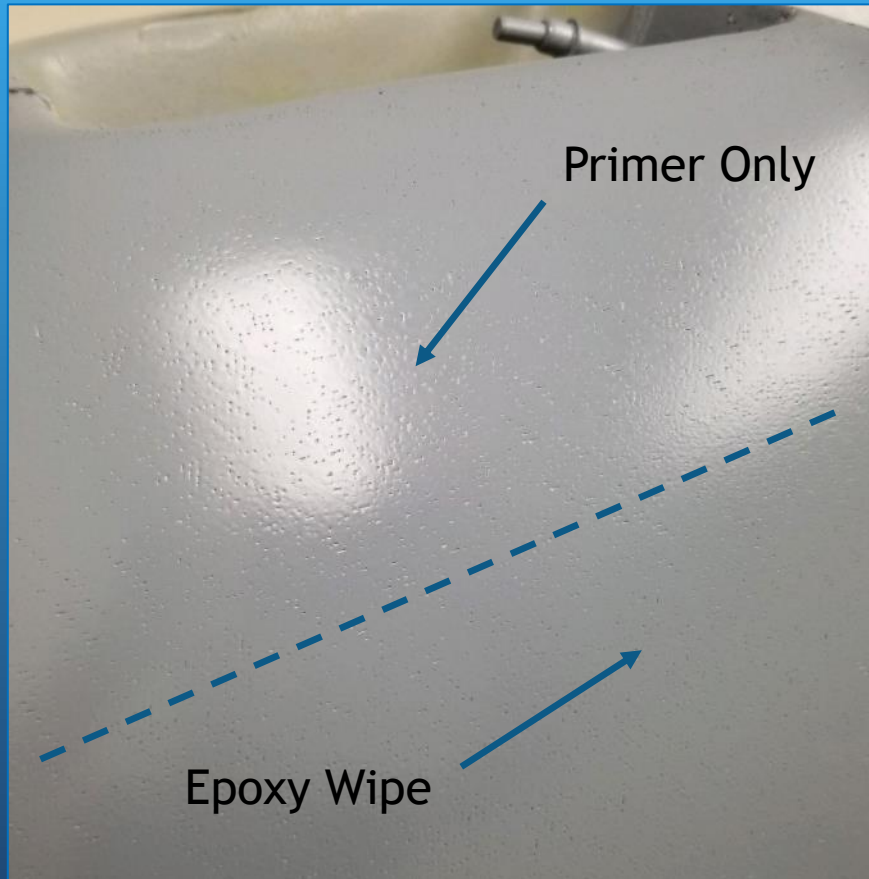
Filling Seam Voids with Micro Putty



2nd Coat Wipe of Micro Putty



Pinhole Busters



- Common to have pinholes in composite parts
- Need to fill pinholes prior to painting as primer alone will not fill them (even high build primers)
- Use 'epoxy wipe' to fill pinholes
- Or, use Loehle Wonder-Fil to fill pinholes

Epoxy Wipe

- Sand and clean the surface (be careful about using compressed air that may contain water and oil)
- Wipe with 98% isopropyl on paper towel and then dry with clean paper towel
- Mix and wipe neat epoxy with rubber edge squeegee
- **!!DO NOT THIN WITH ALCOHOL!!**
- Let cure and sand
- Check for any remaining pinholes
- Repeat as needed
- Hint: only as much as needed

Loehle Wonder-Fil

- Suitable for fiberglass, carbon fiber or sanding scratches on wood
- Quick wipe on
- Wait 15 minutes
- Wipe off with paper towels just like waxing your car
 - Wiping too hard and too long will pull the Wonderfil out of the pinhole
- Disappears with the next sprayed coating layer

