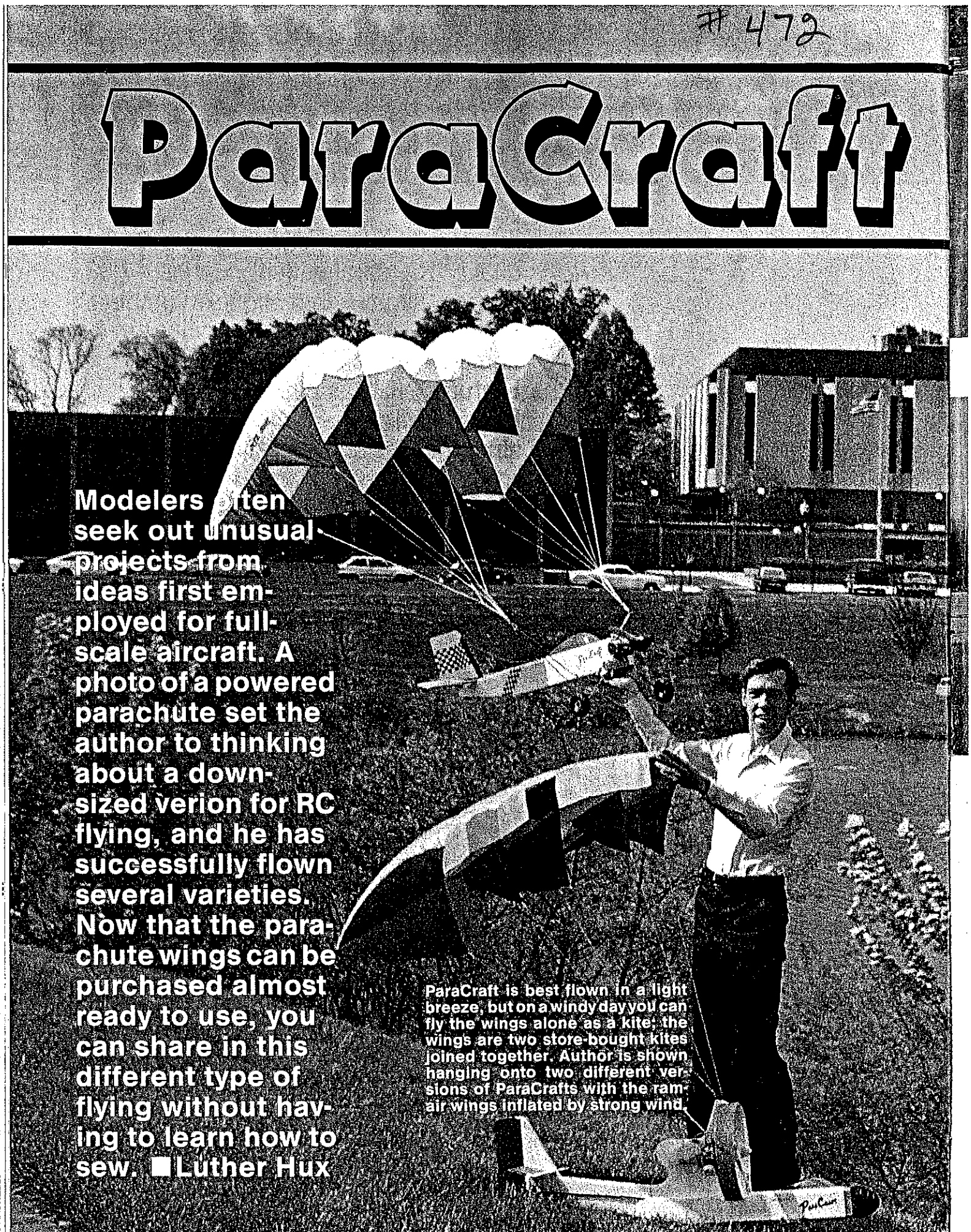
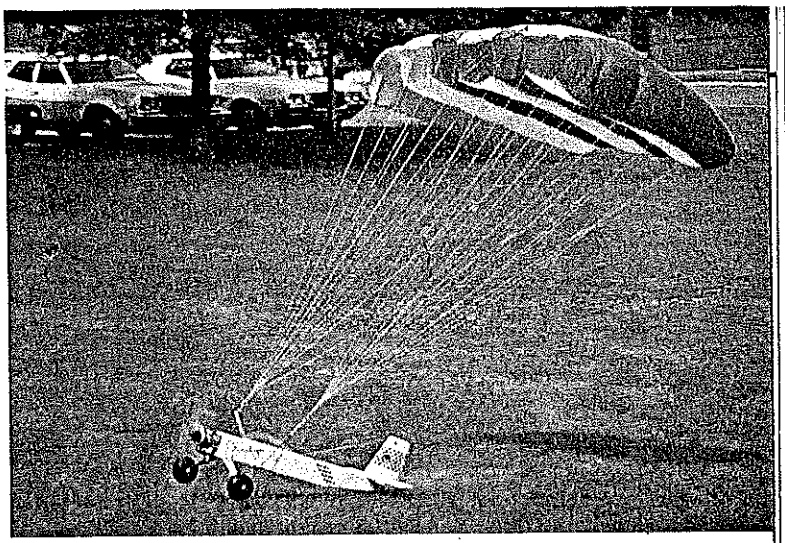
ParaCraft



