SKY-MITE

Small Sport Electric For Geared Speed 400

By Jim Zare

In the late 1960's, I was enamored with 1/2A sport R/C model airplanes. My favorites were the Goldberg Junior Skylark, Jr. Falcon, and Midwest Esquire. These were all powered by the Cox .049 engines and were controlled by single channel radios. They were lightweight, small models that could be flown from schoolyards and small fields. Don't try to fly a noisy .049 in a schoolyard today, you'll be run out of town because of the noise.

Over the years, I've tried many small electrics powered by 020 or Speed 400 sized motors. Several flew very well, but many were totally unsuccessful because of either poor performance, heavy weight, or short duration.

I've now found a combination that recreates all of the benefits of the small 1/2A models of the past and surpasses them in performance and duration.

The Graupner 1703 series of Speed 400 gear drives are perfect for 1/2A size models. I first became aware of these units when I read Bob Aberle's Debolt Kitten article in the June 1996 edition of *Flying Models*.

I decided to design a model specifically for this motor. The result is the Sky-Mite. The Sky-Mite is a simple to build, easy to fly sport model. It features a stylish balsa sided fuselage and a simple wing and empennage. The Sky-Mite is designed to build up fast and light and is a joy to fly!

CONSTRUCTION

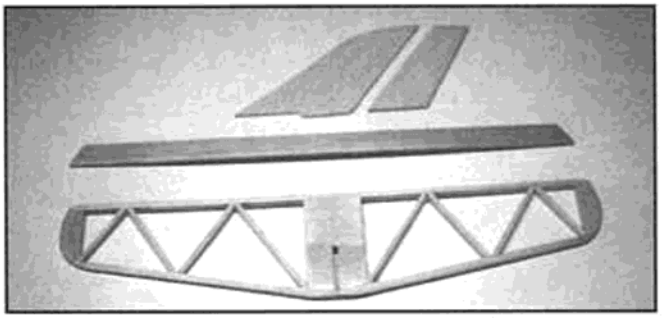
Stabilizer

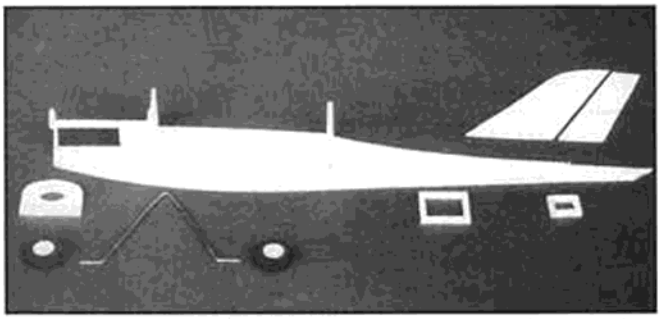
Pin down the 3/16" square balsa leading and trailing edges. Glue S-1, 3/16" balsa center in place along with the two S-2 stabilizer tips. Temporarily spot-glue the elevator assembly to the trailing edge. I use about one drop of CA at each tip and another drop in the middle.

Add the 1/8" x 3/16" balsa diagonals and sand the entire stabilizer assembly to a streamlined cross section starting with 100 grit sandpaper. After a final sanding with 240 and 400 grit sandpaper, cut the elevator from the stabilizer, add the slots for your favorite brand of hinges, and you're ready for covering.

Fin and Rudder

The fin and rudder are cut from 1/8" balsa. As with the stabilizer, spot-glue the rudder to the fin and sand complete. Cut the rudder free and add the slots for your hinges and you're ready to cover.





