



SIMPLE CAP

By Fred L. Reese

Picture this, your model is idling on the runway and you advance the throttle, push in a little right rudder to keep it straight down the centerline. The model gathers speed, the tail comes up, and then it lifts off as you pull back on the stick. The model flies out, gaining altitude. You turn back down the runway and pull up through a loop and then up again into a half reverse Cuban and do a quick roll as you come back down the runway. This is followed by wing overs, snap rolls, spins, and a bunch of other unnamed maneuvers until you sense the tank is getting low, so you throttle back and land right in front of you. Wait you say, this is no big deal, all of the models do this, but then you look again. The model we are talking about has a wingspan of 35", is powered by an .049, and only weighs 21 ozs.

The Simple CAP is the latest of a series of little .049 airplanes utilizing the Ace R/C mini foam wings where the design has been simplified to the point where the model is recognizable, but everything is as basic as possible. The CAP 21 aerobatic airplane is a design that was easily simplified. In fact, the design just fell into place. It looks cute, flies great, doesn't cost much, and builds quickly. What more could you ask for?

I started building Simple Series airplanes

Giant-sized fun in a micro-sized package!

20 years ago, when I discovered the Ace R/C mini foam wings, and these little airplanes have provided more fun per dollar than any other models I can think of. They have given me hundreds and hundreds of flights on very little fuel and a minimum of effort. They have provided a design outlet that satisfied my need to have a particular airplane without expending the time and money to build a traditional version. Most of these designs were two channel, utilizing rudder and elevator control. I found that if the rudder was big enough, and there was enough dihedral, the model performed as if it had ailerons. These models would loop and roll, snap and spin with just two servos, and 20 years ago two servos were all that would fit in a model this size. The first Simple Series design that I published, back in 1972 was the Little Mulligan (RCM Plan #486) that flew like a pylon racer and proved to be very popular with RCM readers. Over the years I have published ten other designs including a Sopwith Triplane and a BD-5. I have designed, built, and flown others using from one to four channels that weighed from 12 ozs.-2 lbs

Most were powered by TD or Medallion .049 engines, but I have used engines of .020-.10 with both the tapered and constant chord wings. It has only been the last few years that I coined the name Simple Series, and published a Simple Citabria, Simple Cub, and a Simple Duster. All of these designs sold very well for RCM, and Dick Kidd has been after me to do something more exciting with the series. Then I bought a new radio with the microsized servos and a Cox Dragonfly .049 engine with throttle and a built-in clunk tank and the Simple CAP had to be done.

The CAP 21 is a natural for the series because of its moments and general arrangement. I fudged the landing gear ahead of the wing and used the Ace R/C small aluminum landing gear that I had used on the other models. What is exciting is that it is a 4-channel, fully aerobatic model using a stock radio, stock engine, and it only weighs 21 ozs. That is 11 ozs. less than a Mooney I built in 1976.

CONSTRUCTION

I use Zap CA Plus for all wood to wood joints including the fire wall and landing

Good things come in small packages. The Simple CAP is an extension of Fred Reese's Simple Series offering two to four channel operation in a model that is quick and inexpensive to build. The CAP 21 is the perfect modeling choice to make a 4-channel mini-aerobatic airplane. There is a lot of fun in this small package.

SIMPLE CAP

Designed By:
Fred Reese
TYPE AIRCRAFT
Sport Scale/Aerobatic
WINGSPAN
35 Inches
WING CHORD
5 1/4" (Avg.)
TOTAL WING AREA
184 Sq. In.
WING LOCATION
Bottom of Fuselage
AIRFOIL
Semi-Symmetrical
WING PLANFORM
Double Taper
DIHEDRAL, EACH TIP
1 Inch
OVERALL FUSELAGE LENGTH
27 1/2 Inches
RADIO COMPARTMENT SIZE
(L) 9" x (W) 2 1/4" x (H) 2 1/4"
STABILIZER SPAN
12 Inches
STABILIZER CHORD (incl. elev.)
3 3/8 Inches (Avg.)

STABILIZER AREA
40 Sq. In. (Approx.)
STAB AIRFOIL SECTION
Flat
STABILIZER LOCATION
Top of Fuselage
VERTICAL FIN HEIGHT
4 1/4 Inches
VERTICAL FIN WIDTH (incl. rod.)
3 3/4 Inches (Avg.)
REC. ENGINE SIZE
.049-.051 2-stroke
FUEL TANK SIZE
2Dcc-1.0 Oz.
LANDING GEAR
Conventional
REC. NO. OF CHANNELS
2-4
CONTROL FUNCTIONS
Rud., Elev., Throt., Ail.

BASIC MATERIALS USED IN CONSTRUCTION
Fuselage Balsa & Ply
Wing Foam
Empennage Balsa
Wt. Ready To Fly ... 21 Ozs. (1 Lb., 5 Ozs.)
Wing Loading 16.4 Oz./Sq. Ft.

gear mounts. I used epoxy only to join the two wing halves and to assemble the aileron linkage. I used white glue to join the wood trailing edge strips to the foam wing. Epoxy builds weight too fast and is just not needed for most of the glue joints we use it on. The complete, covered, and assembled airframe, less any hardware, radio, or engine weighed 7 1/4 ozs.

