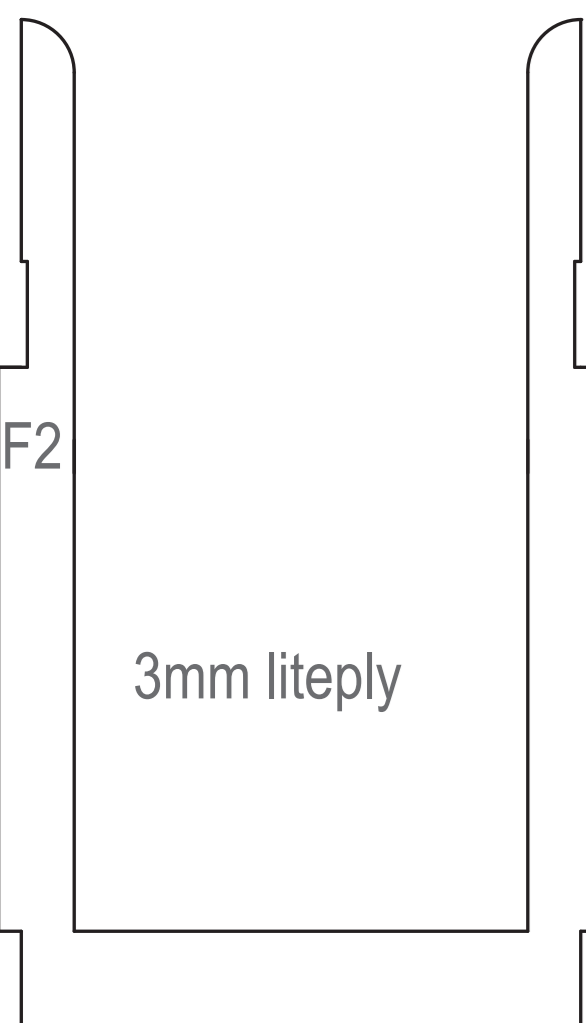
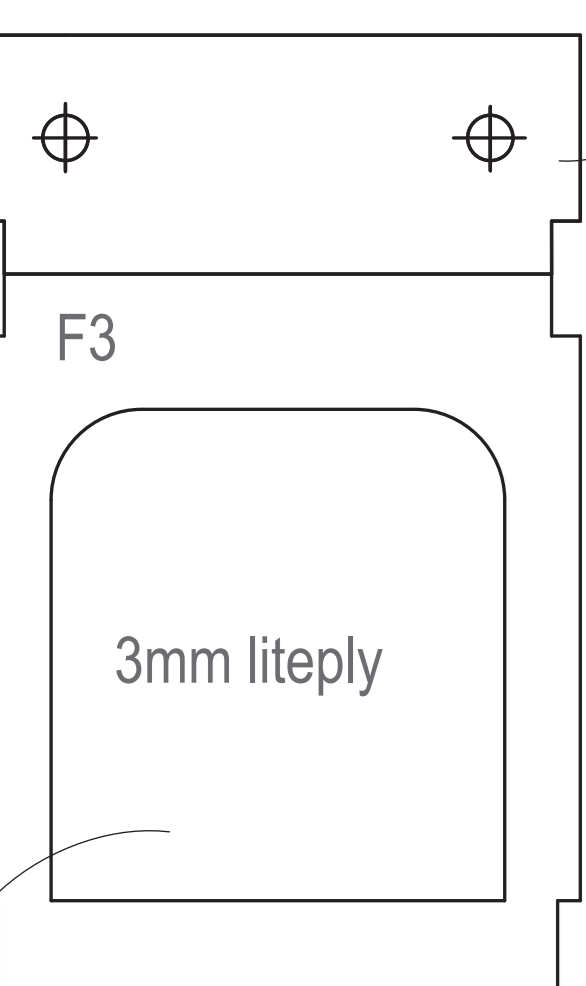


F1: 3mm birch ply (prototype has 3/32" which is also OK). Holes shown match old Astro 15G gearbox.