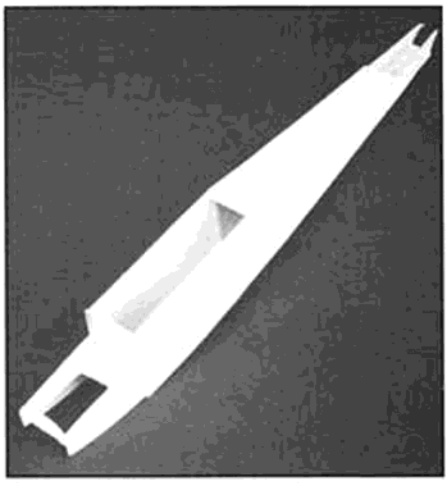
LEFT: Vertical fin, rudder, horizontal stabilizer, and elevator are simple all-balsa structures. RIGHT: Fuselage parts at start of assembly. Very simple construction that builds quickly.

SKY-MITE

Designed by:
Jim Zare
TYPE AIRCRAFT
Electric Powered Sport
WINGSPAN
36 Inches
WING CHORD
6-3/4 Inches
TOTAL WING AREA
240 Sq. In.
WING LOCATION
High Wing
AIRFOIL
Flat Bottom
WING PLANFORM
Constant Chord
DIHEDRAL, EACH TIP
2 Inches
OVERALL FUSELAGE LENGTH
25-1/2 Inches
RADIO COMPARTMENT SIZE
7-3/4" (L) 2" (W) 3" (H)
STABILIZER SPAN
14 Inches
STABILIZER CHORD (inc. elev.)
3-1/2" Inches (Avg.)
STAB AIRFOIL SECTION
Flat
STABILIZER LOCATION
Top Of Fuselage
VERTICAL FIN HEIGHT
3-3/8 Inches
VERTICAL FIN WIDTH (inc. rud.)
4 Inches (Avg.)
REC. MOTOR/PROPELLER
Graupner 1703 Speed 400 w/1.5:1
Gear Drive and 8 x 4 Slim Elec. Prop.
FLIGHT BATTERY
7 Cell Sanyo KR-600 AE
SPEED CONTROL
Jeti JES 10 Proportional Control w/Brake
LANDING GEAR
Conventional
REC. NO. OF CHANNELS
3
CONTROL FUNCTIONS
Rud., Elev., Motor Control w/Brake
To Stop Propeller
C.G. (from L.E.)
2-3/16 Inches
ELEVATOR THROWS
5/16" Up — 5/16" Down
RUDDER THROWS
1/2" Left — 1/2" Right
SIDETHRUST
2°
DOWNTHRUST
3°

BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	Balsa & Ply
Wing	Balsa & Ply
Empennage	Balsa
Wt. Ready To Fly	20 Oz. (1 Lbs. 4 Oz.)
Wing Loading	12 Oz./Sq. Ft.



Fuselage assembly framed-up with top and bottom cross-grain sheeting in place.

Fuselage

Begin by cutting out the formers, the motor mount, and fuselage sides, then mark the locations of the fuselage formers on both sides. Test-fit the 1/8" x 1/4" balsa motor mount reinforcements on each fuselage side using formers F-3 and motor mount F-4 as a guide. Make sure you drill the holes for the brass wire that will later secure the landing gear.

Make formers F-5, F-6, and F-7 from 3/16" square balsa. Glue F-2 to the front of F-3. Next, epoxy formers F-3, F-4, and F-5 to the right fuselage side laid flat on the table top. Use triangles to make sure each of these formers is tangent (90°) to the fuselage side.

When cured, pin the left fuselage side on the building board with the inside surface up. Place a bead of epoxy on all three formers and carefully position them over the left side using the lines you drew as a guide.

Place light weights on the fuselage assembly and check all around with triangles to make sure that both sides are perfectly aligned and let glue completely cure.

Now glue the rear fuselage sides together and cement formers F-1, F-6, and F-7 in place.

Use a bead of thick cyanoacrylate to attach the 3/32" fuselage bottom in place, cross grained. Add your control rods and the 1/8" x 1/4" balsa wing saddle reinforcement. Epoxy the 3/32" plywood wing hold-down plate and add the rear fuselage sheeting. Add the 3/32" balsa fuselage top at the front, then fit the motor access hatch in place. This hatch is secured with a 3/32" balsa lip at the front and a single machine screw at the rear in a scrap piece of plywood ahead of former F-3.