Fuselage:

Glue the top forward sides onto the fuselage sides, then lay the sides over the plan parts drawings to line up the fire wall, F-1. Mark the position of the fire wall on the fuselage sides and glue on the nose doubler and the side doubler leaving a 1/8" gap for F-1. The cutout in the side doubler is to provide a ledge or support for the servo rails. The cutout, as shown, allows the

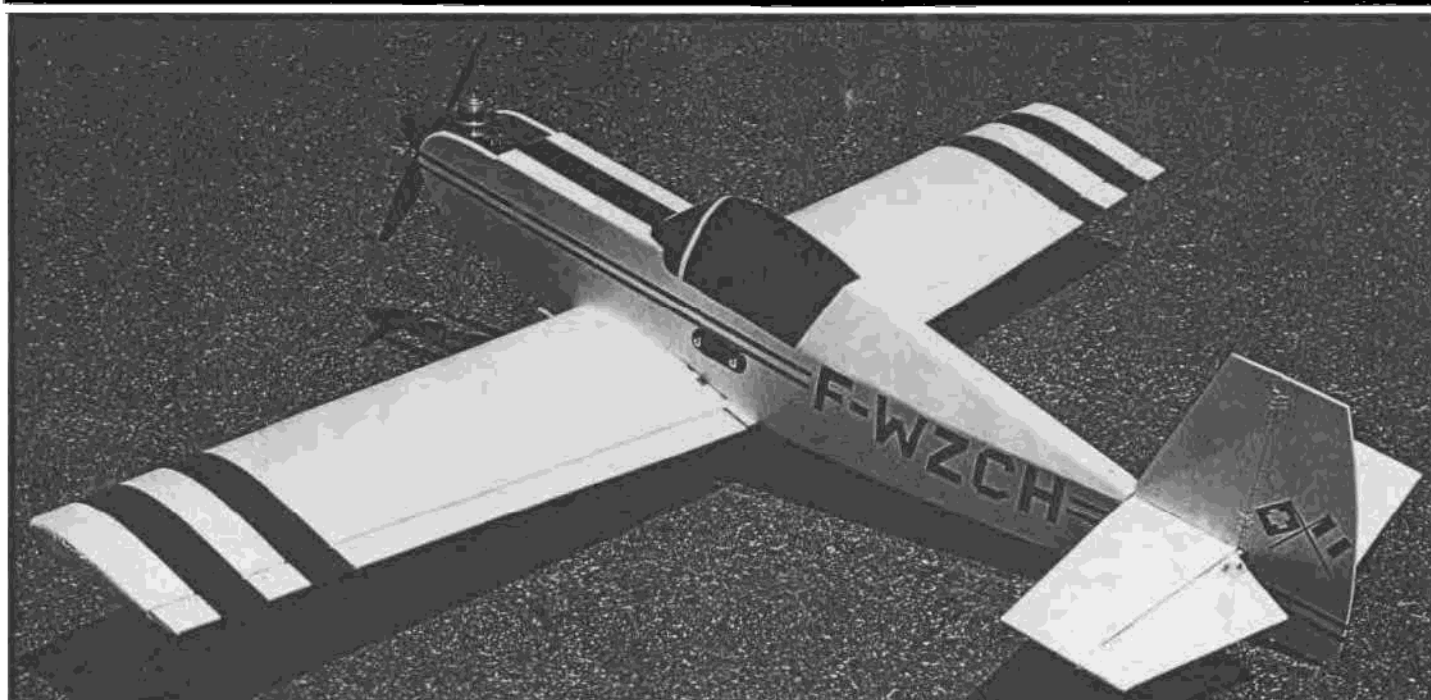
servos to be positioned forward in the fuselage as shown on the plan, or rearward alongside of the aileron servo. You would use the rearward position for 2-channel operation with larger servos. This also allows for a larger receiver forward. Use positioning of the radio components to achieve the balance position rather than by adding weights.

