

Glues and Foamies 101

Dave Shea and Pete Foss
@Skymasters 24OCT2013

Save your Oct 2013 AMA magazine!

Glue type	Common names	Common application	Drawbacks	Advantages
Canopy glue	Pacer Formula 560	Attaching plastic detail parts	Overnight drying time	Water soluble; dries clear and flexible; finished models
Cellulose glue	Ambroid, Duco Cement	Wooden airframe assembly	Flammable when wet because of acetone	Lightweight and easily sanded
Contact cement	GWS Glue, UHU por	Applying wood sheeting to foam wings	Requires a two-step process	Bonds are typically instant and permanent
Cyanoacrylate	CA, Super Glue, Zap, Hot Stuff, Jet Glues	Nearly everything	Can be an irritant; joints are brittle	Fast cure time
Epoxy	Z-Poxy, two-part epoxy, 5-minute epoxy, finishing resin	Bonding high-stress joints; applying fiberglass cloth	Heavy; requires precise mixing	Robust
Goop	Amazing Goop, Shoe Goo	Joining vibration-prone components	Strong odor; somewhat heavy	Strong, flexible joints
Hot glue	Hot glue, low-temperature hot glue	Sheet-foam models	Brittle in cold weather	Allows for fast building
Polyurethane glue	Gorilla Glue, Elmer's Pro-Bond	Crash repairs	Typically has a short shelf life	Expands to fill gaps
PVA glue	White glue, Elmer's Glue, carpenter's glue, aliphatic glue	Wooden airframe assembly	Slow drying; other glues do not stick well to cured PVA	Non-toxic; strong bonds
Water-based polyurethane	Minwax Polycrylic, Rust-Oleum Varathane	Applying fiberglass cloth	Finish is prone to dings and hangar rash	Lightweight; inexpensive; easy to apply

Courtesy AMA "Model Aviation" magazine October 2013 Terry Dunn article p46

Thank you for your polite attention

- That is all.

Butt seriously...

- Overview
 - Glue types
 - Repair techniques
 - Building tips
 - Safety tips
 - Q&A

Glue types

- Rigid glues- Strength where 'flex' is not good
 - Epoxy- 60,30,15,5 minute
 - 60 min is stiff, 5 min is less stiff... I like 15 for non-CA hinges
 - Fiberglass can be added for strength and add'l stiffness
 - Most Cyanoacrylate (CA) Adhesives
 - Polyurethane glue- Gorilla Glue, etc PU resins
 - Somewhat flexible when it foams- firewall on electrics
 - White glue (Elmers)
 - Ambroid
- Flexible glues- these give a little to save airframe
 - Hot Melt glue- (stiffens in the cold weather)
 - Toughened CA's (black is most flexible, clear so-so)
 - Canopy Glues
 - Blue Goo for sheeting
 - UHU for foamy building- used as a contact cement or apply & dry
 - FoamTac for foamy building

Finishing Resins

(use to apply glass cloth)

- Polyester resin
 - Used most often for finishing and glassing- flows well but stinks
 - Cheaper, lower strength
 - Great solvent for polystyrene (Depron, EPS foam)
- Epoxy (Z-poxy)
 - Mix on a clean non-porous surface
 - Mix thoroughly for max strength- sing Happy Birthday 6x...it'll be stronger
 - Use a new stick to apply- toss the mix stick
 - Can be thinned with alcohol and painted on for fuel proofing
 - Cleans up well with rubbing alcohol... Until it dries
 - Sands very well
- Water based Polyurethane (Minwax)
 - Water cleanup
 - Sands rather rubbery
 - Warps wood substrate
 - Good for finishing EPS foam

Epoxy

- Mix on a clean non-porous surface
- Mix thoroughly for max strength- sing Happy Birthday 6x....it'll be stronger
- Use a new stick to apply- toss the mix stick
- Can be thinned with alcohol and painted on for fuel proofing
- For wing joints, apply 30 or 60 minute version thru glass cloth, lay waxed paper on top, squeegee it out thru the waxed paper to remove bubbles and bumps, wipe excess with alcohol
- Cleans up well with rubbing alcohol.... Until it dries
- The faster the cure time the lower the stiffness and strength of the epoxy bond.
- 15 minute epoxy is 15 minutes to GEL not cure! Read the package about final cure time for repairs.