Sand the fuselage to final shape in preparation for covering. I use a Perma Grit 60 grit steel sanding tool to form the fuselage front, as well as for the leading edges of the wing, etc. This is followed by the progressive application of 100, 220, and 400 grit sanding blocks to prepare for covering.

After covering, bend the landing gear from 3/32" piano wire and bind and epoxy it to former F-3 with brass wire. Select the lightest wheels you can find and install them as a last step after covering.

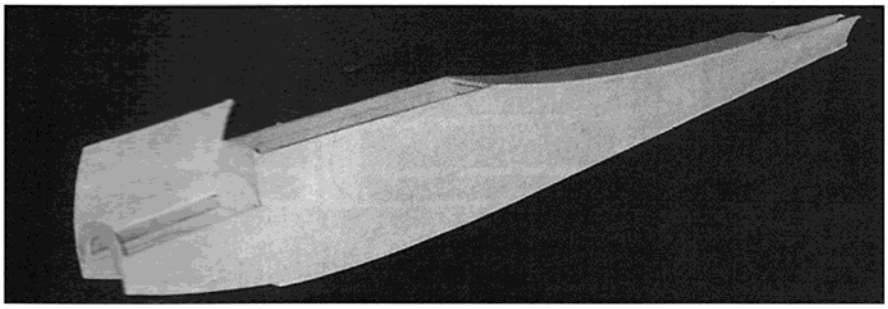
Wing

The wing is a straightforward conventional design. Cut the 3/16" x 1/2" spars from hard balsa and epoxy them together along with the two plywood dihedral braces. Use C-clamps to get a tight fit with minimal epoxy.

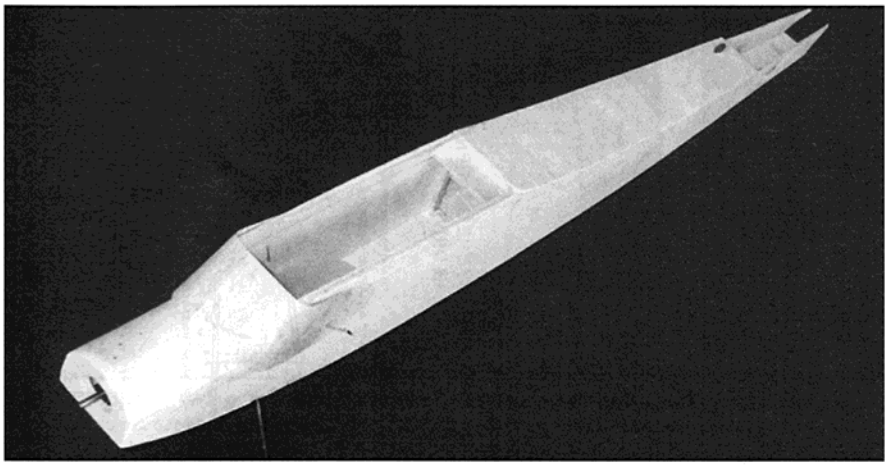
Pin down the leading edge and trailing edge of one of the wing panels using a straightedge to assure that they are lined up properly. Add the spar and test-fit the W-1 ribs at the center section. Add the bottom sheeting and the W-2 ribs.

Build the other panel in a similar manner.

