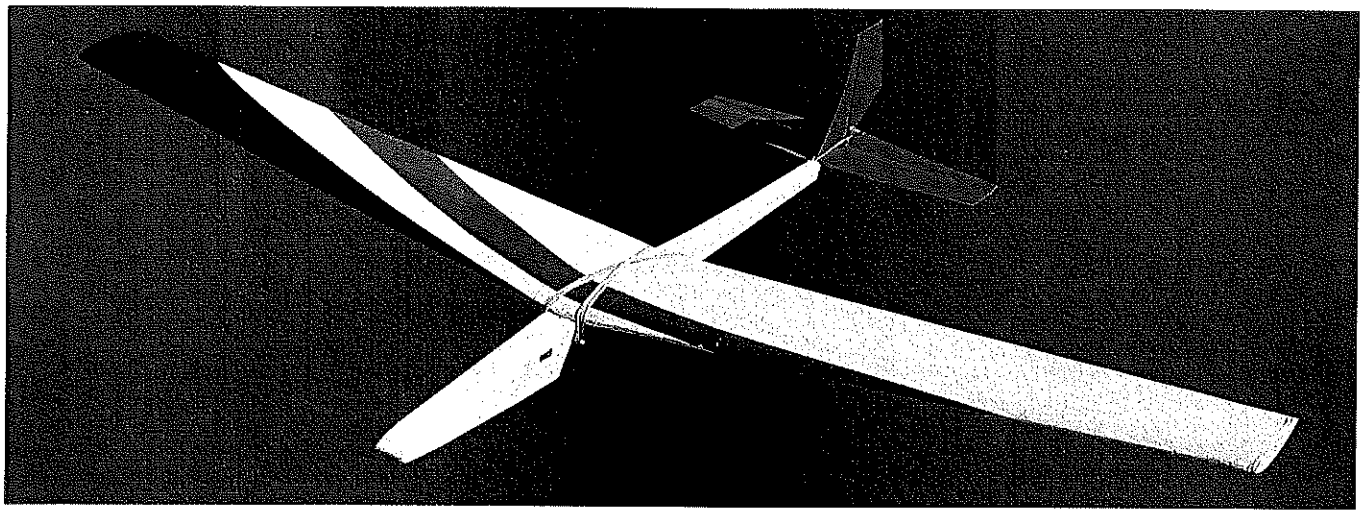
Javelin

■ Neil Allen



Spear some flying fun with this easy to build, low-cost glider

The Javelin is an ultra-low-cost, easy to build design that has surprisingly good performance, because of a high-efficiency Eppler 201 wing airfoil section. The airplane flies well from towline or slope, and makes an excellent trainer. It is intended for use with regular-size servos, receiver, and a 500 mAh battery pack, or the four-penlight dry cell pack that comes with low-cost two-channel radios.

It features a foam wing, with dowel-rod spars, covered with regular brown kraft paper, and a very rugged, simple balsa sheet fuselage and tail. This construction is quite incredibly cheap—maybe as little as $30 ready to fly.

Foam wings may be a bit off-putting to a novice, who does not have the means at hand to cut the foam cores. However, there are several ways around this, and there are big savings in building time if you go this route. Some ways to get foam wing cores:

• There is quite likely to be a club or a modeler in your area who has the equipment, and who will be happy to help you.

• Your hobby shop may be able to help, or put you in touch with someone who can.

• You can order foam cores cut to specification from firms that advertise this service, such as Wing Manufacturing Co.

• You can make up your own foam cutter. Once you have used foam wings, you may want to use this method often in the future. See the brief description on foam cutting at the end of this article, or you may find a detailed description elsewhere, such as in how-to-do-it hobby books on sale, or at your library.

Foam wings have many advantages, including:

• More accurate airfoil section than with traditional rib-and-spar structure. The airfoil chosen can also be more complex, unlike many trainers that use a less-efficient flat-bottom section. Foam wings can easily employ washout, as the Javelin does. (The wing has a slight twist in it, with the tip of the wing having a slightly lower angle of incidence than the root. This prevents tip stalling.)

• Construction is faster—even with the time spent cutting out the foam.

