

# STUBBY

By Ron Daniels

Wet or Dry, This Sport Flier Will Perform!



#### ABOUT THE AUTHOR

Ron is a chemist and is currently working as a shift supervisor for a transportable toxic waste destruction unit in Canada. Ron has been flying R/C since 1989 and has had a club instructor rating since 1991. He enjoys designing and flying his own models and likes to perform wild aerobatics. Currently, Ron is busy learning Design CAD and preparing a 1/12 Scale Hawker Tempest for combat. Ron's wife, Jill, is also an R/C flier and shares flying with him when their busy schedules allow.

The Stubby began life a couple of years ago due to the untimely demise of a modified Sig Kadet Seniorita. The Seniorita was modified to accommodate large barn door ailerons, and dihedral was reduced to 2". A small bomb-bay was also added just ahead of the rear wheels. This airplane, while a good flier, was quite ill-fated. Its brief career was punctuated by engine and radio problems.

Its flying days were cut mercilessly short one fall day when the airplane was lost in a ground altercation with a dead stick pattern plane. The pattern plane won (and, in fact, still wears some paint from the Seniorita as a warning to others...). The wing was only slightly damaged, though the rest of the airplane was reduced to a very easy-to-carry (provided you have brought a bag) form.

The parts were all saved and upon investigation at home, only the wing, the vertical tail, and the hardware was kept.

The following summer, a new fuselage was made with the following criteria in mind: I should not have to make a nose wheel, my hand should fit in the fuselage easily, it should have more drag (steeper approach), and it should look like a Citabria. One week after starting, an airplane that did not look like a Citabria was being test flown. While it did not look like the plane I had



wanted it to look like, it did have a pleasant unique appearance and some even more pleasing flight characteristics. It went "no hands" @ 10' on its test flight.

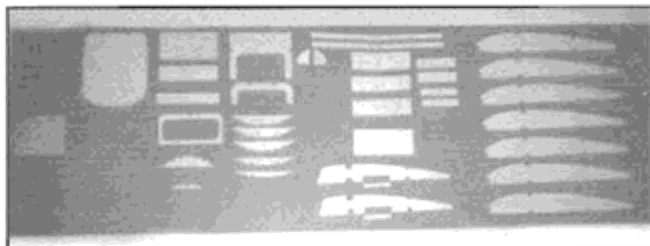
In the hands of an inexperienced pilot, the Stubby is a forgiving, gentle, slow first taildragger that has excellent ground handling, and good stability in the air. In the hands of a more experienced pilot, it is a serious **giggle machine!**

#### CONSTRUCTION

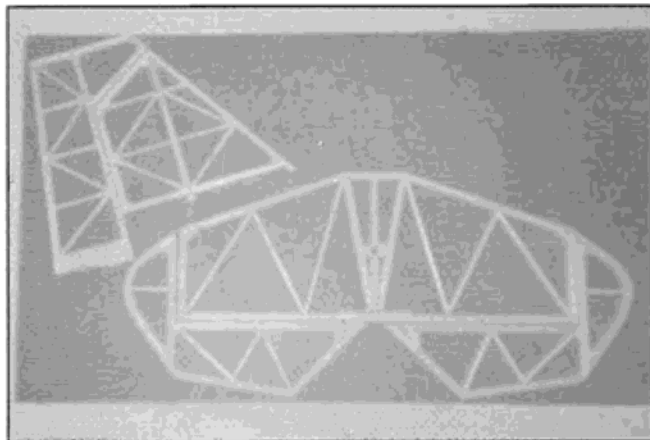
Make a "kit" of parts, and/or start with a Seniorita wing kit.

#### Tail Feathers:

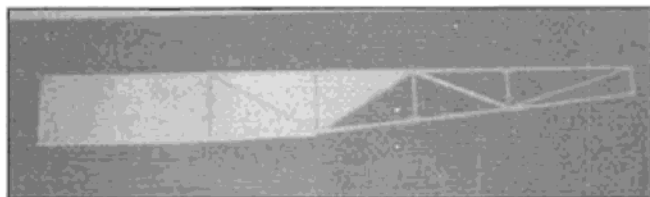
Start construction by building tail feathers over the plans, using 1/4" balsa for the fin and rudder, and 5/16" balsa for the stabilizer and elevators. Use medium weight balsa for the perimeter pieces, and the central upright in the fin, and use lighter pieces for the bracing. Fit all hinges at this point, and then remove them. Sand the leading edge (pivot point) of the rudder and



All cut parts.



Completed tail feathers.



