

which they are accustomed. For the purposes of this article, high performance does not mean flitting around the patch at lightning speed for two or three minutes, and then having to go out on the landing strip (or in the weeds) to retrieve the model. Rather, it seems much more rewarding to take off from a rough grass strip, retract the gear, fly with a reasonable range of speed and acrobatics for five to eight minutes, drop the gear, land, and taxi back to the pit area without fear of the usual taxi noseover.

the "wet" (fuel-powered) models to

The Astro 60 direct-drive motor has been installed out of harm's way at the rear; hence the name NBP: Never Breaks Prop! This motor has also been used in my 1/4-scale Caudron C460 1936 Thompson Trophy Winner. Changing the motor and very reliable 205 speed control from one model to the other is a simple matter of two 6-32 screws and unplugging the Sermos electrical connections involved.

To offset the 23 ounces of motor/prop weight at the rear, I designed the fuselage to hold a maximum of 34 sub-C cells up front. Pulling 25 amps at full throttle can cook a cell pack, so the design provides for plenty of ram cooling air to be taken in at the nose and discharged in front of the wing.

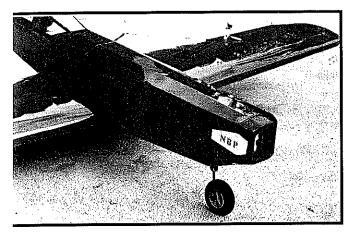


Author and the third model in the series. Subrudder shown on this model was eliminated on subsequent version.

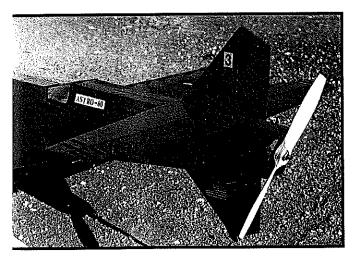
The 1

Zinge

Rear !

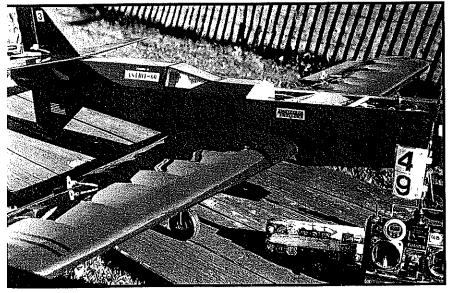


poling air for the 34-cell power pack enters at the nose and exits st ahead of the wing. Motor is direct-drive.



nger 14 x 8 pusher prop was cut to 13 inches for Astro 60 motor. ear motor location means you Never Break a Propl

otos by the author Graphic Design by Julie Anne Visco



he NBP-60 is not difficult to build, but particular attention must be paid to wood election for light weight, strength, and proper balance.

The 34-cell pack must be made up, although it would be possible to purchase six flat six-cell 1400mAh packs, minimizing the soldering to individual cells. One of the packs would be cannibalized to arrive at the desired 34-cell arrangement. The use of heavier 1700-mAh cells limits the power pack to 30 cells.

The model has been designed for Spring-Air retracts. If the builder opts for a fixed-gear version, careful consideration of the lighter-weight landing gear components and necessary changes within the structure will have to be made.

The radio is a Futaba five-channel FM with three 148 servos and one microservo for the retract valve.

#### CONSTRUCTION

NBP-60 is not difficult to build, but weight control is a major item and material selection must be emphasized. Use light balsa (four- to six- pound density, from Lone Star Models) except where specified.

Lightening holes in a complete set of ribs may save 3/4 ounce, but that can easily be lost by the selection of too-heavy sheet balsa or sticks in another area. Removing excess plywood really shows rewards in the weight department. The fuselage nose section uses plywood for strength and "needed" weight! Epoxy is used only in a small section at the rear and at the two hatch retainer-screw areas. My glue of choice is cyanoacrylate (CyA).