3mm liteply



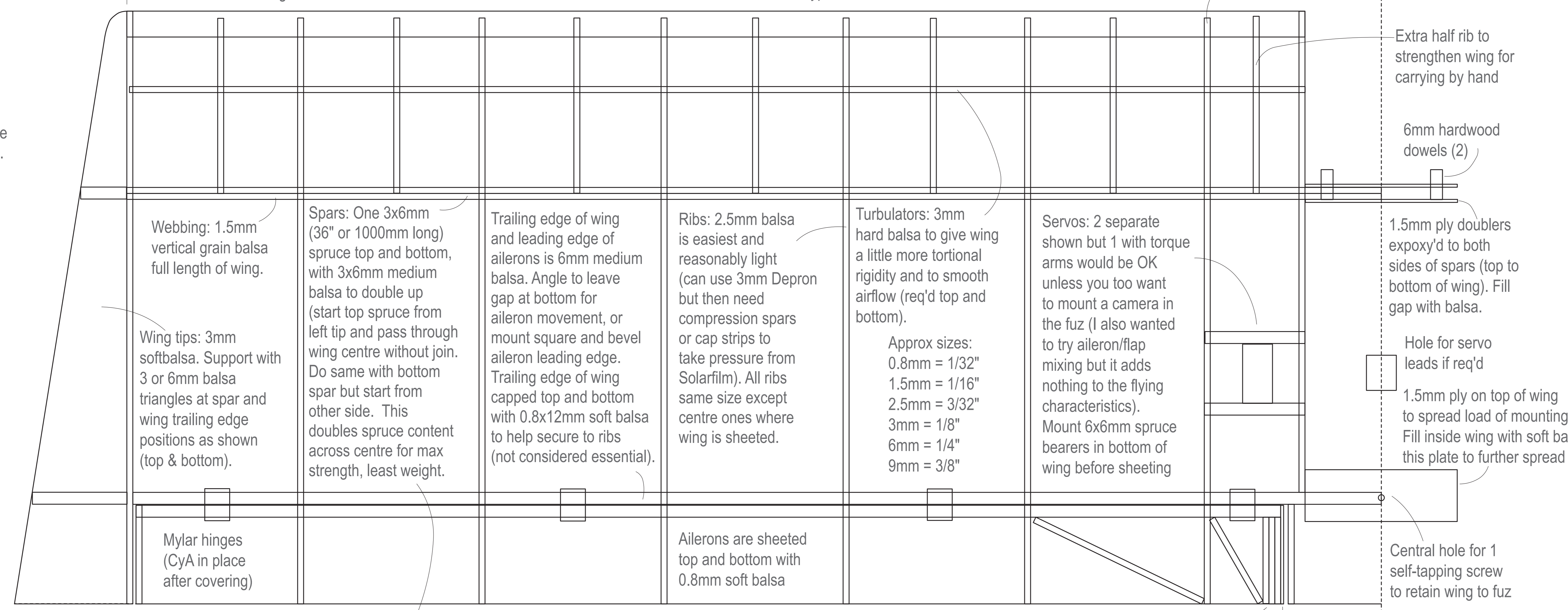
3mm liteply

Insert F5 diagonally through opening in F3, match up locating slots and push to bottom of F3 to create snug fit.

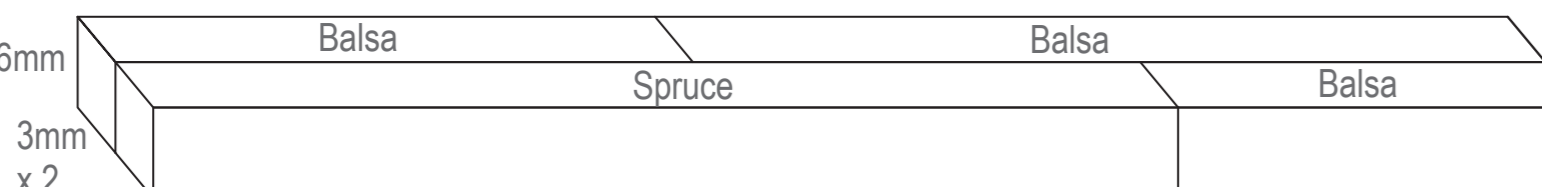


3mm liteply

Wing dimensions not critical but prototype is 630mm from this line to centre of wing
 Leading edge: 9x9mm soft balsa set into ribs at approx 45°. Sand front edge round.
 Prototype covered in clear Solarfilm
 Sheet wing centre only with 0.8mm soft balsa from this rib (mainly to aid carrying and to hide leads)