Modelers often seek out unusual projects from ideas first employed for full-scale aircraft. A photo of a powered parachute set the author to thinking about a down-sized verion for RC flying, and he has successfully flown several varieties. Now that the parachute wings can be purchased almost ready to use, you can share in this different type of flying without having to learn how to sew. ■ Luther Hux

ParaCraft is best flown in a light breeze, but on a windy day you can fly the wings alone as a kite: the wings are two store-bought kites joined together. Author is shown hanging onto two different versions of ParaCrafts with the ram-air wings inflated by strong wind.



Left: The author's wife, Dawn, demonstrates the perfect launch procedure while Luther, behind the chute, commands the radio and waits for the fabric wings to rise. This is an older version of the wing; it proved to be too large for the .60 engine to pull with efficiency. Right: A few seconds after release by the assistant, the fabric wing moves ahead and begins to lift the model's fuselage and tail surfaces.

Above: The smaller kite wings are easier to launch by the pilot alone, but holding the kite and transmitter, while increasing the throttle, is a challenge. A helper holding the kite by the top outer corners, while you throttle up, is the easiest way. Be sure your helper knows when to let go, or the fuselage could take off and loop over the wing into him or her. Right: The store-bought kite wings are small enough to allow a slow forward speed (instead of just hovering as the test models often did). In a light breeze the ground speed drops so you can walk alongside the model as you set up for a landing. It's a different kind of flying!

DEVELOPING NEW ACTS for model show team purposes requires an eye for interesting and unexpected items to fly. This different view on things has led designers to create models such as the flying lawn mower and the flying hamburger.

When a photo of a full-scale powered parachute was presented in *Mechanix Illustrated,* I saw an opportunity for something unusual to fly at shows that was aerodynamically feasible. It's certainly not as difficult as getting a "hamburger" to fly.

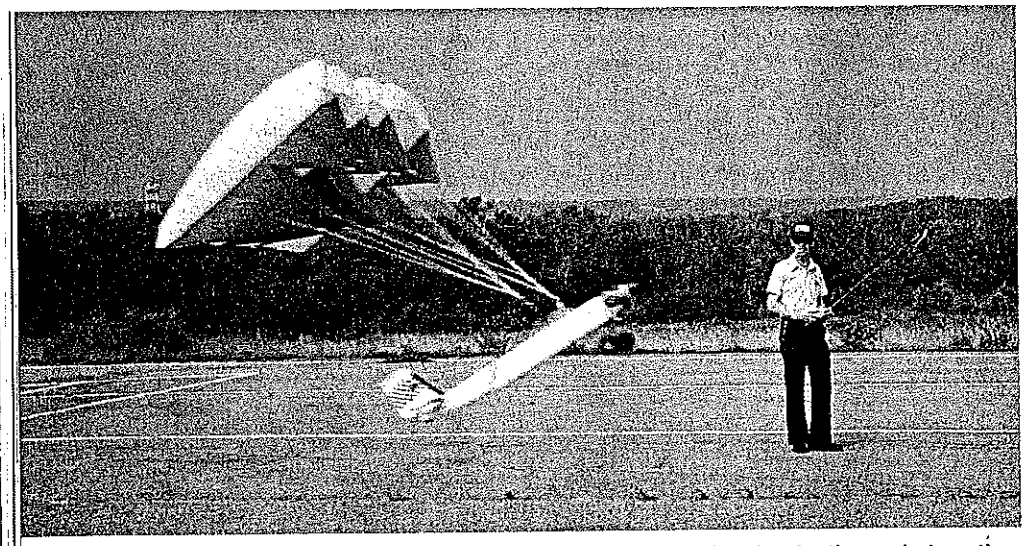
With my background in sewing, I found that I could produce the fabric wings, but there was a lot of challenge to it. It was certainly not something I could recommend for everyone to try. It was only after I found a way to use store-bought parafoil kites that the project became feasible for builders whose expertise was more with wood and metal.

