# Emergent Repair of Glasair I TD Wing

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#### Initial Damage

- Due to a blind spot in field of view Glasair TD pilot strikes leading edge of wing into a golf cart at Sun N Fun 2019 while being marshaled.
- Simple steps were taken to restore the damaged wing to full strength.
- This method is applicable to many types of composite damage of non-primary structure.



## Close Look at the Damage

Good news is that there is no spar or fuel tank impact.



#### Repair Steps

- Assess the pedigree of the local laminate
- Identify suitable materials on hand to match the Glasair laminate schedule to include the foam core.
- Develop suitable scarf repair steps permitting vacuum consolidation of repair laminate to achieve glass to resin ratio and consolidation of stiff triax-glass fiber:
  - Take steps necessary to create vacuum integrity of outer mold line, including create a seal of the inner skin.
- Pull a skin off of the wing adjacent to the damage for inside layer.
- Prefab a skin for bonding to the inside surface permitting vacuum integrity.

#### Repair Steps Cont

- Glasair Laminate Pedigree (innner to outer mold line):
  - 3 Plies 7781 (9 oz areal wt) with Derakane 470 vinly ester
  - ¼ inch PVC foam
  - 3 Plies 7781 / Derakane 470 (novalac backbone => stiffer structure)
  - Outer mold line coating is gel coat; plane never painted
- Repair Laminate Pedigree (inner to outer mold line):
  - 1 ply 7781 with ProSet 145/226 epoxy
  - ¼ inch PVC foam
  - 3 plies of 7725 with ProSet 145/226

## Spot Glaze Putty Applied



Fair in the missing gel coat with lacquer spot glaze putty.

Let cure then wet sand.

## Apply Teflon Tape

Apply 4 mil x 4 inch wide Teflon tape as a surface release.

Area covered: 16 x16 inches



## Laminate 1 Ply of 7781 & Peel Ply



## Tape Edges of Peel Ply Down Tight



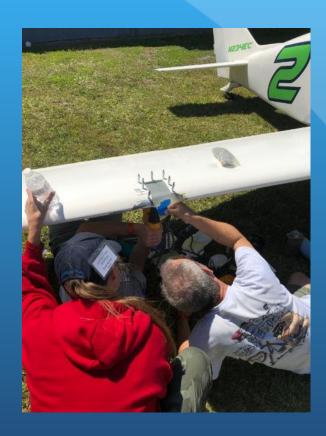
## Remove Damage



Damage and delamination is removed. Only go as far as needed as the 20:1 scarf taper will clean up a lot of the delaminated laminate.

## Preparation of Inside Laminate





Single ply of 'green' 7781 is fitted to the inside, trimmed, inserted and drilled in place for the clecoes.

#### Trim & Fit 7781 Patch



Trial fit inner patch skin with clecoes.

#### **Bond Inner Skin**



Lacking a suitable adhesive bond inner patch skin with epoxy / microfiber putty.

#### Bond in PVC Foam



Fellow SNF volunteer had a sample box of DIAB PVC foam types that we tool advantage of.

#### Foam on Lower Surface



Bond in foam with epoxy / microfiber mix.

#### Fabric Comparison

- Style 7781:
  - Weave: 8H Satin
  - Weight: 8.81 oz/yd2 (299 gm/m2)
  - Thickness: 8.6 mils (0.22 mm)
- Style 7725:
  - Weave: 2/2 Twill
  - Weight: 8.8 oz/yd2 (298 gm/m2)
  - Thickness: 9.3 mils (0.24 mm)

## Grinding 20:1 Scarf



3 plies of Style 7781 is approx 30 mils. At 20:1 scarf taper the outer limit would be  $\geq$  .060 inches.

## Scarf Completed & Fair Foam



Scarf taper was much greater than needed to assure the removal of all delaminations.

## Dry Micro Foam



Apply dry micro (epoxy/micro-balloon) to fair anomalies and fill in scored core lines.

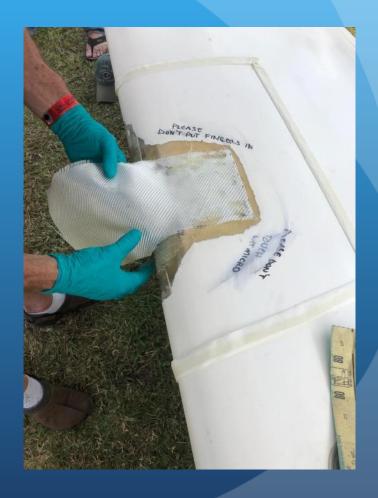
## Two Plies of Triax on L.E.



Lamination of leading edge and repair area completed.

## Laminate 3 Plies Style 7725

Following the two plies of triax to the leading edge three plies of 7725 that progressively increase in size make up the scarf repair.



## Vacuum Bag Preparations





P3 Film is trimmed and placed to control resin bleed & airweave distributes vacuum over entire surface.
Airweave also serves as a visual QC under vacuum.

## Vacuum Bag Placement



## Control the Vacuum by Resin Bleed



## Lower View



## Dry Micro Fair



## Back to the Flight Line