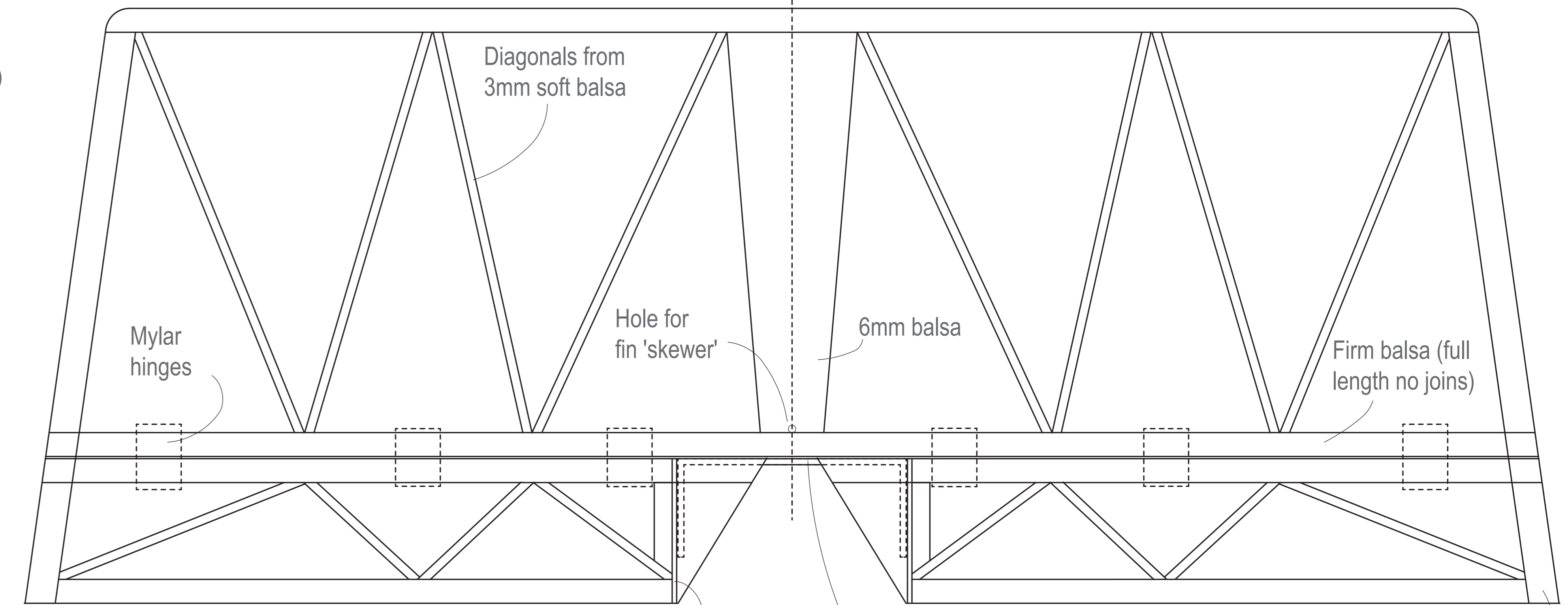


Webbing: 1.5mm vertical grain balsa full length of wing.
 Wing tips: 3mm softbalsa. Support with 3 or 6mm balsa triangles at spar and wing trailing edge positions as shown (top & bottom).
 Mylar hinges (CyA in place after covering)
 Spars: One 3x6mm (36" or 1000mm long) spruce top and bottom, with 3x6mm medium balsa to double up (start top spruce up from left tip and pass through wing centre without join. Do same with bottom spar but start from other side. This doubles spruce content across centre for max strength, least weight).
 Trailing edge of wing and leading edge of ailerons is 6mm medium balsa. Angle to leave gap at bottom for aileron movement, or mount square and bevel aileron leading edge. Trailing edge of wing capped top and bottom with 0.8x12mm soft balsa to help secure to ribs (not considered essential).
 Ribs: 2.5mm balsa is easiest and reasonably light (can use 3mm Depron but then need compression spars or cap strips to take pressure from Solarfilm). All ribs same size except centre ones where wing is sheeted.
 Turbulators: 3mm hard balsa to give wing a little more torsional rigidity and to smooth airflow (req'd top and bottom).
 Approx sizes:
 0.8mm = 1/32"
 1.5mm = 1/16"
 2.5mm = 3/32"
 3mm = 1/8"
 6mm = 1/4"
 9mm = 3/8"
 Servos: 2 separate shown but 1 with torque arms would be OK unless you too want to mount a camera in the fuz (I also wanted to try aileron/flap mixing but it adds nothing to the flying characteristics). Mount 6x6mm spruce bearers in bottom of wing before sheeting.
 Ailerons are sheeted top and bottom with 0.8mm soft balsa
 Extra half rib to strengthen wing for carrying by hand
 6mm hardwood dowels (2)
 1.5mm ply doublers epoxy'd to both sides of spars (top to bottom of wing). Fill gap with balsa.
 Hole for servo leads if req'd
 1.5mm ply on top of wing to spread load of mounting screw. Fill inside wing with soft balsa under this plate to further spread load.
 Central hole for 1 self-tapping screw to retain wing to fuz