Completed fuselage side.



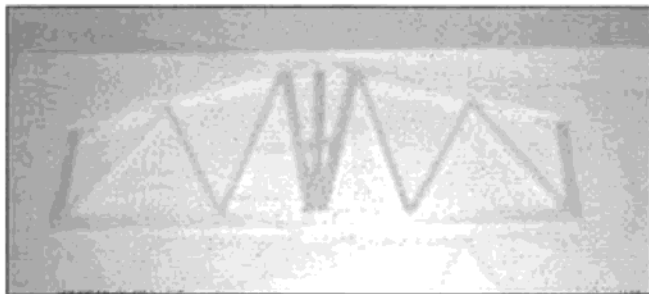
Completed "main fuselage box," ready to be removed from plan so that the fire wall and superstructure (fuel tank cover, cabin, and turtledeck) may be added.

elevators to a "vee" cross section with a beveled sanding block (such as those supplied in some kits). Sand the perimeter of the stab and elevators and all external edges of the fin and rudder to a rounded section using a "leading edge" sanding block. Make the 1/8" music wire elevator joiner, and test-fit it (make a groove for it to sit in along the pivot axis). Place wax paper around the trailing edge of the stabilizer over the center section, and place the stab on the plans. Glue the joiner in place with epoxy, and while it is wet, hinge (but don't glue) elevators to the stabilizer on the plans. This ensures that the halves are aligned correctly, and that proper clearances are maintained. After epoxy has cured, remove elevator assembly from stabilizer, file off excess epoxy, and reinforce with 2-oz. glass cloth

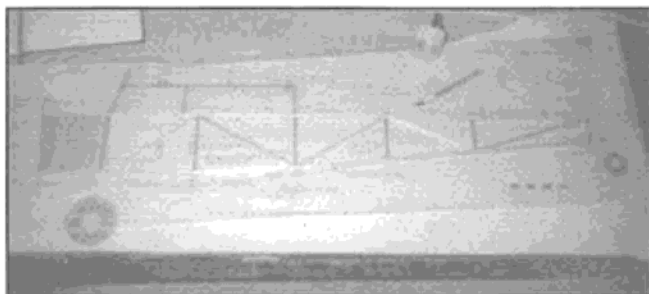
(around area where joiner goes into elevator halves).

#### Fuselage:

The fuselage halves are built up over the plans. The first step is to lay down FL1 and FL2 on the plans and glue in all uprights and diagonal braces between these two longerons. Do not make the cabin (between FL1 and wing) at this time, as this will make the joining of the two halves more difficult later. Soaking FL2 in the area in which it curves prior to pinning (actually, the pins are on either side of the wood, not through it) to the plan helps the side to hold its shape better after it is removed from the plan. Do not remove the side from the plan until all glue is dried, FG1 is installed, and all joints not otherwise supported are gusseted with scrap 3/16" sq. balsa. When the two halves



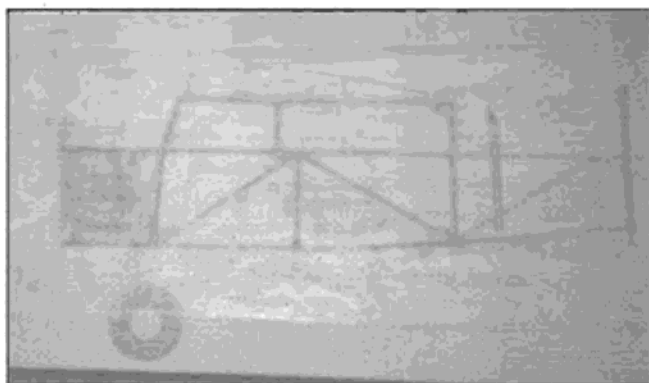
Horizontal tail being built over plans.



Building fuselage sides over plan.

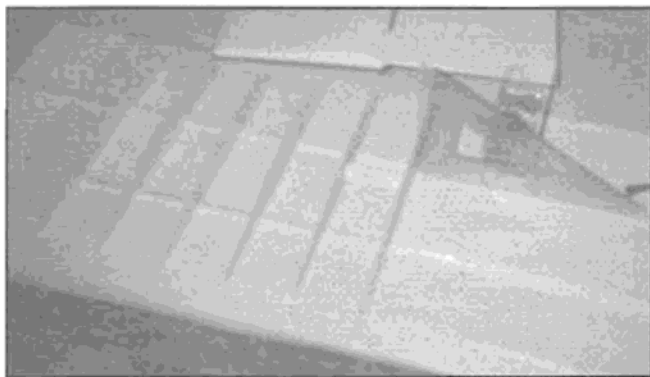


Assembling fuselage sides, using notebook as a weight.

