Osprey Autogyro

by ANDREW FANNING

I HAVE ALWAYS enjoyed scale models, and when I was looking for a subject for *Model Airplane News'* Design Contest, I was looking for an unusual scale! My father suggested the Osprey for a subject, and the idea sounded like a good one to me. We found an old preliminary drawing of the Osprey that looked better to me than what the full-scale Osprey had evolved into.

I found that the autogyro had unusual looks and also flight characteristics that went with them. It uses about 50 feet for takeoff (it needs this to get the rotors up to speed), then it lifts off without use of elevator. That was the first thing I had to learn. Altitude is controlled more by throttle than elevator. The thing turns well with its twin rudders—not much elevator needed here, either! What makes it such a great small-field flier is the slow air speed, and I mean slow! For landing, it doesn't need a field at all. Just fly over the landing spot, not especially low—20 to 30 feet or so—then cut the throttle. Without the pull of the engine, the Osprey stops moving forward and settles straight to the ground with a small bounce.

PHOTOS BY ANDREW FANNING

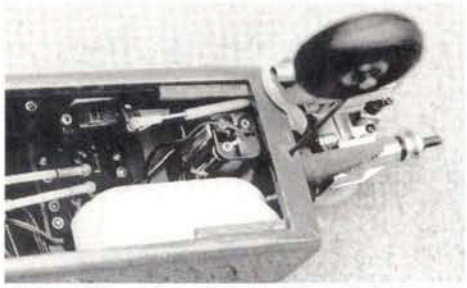
A year or so ago, I built a non-scale twin-rotor autogyro for a .35 engine, hoping to find something that could fly off the ever-shrinking and disappearing flying fields. I didn't have a lot of luck with it, but it helped a lot with the construction of the Osprey. With the first Osprey, I followed scale closely, and that is why it barely got off the ground. The second craft was what I call "stand back and squint scale." I increased the fuselage length and the wing span to get a larger rotor diameter. The tail surfaces are also much larger than scale. All this seemed to do the trick. The Osprey should be able to fly in an area as small as a softball field.

AN ODD BIRD THAT'S A LOT OF FUN

CONSTRUCTION

I used an O.S. .15 for power. It worked well, but something in the .19 to .25 range will make the weight a little less critical. I

used a Cox* 3-channel Cobra radio; it's a very nice, small package that helped to keep the plane's weight down to 41 ounces. At first look, the construction may seem a bit complex and unorthodox, but with simple construction methods and vacu-formed parts, the Osprey isn't as much work as it looks. A small band saw and a belt sander aren't absolute necessities, but they make everything a lot faster. Shaping the molding plugs for the side blisters, nose and canopy only takes a few minutes with the sander and band saw. The sander also



A view of the radio and the tank through the access hatch in the bottom of the nose.

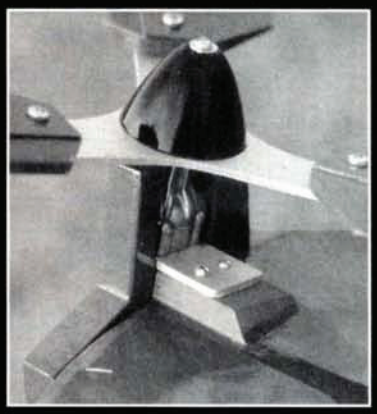
makes the shaping of the rotor blades and wing ribs a lot faster. The covering is MonoKote with a little O.D. Pactra Formula U*. I used two .049 crankcases for the rotor bearings and one crankcase with a tank for the rotor balancer and trimmer.

FUSELAGE

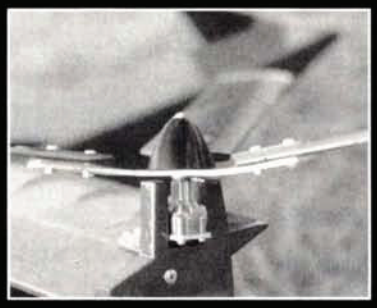
Lay the two fuselage halves on the drawing. The 3/8-inch-square stringers are made of light balsa. The 1/8-inch sheet and the 3/8x1/8-inch spares are made of medium balsa. When you install the balsa sheeting on the nose, don't forget to make a right and a left side. Then stand up the sides in place on the 1/8-inch ply firewall. After installing the main landing-gear mounting-plate, add the fuselage cross-braces from there forward. When it has dried, pull the aft sides together and attach them to the wedge, being sure to get the same amount of curve in both fuselage sides.

