SUPPLEMENTAL EASY LT/S FILE (Sept. 5, '09)

By Harley Michaelis

This 10' span version has a foam core skinned with 1/16" balsa. The two I built weighed 61-62 oz. They tow, zoom, scoot, thermal, float & land far better than expected, making another easy-handling, fine-performing 6 servo ship. Materials cost is about $200 using commercial cores.

After losing 1/8" of core for skins & another 1/16" for a servo mounting base & a "hat bracket" as used on the HEMS servo mounts, the remainder has to fully recess common 1/2" thick servos without a bulge. The venerable SD7032 airfoil, employed on the very successful Jouster series of thermal competition ships & on early Big Genies, allows that. Tip cores are cut single taper & then, as explained below, are trimmed to create the planform shown above.

If you can hot wire your own cores, the links below provide patterns for making core cutting templates with 1/16" setback for the skins.

http://groups.yahoo.com/group/harleysgenie/files/EZ-LTS%20Templates%20-%20SD7032.pdf

http://groups.yahoo.com/group/harleysgenie/files/EZ-LTS%20Templates%20-%20Right%20-%20SD7032.pdf

The bottom pattern is positioned even with the core blank bottom to first cut the bottom. Overlaid on it, the top one is positioned to cut the top. Make keying pinholes at the tiny black dots. Use the bottom pattern to mark the saddle on the ply slab sides. 3/8" to ½" of the airfoil extends beyond the high point of the 48" ply slab sides for the canopy to fit around.

Cores are cut for a finished 10" center chord from two 23-1/2" blanks. Tips are cut single taper from one piece blanks 35" long and as though the finished tip chord is 6-1/2". The one-piece tip sections are then trimmed outboard as shown on page 3.

Except for parts of File 3 related to vacuum bagging, follow it & this supplement. Use .030 x 3/8" x 48" CF spars. With dense foam for webs between them & wrapped with Kevlar thread, the wing handles high stress launches.

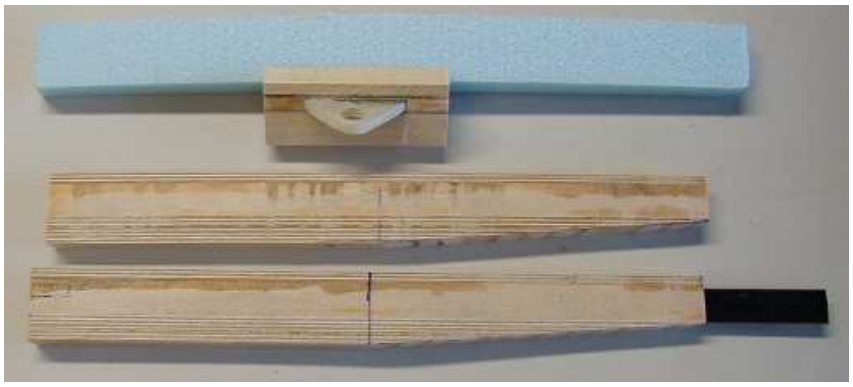
Like other Genies, the all-internal RDS for flaps & ailerons are used to reduce parasitic drag & make a very quiet ship. All servos go in the center. Durable hinging is easily done by surface-mounting the unique individual Kevlar hinges detailed in CONST. File # 7.

MAIN SPAR LOCATION: Locate the 3/8" wide spar so its front edge is 2-1/4" behind the LE of the center cores after they are trimmed back 3/8" for the sub LE & LE. Mark both spar lines on top. Mark the rear line on the bottom.

CHANNEL FOR LONG AILERON SERVO LEADS: On the center section bottom, mark a center line 1-1/4" behind the rear spar line. Router or hot wire a channel across the entire bottom.

SPAR CUT: Remove a strip, top to bottom, where the spar goes. The strip is too narrow & tall to use for vertical webs. The 4 core pieces may go crooked from stresses released. Later attachment to the actual wrapped spar straightens them. Attachment of endcaps, skins, sub-LE & LE should then make a nicely squared-up, rectangular center.

COMMERCIAL CORES: Anker Berge-Sonne cuts very fine Easy LT/S cores using Dow Hi-Load 60. See http://www.stealthplaneworks.com/. The center section comes trimmed for the sub LE & LE, is sectioned for the 3/8" wide spar & has a channel cut for the long aileron servo leads. 3/8" wide webbing strip of Hi-Load 60 is provided, sized vertically to fit between .030 CF spars, ready for wrapping. Tip cores are trimmed as shown on page 3.



To put the bolt head about even with the top skin, put 7/16" of wood under the 1/8" thick bolt plate & 3/I6" over it. On the straight blade boxes, 5/16" goes under the uprights & 1/8" over them. Trimmed for 4 degrees dihedral no trimming on the 3/8" blade is needed. Remember to wrap the outer blade box with Kevlar thread before installing it in the tip core.