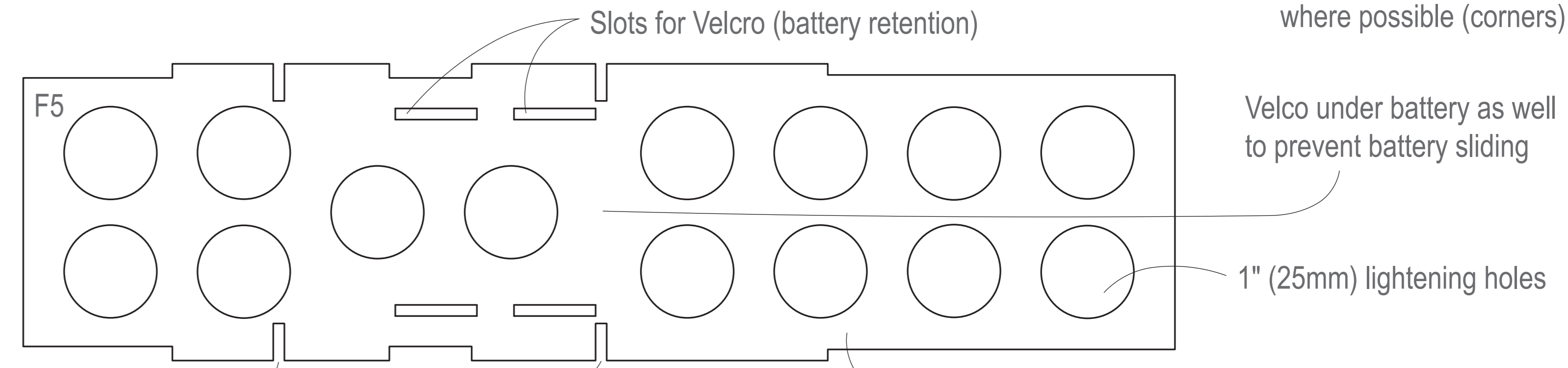


Example of 1 assembled spar full length of wing (not to scale).

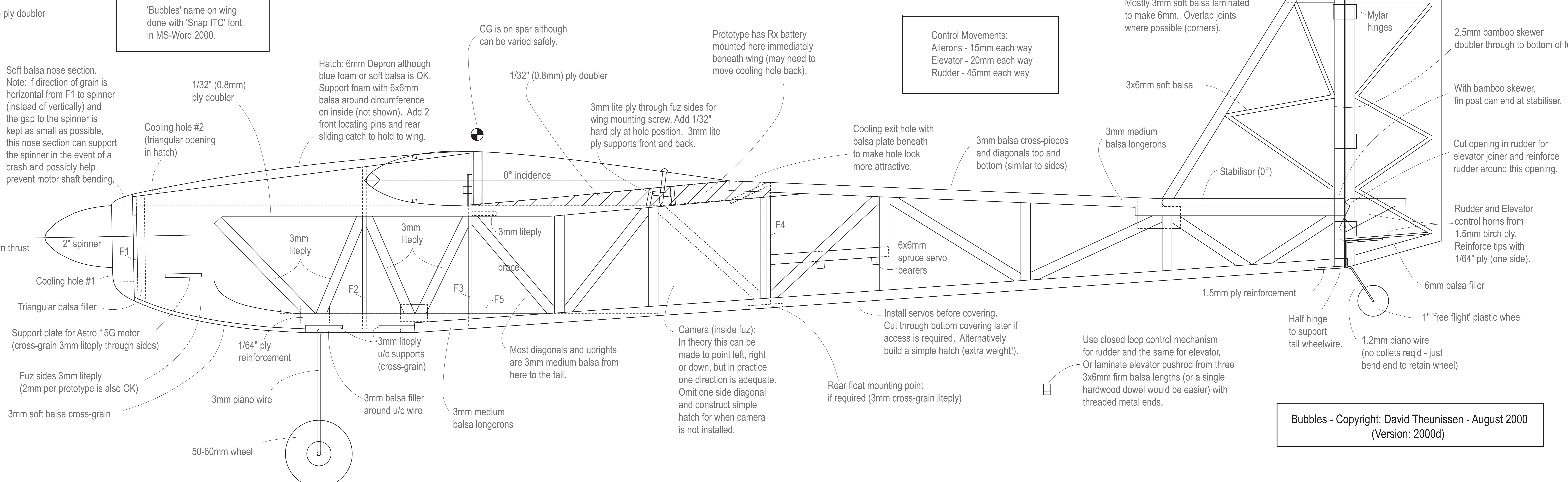
3mm light balsa doublers and diagonals to spread load and stiffen root
 Servo horn: 1.5mm ply with tip doubled with 1 layer 0.4mm ply. Epoxy to aileron.



