

Repair Instructions

for the Glass Fiber-Plastic Sailplane

"CIRRUS"

Construction

In the CIRRUS sailplane we find three basically different construction methods. Repairs must for this reason be performed differently on the respective parts.

We differentiate

1. Wing and stabilizer
2. Rudder, elevator and ailerons
3. Fuselage

- 1.) Wings and stabilizer are built in a ribless glass fiber-plastic foam sandwich construction. This means in event of damage that we find a PVC rigid foam (5/16 inch thick, 3.7 lb./cu.ft.) bonded on both sides with a glass cloth laminate.
- 2.) The controls likewise consist of a sandwich construction. However here the supporting core is not PVC rigid foam but a 5/32 inch thick foamed polystyrene (Styropor) sheet with a specific weight of only one lb./cu.ft.
- 3.) The fuselage, in contrast to the above parts, is not in sandwich construction but in a pure approximately 1/16 to 3/32 in. thick glass fiber-plastic layup which is reinforced at two locations with bonded-in foam rings.

The following materials apply to all parts:

Resin Shell Epikote 162
Hardener BASF Laromin C 260

Mixing proportions
 by weight 100 resin to 38 hardener
 by volume 2 resin to 1 hardener

After proportioning stir until striations disappear.
 Add filler after stirring.

Glass fibers and cloth

Use only alkali-free "E" glass cloth with Volan A or I-550 finish (INTERGLAS).

INTERGLAS Style	U.S. Style	Weave	Weight lb./sq.ft.	Application
91110	120	↑ Crosstwill ↓	.022	Elevator & rudder
92110	---		.033	Fuselage, ailerons, stabilizer
92125	---		.058	Wings & fuselage
92140	152-150		.082	Fuselage
92145	181-150	uni- directional	.044	Wings

Repair Instructions for the STANDARD CIRRUS

The construction methods on the ST. CIRRUS are almost the same as on the OPEN CIRRUS. Therefore repairs can be performed in the same way as described in the enclosed INSTRUCTIONS for the CIRRUS.

In the STANDARD CIRRUS we find the following different construction methods:

1. Wing and horizontal tail plane

Glass fiber-plastic foam sandwich construction, this means PVC rigid foam (8 mm, 5/16" thick) bonded on both sides with glass cloth.

2. Fixed vertical tail plane fiber

Glass fiber-plastic foam sandwich construction,

front part up to the spar
with CONTICELL 60, 6 mm thick

rear part behind the spar
with CONTICELL 60, 4 mm thick

3. Fuselage, ailerons, rudder

Pure glass fiber-plastic layup.

Should a fracture or damage occur to the sailplane, you should first inspect the damaged area to determine exactly the type of construction and to find the appropriate repair method.

Rovings

GEVETEX Type ES 10-40x60 K 43 Textilglas GmbH
GEVETEX

Foams

PVC Rigid Foam Conticell 60 Continental AG
5/16 in. thick, 3.7 lb./cu.ft.

Styropor THERMOPETE Super PORON
5/32 in. thick, 1 lb./cu.ft. Kunststoff Werke

Resin - Fillers

Microballoons, white Union Carbide
Microballoons, brown (Brenntag GmbH)
Aerosil Degussa-Wolfgang
Styropor kernels 1/16 - 3/32 dia. BASF
(expanded polystyrene kernels)
Chopped cotton wool

Lacquer

Lesonal-Werke

PE - Lackvorgelat, white No. 3-6910
(resin paint)

PE - Hardener No. 7-2050

Mixing proportions by weight

100 parts Lackvorgelat to 10 parts hardener

PE - Thinner No. 6-3026

~~PE - Filler, white No. 62-507~~

~~PE - Hardener No. 7-2050~~

~~Mixing proportions by weight~~

~~100 parts filler to 10 parts hardener~~

~~Resin paint "Lackvorgelat" and filler can be mixed in
one to one or other proportions.~~

Repair

Should a fracture or damage occur to the sailplane, you should first inspect the damaged area to determine exactly the extent of damage and type of construction. The type and density of weave can usually be determined by sanding to the cloth. If this is not possible, break off a piece of the laminate and ignite it. After the resin is burned the type, density and direction of the weave will be evident.