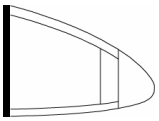
The wrapped center spar, top to bottom, including CF spars, is to equal to the height of the removed core strip. Make vertical webs from dense foam or light 3/8" balsa sheet, grain vertical. The wrapped spar is not to be shimmed up as when attaching it to a core to be bagged with CF & glass skins.

Using epoxy or Elmer's Ultimate, first attach the wrapped spar to the rear core, holding parts in contact with masking tape. Join on the front core sections. Attach the sub-LE's.

SKINS PREPARATION: True the edges of the balsa sheets & over waxed paper or plastic grocery bag, "spot weld" them together with tiny drops of instant CA glue. Block sand the joints smooth.

CENTER SECTION SKIN: Size the 48" bottom skins front to back to extend from 3/8" behind the core TE's & to 1/8" beyond the core sub-LE's. Make tops 1/8" larger in chord. Set aside for now.

TIP SECTION CORES: Cut these single taper from blanks 35" long. Cut in washout (TE up relative to the TE) from 0 at the tip root to ¼" at the extreme core end. If you're cutting with a programmable outfit enter 2.2 degrees, but don't inadvertently program in "washin" & make a sluggish, unmanageable monster.



As illustrated here, courtesy of Duane Beck, a 1/8" balsa sub-LE & a ¼" balsa LE are used. Center cores can be cut to allow that 3/8" or cut with the LE airfoil intact & then trimmed 3/8" including wire/blade kerf.

3/8" <u>BALSA ENDCAPS</u>: Mark around the root end of a tip core on 1/16" ply for a pattern. Make a set of four. Skins go over the endcaps.

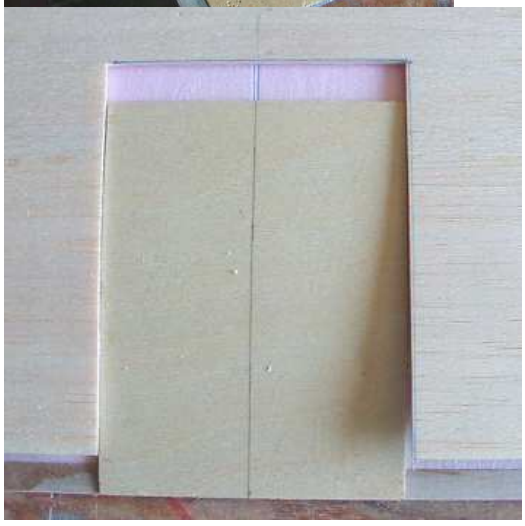
With the single taper tip cores trimmed the 3/8" along the entire intact LE they are fashioned into triple taper planform as next detailed.

<u>MODIFYING THE TIP PLANFORM</u>: Make marks 22" & 30-1/2" from the root end. At the 30-1/2" point, mark 1-1/4" behind the trimmed LE. At the extreme tip, mark 2-1/2" behind the LE. Connect the dots. Trim as shown. About 1/3 back of the trimmed LE, mark a line as the new high point of the panel.

<u>MODIFYING THE AIRFOIL:</u> Use a 10"-12" long sanding block to gently shape the upper side to a generic airfoil without compound curves so the sheeting will lay flush to the core.

The overall center spar, top to bottom, is to equal the height of the removed core. Make vertical webs from 3/8" wide strips of dense foam or light 3/8" balsa sheet, grain vertical. The wrapped spar is not shimmed up as when attaching it to a core to be bagged with CF & glass skins. Using epoxy or Elmer's Ultimate, first attach the wrapped spar system to the rear core, holding parts in contact with masking tape. To center & tips, attach 1/8" balsa sub-LE's.

A zero thickness balsa TE is impractical. Using the setup shown, bevel both skin TE's inside close to zero. With a strip of 1/64" ply between them & a little outside sanding after skinning you get a thin, but practical TE. Up front, about ½" of wing will extend ahead of the fuselage high point for the canopy to fit around.



<u>CENTER SECTION, 3" wide 1/16" PLY EXTENSION BETWEEN FLAPS</u>: Grain running span-wise, cut a 3" x 4" plate of 1/16" ply. Center it on the top skin, even with the TE. Mark & cut around it.

Bevel the underside of the rear edge. This is to extend beyond the core TE like the bottom skin. Nicely squared up & centered, join this on top of the core with a thin coat of epoxy. When cured, it's used to key the top skin in place. Note the 1/64" ply strip along the beveled TE of the bottom skin. With the balsa skins beveled down to near the strip, a thin, but still reinforced extreme TE has been made. The rear bolt fairing bears on the ply extension.

SHEETING (SKINNING): If you have bagging equipment, quickly spread a very thin (almost dry looking) coat of thin bagging epoxy overall on the center bottom skin. A credit card makes a good spreader. Get this into the bag & when cured, separately attach the center top skin. 6 drams per skin is just right & convenient using West epoxy calling for a 1 to 5 mix.

Lacking bagging equipment, skins can be attached by applying opposing thin coats of such glues as aliphatic resin. Let dry & activate bonding the coats together with a hot sealing iron. The bond is tenacious. Try it on scrap to see how it works. For real, just smear some on chordwise with the finger at 2"-3" spacing on both the skin & core & along the hingeline.