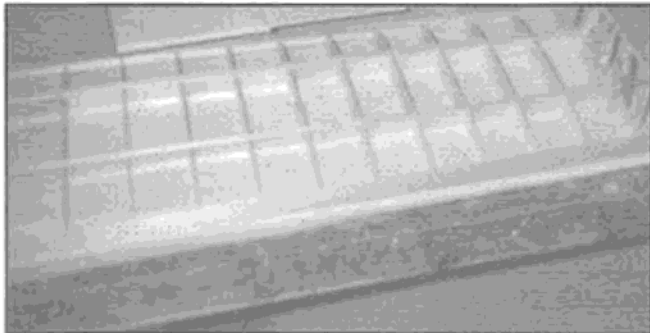


Cabin section being built over plans, prior to its installation on the fuselage.

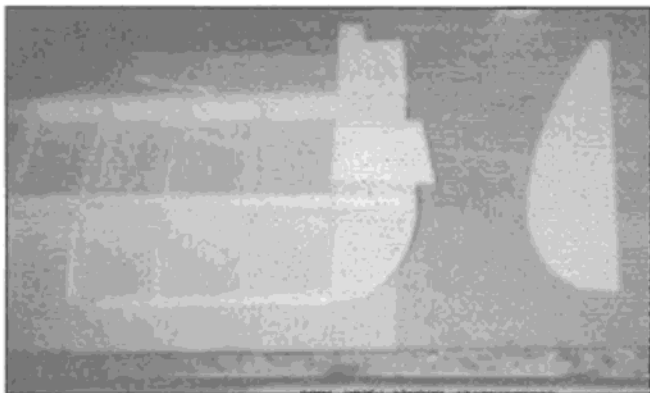
are complete, lay them on top of each other to check that they are identical. Glue 1/16" side sheeting to the fuselage halves. **Make sure you make a right and a left!** Place the mirror-image fuselage sides on the top view upside down and install the cross members (3/16" sq. medium hard balsa). Hold the rear joint together with clothespins for now. Use squares to align the sides, and temporary "jigs" (scrap sheet balsa) tack-glued in place while assembling the sides into the lower fuselage box. The cross member at the rear of the cabin (on FL1 @ doubler 1) is moved 3/16" forward to allow for doubler 2 to be installed when the cabin is attached to the main fuselage box later. Once again, all joints are gusseted with scrap 3/16" sq. balsa. Epoxy LGF in place at this time. Gusset with 1/2" tri-stock and further rein-



*Installing ribs on the lower spar — note that BSP (wing strut attachment plate) is already installed.*



*Gluing WR1-D to W1.*



*Installation of wingtip sheeting.*

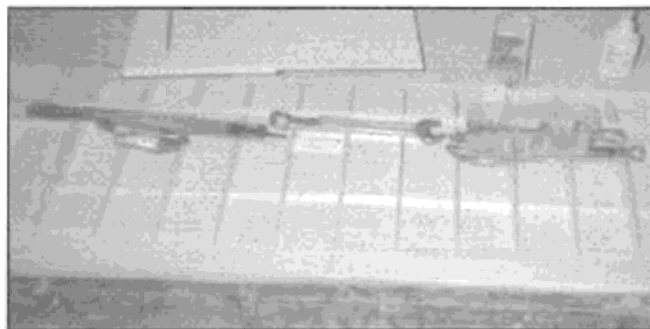
force with 6 oz. glass cloth or better (I use 5 oz. Kevlar). If you might want to put floats on the plane in the future (32" built-up recommended), also install LGR at this time. If you know you will never want to, simply omit LGR and FF7. Install bottom stringers, and, after glue dries, cut openings for the landing gear and floats by removing the stringers from these sections as shown on plans. Install strut support assembly, and fill in tail joint between FL2 longerons to make a support for the tail wheel. Remove from plan and epoxy fire wall to the fuselage main box, reinforcing the joint with 1/2" triangle stock balsa.