I. Damage to Wing or Stabilizer

The damages which can be repaired by you fall into two groups:

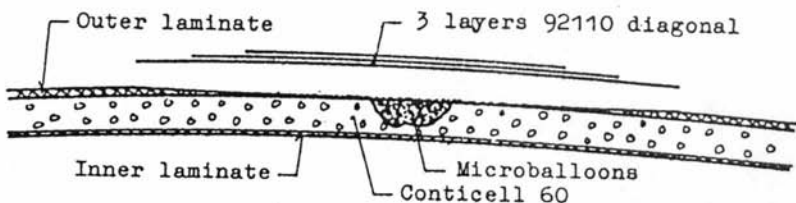
- a) Simple surface damage (only the outer glass fiber laminate damaged)

b) Destruction of the whole shell (also the inner glass fiber laminate destroyed)

a.) If the outer shell receives a puncture or a fracture, tap to determine the extent of delamination from the foam. Follow by removing the lacquer with a sanding disc or block and remove from the foam the portion of the shell which has become delaminated. Around the edge of the damaged area where the shell is still firmly bonded, scarf with an abrasive block or a plane blade at least 1-1/2 inches (for each cloth layer about 3/4 inch is necessary).

After scarfing the shell, blow out thoroughly the whole repair area including the pores of the foam and wash the scarf with carbon tetrachloride or acetone.

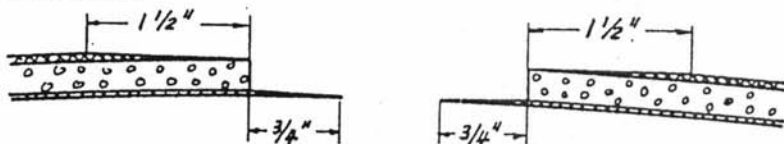
Now fill the hole in the foam with microballoons and simultaneously fill the pores of the exposed foam. Then lay three patches of the 92110 cloth with diagonal weave direction (stepwise largest patch first) over the damaged area. The applied cloth must be dry and dust free.



After hardening (appr. 8 hrs. at 20 deg. C. or 68 deg. F.) the damaged area should be smoothed, filled and painted. In smoothing take care that only the edges of the patches are sanded.

b.) If there is a through hole in the sandwich shell then the inner laminate must be repaired.

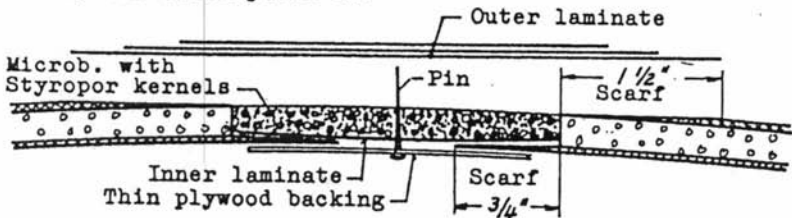
We remove the outer laminate in the region of the damage which is no longer bonded to the foam and enlarge the hole in the foam and inner laminate until good bonding to the foam is evidenced. Then the foam is further removed 3/4 inch around the hole in the inner laminate and the outer laminate scarfed as under paragraph a. Now the projecting inner laminate is cleaned of any foam and feathered.



If the hole in the foam is smaller than a fist then glue with Patex a thin plywood or polyester plate from the inside to the laminate, lay on the inner laminate (1 layer 92125* or 2 layers 92110*) and fill the hole in the foam with microballoons mixed with Styropor kernels or crumbled Styropor.

If you are not hurried let it harden (8 hrs. at 68 deg. F.) sand and apply the outer patches.

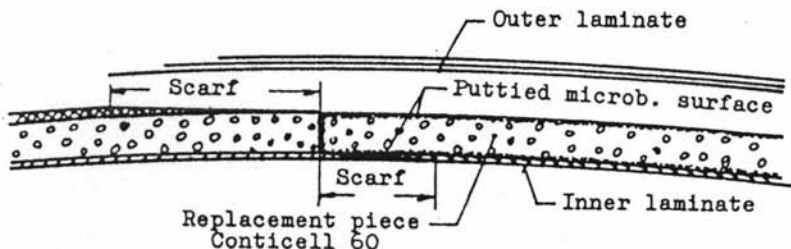
A tip on gluing the plywood plate - the hole in the inner laminate should always be a bit oblong so as to insert the plywood backing plate. Before inserting the plywood drive through the middle of the ply a pin or nail by which it can be drawn against the inner shell. With additional nails or pins it is in this manner possible to close very large holes to the proper contour to lay the cloth patch on.



Basically it is possible to repair also larger shell parts in the foregoing manner. Because of weight you should use a plug of foam in place of the microballoons and Styropor kernels.