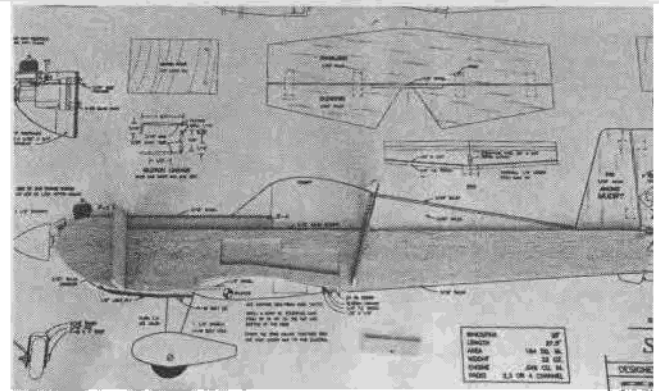
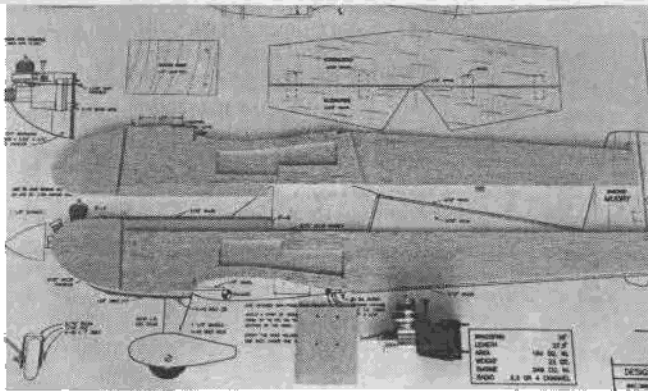
Drill F-1 for the engine mount bolts and fuel lines, and glue in the blind nuts. The Dragonfly engine comes with 3-48 engine mount bolts, so use 3-48 blind nuts if you are using this engine. Either 2-56 or 4-40 bolts and blind nuts can be used with the Ace R/C engine mount and a TD .049. Also drill F-2 for the wing mount dowel at this time.

Glue F-1 and F-5 to one of the fuselage

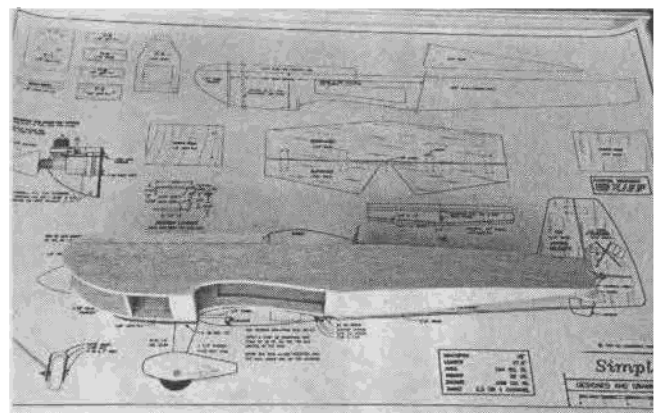
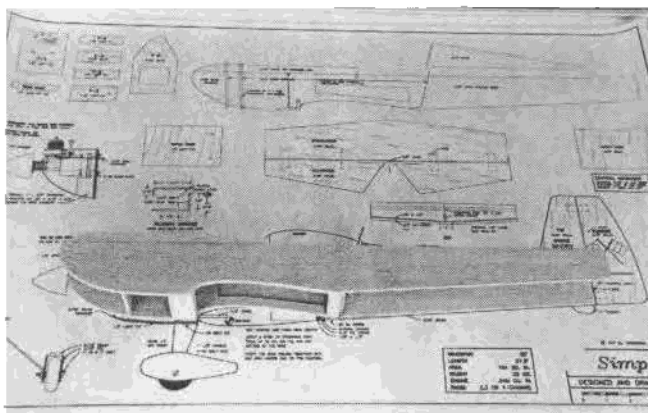
sides, then glue on the other side. Glue in F-2, F-3, F-4, and F-6. Pull the tail together and glue, keeping the fuselage straight. Glue on the bottom rear 3/32" balsa sheeting. You can glue in the 1/8" plywood tail skid now and fight around it while covering, or wait until the fuselage is covered.

Flip the fuselage right side up and glue on the 3/32" balsa top front and cockpit floor. The top rear sides have to be bent and glued at the same time but it isn't difficult. Start by gluing the top rear side to F-5 and the first couple of inches of the fuselage side. Do both sides. Pull the rear end of the top side over and glue to the fuselage side, then apply glue into the remaining seam. Sand the top edges with a sanding block to true them up, then glue on the 3/32" balsa top.