Make the cabin halves over the plans (again, left and right), using spruce for the top, doubler 1 and doubler 2, and using hard balsa for the 2" uprights and gussets. Install on the fuselage as shown on plans, making sure that doubler 1 overlaps FL1, FL2, and FL3, and doubler 2 overlaps FL1 and FL3. Glue FF 1-5 on the fuselage and add turtledeck longerons. Glue 3/16" sq. balsa

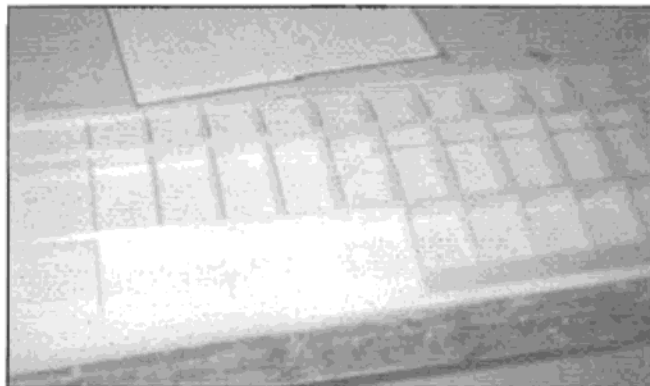
crosspieces in front of FF2 and FF3. Fuselage "jigs" can now be removed without rear of fuselage twisting.

Epoxy WBP in place and gusset with 1/2" tri-stock. Fill top of this piece with scrap balsa, making sure that it is also glued to the rear cabin upper cross member. Make cabin "windows" from 1/16" balsa and install. Glue 1/16" "taper down" pieces to FL1 and FL2 at the rear of the side sheeting. Install blind nuts for landing gear and strut anchor plate.

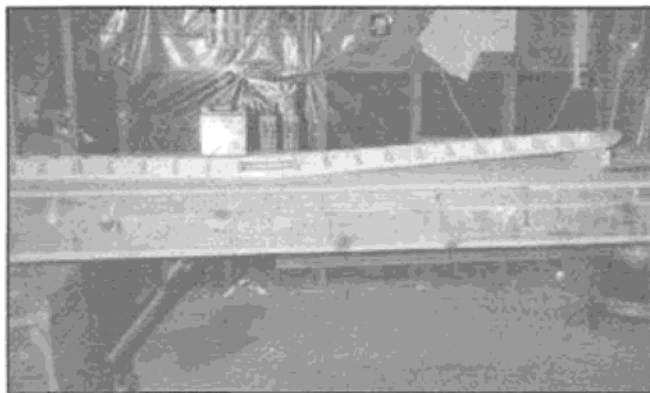
Now, before closing off the fuel tank cover, install fuel tank rails, engine mount blind nuts, throttle cable, fuel lines, and test-install the tank. Add sheeting supports between fire wall and FF1 and sheet over tank area. Tack glue tail feathers in place and test-install elevator, rudder, and throttle servos, pushrods, and cables and control horns. Fill area in front of stab on either side of fin with scrap balsa and fair FF5 to front of stab. Don't glue to the fin or stab yet. Make pushrod exits at this time and install.



*Installation of upper spars, and shear webs — note the weights holding the wing flat.*



*Aileron bay after ribs and trailing edge removed.*



*Setting 2" dihedral while epoxying wing halves together.*

Note: I use sections of outer NyRod going through scrap balsa pieces glued between the 3/16" sq. "sticks" at the exit point. I then place inner NyRod on the 2-56 rods on the end of my pushrods. This gives a reasonable seal for float-flying, and eliminates slop.

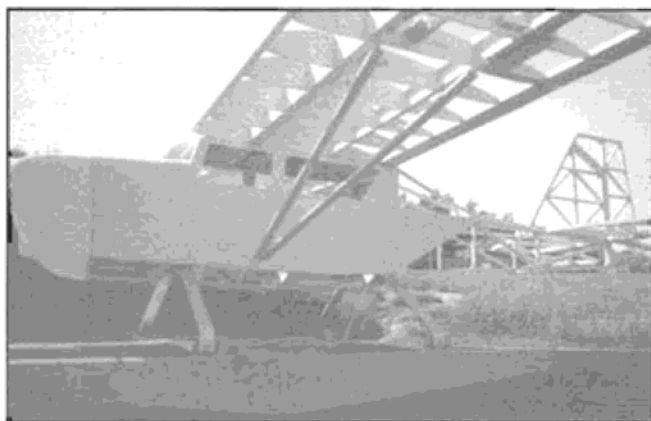
Place fuselage aside until wing is complete.