• If the foam wing is covered with brown paper and painted, there is a big cost savings over a film-covered balsa structure.

• The wing is very tough—almost crashproof.

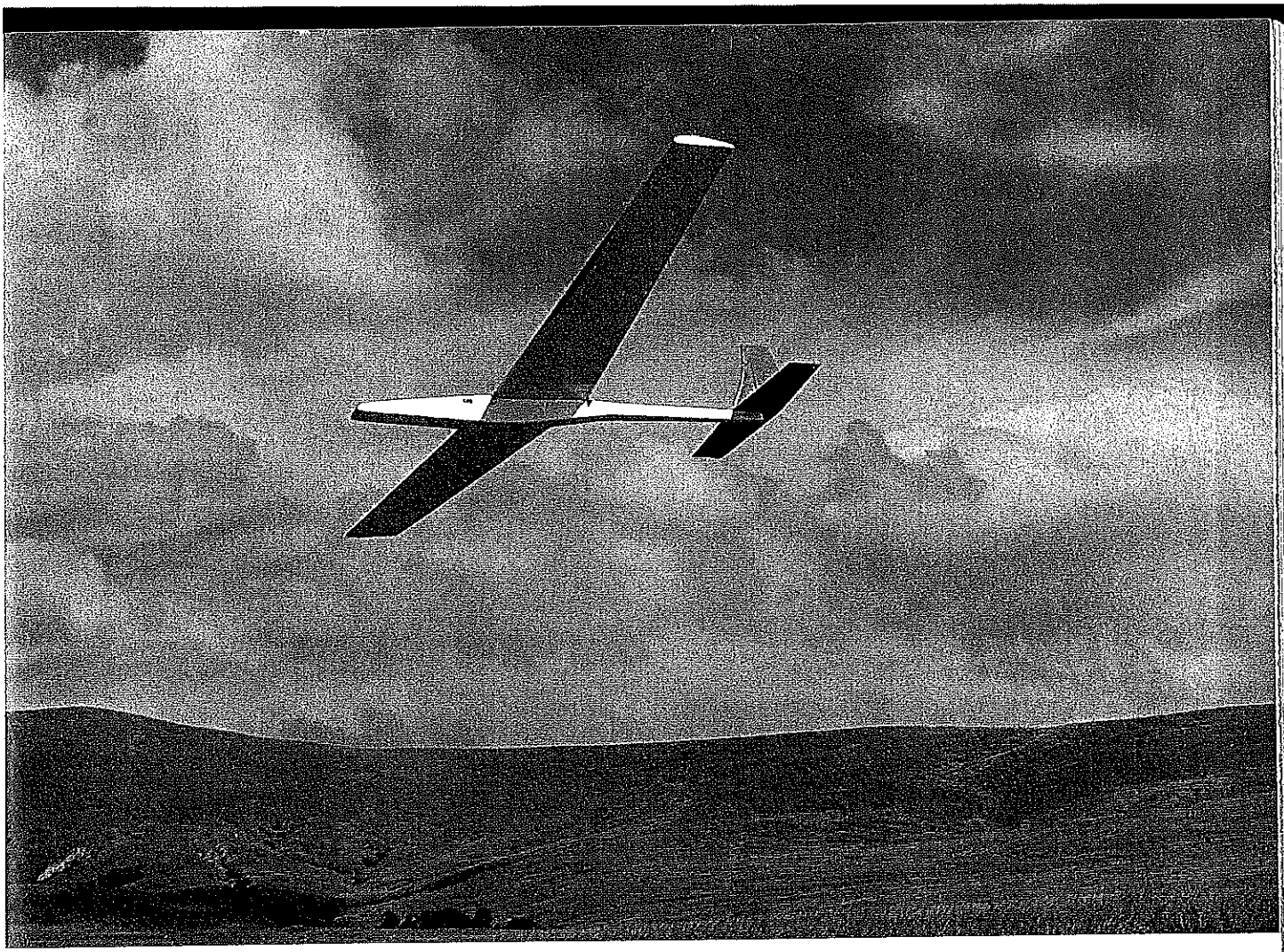
• Many high-performance sailplanes use foam-core wings. You may as well start with the method you will probably end up using anyway.