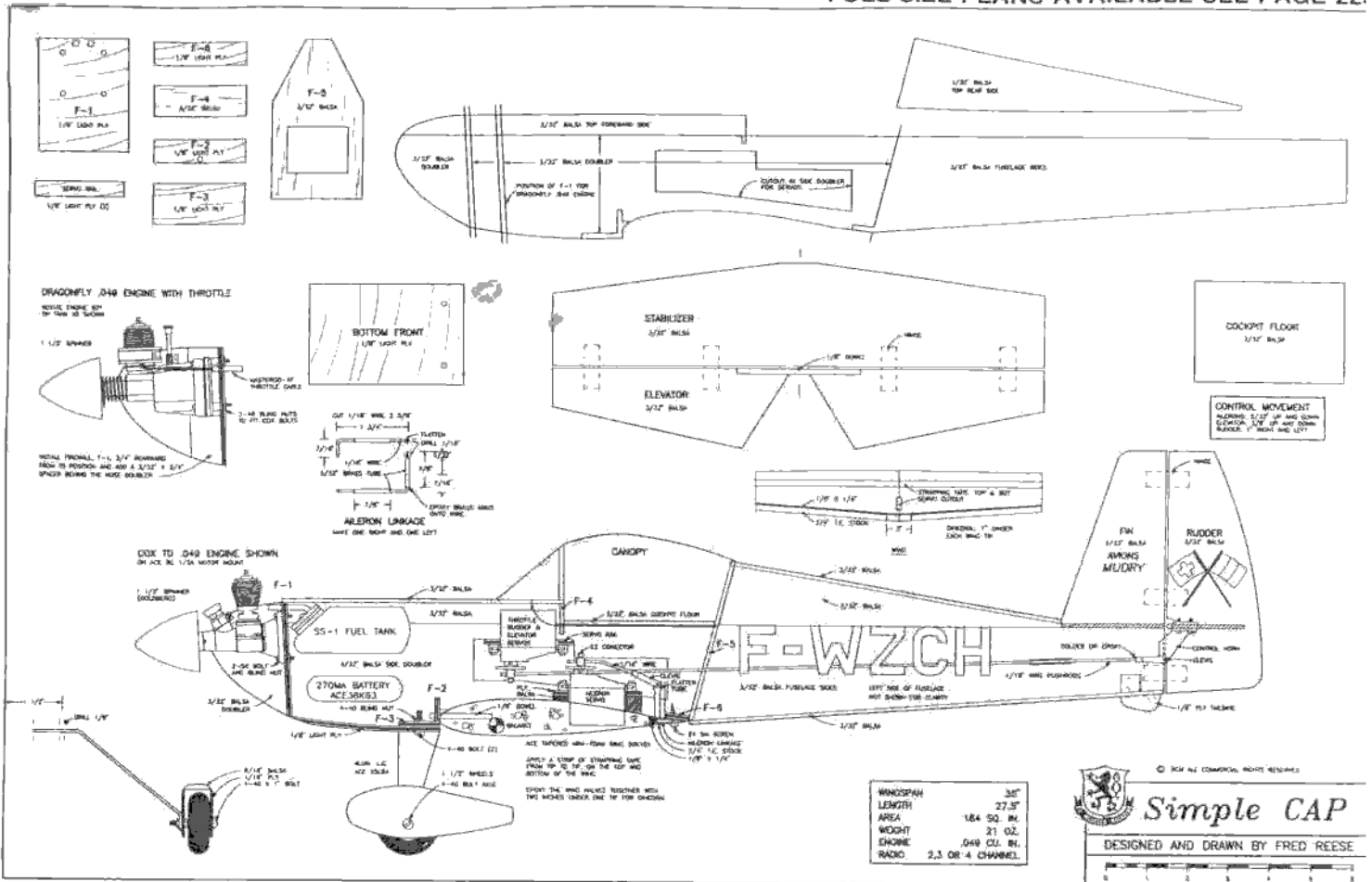




LEFT: Glue the top front side to the fuselage side. Mark the position of the fire wall on the fuselage sides and glue on the nose doubler and the side doubler, leaving a 1/8" slot for the firewall F-1. Drill the motor mount holes in F-1 and glue in the blind nuts. **RIGHT:** Glue F-1 and F-5 to one of the fuselage sides. Drill F-2 for the wing mount dowel.



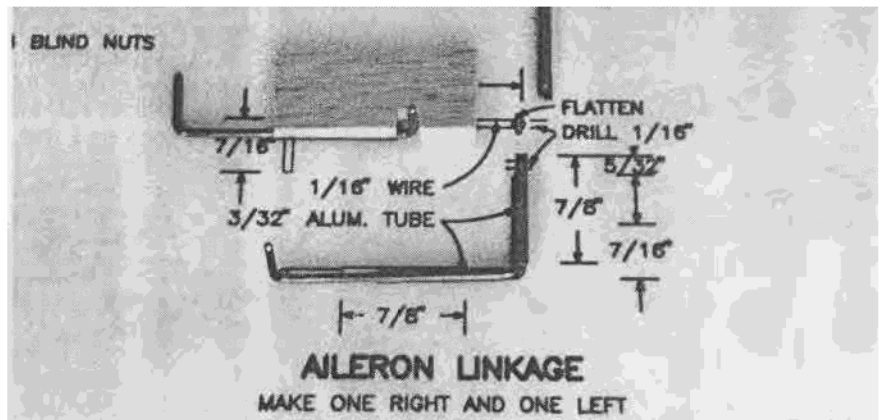
LEFT: Glue on the other fuselage side. Glue in F-2, F-3, F-4, and F-6. **RIGHT:** Pull the sides together at the tail and glue. Glue on the 3/32" balsa bottom rear sheeting.



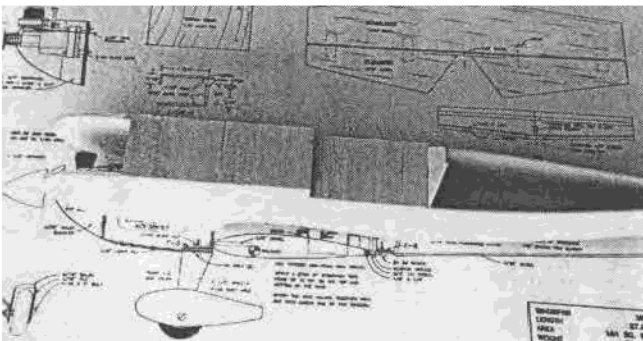
Order a canopy from Ace R/C and you won't have to build a balsa canopy.