Motor Mount: Consult the detail of the mount on the plan. The motor mount tube is made from 12-inchwide 1/64 plywood wrapped around the Astro 60. Check the grain orientation for bending, then cut two pieces 21/4 x 7-1/4 that can be wrapped around the motor. Wrap two layers of waxed paper around the motor. Wrap one piece of 1/64 plywood around the motor, holding the plywood in place with a rubber band. Glue at the slight overlap with CyA. Remove the rubber band and add the second plywood layer, staggering the overlaps.

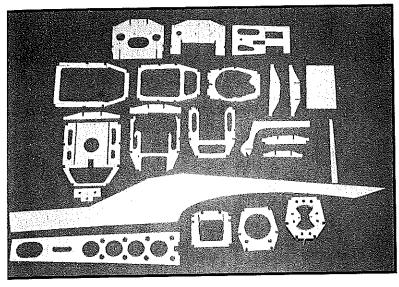
Remove the motor from the plywood tube and

remove the waxed paper. The motor should slide easily into the tube. Block-sand the aft edge of the tube, squaring it up (making it 90° with the tube). Slide the tube over the motor.

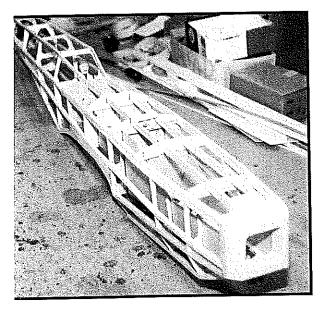
Cut pieces 11 and 12 from the plywood specified, and include the cutouts; some are for lightness, and others are for cooling air. Pay particular attention to #12 and the two motor holding-screw locations and attach the motor to #12 with two 6-32 screws.

Orient the motor brushes as shown and glue #12 to the plywood tube with CvA. Add the 1/16 plywood support to the tube bottom and remove the motor. Cut out the four areas to reduce weight. Coat all exposed edges of the plywood tube with CyA and you have a very strong and light mount.

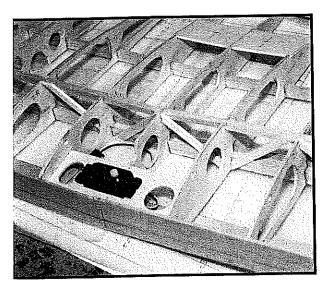
Fuselage: Consult the fuselage plan



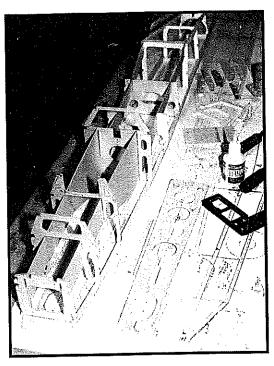
ilsa, Lite Ply, and birch plywood are used for fuselage bulkheads and mers to control weight for proper CG location.



uselage frame complete, with upper hatch in place. Note nxious pilot already in place—he's ready to go!



Fail group has been rough-framed. The motor is slipped into place from inside the fuselage.



Fuselage bulkheads have been attached to the crutch and the  $\frac{1}{16}$  plywood beams have been slipped into position.

and note the two  $\frac{1}{6}$  plywood fuselage beams that extend just past the wing saddle. These two parts can be traced and cut from one sheet of  $\frac{1}{6}$  x 6 x 36 plywood. When installed, these two members establish the two degrees of wing incidence and provide the necessary strength for the nose wheel loads and the major portion of the component weight.

Cut the other fuselage parts from the materials specified. Test all the slots in the bulkheads and make sure they will accept the fuselage beams easily, but snugly.

Protect the plan with waxed paper and pin the <sup>1</sup>/<sub>4</sub> square medium-hard balsa crutch members in place. Note the extension of the crutch members past #12 and temporary cross-members that will be cut out later. Position bulkheads 1-10 on the crutch but do not glue #6. Add the <sup>3</sup>/<sub>52</sub> sheet brace in front of #8; this also provides support for a Williams pilot bust.

Carefully slide the fuselage beams into the slots in the bulkheads. Number 6 must be moved and repositioned as the beam is installed. The 3/16 plywood cell pack mount can now be installed between bulkheads one and five, and flush with the lower edges of the beams. Add the medium-hard lower longerons. Remove the partial assembly from the building board.