CONSTRUCTION

Wing: Be careful using glue on Styrofoam™. PVA (Poly Vinyl Acetate) or aliphatic resin glues (like Titebond) work well, as does epoxy, but epoxy is quite heavy, and should be used sparingly. Glues with solvents, like balsa cement, and normal cyanoacrylate (CyA) glues will melt foam. There are special CyA glues available that are suitable, however.

Cut the foam cores and sand lightly with 200-grit sandpaper to smooth them off. Do not try to sand the rear of the trailing edge to a sharp edge; if it is too thin, it will warp when covered.

Mark the spar positions with a felt-tip pen and a long



Javelin being flown on the slopes above the city of Pietermaritzburg, South Africa.

Photos by the author Graphic Design by Carla Kunz

straightedge. Cut the grooves for the spars. These do not have to be precisely fitted at the bottom of the groove. Cut the sides of the grooves with a sharp knife, and then chisel out the foam with a small screwdriver or a Dremel tool. You could also do the job with coarse-grit sandpaper wrapped around the edge of a ruler, or with an ordinary file.

Glue spar dowels in place with white glue. Do not try to fill up the slot with glue—use just enough to secure it in place. When dry, trim off excess dowel lengths at the ends, and glue on the tip plates.

Cover the wings with brown kraft paper, in one piece, wrapped around the leading edge. Start at the bottom, with a little excess sticking out at the trailing edge (TE). When the bottom is covered with creases smoothed out, trim excess paper at the TE.

I used thick wallpaper glue, but white glue thinned 50/50 with water also works well. Wet the paper thoroughly with the glue when covering, and wait for at least five minutes before using it, to let it soak up some of the water. Note that it expands somewhat when wet, and shrinks on drying, so minor wrinkles will disappear.

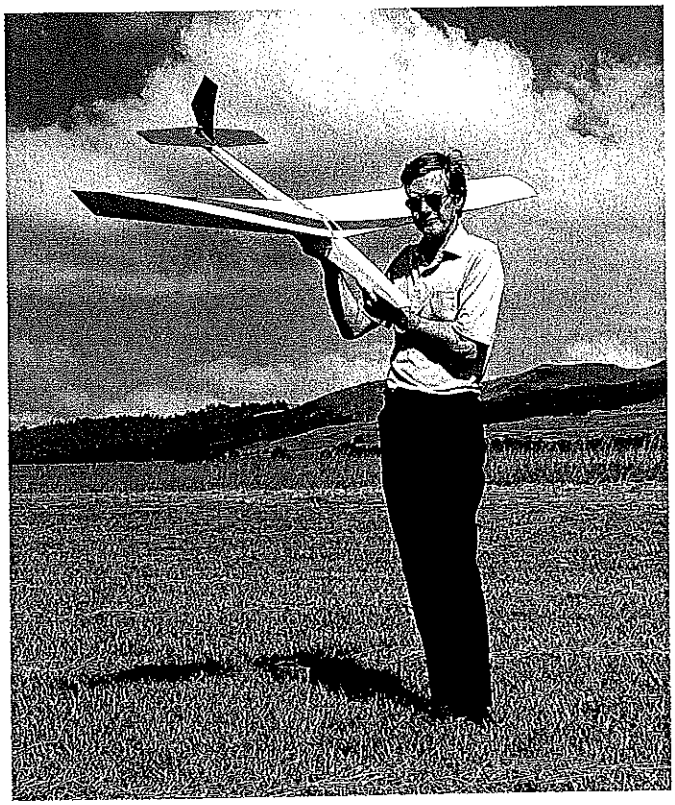
Wrap the paper around the leading edge, and smooth on to the top. Wrap around the TE and trim the paper, leaving about ¼-inch overlap at the bottom, to add strength to the thin TE.

Let the wing dry for about four hours, then replace in the foam blocks from which it was cut. Pile books on top to weight it down, and let it dry for a night or so. This will ensure that it is straight and not warped.

Glue one (preferably, two) strips of brown paper about an inch wide along the leading edge. This is to reinforce it when landing on spiky grass, etc. on the slope. Gummed paper tape can also be used.

Sand the root ends to the correct sloped angle, so that when the halves are joined for dihedral, they fit reasonably well. Use quick-setting epoxy to join the wing halves.