Wing:

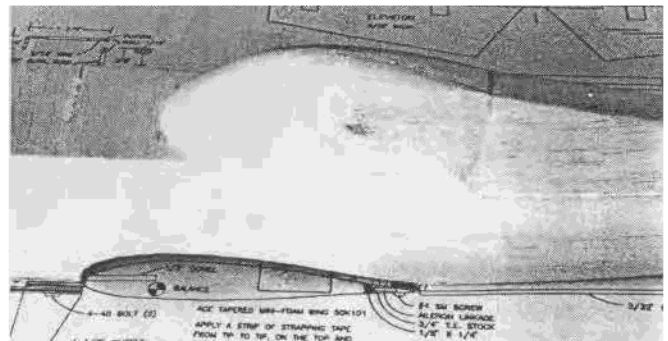
Trim 1/4" off the trailing edge of the wing panels with a razor blade and a yardstick and glue on the 1/8" x 1/4" balsa strips. Hold the strips in place with pins until the glue dries. Bevel sand the root ends of the panels to fit together with one tip blocked up 2". Fit the 3/4" trailing edge stock for the ailerons and 1 1/2" inboard sections with the aileron linkage. Bend and assemble the aileron linkage from 1/16" wire and 3/32" brass tube and notch them into the two inboard trailing edge sections. Since the trailing edge stock is thin, just notch the bottom for the linkage. Glue on the inboard sections with the linkage. Epoxy the wing halves together over waxed paper or Saran Wrap with one tip blocked up

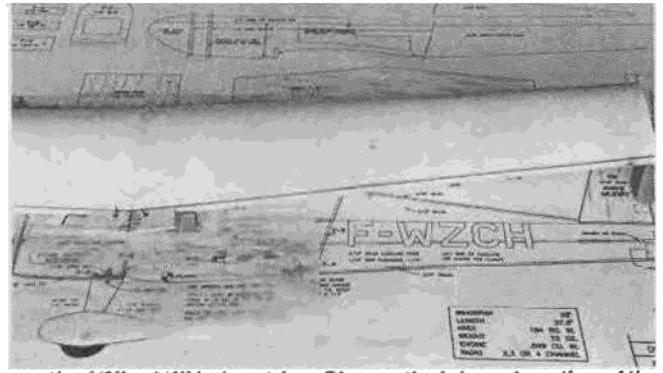
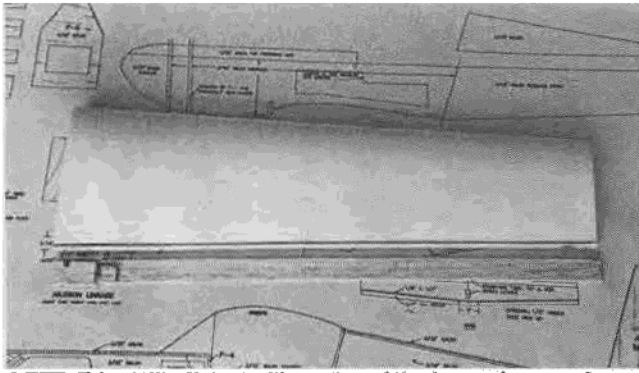


Bend the 1/16" wire aileron linkage using the plan as a guide. Epoxy the vertical brass tube with the drilled and flattened end onto the wire. Notch the 1 1/2" inboard section of the 3/4" trailing edge for the aileron linkage, and glue in place. Glue only the brass tube to the wood.

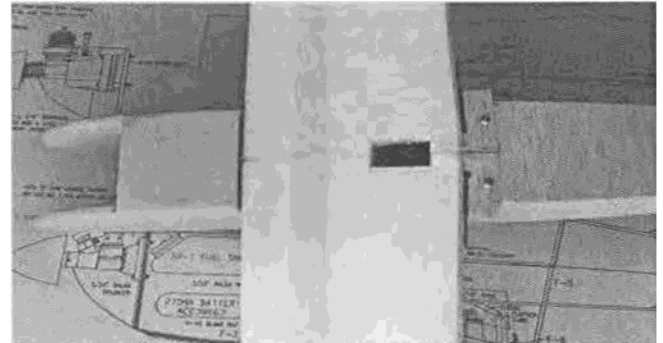
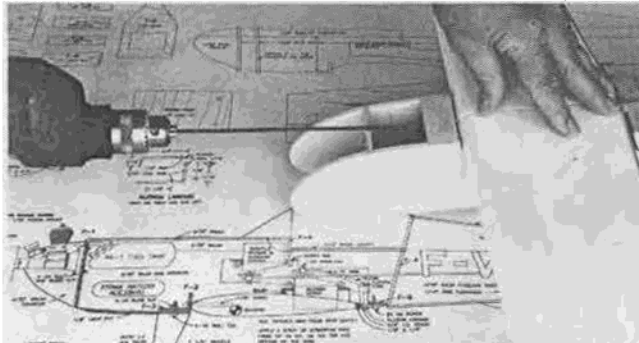


LEFT: Glue on the 3/32" balsa top front and the cockpit floor. **RIGHT:** Glue on the top rear sides and top. A clear plastic canopy can be ordered from Ace R/C, or it can be built up from wood and carved to shape.