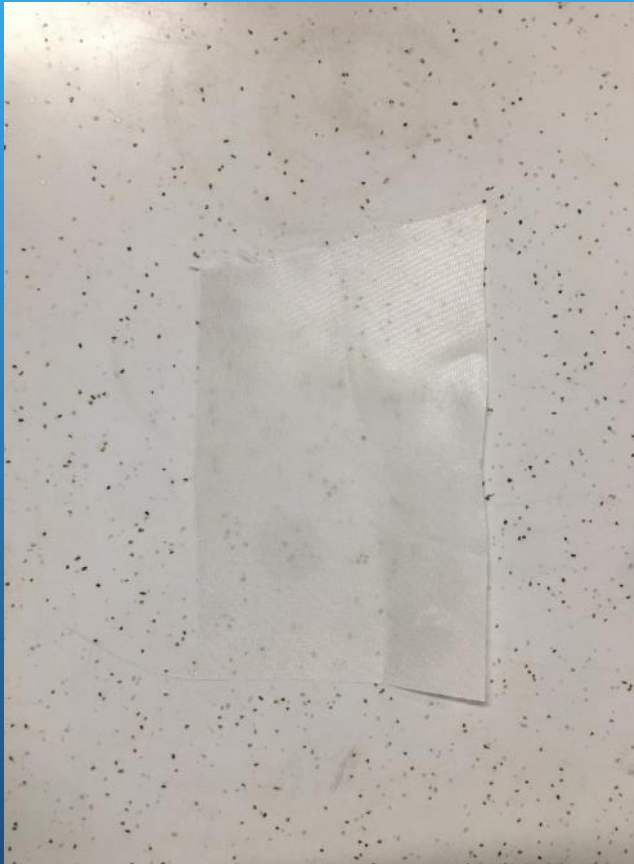
Composite Wing & Stabilizer Tips



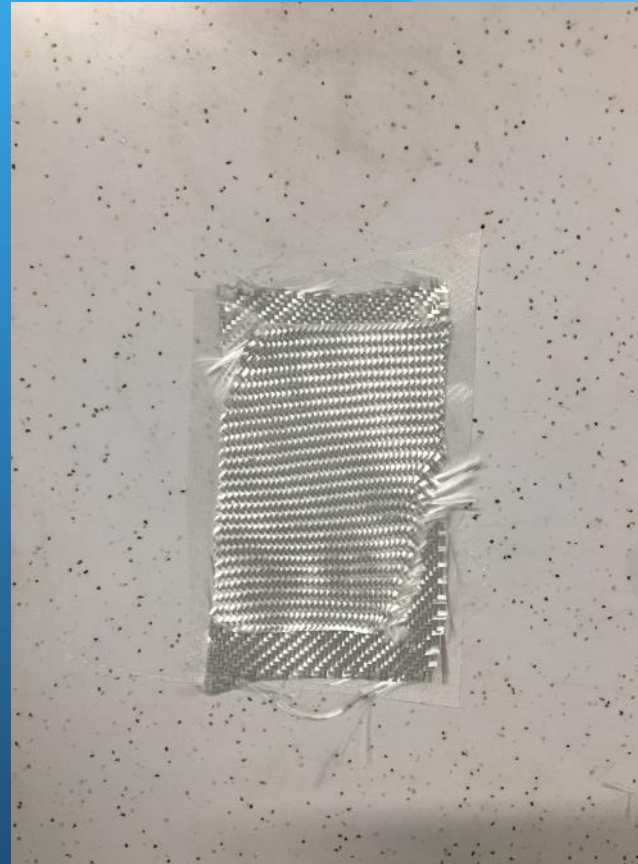
Fillet Fabrication

- Needed:
 - Mold released surface (glass or Formica)
 - Peel ply
 - 7725 glass fabric (Rutan fabric)
 - Resin
- Peel ply against a flat and released surface
- Three plies of cloth wetted out with resin
- Peel ply on top

Fillet Fabrication Cont.

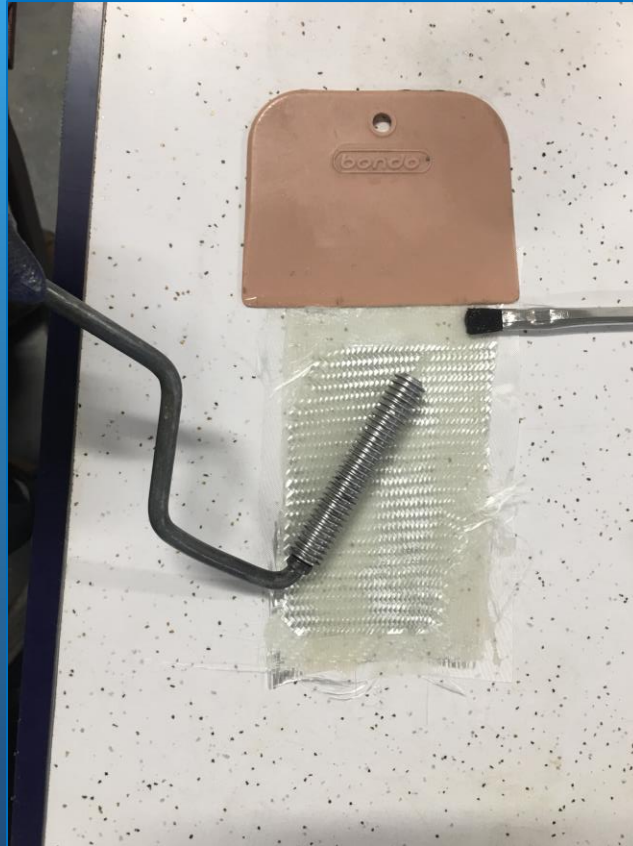


Peel Ply



7725 Fabric over
peel ply

Fillet Fabrication Cont.