Add glass cloth and epoxy resin to the center-section covering.



The author and Javelin. Simple, rugged construction provides plenty of flying for minimal time/money investment.

ote that normal fibreglass resin (polyester) tacks foam, so use epoxy resin. Epoxy lue from tubes will work fine if spread inly, but use the slow-setting type.

ail: Cut the parts and sand the edges ghtly to round them. Covering with plastic lm is then recommended, but not essential; ou could undercoat, sand, and paint. lastic film is lighter, which avoids having) add lead weight in the nose to balance the irplane.

Make the two control horns and glue iem into the notches cut into the elevator nd rudder, using epoxy or CyA.

Cut slits in the surfaces for the hinges, nd hinge the rudder to the fin and the levator to the tailplane. Because of the thin alsa, Easy Hinges or similar thin Mylar™-ype hinges are used.

If film covering is used, it must be emoved where the rudder is to be glued on ie elevator, and where the 3/16 triangular einforcement is to be fitted. Cut the film ghtly with a sharp blade and peel it away, eing careful not to cut the balsa.

Glue the rudder onto the elevator, and dd the triangular sections. When dry, cover ie triangle balsa with a small piece of film.

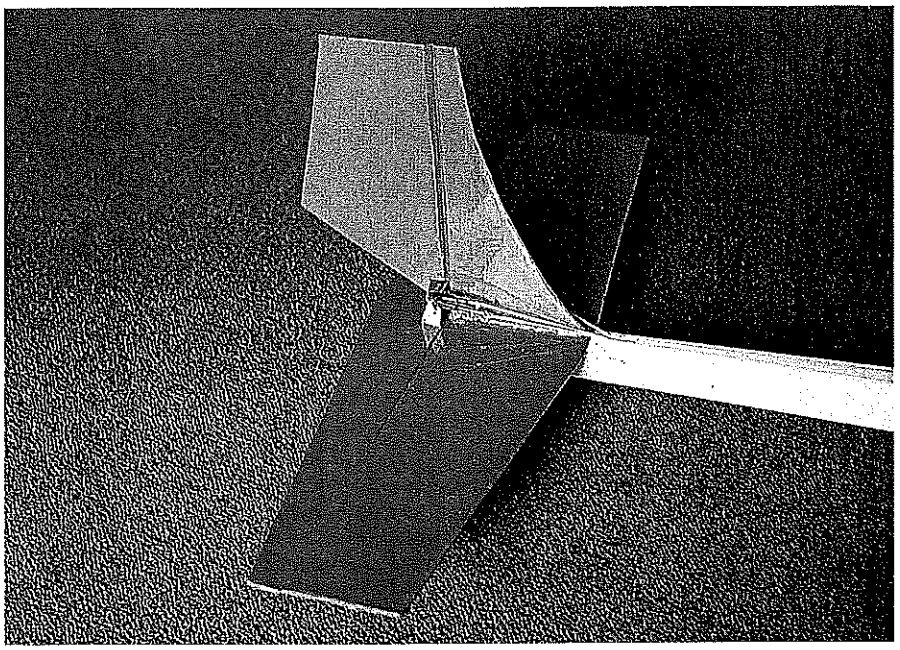
'uselage: Glue the F5 tail doublers to the .iselage sides at the rear. Glue the fuselage ides to the nose block and former F1, on op of the plans to ensure an accurate fit.

Add the Styrofoam™ filler at the nose, nd sand smooth to match the top and ottom.