LEFT: Trim 1/4" off the trailing edge of the foam wing panels and glue on the 1/8" x 1/4" balsa strips. Glue on the inboard section of the trailing edge with the aileron linkage. Fit the ailerons and bevel the leading edge of the ailerons. **RIGHT:** Epoxy the two wing panels together blocking up one wing tip 2" for the dihedral.



LEFT: Fit the wing to the fuselage, then drill a 1/8" hole through F-2 into the center of the foam wing 1 1/2". Remove the wing and epoxy in a 2" length of 1/8" dowel. Round off the exposed end of the dowel. **RIGHT:** Install the two #4 SM screws through the trailing edge into F-6. Remove the screws and apply a drop of Zap into the holes to harden the wood around the screws in both the wing and F-6. Sand off the flashing on the leading edge and the little bumps on the surface of the wing with very fine sandpaper. Apply strapping tape from tip to tip, top and bottom of the wing.

2". Use pins if needed to keep the two panels aligned. Cut out the hole for the aileron servo and sand off the mold flashing on the wing with 220 or finer sandpaper. Apply a strip of 3/4" to 1" wide nylon filament strapping tape from tip to tip, top and bottom of the wing as shown on the plan. Sand the trailing edge strips to fit the wing and bevel sand the aileron leading edge. Leave a 3/32" gap between the ailerons and the fixed inboard section.

Fit the wing into the fuselage and drill a 1/8" hole into the wing center through the hole in F-2. Run the drill in about 1 1/2". As you can see in the photo, it takes a long drill bit to line up correctly. Epoxy the 1/8"

dowel into the wing for the front hold down. Install two #4 SM screws at the rear edge of the wing and into F-6, for the rear wing mount. Remove the screws and put a drop of Zap into the holes to harden the wood around the screws.

Glue on the 1/8" lite ply bottom front and finish sanding the fuselage. Drill two 1/8" holes through the landing gear for the mounting bolts and use these holes as a guide for drilling through the bottom front and F-3. Enlarge the holes in the bottom of the fuselage to 5/32" and install two 4-40 blind nuts. Mount the wheels to the aluminum landing gear with 4-40 bolts and nuts. Make the wheel pants with 1/16"

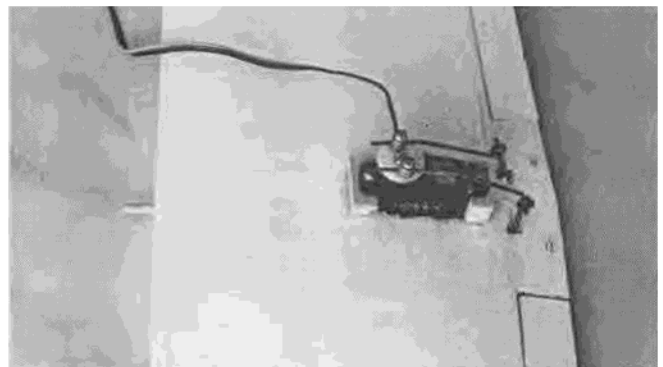
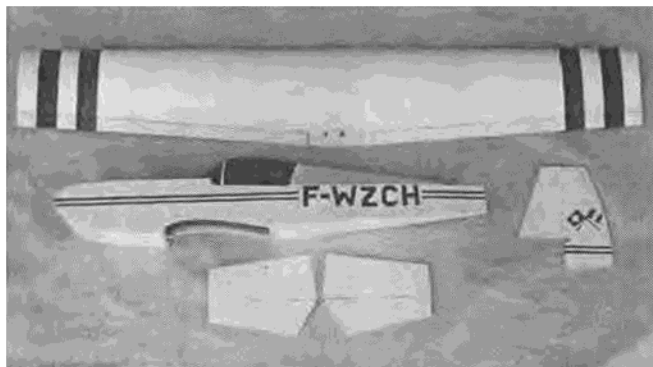
plywood or 1/8" lite ply and balsa cores. Carve and sand the pants to shape and cover to match the model.

Empennage:

Cut out and sand the tail parts. Join the two elevator halves with 1/8" dowel. The tail parts can be covered, decorated, and hinged before gluing onto the fuselage. Just be sure to cut away the covering where there is to be a glue joint.

Covering:

Give the fuselage and tail parts a coat of Coverite's Balsarite for better adhesion of the covering material. Do not apply Balsarite to the foam, because it will dissolve. Cover the model with the base



LEFT: Sand all of the wood with fine sandpaper and apply a coat of Balsarite, and lightly sand again to remove any fuzz. Cover the model and decorate as desired before final assembly. Be sure to trim away any covering where there is to be a glue joint. Decals can be ordered from Ace R/C. Hinge the control surfaces before final assembly, too. **RIGHT:** Install the aileron servo with balsa and plywood spacers. The installation shown uses 1/16" wire pushrods with 90° bends and nylon keepers at the aileron linkage and EZ connectors at the servo wheel for adjustments.