Wet out with epoxy resin and outer layer of peel ply. Consolidate with roller or spreader.

Fillet Fabrication Cont.



Teflon tape on part



3 Plies glass over tape

Fillet Fabrication Cont.



Flange fabricated



Flange trimmed & set on flat laminate

Fillet Fabrication Cont.



Bonded flange to fillet



Fillet inserted & glued
in place with epoxy

Windshield Installation

- Bonded vs Fastened Windshield
 - Van's Aircraft plans for Windshield installation steps through the process of fastening with screws and rivets.
 - The leading edge of the canopy utilizes a laminated fiberglass fairing to cover where it meets the fuselage.
 - The risk of fiber glassing over the fasteners is seeing the fastener another day.
- **DO NOT FIBERGLASS OVER FASTENERS!!**
 - Fasteners will eventually show through
- Van's RV-14 windshield technique is overkill
 - Easier method demonstrated below on RV-8

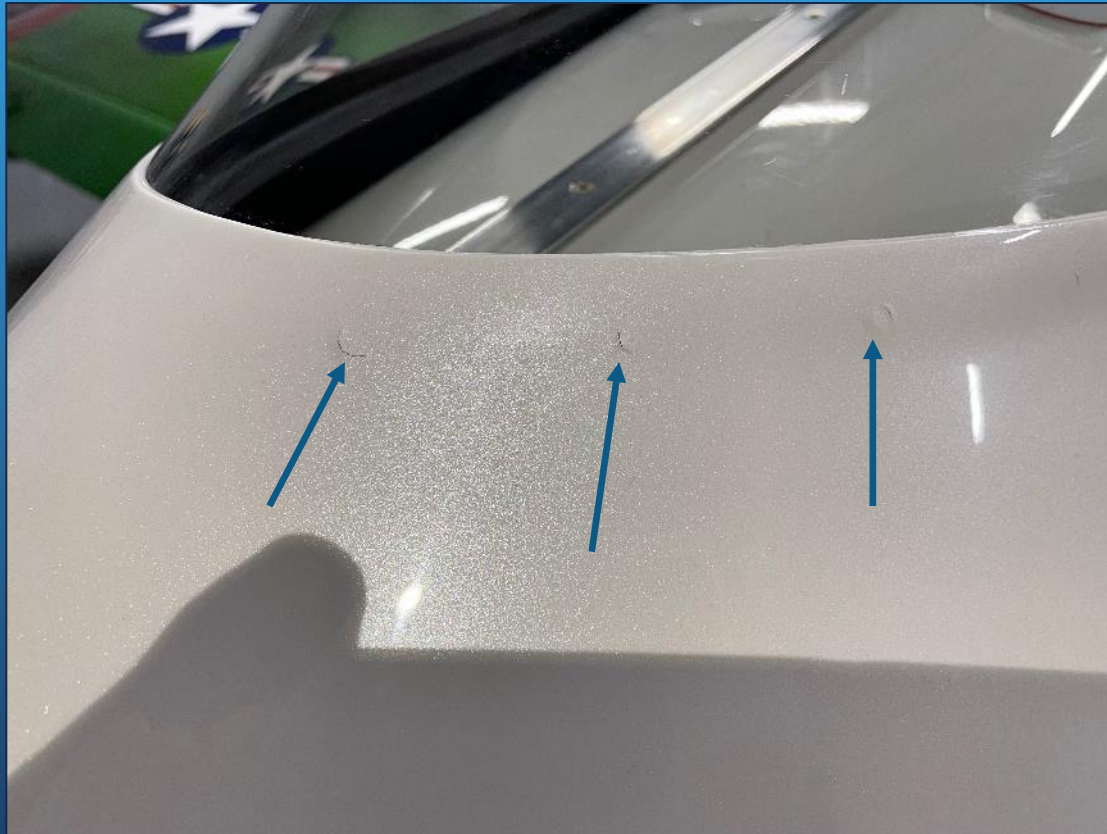
Windshield Installation

- Mark Beard's Beautiful RV-8



Windshield Installation Cont.