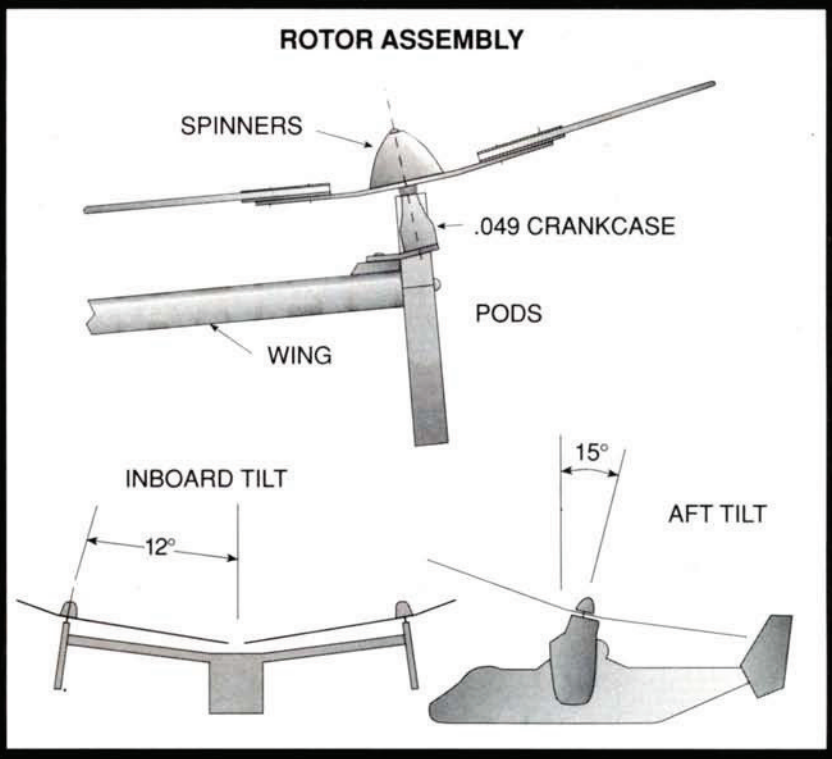
After filling in the rest of the braces, install the wing saddle and the rest of the sheeting. Mark and drill all the holes for the engine and fuel line before giving the fuselage one coat of paint to help seal it. Once the gear wire is bent to shape, glue it in place with epoxy and 1-inch glass-cloth tape. (This is also the way I attached the nose gear before I tried the swiveling gear attached to the engine mount; see plans.) I have found from experience that it's better to install control rods and servos in an open fuselage than in one that is covered with MonoKote. Don't forget the ply and balsa blocks for attaching the canopy and cowling.

ROTOR ASSEMBLY



With the rotor components complete, the .049 crankcases can be attached to the aluminum tabs, which are bolted to the wingtips. The tabs should have a 7-degree bend in them to give the crankcases a 12-degree inboard angle. The tabs are bolted through pine blocks on the wingtips that should also give the crankcases a 15-degree-aft angle. I use small washers to do any fine adjusting that the rotors may need, and a wood screw to attach each engine pod to the wingtips, being sure that they will not interfere with the rotors. Use the alignment tool one last time to check the rotor pitch and dihedral. This is very important, because it helps you get lift from both rotors at the same time at takeoff. Using the shaft bolts and spinners, attach the counterclockwise rotor on the right crankcase and the clockwise rotor on the left crankcase. To see that both rotors are at the same angle, it is necessary to check that the rotor tips pass over the wing center at the same angle.





WINGS AND PODS

Cutting the wing ribs is fast with the band saw and sander. I just make a stack of balsa sheets with a template of the ribs on top, then cut and shape to the template. An option is to make two templates of stiff con-