#### **Wing:**

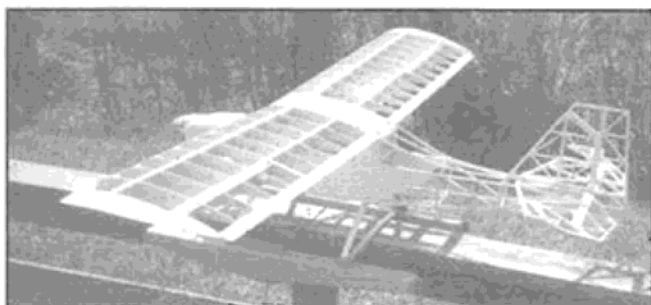
Laminate spar doublers to spars (upper and lower front spars, lower rear, W1-5). Lay lower spars on plan with spar doubler on top of spar and ending at W5. Glue ribs to spar as shown on plans, using a square to ensure that they are all vertical. Start at one end, and when W6 and W7 are installed, glue BSP to these parts. Complete gluing ribs to spar. Place weights on top of ribs to ensure that wing sits flat to building board. Install top spars, leading edge, trailing edge (don't glue to W7-10), and shear webs. Cut 1/8" x 1/4" rib spacers and install between W1-6. Remove wing half from plans, cut spar overhangs, glue WR1-D to W1 and



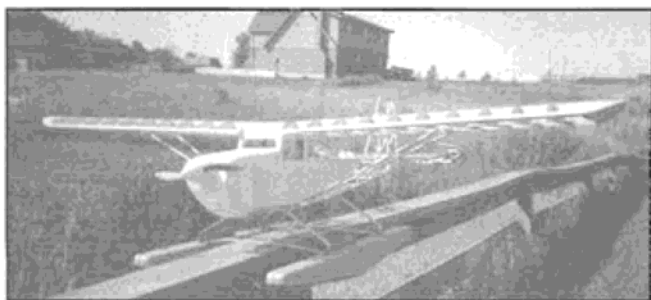
Completed aileron.



Lower view, showing float and strut attachments.

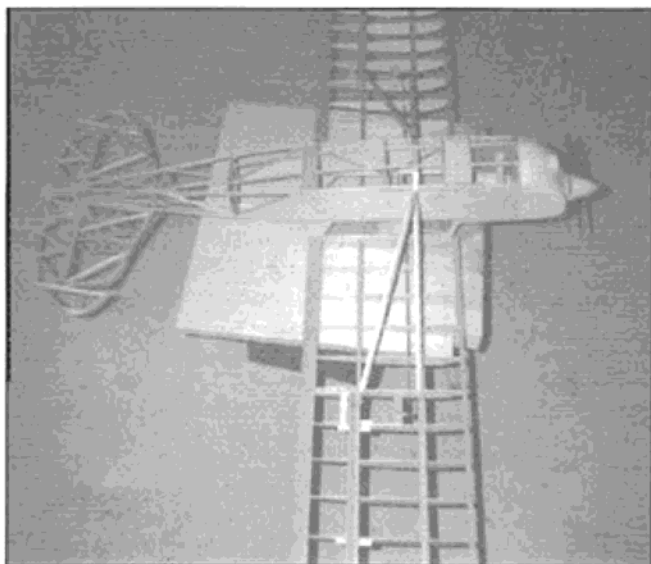


ABOVE AND BELOW: If using floats, the author recommends 3/2" units and aluminum or fiberglass legs.



notch top spars at W11 to allow for wingtip sheeting. Cut trailing edge at W6 and at I1, as shown on plans. Remove W7-10 behind rear spar using a razor saw. Save cuttings to make ailerons with later. Return wing half to the plan. Install 3/32" sheeting on back of rear spar at aileron bay (grain span-wise), and glue wingtip angle plate and tip spar in place. Sheet wingtip with 1/16" balsa between W11 and wingtip angle plate. Fill front of tip with scrap balsa. Add strut support plates and blind nuts, as well as outer NyRods for ailerons. Repeat procedure for other wing half.

After the ailerons have been built and test-fitted, join the wing halves using DB2 and DB2B as guides for the trimming of the spars, leading edge, and trailing edge. Set wing halves together on a flat surface and prop up one tip. View along the spar, leading edge, or trailing edge to ensure that the wing has no sweep and, when everything lines up correctly, epoxy DB, DB2B, and the leading



Underside bones view — note strut attachments and landing gear plates.

edges and trailing edges in place. When the epoxy cures, remove the wing from the table and epoxy the two DB1 braces to the spars. Now, install the wing servo mount plate with the blind nuts in it, as required to mount your servo.