Glue formers 6-10 in place, and the one-piece bulkhead #11. (The cut-out center of #11 is slightly oversize to allow adjustment when installing the motor mount.

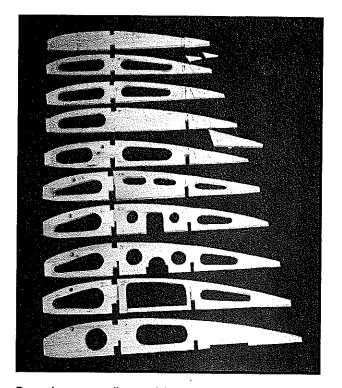
Add the upper longerons and the two lightweight 1/4 square stringers to each side. Add the 1/8 sheet fills above the wing saddle between #5 and #8, leaving them about 1/8 oversize for sanding to match the wing contour.

The 1/8 Lite Ply member for the two 1/4 wing bolts is made up with the two 1/4 plywood blocks and attached. The bolt holes are drilled and tapped later.

Hatch: Add a waxed-paper glue barrier to the top of the crutch and construct the removable hatch in place. The ½ x ½ hatch stringers are added and can be sanded down at the nose to conform with the balsa nose block. Install the hatch hold-down units with the two trapped 4-40 bolts and add the ½ dowels at the aft hatch former.

Now install the motor mount. It is slipped into place and the

Continued on page 20



Removing excess rib material, especially at the plywood rib doublers, can help reduce weight.



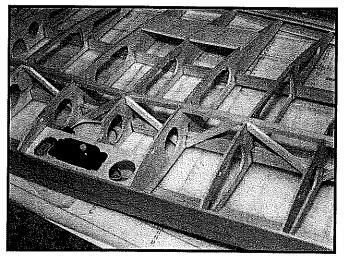
Motor: Astro 60, direct drive

Functions: Speed control, rudder, elevator, ailerons, retracts

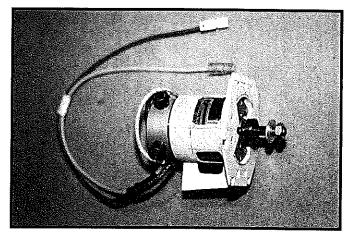
Flying Weight: 9 pounds 10 ounces

Construction: Built-up

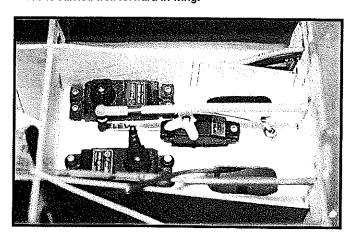
Covering: Iron-on film



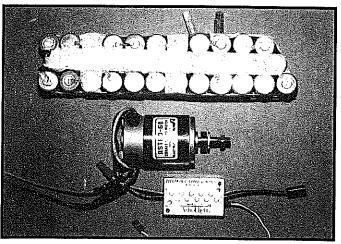
Main spar includes diagonal shear braces. Futaba 148 aileron servo is carried well forward in wing.