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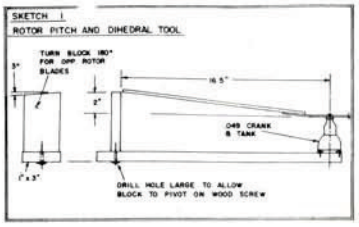
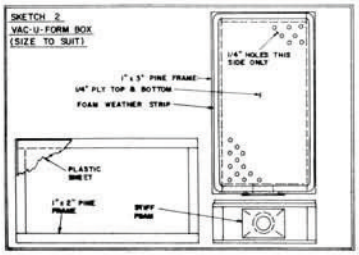
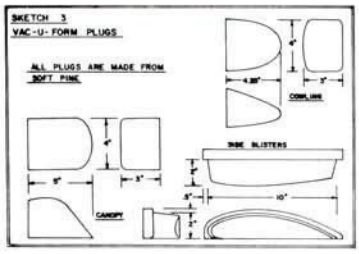
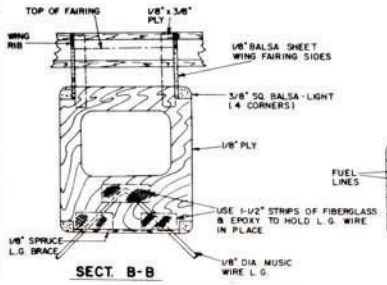
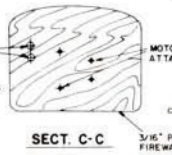
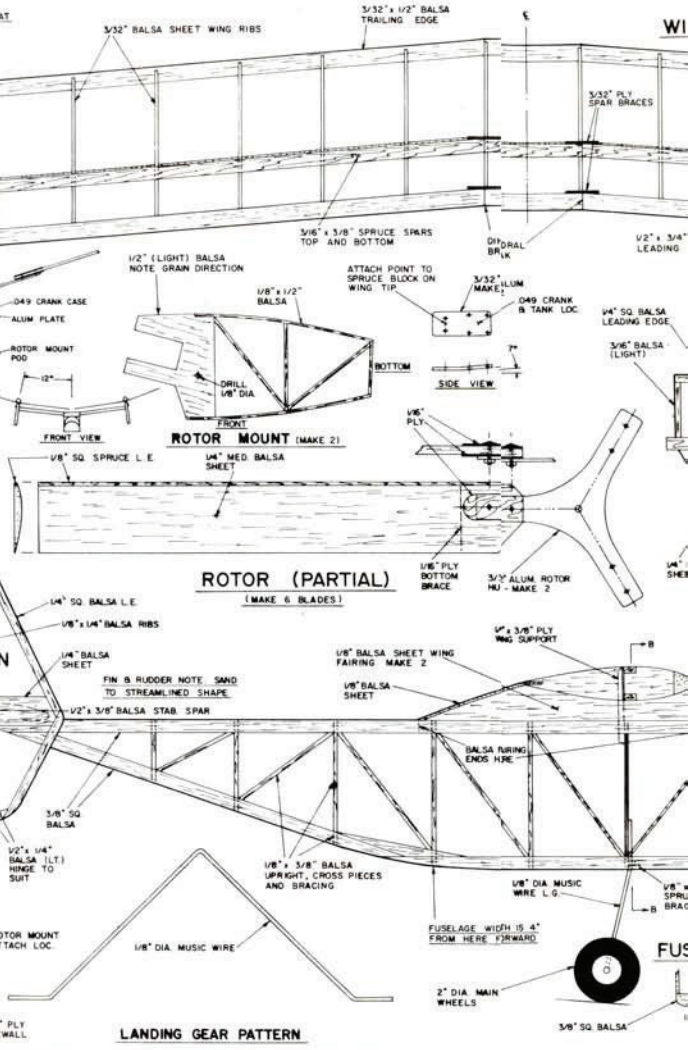








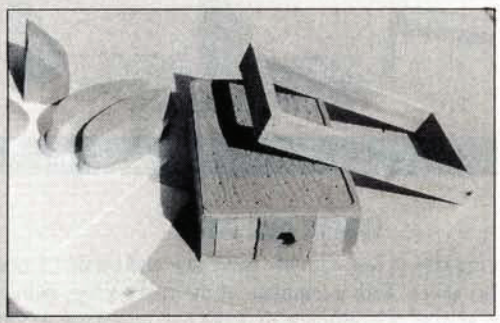




VACU-FORMING

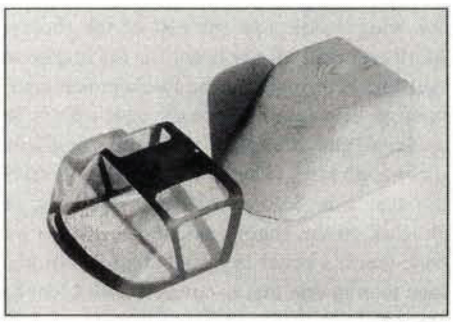
If I had known that vacu-forming was this easy, I would have tried it a long time ago. I build my box based on the size of the available plastic. Evergreen Scale Models sells .030-inch-thick white sheets, which I use for the side blisters and .060-inch-thick, which I use for the cowl. For the canopy, K&S* sells a .040-inch-thick butyrate sheet. As you can see on the plans, I use a stiff foam to seal around the hole in which the vacuum hose is placed. The sheets are stapled to the frame with the staples about 1 inch apart.