Cyanoacrylate (CA, KrazyGlue)

- 9 types- not counting the various Loctites
- Webpages of interest:
 - Flightline Hobby!
 - Bob Smith Industries www.bsi-inc.com
 - Zap www.zapglue.com
 - Balsa USA www.balsausa.com
- Most common: Thick, Medium, Thin
 - OK for EPP to EPP or Wood, CF and good for EPP to ABS
 - Not good for Styrofoam, Depron, many plastics (tends to dissolve them)
- Special types:
 - Rubber toughened- black- servo rails, used mostly for wood
 - Toughened – clear
 - Special for CA hinges: Instaflex
 - Gel- thicker than thick.... works well vertically or upside down, more sandable
- ODORLESS Thick and Thin ~3x the price/oz
 - Great for Styrofoam, Depron, field repair kit
 - Useful for indoor use if you are sensitized or don't want to become sensitized to fumes
 - Usually needs to be "kicked" due to low moisture content in foam.

White Glue and other Aliphatic Resins

- Elmers
 - Fuel resistant/fuel proof!
 - Fairly strong, not very waterproof
 - Easy to work with, water cleanup
 - Air dries slowly
- Carpenter's wood glue
 - Good for large areas, cheap and strong
 - Fuel resistant
 - Somewhat waterproof
- Applying tissue to balsa with glue stick
 - Apply glue stick to wood and tissue.
 - After dry, iron in place with covering iron.

Ambroid Glue

- Classic for framing balsa structures
- Slower than CA
- Easy to apply light since 40-50 solvent.
- Not commonly used anymore
 - Most of the advanced users got too high!
 - CA is also much quicker
 - Getting hard to find- used to be a staple at LHS

Hot Melt Glue

- VERY HEAVY
- Low stiffness and strength
- Good for mounting servos
- Better alternatives for foamy building.

Toughened CA's

- Mostly for wood
 - Servo trays, etc where shock is an issue
 - Two kinds
 - Black- strongest but ugly
 - Clear- less strong, carbon removed
 - Still stronger and tougher than regular CA
 - CA hinging specialty glue- thicker than thin CA
 - Tougher, needs 1/16" hole drilled so that it can get in
 - Will soak into hinge fabric from the hole

Canopy Glue

- i.e. "RC 56" or "Aldeen's Tacky Glue"
- Acts like Elmer, but thicker so it won't run
- Dries clear
 - Tends to fog/whiten when wet
 - Add screws, pins, etc. for water planes or rain flying
 - Or use odorless CA to avoid smoking stains on the canopy
- Fuel resistant
- Dries slowly
 - Be patient, have a plan- you won't hold it in place
 - Plan your "fixturing" which is often tape....or pins

Contact cement

- Blue Goo
 - Great for balsa sheeting foam wings
 - Turns from Green to Blue when it is dry/ready

UHU, FoamTac and GWS

- Rubbery polymer dissolved in solvent.
 - Act both as “glue” and “contact cement”.
- Most good for any foam but test on scrap.
- Assembly
 - Apply glue to one surface
 - Put together and wipe off excess glue
 - Pull back apart to allow solvent to flash
 - Reassembly after a minute or two.
- Excellent for adhesive hinges.

What adhesive for what foam?

- Polystyrene based foams (Depron and EPS)
 - Epoxy – heavy but strong
 - Foam safe CA – cures fast with kicker, heavy and brittle, sometimes thick CA more controllable
 - FoamTac and UHU – lightest but not as fast as CA, flexible
- Polyolephin based foams (EPP, EPO, Elapor)
 - Epoxy – heavy but strong
 - Regular CA
 - FoamTac and UHU – best overall choice

Repair Techniques

- Consider why it broke...
 - Do you want it stronger than before
 - Or was it a good mechanical fuse?
- Prepare for the fix
 - Pick your location and lay down paper/waxed paper
 - Decide what if any reinforcement you will use
 - Decide what if any fixturing will be needed
 - Masking tape + T pins make great self-fixturing repairs
 - This includes managing drip and foam expansion
 - Decide what glue to use
- Fix it...!
- Test it- give it a good twist before flying