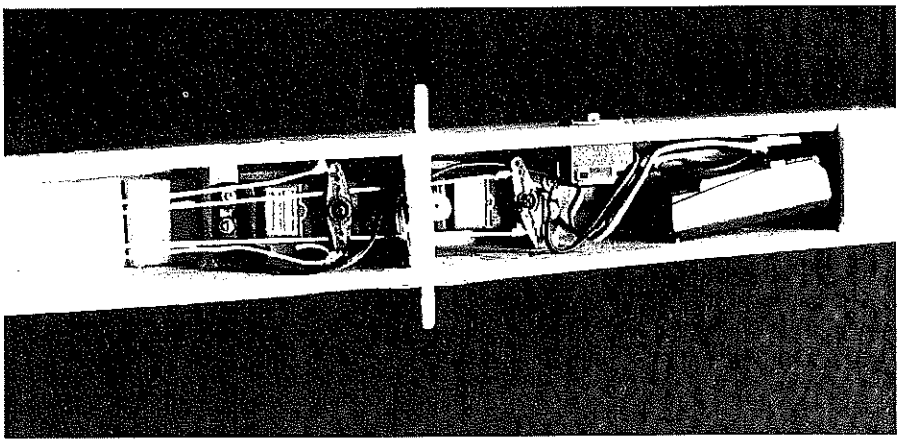
When dry, add F2, F3, and the tailpost, sing a clothespin or similar clamp to hold ie rear together. This should also be done ver the plans to ensure straightness.

Fit the bottom sheet below F1, and the lywood towhook plate. Glue in the four ervo mounts, with the correct spacing for our servos. When dry, enlarge the holes or the servo lead wires if neccessary.

Add the rest of the bottom sheeting. Note that the bottom sheeting at the nose



Control cords exit fuselage through slot in top sheet, except for lower elevator horn cord, which exits from slot in fuselage side.



Basic radio installation in sheet-balsa fuselage. Note control cord routing.

Javelin

Type: RC slope sport/trainer glider

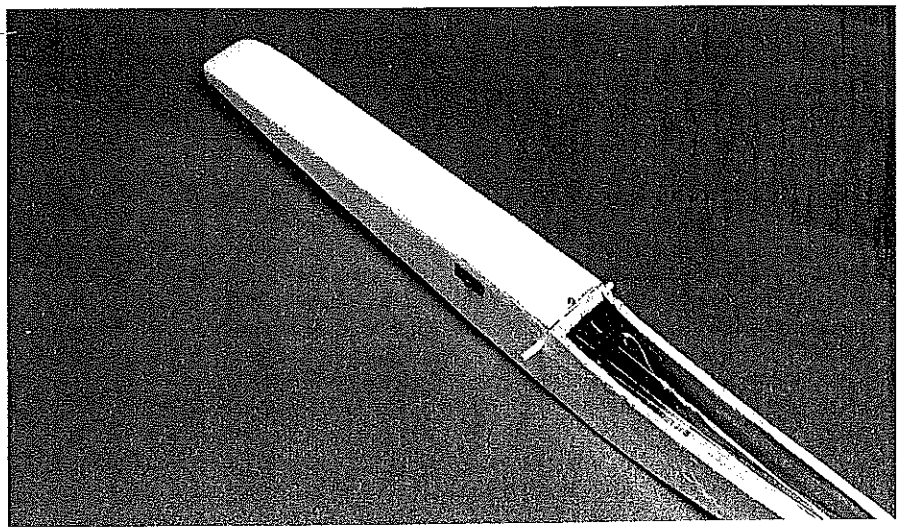
Wingspan: 72 inches

Functions: Elevator, rudder

Flying Weight: 25 ounces

Construction: Balsa fuselage and tail; Styrofoam™ wing with dowel spars

Covering: Kraft paper on wing and fuselage; film on tail



Hatch cover is held in place with balsa "tongue" at the front and screw in back.

Cutting Foam Wings

A wooden bow about 40 inches wide is made up. The best design uses two twisted cords across the top, to allow it to be tensioned easily.

The nichrome foam cutting wire is available from Sig or Radio Shack stores. It must be matched to a suitable-voltage transformer to power it. Mine uses nichrome wire from a spiral-wound heater element, and 30 volts is correct.

The foam material must be cut to the desired span and width. The thickness does not matter. Mark out the size you need with a felt-tip pen and a straightedge, and pin strips of Masonite™ along the straight edges to be cut. Switch on the bow, and cut these.

The cutting templates must be marked with a series of equally spaced numbers (say, from 1 to 16) along their length and on both sides, so that 8 is in the middle of the tip and the root. Drill holes for finishing nails.

Mark out the foam blocks for the wings and attach the templates with nails pressed into the foam block. Check carefully that the alignment is correct, and that you are not cutting out two left wings, or that the root and tip are opposite ways up—it happens to us all!