When dry, position the skin & progressively bond it on. Work in the beds on a true flat surface so as to not build any unwanted twist into the panels. Skins & sub-LE can be wick joined with small drops of ordinary instant CA glue. Attach the LE with a thin coat of quick epoxy.

TIPS: After wetting out a skin or smearing the aliphatic resin, place a 2" x 4" patch of CF cloth, fibers running chordwise, across the tip blade box area, top & bottom. Wet out the patches.

The patches help prevent the tip blade box from breaking out on a hard launch or tip landing. As shown, strips of CF cloth may optionally be used top & bottom to further strengthen the tips. A good CF item is ACP Uni-Web Graphite, item UP-06, a soft, all-CF unidirectional cloth sold by the foot in 12" width. Go for 4 feet. It cuts with scissors & is very handy to have around.

Skin all bottoms first. If using CF strips, wet out well with epoxy, preferably with thinner, slower bagging epoxy. It's really nice to have a vacuum bagging setup to stick the work into after spreading epoxy overall on a skin & wetting out any CF cloth pieces.

At this point, the center section has been covered top & bottom. Tips have the outer blade box installed, are only bottom skinned & have sub-LE & endcap attached. Final trim the flap TE's & then cut them away for a chord of 1-7/8".

Aileron root hingeline is to be the same as the flap. After the hard slot has been installed & the top of the tip section skinned, the aileron will be cut to taper to 1-1/4" at its end.

HARD SLOT UNIT IN THE AILERON ENDS: Please go to separate CONST. File 10 for details. Continue following File 3, Part 2.

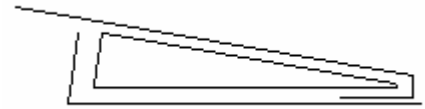
Here's a routed out aileron servo well reinforced with a plate of 1/32" ply & then lined with balsa to stick the film covering to. The black line represents the rear edge of the spar. The channel for the long servo lead is centered 1-1/4" behind the spar. Make aileron servo wells ¼" shorter than for flap servos by jamming a ¼" shim inside the template (File 3). Shift the template back ¼" along the shaft path so the lead exits conveniently as shown here.

Line well edges with soft 1/32" A-grain balsa that bends. Cut pieces an inch or so high across the grain, run a little aliphatic resin about at the middle, press in place & tack top & bottom to the skin

edges with instant CA glue. Trim excess. When covering, slit the film over the well openings to wrap & seal inside to the balsa.

If flap servos wells are located 2" apart & just behind the spar, the shafts cross the hingeline at practical points at which to center the "pockets" the shafts slip into. Flap pockets are installed after flaps are cut loose. When it's time to put in the wiring harness, remove a strip of bottom skin between the wells to position & exit the servo leads. Fill back as needed before film covering. After covering, 2" colored duct tape makes easy well covers.

To tip sections add top skin, LE & tip block. A small block of bass, etc. can be shaped & flush glued to the squared-up extreme tip. Cut the aileron loose. Note the 1/64" ply between the skins at the TE.



If using film, it's easiest to cover with two pieces, as illustrated here on a flap. Invert a panel over the top piece to first fold & attach it along the TE of the bottom skin. Next apply the bottom piece, sealing it to the face of the flap & then to the bottom along the TE. Trim excess at the TE. Place the panel upright to come down & around the face with the top piece. Trim excess. Remove film where the RDS flap pockets go.

HINGING: The "individual Kevlar hinges" detailed in File 7 work especially well surface-mounted to flaps & ailerons. Here's how:

Be sure the covering is sealed well either side of the hingeline. Make 1" x 1-1/2" hinges, creased & flexed, ready to apply. Flaps will be hinged on the bottom & ailerons on top. Position the surface by the wing, temporarily holding it in position with pieces of masking tape across the hingeline.

Holding a hinge with tweezers, spray one surface with 3M77. When tacky, apply it so the crease is at the hingeline. Use 5 hinges per flap & 7 per aileron. Apply a hinge near each end & space others equally between.

The pic below displays a finished tip area with surface-mounted, individual Kevlar hinges & contrasting film trim.

To hide the ugly Kevlar & make a decorative pattern, the hinges can be sealed over with either matching or contrasting ¾" x 2" pieces of film ironed separately either side of the hingeline. The thin line of Kevlar showing can be hidden with a colored pen if you like. If a hinge lifts, reactivate the adhesive with a sealing iron or heat to peel off & replace.

If you like the Easy LT/S a next step would be to start gathering things to build the bagged version. The Supplemental LT/S file details an option to make a glassed-over 2-piece slab side that is a bit longer than you can get from a 48" sheet. Except for the splice up front it's built the same way. Your Easy version in nice shape should sell for enough to build the bagged one.

FUSELAGE: Build it with either the longer LT/S slab sides or shorten them to cut one-piece from 48" ply. New plans show a saddle pattern for the SD7032 airfoil.