In these cases proceed as follows: You cut or sand a plug of foam (Conticell 60) to fit the hole, spread the inner side thinly with microballoons (to close the pores) and lay on it the inner laminate. The inner laminate must harden before doing further work. If the hardening is complete or at least progressed so that the laminate does not separate from the foam, then glue the plug in the hole with thickened resin (chopped cotton wool, microballoons). The foam with laminate on one side is flexible so that it can be fitted to the wing contour (if necessary warm the foam with a hairdryer and bend). Once the foam is glued it can be smoothed, puttied with microballoons and the outer laminate applied.

Caution: Avoid strong heat, otherwise air bubbles form.



II. Damage to the Controls

Basically the same procedure can be used as on the wing. Only in place of the PVC foam a polystyrene foam layer, "Styropor Thermopete Super" 5/32 inch thick, is used. The Styropor piece need not be coated with microballoons, the cloth adheres very well with pure or slightly

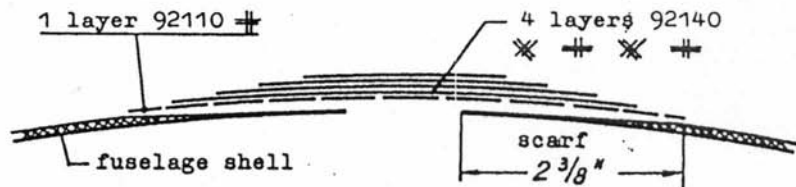
thickened resin which must not harden in any case before doing further work. However with larger replacement pieces you should let the laminate harden on one side and glue the foam thereto in order to keep the surface wave free.

Caution: Do not apply too much heat to freshly laid cloth otherwise it causes ugly blisters and you must start over.

Caution: On the controls minimize weight in the repair. The surface should require very little filling.

III. Damage to the Fuselage

In the repair of the fuselage we save the annoying replacement of the foam. We have here, as already mentioned, only to do with the simple glass laminate which in most places consists of five layers. Therefore we need larger scarfs. These should, for larger holes or cuts, never be less than 2-3/8 inches wide. With all fuselage shell repairs apply resin first to a layer of 92110 + cloth following with four layers of 92140 cloth alternating the weave lengthwise and diagonally. Then you are always on the safe side. Each succeeding layer should be about 3/8 to 1/2 inch smaller than that under it.



For small holes or fractures the repair is no problem. You sand your scarf, clean well with carbon tetrachloride or acetone, lay on the cloth layers and, if the resin is dry, can finish the whole repair with microballoons after 2 or 3 hours.

Caution: If the room is cold or if you are hurried you should nonetheless not use a concentrated hot air stream. Better, make a large tent over the area from aluminum foil and heat the space from a safe distance. There is little likelihood of blisters but overheating can occur and the resin may become brown. If you do not have a source of hot air, put a sheet of foil over the applied cloth and use a heat pad or hot water bottle.

For larger holes in the tailcone not accessible from the inside, we must again fabricate a backing on which to contour the repair cloth. This can be retained as discussed previously with the aid of plywood, a nail and a little Patex. It cannot later fall out, the cloth being directly on the plywood and so is bonded thereto. After the plywood backing is secured proceed as previously discussed.

Lacquer Work

After sanding the edges of the patch or the area filled with microballoons until the original contour is attained the puttying can be abandoned and the lacquer (PE-Vorgelat or PE-Vorgelat and filler in 1 to 1 proportion) applied directly with a brush (not sprayed). After hardening sand the area and wet sand with 360 grit wet-or-dry paper. If at no place the weave shows then final sanding can be done with 600 grit wet-or-dry. Polish with rubbing compound. If the weave shows repaint with lacquer.

Repairs to Fittings

> the appearance of a damage to a fitting, the cause of which is not known, contact the factory.

Welding should be carried out only by an approved aircraft welder.

All weldments made by the factory are by the Argon-arc method using 1.7324.0 welding rod.

Larger Repairs

You should not attempt to make larger repairs of the following types:

If the wing, fuselage or controls are broken apart.

If the spar flanges are damaged.

If the main fittings at the root rib, fuselage or in the controls are broken out.

If in the area of the fittings the laminate shows white areas or cracks.

When you cannot guarantee the repair.

Kirchheim-Teck
26th March 1968
Schempp-Hirth K.G.

ss Klaus Holighaus

Translation by F. H. Matteson