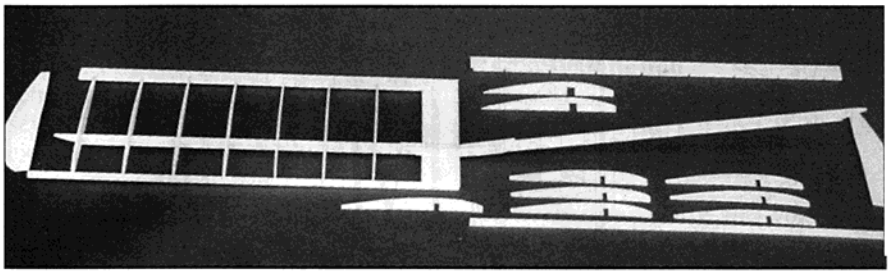
At this point, use your X-Acto knife to cut an elliptical hole in the wing bottom sheeting and slot the two center W-2 ribs for the 3/16" wing dowel. Trial-fit the wing on the fuselage. You can use rubber bands to hold the unfinished wing on the



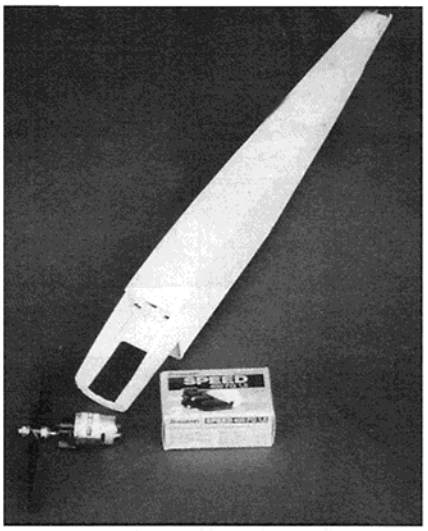
Nose section top sheeting being glued in place. Note that this wood grain runs front to rear.



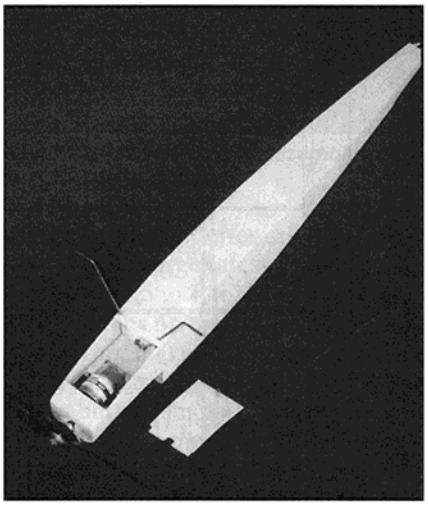
The windshield is made from 1/64" plywood and glued in place (pattern on plans).



Right wing panel framed-up, ready to begin on left. Wings are assembled on the pre-joined spar.



Fuselage is ready for fitting the Speed 400 motor/gearbox assembly.



With motor fit in place, the nose block and bottom access hatch can be made up and installed.

fuselage while you epoxy the 3/16" dowel in place in the slot in the two center W-1 wing ribs.

When cured, remove from the fuselage and add the center sheeting and the wingtips. At mentioned, I use a Perma Grit 60 sanding tool to rough-shape the leading edge.

Sand the wing leading edge to the section shown and streamline the wingtips. Add either fiberglass or kevlar reinforcement at the wing dowel and bolt area. Refit the wing on the fuselage and drill and tap the hole for the 1/8"-32 nylon wing hold-down bolt.

Covering

The model was covered with Litespan. This is a strong synthetic material which is airtight, waterproof, and heat shrinkable. It is also very light with a weight of 28 grams per square yard (less than 1 ounce). The only perceived problem to the uninitiated is that it comes without an adhesive. As a youngster, I remember tissue and dope covering with the overnight water shrinking; repairs took a couple of days. I likened Litespan to the old tissue and dope method. This false impression about Litespan kept me from using it. However, I wanted to achieve the goal of 20 oz. RTF and this was the lightest material I could find, so I thought I'd give it a try.