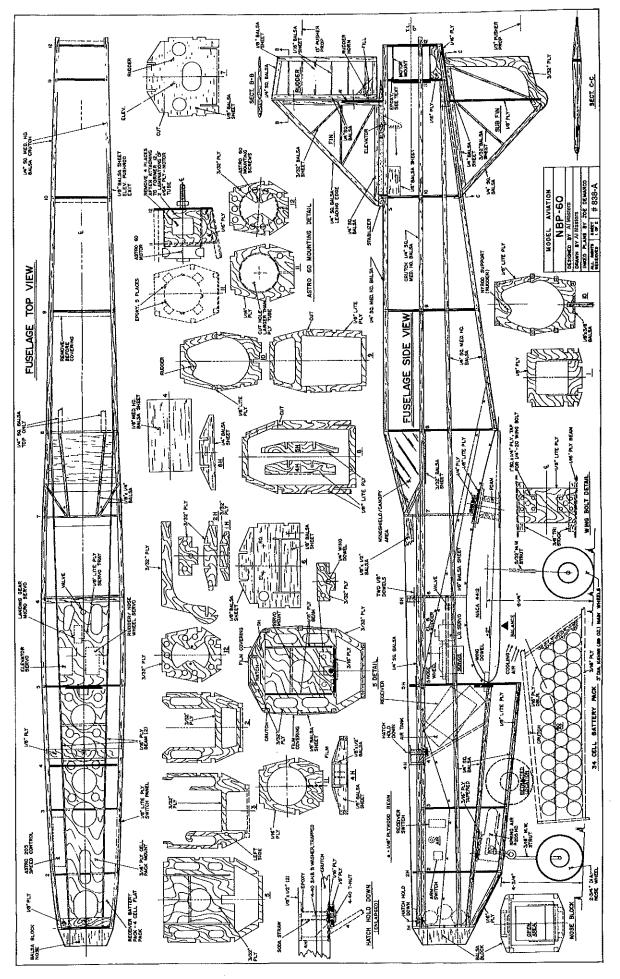
Astro 60 motor in lightweight plywood mount. Held in place with two 6-32 screws. Sermos connectors.