Diagonals from 3mm soft balsa
 Mylar hinges
 Hole for fin 'skewer'
 6mm balsa
 Firm balsa (full length no joins)
 Elevator control horn from 1.5mm birch ply. Reinforce tip with 1/64" ply (one side).
 2.5 or 3mm piano wire elevator joiner
 Stab and Elevators: Mostly 3mm soft balsa laminated to make 6mm. Overlap joints where possible (corners).



Slots for Velcro (battery retention)
 Velco under battery as well to prevent battery sliding
 1" (25mm) lightening holes
 3mm liteply (appears light and fragile until glued between fuz sides).
 These slots are designed to 'key' with F2 and F3 to create a crutch around which the rest of the fuselage is built.



Soft balsa nose section. Note: if direction of grain is horizontal from F1 to spinner (instead of vertically) and the gap to the spinner is kept as small as possible, this nose section can support the spinner in the event of a crash and possibly help prevent motor shaft bending.

1° down thrust
 2" spinner
 Cooling hole #1
 Triangular balsa filler
 Support plate for Astro 15G motor (cross-grain 3mm liteply through sides)
 Fuz sides 3mm liteply (2mm per prototype is also OK)
 3mm soft balsa cross-grain

'Bubbles' name on wing done with 'Snap ITC' font in MS-Word 2000.

1/32" (0.8mm) ply doubler

Cooling hole #2 (triangular opening in hatch)

Hatch: 6mm Depron although blue foam or soft balsa is OK. Support foam with 6x6mm balsa around circumference on inside (not shown). Add 2 front locating pins and rear sliding catch to hold to wing.

CG is on spar although can be varied safely.

1/32" (0.8mm) ply doubler

3mm lite ply through fuz sides for wing mounting screw. Add 1/32" hard ply at hole position. 3mm lite ply supports front and back.

Prototype has Rx battery mounted here immediately beneath wing (may need to move cooling hole back).

Cooling exit hole with balsa plate beneath to make hole look more attractive.

Control Movements:
 Ailerons - 15mm each way
 Elevator - 20mm each way
 Rudder - 45mm each way

3mm balsa cross-pieces and diagonals top and bottom (similar to sides)

Fin and Rudder: Mostly 3mm soft balsa laminated to make 6mm. Overlap joints where possible (corners).

3x6mm soft balsa

3mm medium balsa longerons

1.5mm ply reinforcement

Half hinge to support tail wheelwire.

1.2mm piano wire (no collets req'd - just bend end to retain wheel)

2.5mm bamboo skewer doubler through to bottom of fuz.

With bamboo skewer, fin post can end at stabiliser.

Cut opening in rudder for elevator joiner and reinforce rudder around this opening.

Rudder and Elevator control horns from 1.5mm birch ply. Reinforce tips with 1/64" ply (one side).

6mm balsa filler

Bubbles - Copyright: David Theunissen - August 2000 (Version: 2000d)

50-60mm wheel

Camera (inside fuz): In theory this can be made to point left, right or down, but in practice one direction is adequate. Omit one side diagonal and construct simple hatch for when camera is not installed.

Rear float mounting point if required (3mm cross-grain liteply)

Use closed loop control mechanism for rudder and the same for elevator. Or laminate elevator pushrod from three 3x6mm firm balsa lengths (or a single hardwood dowel would be easier) with threaded metal ends.