Epoxy DB3, and the 1/2" tri-stock braces to the front of WR1-D. Once this is complete, the leading edge can be removed between W1 (left) and W1 (right). Sheet over the center section of the wing (top only) with 1/16" balsa, with the grain running span-wise. Install your aileron pushrods and pushrod ends. Refit the ailerons and adjust the linkages to give the correct ratio of differential, and so that an equal movement right and left at the servo will produce equal amounts of right and left aileron. Remove the ailerons and glue CS-1 to each of the wing halves without removing the aileron-bellcrank link (2-56 pushrod).

#### Ailerons:

Trim aileron ribs to match the shape shown on the plans. Make four more out of 3/16" balsa for the ends of the ailerons. Make cuts for the AHS on two of the 3/16" parts, and two of the 3/32" parts. Assemble over the plans, gluing to the trailing edge, adding the 1/8" x 1/4" rib spacers, and then adding first the bottom of the leading edge, and then the top. Be sure to bevel the edges of these front 3/32" pieces to match the cross section shown on the plans. Add AHS and hinge blocks (hinge blocks are made from scrap balsa and their exact location is determined by the type of hinge being used). Test fit the aileron horns. Make sure that they are the same distance back from the hinge line, as the differential action is determined by the distance of the clevis pin back from the hinge line.

Test-fit the ailerons on the wing halves by hinging (but not gluing them in the aileron bays). Install a 2-56 link between the aileron horn and the bellcrank, and adjust such that the bellcrank arm and the link are at 90° to each other when the aileron is centered. Be sure to put the adjustable clevis on the aileron end. Remove the ailerons, leaving the link attached to the bellcrank, and complete the wing as stated above.

#### Struts:

Make wing struts from 1/4" hardwood dowels as though you are making a pushrod. The final length will be determined by the amount of dihedral you use, the length of your clevises, and the length of your (aluminum) strut mount plates. I used 2" dihedral, and cut the dowels to 14" (front), and 14-3/8" (rear), and left 1" of threaded rod on each end. Any extraneous threaded rod can be trimmed during the final fitting of the struts. When this is done, sand a 3/16" flat-spot along the side of the strut in which the wire is recessed and glue on a piece of soft to medium 1/4" sq. balsa. Sand the assembly to an airfoil shape.

#### Final Assembly:

Place the wing on the fuselage, using FF2 as a pivot, and, measuring from the rear fuselage joint to the front corner of the aileron

bays, adjust the wing until these distances are equal.

Then, adjust the wing so that the dihedral is equal on either side of the fuselage. The easiest method I've found is to measure from the bottom of W11 at the front spar to the support for the wing strut plate at FL2. When this is lined up, brace it in place, and drill your holes for the wing mount dowels and the wing bolts. Install your blind nuts in WBP and glue your wing dowels into the wing, leaving 1/4"-3/8" sticking out in front of DB3.

Cover the airplane, making use of the covering notes below. The turtledeck should be covered in four pieces, each bridging two longerons. This should be done before the sides of the fuselage are covered, so that the side covering can overlap the top covering for longevity. Set wing wash-out (1/8" normal, none for aerobatics) when shrinking wing covering, rear struts will hold it during flight. Cover bottom of aileron, and install control horn, then cover the rest of the part. The rest of the covering is straight-forward. Note: Seal the aileron gap with covering material.

Line up the stab with the fuselage and wing (I used a level to ensure it was level relative to the dihedral), and after removing sufficient covering to allow good wood to wood contact (the fill blocks on either side of the fin are a good "mount" for the front of the stab), epoxy in place. Hinge elevator to stab, this time gluing the hinges in place. Epoxy the fin in place using the same care as with the stab. Hinge the rudder in place, gluing its hinges. Install tail wheel, main gear, and rudder and elevator pushrods.

Make and install windows and a windshield. Make these out of acetate of suitable thickness, and use a paper template to determine the shape of the sheet needed for the front windshield. Trim the "windshield support" pieces so that the window sits flush with the wing (I had to trim 1/8" off).

Seal aircraft against fuel seepage; install radio, engine, fuel tank, fuel lines, landing gear, and any other necessary running gear and prepare for flying. Charge your radio, check the controls for proper operation, do a range check, and check linkages for binding. Control movements should start at 1-1/2" left and right rudder; 1" up and down elevator; and 1" up, 3/4" down for the ailerons.

Add strut support plates on fuselage, and strut attachment plates on the wing. On the fuselage plates, use small wood screws, such as servo mount screws in tandem with the 2-56 bolts to prevent the rotation of these plates.

Assemble and balance laterally and longitudinally. The C.G. is okay anywhere on the spar, though the front is very safe.

Add the struts, adjusting the clevises so that there is no tensile or compressive loads on them in the static condition.