More Repair Techniques

- Most glues will not adhere if Oil is present
 - Big issue on Glow planes: Use K2r CLEANER 2-3X
 - Foamies not immune... eating pizza during repair
- Wax Paper Sandwich technique- foam
 - Gorilla/PU glue with Clamped plates or tape
 - Fills well, but need to control expansion
 - Use light water mist during OR after assy to get foaming
 - Watch the foaming for ½ hr, remove or squash excess.
- Consider 1mm CF rod, tow, balsa, birch ply splints
- Wax paper doesn't stick to Epoxy and PU/glue
- HEAVY PE plastic peels off of CA (Dubro packages, etc)

Foam Focused Repair Techniques

- Rule #1: don't crash
 - Rule #1A: pick up all the pieces- a week later it looks more repairable!
- Rule #2: all repairs add weight- minimize weight
 - Don't over repair- make it like it was
 - If you add too much weight, you won't like the plane anymore
- Rule #3: save all of the foam punch outs when you build
 - Iron testing
 - Filler scraps
- Holes and missing chunks can be replaced with foam scraps,
 - or you can "grow" foam with Gorilla glue
- Foam, like Balsa, can be puffed back up
 - Pin pricks, add alcohol, hit with iron
 - Use a scrap foam to tune the iron heat
 - The steam from the alcohol repuffs the foam
 - Almost like new, but weaker now
 - Best to impregnate puffed foam with some glue
 - Lather, rinse, repeat- each cycle gets a little more expansion
 - Let dry before gluing- rubbing alcohol is half water and may not steam out
- Splint plus CA works well
 - CA alone only for lower stress joints and field repairs
- CF tow plus CA can stiffen foam that has been crash softened and repuffed.

Foam-Focused Building Tips

Use more flexible adhesives for crash resistance

- Landing gear

- Smaller Electrics Firewall (spark wall?) PU works well

- Large wing joints

Use more rigid adhesives for stiffer structures

Lay Carbon fiber threads/tow down with CA

- Cover and smear with heavy plastic bags (PE), peel when done

- Great for controlling 2mm foam warping, extending control horn forces

- Tow is messy, esp if you are picky and comb it... get a helper

Use Carbon fiber tubes and rods but sparingly

- to stiffen/strengthen/reinforce airframe, elevator halves, Chin/Firewalls

Gorilla Glue roots into foam well when it expands

- Light mist of water recommended to trigger expansion/foaming

- Control expansion with wax paper isolated tape and wood plates/clamps

Foam Finishing and Painting

- Depron (EPS)
 - Test any paint on scrap
 - Several light coats may not attack foam where one heavy coat will.
 - Acrylics work best, thin with windshield washer fluid or Tamiya thinner.
 - Paint shrink may warp 3 mm or thinner sheet. Acrylics don't seem to shrink much.
- Expanded Polystyrene (typical bead cooler foam)
 - Test any paint on scrap
 - Several light coats may not attack foam where one heavy coat will.
 - Acrylics work best, thin with windshield washer fluid or Tamiya thinner.

 - Apply glass cloth with either water based polyurethane varnish or epoxy finishing resin.
 - Be careful with lacquer based sandable primers they may attack the foam if they can get to it.
- EPP
 - Paint with virtually any paint but adhesion and durability may be poor.
 - "Plastic" versions of rattle cans the best.

More building tips- not just foam

- Pin prick balsa or foam in horn areas + thin CA
 - Hardens up the area to distribute the load better
 - Exactimatively 1/16" apart, both sides
 - This will smoke- be prepared- be outdoors...
- Pre impregnate porous joint ends with thin CA
 - Then use Medium CA to adhere pieces
- Baking soda & other fillers can be used to fill
 - Mix w/ epoxy or put in joint & add CA med or thin

Some Safety Pointers

- Watch ignition sources around solvents
 - Smoking, sparks, etc.
- Consider wearing safety glasses in case the CA or other glue spurts
- Ventilation
 - Many become sensitized to CA- odorless CA helps....
- CA has a severe exothermic reaction with cotton and wool
 - ? Build in the buff or use
- Have CA debonder and or Acetone handy
 - If you glue a model you'll get attached to it...
 - Don't use deponder on joints, hard to clean off!
- Do not sand Gorilla Glue/Polyurethane glue- shave it off w/ razor
 - Dust is not healthy
- Do not sand Carbon Fiber indoors
 - This dust is not healthy either- irritant, slow dissolving

Questions?