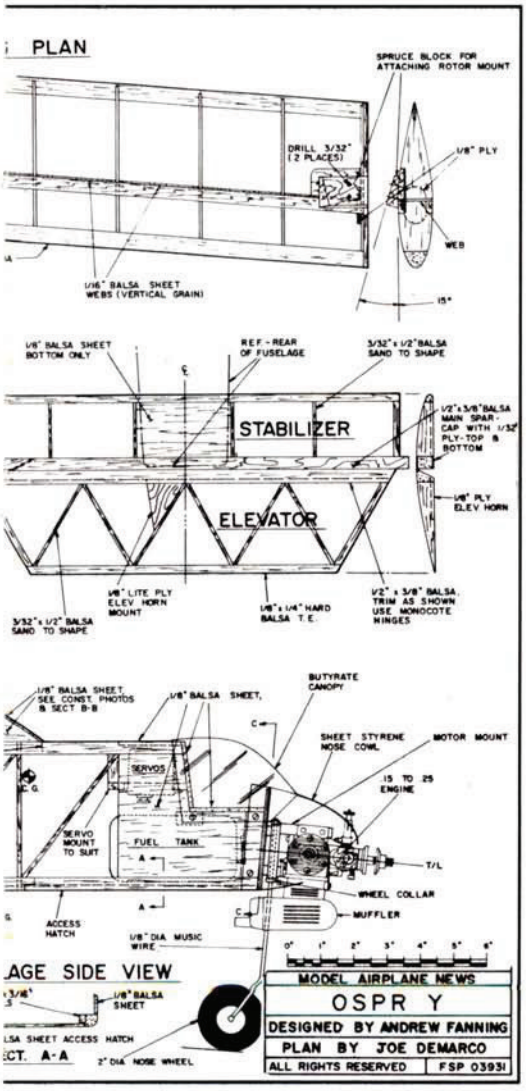
The forming blocks are larger than the part needs to be so that it can be trimmed to fit. I put the frame with the plastic side up on the second level in the oven, set it on broil and leave the door open so I can keep a close watch. As soon as the sheet begins to sag, I turn on the vacuum, then pull the frame out and press it with the plastic side down on the box. I have to hold it there for a few minutes until the plastic cools. After the parts are trimmed to fit, paint them with the O.D.

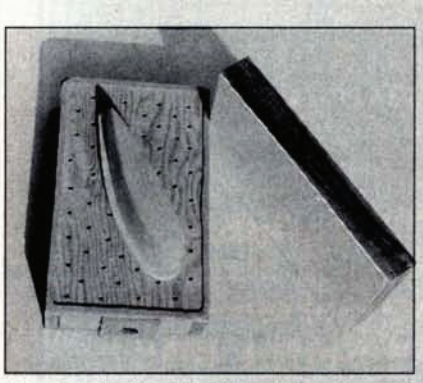


Left: vacu-forming unit and plugs. They don't have to look good; they just have to be functional.

Right: The trimmed, painted canopy beside its plug.