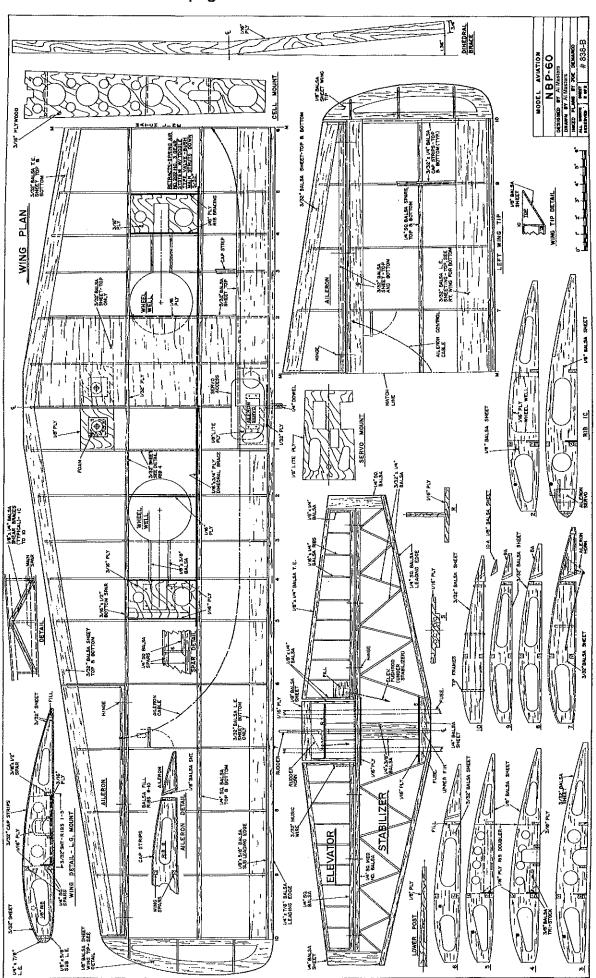


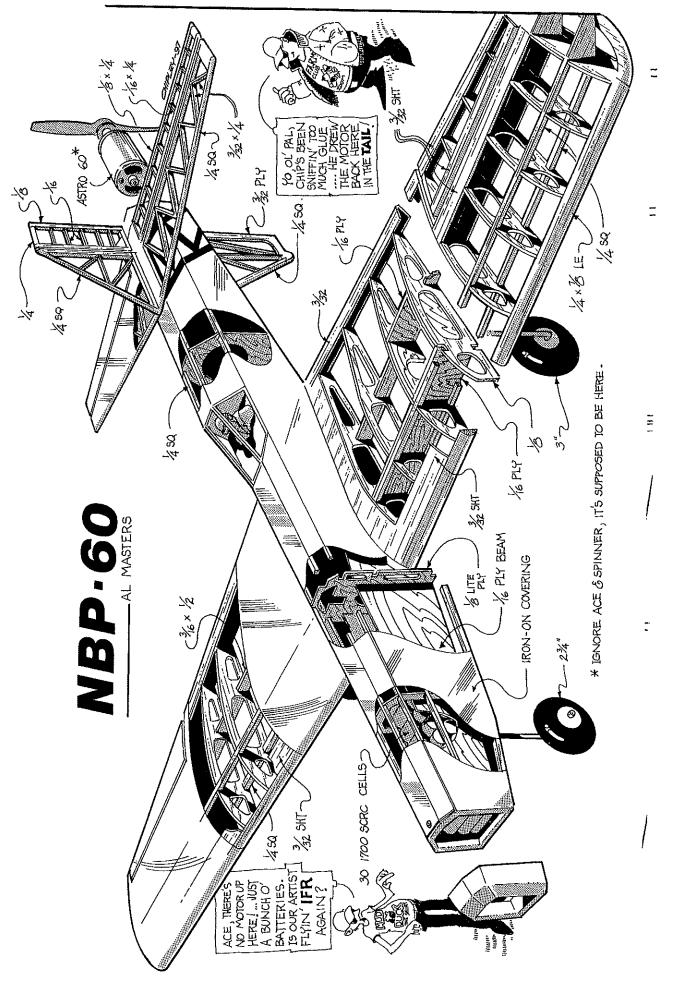
Rudder/nose wheel and elevator servos are standard Futaba 148s; microservo trips Spring-Air retract toggle valve.



A 34-cell pack, Astro 60 motor with prop, and Astro 205 speed control account for 55% of the model's weight.







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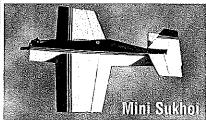


Designed by Rich Uravitch • Vacuum formed cowl • All machine & die-cut parts • Wingspan: 50" • Length: 40" • Wing Area: 800 Sq. In. • Engine .40-.46(2C), .50-.70(4C) • 4 Ch Radio required



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Designed by Nick Ziroli • Wing Span: 34" • Wing Area: 245 Sq. In. • Length: 24" • Engine: .049 - .099 • 2 - 4 Ch Mini Radio Required

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## **NBP-60/Masters**

Continued from page 11

plywood tube is passed through #11 and should extend about 1/8 past it. The opening in #11 allows the mount to be cocked for correct alignment of the thrustline. This is critical-after the mount is glued in place, no adjustments can be made! The epoxy at #11 is not applied until after the motor has been trial-fitted. The motor is installed by passing it through the bulkheads, starting at #8. Attach a 36-inch piece of 1/16 diameter music wire to the motor shaft, and holding the fuselage vertical with the tail up, guide the motor to the plywood mount tube. The motor slips into place neatly and is retained by the two 6-32 screws. The motor can be removed by reversing the sequence.

Work with the nose wheel unit and add the piece of ½16 plywood that is sanded and placed to establish the correct angle to mount the retract unit. Four 4-40 screws and T nuts hold the unit and a piece of ½16 plywood should be placed over the top of the T nuts to safeguard against electrical contact with the Ni-Cd battery pack. Route the nose wheel steering nyrod to the Rudder servo area.

Complete the rest of the fuselage by adding servo mount, wing hold blocks, etc. The ½ plywood part that holds the wing dowel to #5 is not installed until the wing is fitted to the fuselage.

Since the motor must be installed from the inside of the fuselage, the elevator and rudder nyrods must be run so a clear passage is maintained to the motor mount at the rear.

Tail Feathers: The tail group is very light, only beefed up in the skid and center sections. The upper fin and stabilizer are built together and 1/16 plywood (S) is added after the stabilizer is removed from the building board. After the hinges are installed, the tail group can be covered before attachment to the fuselage.