Switch on the bow, and when hot, cut smoothly and slowly. Two people are needed, and the one at the root end calls out the numbers as he passes them. The person at the tip keeps up at the same numbers on the templates.

Repeat the process for the top and bottom, and for the two wings.

It is really quite easy, and if you mess up the first one or two, it is not serious. ✈

Neil Allen

has the grain running across the fuselage to strengthen it against landing impact.

Attach the top front sheeting, as far as the hatch start line. Drape kitchen cling wrap over the fuselage sides at the hatch, and pin against the sides the hatch side reinforcing rails (the pins to be removable from the outside, please!). Glue the hatch sheeting onto these. When dry, remove the hatch and add the front tongue and the hold-down screw.

Glue the antenna tube (made from drinking straws) in place. Note that you join drinking straws by cutting a short slit at one end, and forcing this end over a second tube. Make the second tube become the forward one, so that when you feed the antenna wire down the tube, it does not catch on the joint.

Fit the control cord tube in the same way. Feed four lengths of kite string, or heavy cotton, through the control cord tube. Note that one cord must now be sent through a hole in the fuselage side for the lower elevator horn. Make large knots or tabs of masking tape to prevent the ends slipping back inside the tube. If necessary, a fine piece of wire can be fed through the completed model from the rudder end, to rethread control cords to the model. Or if one string breaks, one of the remaining cords can be used to pull a new set through the tube.

Glue the rear top in place. Sand the fuselage smooth, being careful of the control cords.

The original fuselage was covered with brown paper. This is economical, adds strength, is simple, and gives a good finish for the paint. Plastic film can also be used, or the balsa can be undercoated and painted.

Cover the nose with fibreglass or cloth as per the plan. Polyester or epoxy resin or white glue can be used here on the cloth.

Assembly: Attach the wing rubber band dowels and sand the fuselage sides if neccessary to let the wing fit snugly on top. With the wing mounted on the fuselage, trial-fit the tailplane to the fuselage. Looking from the back, the tail must not have any tilt compared to the wing. Trim the fuselage sides where the tail is mounted until this is accurate. Also check that when looking from the top, the tailplane is at right angles to the fuselage. When aligned correctly, glue the tail in place.

Paint the wings and fuselage. When painting the foam wings, do not use a solvent-type paint such as dope, as this may attack the foam through the paper. I used one coat of ordinary PVA house paint, followed by one coat of household polyurethane satin-finish paint. Sand smooth after the first coat for a good finish, using 220- to 360-grit paper. Paint on color trim if desired. Painting a different color on the underside will help to orient you when flying.

Mount the switch and radio gear. If your battery pack is the four-cell flat type, it will not fit in the nose (nor will it fit most other gliders, either). Find someone handy with a soldering iron to rearrange the cells to a "cube of four" instead.

Clamp the elevator and rudder, using strips of balsa and clothespins, then tie the control cords on to the threaded adjusters and quick links on the servos and control horns. On the rudder, use the servo arm holes furthest from the servo, and the holes on the rudder closest in. On the elevator, use the second hole from the servo center, and the hole farthest from the center on the elevator. Move these if needed to get the correct amount of total movement as specified on the plan.

Remove the clothespins and use the threaded rod adjusters to get the controls centered and the cords gently tightened.

An alternative to threaded adjusters is to simply use a length of soft wire from a straightened paperclip between the horn and the string. A loop is made on each end (one for the string and one to go through the horn). Adjustment is made by putting zigzag bends in this to tighten it.

Check that the model balances close to the marked balance point. If it is behind this, it is tail heavy, which could cause unstable flight, and unwanted snap rolls. Add lead to the nose until it is within ¼ inch of the plan position. You can remove this in stages after flying, and test the effect.

If the balance point is slightly in front of the plan position, it is not very serious, as it will just mean lots of up elevator is needed to keep the nose up. You can go ahead and fly it.