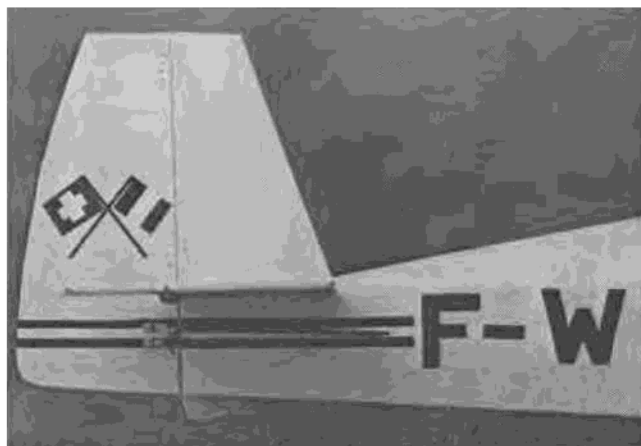
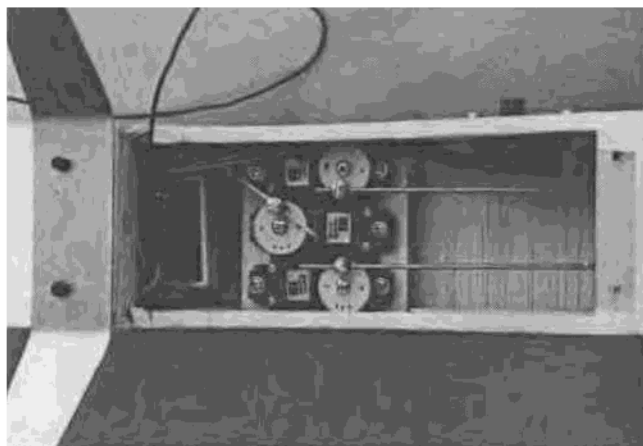
color and cut out trim patterns from other iron-on film colors and iron in place at a low temperature quickly so as not to induce bubbles. (Editor's Note: Decals, canopy, engine mount, landing gear, and foam wing can be purchased from Ace R/C, P.O. Box 511, Higginsville, Missouri 64037, 816-584-7121, FAX 816-584-7766. Check with Ace R/C for prices.)

Final Assembly:

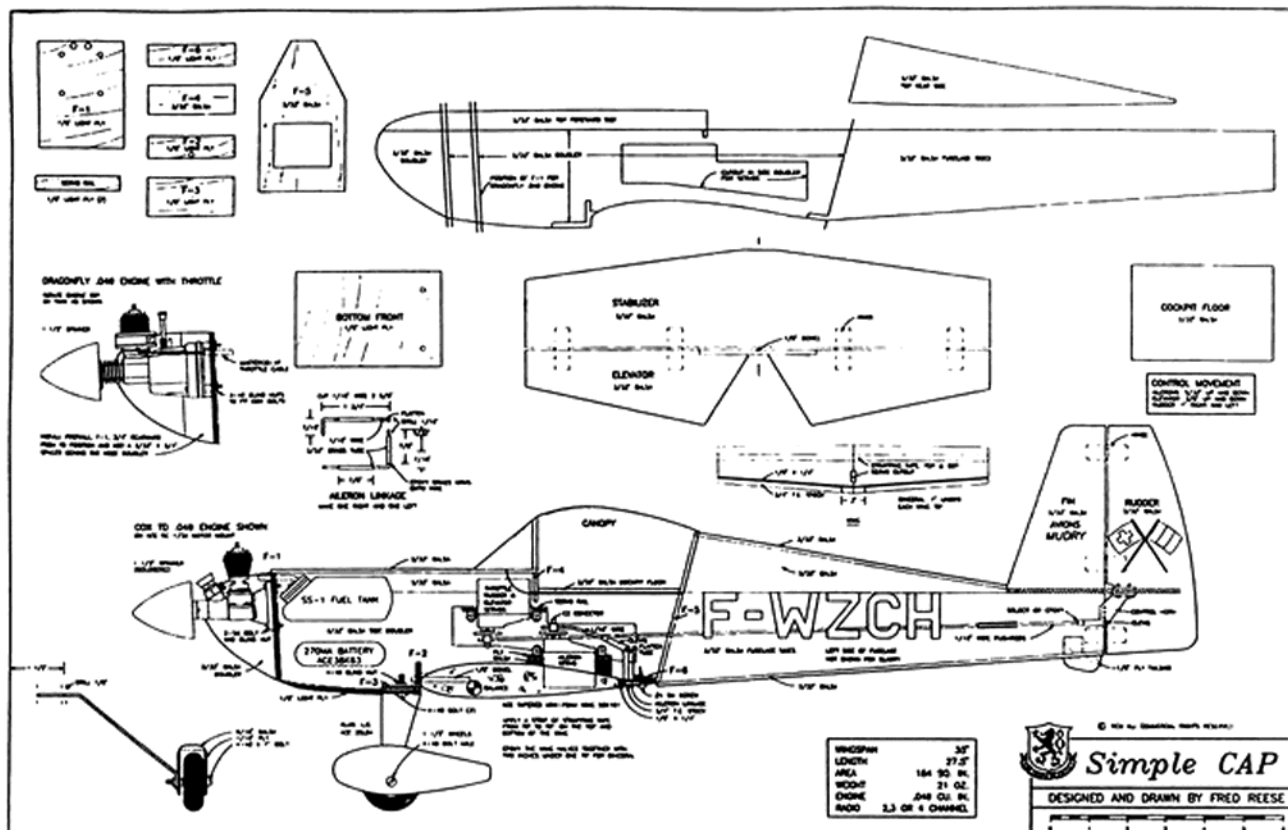
Bolt in the engine and landing gear. Glue in the servo rails. If you are not sure about the C.G., just tack in the servo rails for now