- Fasteners pushing through



Windshield Installation

- Initial bonding of windshield
 - Abrade the contact area of the aluminum and steel roll bar
 - Cut back the inside protective film with scissors
 - Sand the contact area of the acrylic with 80 grit about 1 inch from the trimmed edge
 - Wash all surfaces with 98% isopropyl and wipe dry with separate paper towel
 - Locate windshield for best fit and predrill for Clecoes
 - Etch the cowl boot bonding area of aluminum with 10:1 phosphoric acid (recommend plastic taped below the work area to prevent acid on other parts of aircraft)
 - Rinse well and **QUICKLY** dry with paper towels
 - Treat etched surface with 3M AC-130 (or use the wet epoxy-sand technique)
 - Apply adhesive to aluminum and steel roll bar (two pairs of hands here)
 - Apply just enough for a squeeze that results in a $\frac{3}{4}$ inch wide bond line
 - Clecoe in place and let cure

Windshield Installation Cont.

- Clecoes & clamping windshield
 - Cleco along trimmed edge onto cowl boot
 - Clamp along tubing



Windshield Installation Cont

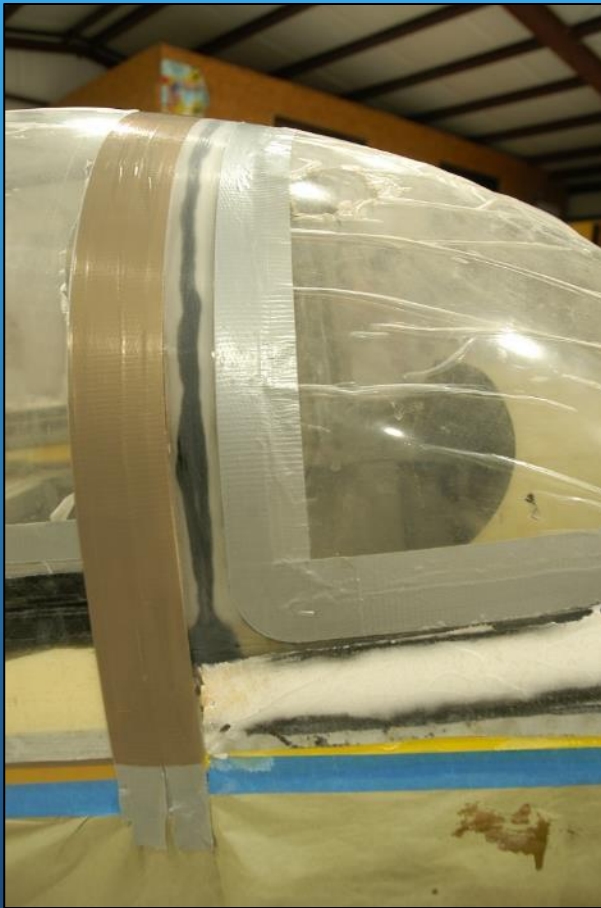
Grind taper on edge and apply epoxy



Peel ply applied over epoxy remove lightly sand and apply micro putty

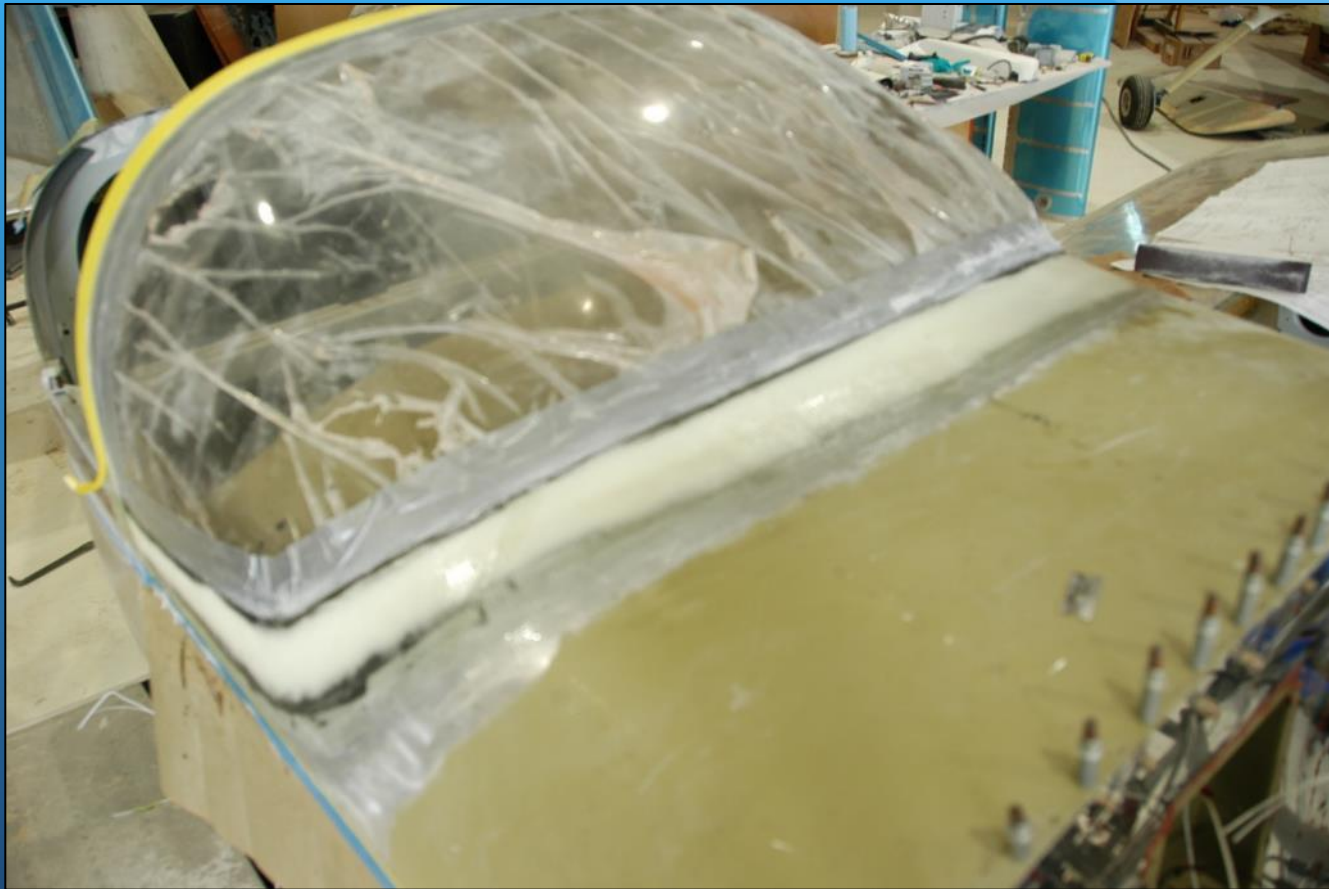


Windshield Installation Cont



Teflon tape over canopy, laminate and peel ply

Windshield Installation Cont.



Sand micro to contour and apply one layer of epoxy / glass

Windshield Installation Cont.

Using masking tape directly over the roll bar and add one more to provide $\frac{3}{4}$ inch trim line. Trim edge near net and sand to finish edge. Dry micro fillet above roll bar to new flange and apply one ply of epoxy / glass.



No No's

- Rags (read bond breaker)
 - Cloth rags are not used no matter how often they are washed or washed with TSP
 - Preferred are the Scott Blue Shop towel or the household paper towel