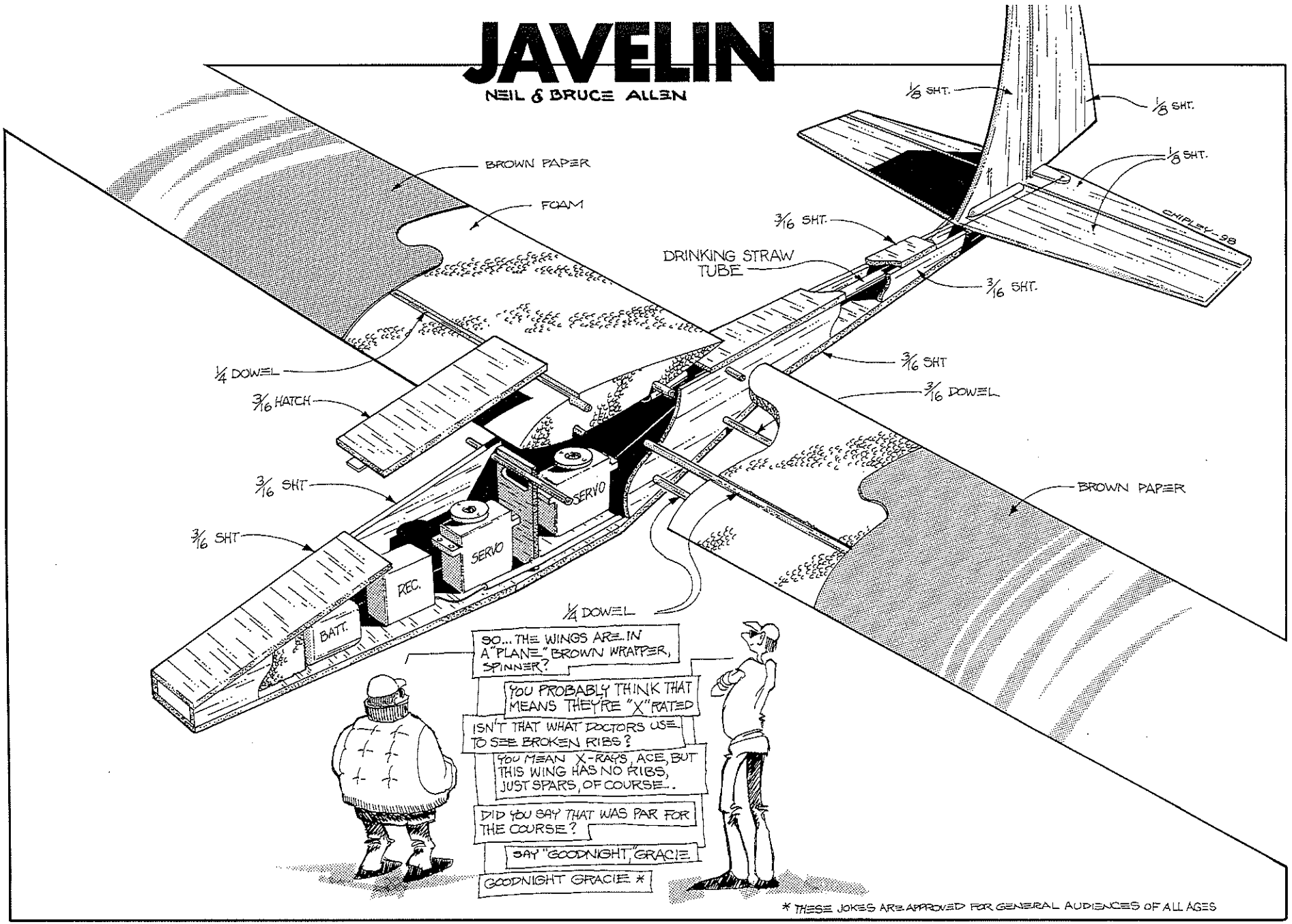
There is little to say about the flying performance; Javelin is easy to control. It launches well off the towline, electric winch, or hi-start, and slope-soars superbly, even in gentle winds.

You can even have flights from a hand launch; just ask your helper to throw it like, well ... a *Javelin*! ✈

Neil Allen
Box 132
Pietermaritzburg 3200
South Africa

JAVELIN

NEIL & BRUCE ALLEN



* THESE JOKES ARE APPROVED FOR GENERAL AUDIENCES OF ALL AGES

Full-Size Plans Available—see page 165