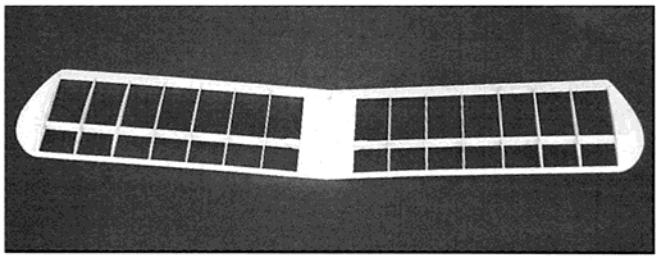
The first step is to apply Balsaloc to the air frame where you want the Litespan to stick. Balsaloc is a liquid heat sensitive adhesive. It is water soluble and dries ready to use in about 20 minutes.

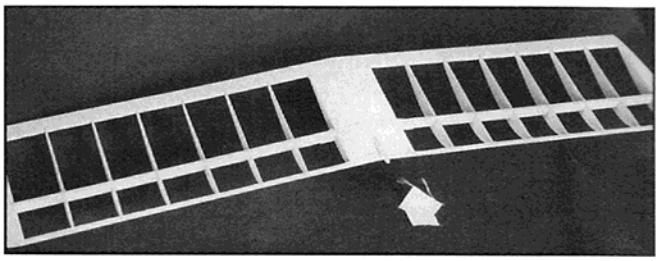
I painted Balsaloc on the bottom of one wing panel, the bottom of the stabilizer and elevator, the bottom of the fuselage, and one side of the fin and rudder. I went upstairs, had dinner, and returned to start the covering session.

Use a low temperature setting on your iron and tack and seal the Litespan just like any other plastic covering material. The only difference is that after you complete a section, the bottom wing panel for instance, you will have to apply Balsaloc to the adjoining section (wing top, making sure that you paint in an overlapping joint where you want the material to stick). By working on several airframe components in sequence, you can add adhesive to all the surfaces and cover the Sky-Mite in a single evening, without a lot of waiting time.

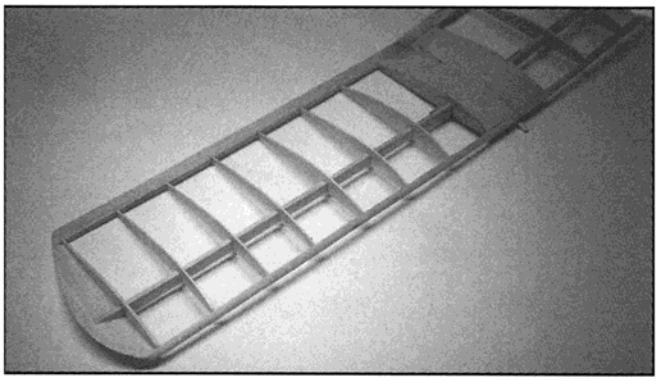
I used the paper cut out approach to create the AMA numbers and trim from Litespan. Before I sandwiched the Litespan between the paper pattern sheets, I painted the entire surface with Balsaloc and waited for it to dry. In this manner, the adhesive is already on the trim material just like any other covering.

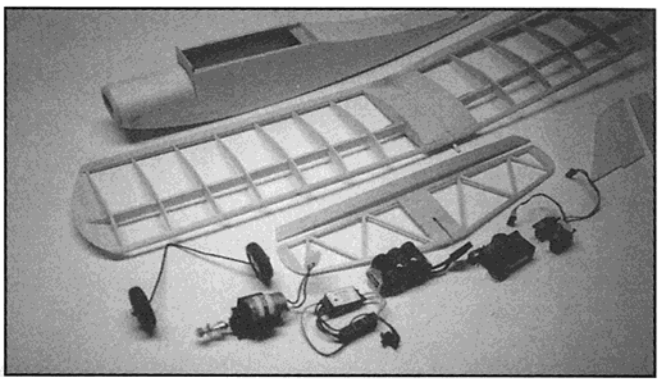
The Litespan/Balsaloc





LEFT: Wing assembly completely framed-up, ready for wing dowel installation. RIGHT: After wing dowel is installed, it is reinforced with fiberglass cloth or Kevlar and epoxy.