until the rest of the installation is complete. The model in the article balanced with a 270 mA battery pack and the receiver wrapped together in foam and placed up in the nose. The EZ connectors work well to provide an adjustment with the 1/16" wire pushrods. I have used a threaded coupler and adjustable quick link at the control horn and a "Z" bend at the servo on other models, but this is easier. You can use push-on nylon keepers or 1/16" wheel collars on a 90° bend at the control horn instead of a soldered-on clevis. Any of these methods will work at either

end of the pushrod. I used a Masterod-XF (extra flexible) for the throttle linkage soldered to a little "Z" bend wire bent from a paper clip to attach to the throttle barrel on the Dragonfly .049. I used my heat gun to bend the plastic tubing inside the fuselage to direct the cable to the servo in the center. See the photo. The plastic tubing will take a permanent set or bend with heat, great for routing the cable around things. The switch is mounted in the doubler cutout area behind the servos and does not interfere with the pushrods. There is enough room between



LEFT: This is a 4-channel installation using Ace R/C Mini 310 servos, Pro 810 receiver, and 270 mA battery pack. The throttle linkage is a Masterod XF flexible cable to the Cox Dragonfly .049 engine throttle control ring. EZ connectors are used on all of the servos to connect to the pushrods. Note the position of the switch. **RIGHT:** Ninety degree bends at the end of the 1/16" wire pushrods in the control horns are secured with nylon keepers. "Z" bends or 1/16" wheel collars could also be used. Figure "8" sewn thread hinges were used by the author.



the two pushrods for the aileron servo and linkage. It is close, but it works. The little servo wheel output was not enough to give full movement of the Dragonfly throttle so I changed to a longer arm than is shown in the photo. The throttle would work in conjunction with the trim lever, but it was awkward, so I changed it. I found, too, that some of the little servo wheels do not have enough room for a whole keeper for the EZ connector under the wheel. By drilling a new hole as close to the edge as possible, along with trimming the keeper, they will still work, or you can use longer arms. A trick to get really free working pushrods is to attach the pushrod to the control horn first and then attach the control horn to the rudder or elevator.



Cox .049 Dragonfly engine with throttle control and 20cc clunk tank. Effective throttle from idle to full power. Power of the Dragonfly is less than a TD, but can be improved with a TD glow head. Still plenty of power to fly the Simple CAP.

I have found that for this type of model, the Cox gray competition 6 x 3 props along with Cox Super Power glow fuel give the best performance and get the most power out of these little engines. The reed valve Dragonfly .049 is not as powerful as a TD but it has enough power to make this little airplane perform, and best of all it has a throttle that really works. The throttle is a simple rotating exhaust restricter that very effectively slows the engine and is not the least bit fussy. Throttle response is immediate between low and high and everywhere in-between. If you have a TD .049 or .051 you can get the same type of throttle sleeve from Ace R/C. If you have a newer TD .049, the throttle sleeve will not fit, but you can also buy from Ace R/C a replacement cylinder that will fit your engine and the throttle sleeve.

Flying:

Flying the model went pretty much like the introduction except I was hurrying to test fly the model on a day when the wind sock was standing straight out. I was sure the model would fly and I was correct about that, it did, and nicely, too. I am still a little nervous on that first flight, a time when I should be calm and in complete control, a finely tuned machine, ready to respond to my model's needs. Sure I set the model

that the model was well away from the edge of the roof, and there was no way to get up on the roof, but by standing on benches and up on my toes, I could just barely reach through the slats to move the model, one slat at a time until I finally got it to the edge, and by hanging on to a post I was able to get hold of the little CAP and bring it down. Except for one little dent in the nose, there was no damage, and no reason not to try again. This time I was able to keep the Simple CAP headed down the runway and was ready for the left turn, and circled out to the right, away from that pole. A couple of clicks of trim leveled it off nicely. Once I was breathing normally, I realized I should do something more adventurous than just chase it around the sky. So I did a loop and a roll, followed by a whole bunch of stuff until I knew I had better land soon. I throttled back and set it down right in front of me, just like those big airplanes. Then I was sorry no one was around to see it. I am going to have a lot of fun with this little bird. □

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