- Fabric Handling - not handle with bare hands
- Shop heating - I do not recommend kerosene heat as it puts contaminants in the air and so on the surface of your work
- Diluents in resin - some have used alcohols to thin out epoxy resin - DON'T! Keep your resins at temperatures in the 80's or 90's. Use a heat box if you have to (wooden box with light bulb & thermostat).
- Open Fabric storage - keep your fabric in a bag to be free of dust and moisture: preserves sizing
- Open Resin storage - epoxies last a long time when stored cool & dry
- Solvent wiping / cleaning - many like to clean with acetone or MEK; these are potential bond breakers. I recommend isopropyl alcohol as it does not have any recycled additives due to the medical requirements. Try to get greater than 95%.
- Additives (fumed silica aka cabosil, micro-balloons, flox) - cabosil at less than 2% for thixing and balloons or flox as required. Cabosil has no strength. Additives are introduced after resin & hardener is thoroughly mixed

Source List

- Teflon Tape: CS Hyde Company, 1” wide Skived PTFE Part# 15-2A, 2” wide Skived PTFE Part# 15-2A (found it on Amazon recently)
- Airtech Flashbreaker Tape - Airtech (www.airtechonline.com) or Freeman Supply (www.freemansupply.com)
- Scissors: Kretzer Finny 74525 10.0” - Sewn Products Equipment Co., PO Box 357, Jefferson, GA 30549. www.sewnproducts.com
- Wheel Cutters: Olfa Rotary Cutter sold at many fabric stores
- Fiberglass rollers: Fiberglass Coatings Inc., Ft Lauderdale, FL (www.fgci.com)
- Assorted processing supplies (resin, fabric, vacuum bag, taps), FGCI
 - Discount code: sunnfun2025
- Tongue Depressors: non-sterile - any online medical supply
- Resins: Aircraft Spruce or Composite Envisions
- Fabric, resins and vacuum bag supplies: Composite Envisions (www.compositeenvisions.com)
- Wonderfil, Loehle Coatings: <https://loehlecoatings.com>, ph: 850-482-4141