LEFT: Completed wing, ready for final sanding and covering. RIGHT: All parts completed and ready for covering/final assembly. (Note: windshield was not added yet at time of photo.)

combination works especially well on sheet balsa. The fuselage fin and rudder were covered without any bubbles or wrinkles. They have remained in a like new state after several months of flying and exposure to ultraviolet light and temperature variations.

The simulated windshield is merely a piece of 1/64" plywood cut to the pattern shown on the plan. It was covered with blue Litespan prior to being glued to the fuselage sides. You don't need to glue the windshield to the top sheeting at the front of the fuselage. A few drops of CA in the side and the top of former F-3 were all that was required.

Motor Installation

The Graupner 1703 series Speed 400 motors are offered in three gear ratios: 1.5 to 1, 1.85 to 1, and 2.33 to 1. Graupner has produced two special propellers for these gear drives; the Slim electric propeller series includes an 8 x 4 and a 9 x 5 propeller.

I chose the 1.5 to 1 gear ratio and the 8 x 4 for my Sky-Mite. I used the traditional Sermos Power Poles and mounted the motor with four machine screws. I subsequently found that I needed to add a small washer under each of the front screws to add a little more down thrust.

This motor combination provided more than enough power for this airplane. I believe that the other two gear ratios would work as well, I just haven't had time to try them. In any event, I fly most of the flights at 1/3 to 1/2 throttle with the Sky-Mite.

Radio Installation

I used the Hitec Micro 535 Receiver with two Cirrus CS-20-BB sub-micro servos for rudder and elevator. These servos are actually relatively inexpensive and weigh only .32 ounces each. The Micro 535 Receiver weighs in at 1.0 ounce. A JES 10 speed control with BEC and brake was installed. This unit weighs in at 1.2 ounces with connectors and receiver plugs. Thus, the all up weight of the radio control components is 2.8 ounces.

The servos were mounted on spruce rails as shown on the plan. The receiver and speed control were mounted with adhesive backed Velcro tape.

At the July 1997 Ann Arbor Falcons Fly-In, I saw a new speed control for the Speed 400 called the Sprite 20 by Castle Creations. This unit will handle 6 to 10 cells at up to 20 amps, has soft start, BEC and brake, and weighs only .5 ounces ready to fly. Using this speed control instead of the JES 10 will reduce the R/C package weight to a mere 2.1 ounces.

Battery Selection

The Speed 400 motor in the Prototype Sky-Mite was powered by a 7-cell Sanyo KR-600 AE flight battery. The 7-cell 600 mA pack with connectors weighs in at 4.6 oz. These high capacity batteries are designed for low discharge rates. Although the Graupner 1.5 to 1, 1703 Gear Drive pulls 7 amps on the bench with an 8 x 4 prop, it averages 4 amps in the air at low throttle. The batteries get warm but were not adversely affected by an entire summer of flying.

Flying

Check out the balance and the radio with the motor off and on. With a firm toss into the wind, you will find that Sky-Mite will climb at a nice pace. The model will maintain level flight at about 1/3 throttle. I like to fly around the field at about 20' and listen to the propeller sound which sounds very much like a real light plane. Climb up to a safe altitude and you will find that the Sky-Mite will loop, roll, and spin. My flight times are in the 10-12 minute range with most of the flight at 1/2 throttle.

I consider the Sky-Mite a test bed. I have visions of a number of scale monoplanes and biplanes from the Golden era that will be perfect for the Graupner 1703 series motors.

I hope you enjoy your Sky-Mite.

The Graupner 1703 gear motors, Balsaloc, and Litespan are all available from Hobby Lobby. The Sprite 20 speed control is available from New Creations RC. New Creations is a Hobby Lobby dealer and stocks all of the Graupner items.

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