Wing: Make up a complete main lower spar by gluing the ½ square hard balsa members to the ½ plywood dihedral brace. Note that the two-piece spar build-up ends at rib #6. The ½ rear spar is made up and shimmed ½ off the building board. Make a right and left rib set with plywood doublers. Add the ribs to the spars and lower trailing edge sheets. Attach the sub-leading edge and complete the wing framing with the ailerons.

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The ailerons are cut free and the hinges can be placed. The medium-hard diagonal shear braces are placed before adding the rib capstrips. After completing the wing framing, the servo mount and nyrod aileron controls are positioned. Two foam blocks (wing bolt guides) are added and the <sup>3</sup>/<sub>32</sub> sheeting added over. A minimum of <sup>3</sup>/<sub>32</sub> wing sheeting is used around the wheel wells. When the <sup>3</sup>/<sub>22</sub> capstrips are installed, they can be omitted from aileron ribs 7-10.

Electrical: All wiring for the motor circuit is 12-gauge stranded silicone—the largest size that fits into Sermos connectors. Copper braid (3/16 wide, from Hobby Lobby) is used for the Ni-Cd cell interconnectors. I use a Radio Shack MS-169 for the arming switch and a 30-amp inline fuse. The made-up cell pack is wrapped with a minimum of fiberglass tape and is held in place by two rubberband lashings across the top at the plywood bulkhead hook.

A 34-cell pack using 1400 mAh SCR Ni-Cds will weigh about 60 ounces; a 30-cell pack using 1700 mAh SCRCs (heavier) will weigh the same. The model is designed with more than 100 watts/pound, so the choice is up to the flier.

The four-cell flat-pack receiver supply nests in a pocket up front and the Astro 205 speed control is trapped within its compartment without hold-downs.

Landing Gear: This model has been designed using Spring-Air heavy duty retracts. To save weight, the main struts

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ere bushed with K&S brass tubing to fit ne retract unit with 5/32 struts.

The nose wheel strut is the standard 16. The lightest wheels that I have found re Kavan-again, from Hobby Lobby. A eavier nose wheel can be used for Center f Gravity (CG) correction.

Covering: An iron-on film would be uilder's choice-I have used MonoKote n the four NBP-60s built to date. The anopy area was covered with Clear 4onoKote.

'lying: A Zinger 14 x 8 pusher propeller, ut to 13 inches and balanced, works fine. tefore turning on the arming switch, nake sure that the throttle and throttle rim are fully retarded! With all checks nade and the retract tank pumped up, turn in the arming switch and taxi to takeoff

The static attitude of the airplane is uch that the elevator must be given a ittle "up" for rotation and takeoff. After akeoff, raise the gear and reduce the uplevator (or, if you're a real hotdog, and till at full throttle, you can easily do a (alf Cuban 8). Rolls are a pleasure.

The Astro 60 motor with 34 cells puts nut plenty of power for this model, so educed-throttle flights are the norm. Cutting back the throttle to just fly the nodel can give 10-minute flights; throttleup aerobatic flights will be four to five minutes long. The ability to hold altitude at half-throttle allows an anxious pilot to plan ahead for that first approach to landing, and save power for a go-around if necessary!

In the glide mode, the model is somewhat of a "floater" with the NACA 4412 airfoil-even at 28 ounces/sq. ft. loading. So the landing flare must be extended and the nose held off until the model is ready to set down on the mains (gear down, of course!). Allowing the airplane to fly to the runway can result in a rather uncontrollable series of bounces that may cause damage to the lower vertical fin—especially on a hard surface!

Research indicates that the power system in an Electric should make up 40-60 percent of the finished model weight. The cell pack, motor/prop, and speed control weigh 85 ounces, or 55%—acceptable!

Getting into the Electric side of the hobby has been easier than I anticipated. Information gleaned from Bob Kopski's articles and from Keith Shaw has been very helpful. The Astro 112PK charger has been a wise investment-it will handle up to 36 cells, thus covering a wide range of power requirements for future designs!

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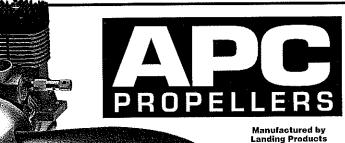


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