Install "keepers" on all clevises, including those on the struts.

#### Flying:

**Never fly your Stubby without struts,**

**as the wing was originally designed for .25 power!**

Have an experienced pilot test-fly your Stubby and adjust your thrust angle until no yaw or roll changes result, and the nose drops very slightly upon going from full throttle to idle in flight. It should be pretty close with the recommended right and down thrust. When you have achieved this, make and install your cowl. (I have a mold for fiberglass cowls like mine, and can sell you one if you'd like).

To take off, line up with the runway (taxi with full-up elevator) and advance throttle slowly, gradually releasing elevator as speed builds. Let it roll along on the mains until a small input of elevator produces lift off. It will happily run around on the main wheels "all day" with the rudder providing strong directional control, so pilots raised on trike gear need not be intimidated. The Stubby actually ground handles easier than many trike gear models. Alternate (maximum performance) method ... Hold full-up elevator. Give full throttle. Release elevator to control rate of climb ... stall. Note: this might never happen with the engines at the upper end of the recommended range. Will hang on the prop on climb-out with an O.S. .48 Surpass and Graupner 12-1/2 x 5! No rudder correction should be needed for either method. Method one takes about 35' off grass with a 6 lb. Stubby and a 12 x 6 @ 7800 rpm, and method two takes about 5'. With the second, lighter prototype, both methods take less.

All rolling and looping maneuvers are available to this airplane, but it will not snap roll on demand with washout. It will snap out of inverted flight in this configuration though. With washout and a forward C.G., the Stubby is quite docile and though I have not flown mine off water yet (the floats in the pictures are too short), it should make an excellent bush plane. Knife-edge flight is available with the more powerful engines, though considerable aileron correction is needed.

Then there is no washout, sustained inverted flight is possible, with moderate down elevator. Mine has no washout, and a mid-spar C.G. In this configuration, the airplane is very maneuverable, yet must be forced into a tip-stall through application of rudder in a high angle of attack, and low speed. It will snap roll with application of full elevator and rudder, and this leads to the Stubby's forte' ... spinning. Reduce throttle to idle at high altitude, and gradually increase up elevator until airplane stalls at full elevator. At this point, kick in full rudder and watch the show! 18+ turn spins are the norm with this airplane (and that's with my 6 lb. Stubby). Rotation is rapid, the fuselage remains relatively level, and the sink rate is extremely low (I wonder if the new, lighter one will climb in a thermal...). Release the controls and the airplane will recover immediately to a 45° dive.

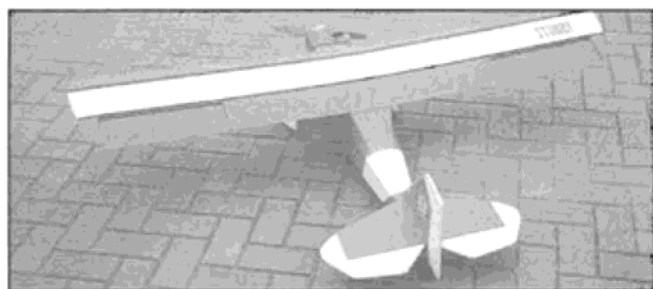
This airplane is a good platform for both dive and level bombing, and with modifications to the strut supports and servo loca-

<b>STUBBY</b>
Designed by: Ron Daniels
<b>TYPE AIRCRAFT</b> Sport
<b>WINGSPAN</b> 63 Inches
<b>WING CHORD</b> 12 Inches
<b>TOTAL WING AREA</b> 740 Sq. In.
<b>WING LOCATION</b> High Wing
<b>AIRFOIL</b> Flat Bottom
<b>WING PLANFORM</b> Constant Chord
<b>DIHEDRAL, EACH TIP</b> 1 Inch
<b>OVERALL FUSELAGE LENGTH</b> 44-1/2 Inches
<b>RADIO COMPARTMENT SIZE</b> (L) 10-1/2" (W) 4-1/2" (H) 4-1/4"
<b>STABILIZER SPAN</b> 20-5/8 Inches
<b>STABILIZER CHORD (inc. elev.)</b> 7-7/8 Inches (Avg.)
<b>STABILIZER AREA</b> 160 Sq. In. (Approx.)
<b>STAB AIRFOIL SECTION</b> Flat
<b>STABILIZER LOCATION</b> Top Of Fuselage
<b>VERTICAL FIN HEIGHT</b> 7-1/2 Inches
<b>VERTICAL FIN WIDTH (inc. rud.)</b> 10 Inches (Avg.)
<b>REC. ENGINE SIZE</b> .35-.51 2-Stroke, .40-.70 4-Stroke
<b>FUEL TANK SIZE</b> 10 Oz.
<b>LANDING GEAR</b> Conventional or Floats
<b>REC. NO. OF CHANNELS</b> 4
<b>CONTROL FUNCTIONS</b> Rud., Elev., Throt., Ail.
<b>C.G. (from L.E.)</b> 3 to 3-1/2 Inches
<b>ELEVATOR THROWS</b> 1" Up — 1" Down
<b>AILERON THROWS</b> 1" Up — 3/4" Down
<b>RUDDER THROWS</b> 1-1/2" Left — 1-1/2" Right
<b>SIDETHRUST</b> 2-1/2" Right
<b>DOWNRHUST</b> 9°
<b>BASIC MATERIALS USED IN CONSTRUCTION</b>
Fuselage ..... Balsa, Spruce, Ply
Wing ..... Balsa, Spruce, Ply
Empennage ..... Balsa
<b>Wt. Ready To Fly</b> . . . 64-104 Oz. (4-6.5 Lbs.)
<b>Wing Loading</b> . . . 12.5-20.25 Oz./Sq. Ft.