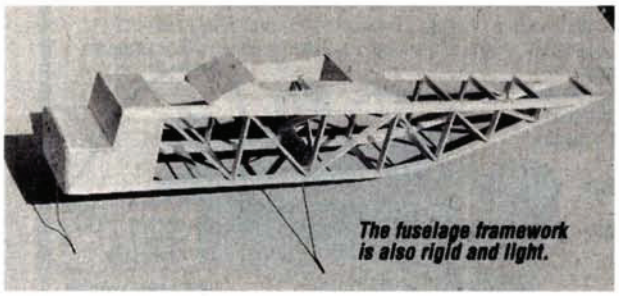




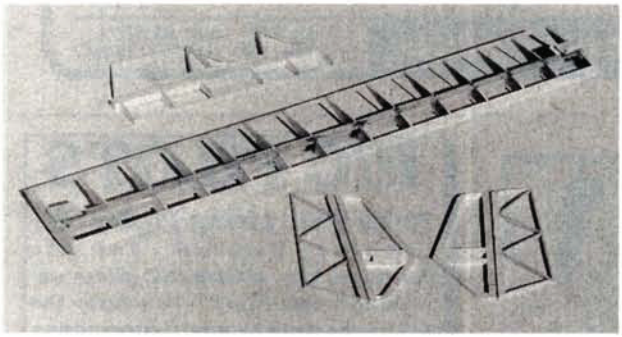


The plug for the side-blister is in place, and plastic is stapled to the frame—ready for the oven.

Pactra Formula U. I use one coat of clear to give the parts a gloss to match the MonoKote that's on the rest of the craft. The canopy is masked and painted from the inside, so the clear coat isn't necessary.



The fuselage framework is also rigid and light.



The open framework of the finished wing and tail is light and strong.

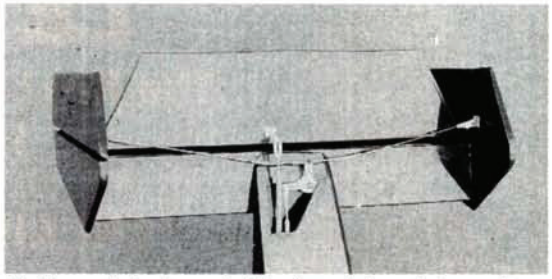
OSPREY AUTOGYRO

struction paper and put them on both sides of the stack of balsa sheets, then shape with a fine-tooth saw blade and a sanding block. Pin the bottom spar on the plans, and use a 1/2-inch-square scrap located at the trailing-edge position to help keep the trailing edges lined up as you glue them to the lower spar. Next, slide the trailing edge of the ribs into their slots and glue them before adding the top spar and leading edge. Using a sanding block, create the angle to give the wing dihedral. After gluing in the plywood to hold the dihedral braces in the wing, put the 1/16-inch balsa web between the top and bottom spars.

When I attach the angled rotor blocks to the wingtips, I use a little epoxy and glass cloth to hold them to the top spar and wingtip. Then I paint the blocks and bolt the aluminum brackets in place before covering the wings. It may be tempting to forget the engine pods, but they're more important than they may look. When I was test-flying the first model, I found that these pods saved a lot of rotor blades. They worked like wingtip skids to protect the rotors. The construction is simple. I just laid them up on the pattern, sanded them, and covered them with MonoKote. There was no right or left until I attached them to the wingtip with one screw, being sure to hit the ply tabs inside the wing.

TAIL SURFACES

Build the tail fins from light balsa, and sand them to shape after assembling them on the drawing. The main spar is a sandwich of balsa and 1/32-inch thin ply. I sanded the leading edges of the rudder and elevator to a sharp 45-degree angle so I could use MonoKote covering for hinges.



Rudder and elevator control hook-up. Only a photo can show the simplicity of the mechanics.

ROTORS

Use a medium balsa for the rotors. When you buy supplies for the rotors, get enough to build at least a couple of extra blades—odds are that you'll need them. After "Zapping" the pine leading edges onto the planks, set up the belt sander with a fence for the planks. I adjusted the tilt of the table on the sander, and then ran a scrap of wood to check how much to take off to get the airfoil I needed. Finish shaping with the old sanding block, and then cut all blades to the same length. Glue the thin ply on the top and bottom of each rotor at the hub attachment point. Don't

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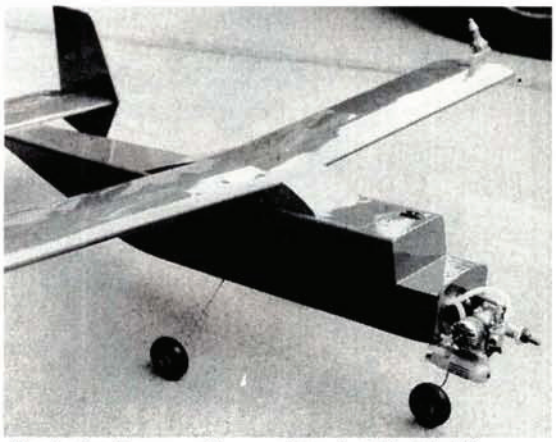

Here's the Osprey with everything installed but the vacuformed parts and the engine pods.