tion, there is room for a very large internal bomb-bay with double action doors. This is quite a surprise at a fun-fly.

After a good spin off to one end of the runway, side-slip it into the wind to bring it down to the field, and then hover it into a landing. Taxi it back and shut it down, and when you stop giggling, fuel up and do it again.

The following items for the "Stubby" are



available direct from the author at a very reasonable cost and are of very high quality:

Wheel Pants — \$15.00

Cowling — \$12.00

Carbon Fiber/Glass L.G. — \$12.00

\*or all three for — \$35.00

Shipping \$7.00 (via UPS — U.S. and Canada only) To order, contact: Ron Daniels, 15 Tradewinds Place, Kitchener, Ontario N2N 3G4, Canada.

email: [ADani60140@AOL.com](mailto:ADani60140@AOL.com)



#### BILL OF MATERIALS

##### Sheet Balsa

- 1 — 3/16" x 4" x 36"
- 7 — 3/32" x 3" x 36"
- 2 — 1/16" x 6" x 42"
- 2 — 1/16" x 3" x 36"

##### Stick Balsa

- 2 — 3/8" sq. x 36"
- 4 — 5/16" sq. x 36"
- 2 — 1/4" sq. x 36"
- 2 — 1/8" x 5/16" x 36"

(may have to cut)

- 4 — 1/4" x 3/16" x 36"
- 3 — 1/8" x 1/4" x 36"
- 2 — 1/8" x 3/8" x 36"
- 8 — 3/16" sq. x 36"

##### Cut Balsa

- 2 — 3/8" x 1" x 36" trailing edge stock
- 1 — 1/2" x 36" triangle stock

##### Hardwood

- 3 — 1/4" x 36" dowels

##### Spruce Sticks

- 6 — 3/16" x 3/8" x 36"
- 6 — 3/16" sq. x 36"

##### Plywood

- 1 — 9" x 16" x 3/16" aircraft ply
- 1 — 12" x 24" x 1/8" lite ply

##### Hardware

- 2 — Pushrods with 2-56 threaded ends 20"+ each (1 used dowels)
- 20 — 2-56 Clevises, one for each end of each control linkage
- 2 — 12" 2-56 threaded rods
- 1 — 36" stiff Nyrod
- 10 — 4-40 Blind nuts (6 if using 6-32 for engine mount-fire wall) with bolts
- 6 — 2-56 blind nuts with 1" bolts
- 2 — extra servo mounting type screws
- 2 — 6-32 blind nuts (6 if using 6-32 for engine mount-fire wall) with bolts
- 11 — hinges

- 1 sq. ft. window material
- 1 — 1-1/2" tail wheel assembly
- 1 — .40 sized main gear (Klett 11" works well, or I can make from carbon/glass)
- 4 — control horns
- 1 — fuel tank and fittings/lines
- 1 — suitable engine mount with engine bolts
- 2 — main wheels (2-3/4" to 3-1/4")
- 2 — 3/4" bellcrank assemblies
- 1 — cross connecting servo link for center of aileron NyRods (i.e., double-ended ball link)
- 1 — suitable mount for wing servo with bolts/blind nuts as necessary
- 1 — 1/2" x 6" x 1/16" piece of aluminum or brass
- 1 — 1" x 6" piece of 2 oz. glass cloth.