As a novice in kites, I endured many trial-and-error flights. In the September 1980 *Model Aviation* story of the ParaCraft, I closed the story by saying that there was much experimentation left to do. By the time the article was in readers' hands, I was sure that the chute was oversize and was too much strain on the engine. After cutting off 30% of the chute, the model flew at a graceful 10 mph and was much easier to control. The larger chute caused the model to just hover. Responses to that article showed that there were many individuals and corporations involved in both RPV and full-scale development of powered parachutes.

As I learned more about parafoils, I found that the original parafoil was a kite designed by Domina Jalbert in 1967. The design was later adapted to ram-air parachutes by sky divers. Since the powered full-scale designs used the parachute, it made sense for my models to use the smaller kites. The problem with the ready-made kites was the design ratio that had the chord greater than the span. Also, the kite had three rows of ventrals (sub-fins), and that was difficult to rig to two support points. When the solution came to me, it was simple: attach two chutes side-by-side. This created a wing-like ratio with more span than chord. It also provided two chute attachment points ready for hookup to ParaCraft.

After describing the idea to the owner of Kite Site, he provided me with two kites to try it out. With only 10 minutes of simple sewing to join the chutes, the new wing was ready to check out on ParaCraft 3. It flew right off the drawing board. This model was suitable for sharing with others.

Another development in fabric-wing models that has come to my attention is the British-sold Windbag. This RC model is based on the kite called a Flexifoil. It appears similar to the Jalbert kite, which I use, except there are only two lines to the



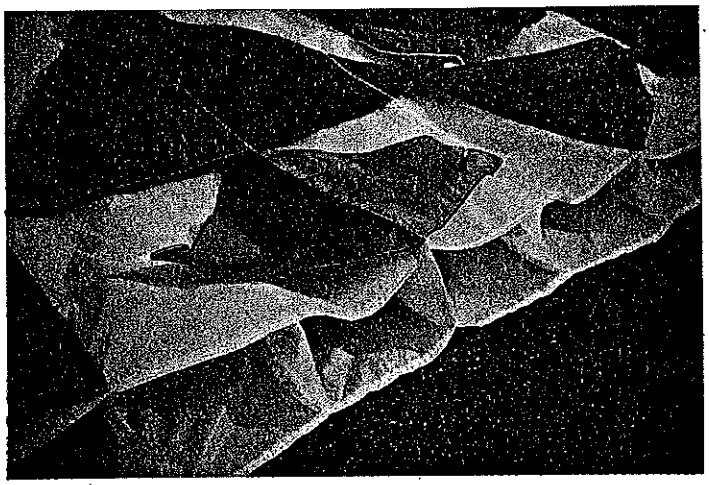
The author doesn't normally stand on the runway when flying, but for these photos other club members agreed to stay down while Bill Hershberger took pictures of ParaCraft's low-flying capability. Getting special clearance was easy because of the unusual show offered.

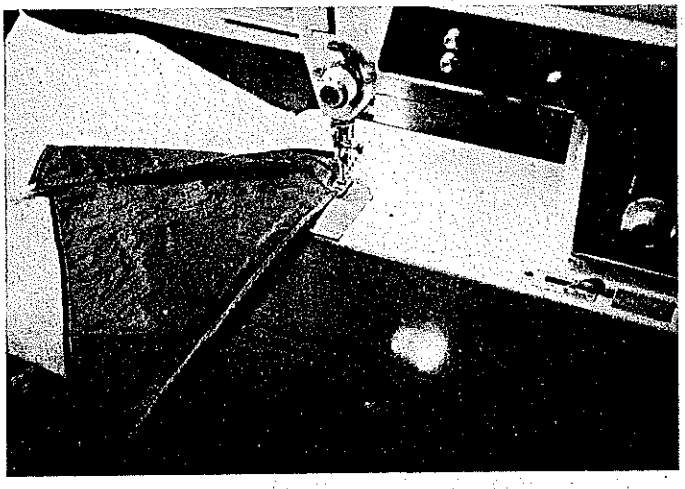
the kite will follow.

I have developed several unusual designs for ParaCraft. The exotic designs are fun to watch. However, I am presenting the simplified design of ParaCraft 3 (tail-dragger version) to ensure your success. A more capable builder may choose to try ParaCraft 4, but there is no need to burden the novice builder with unusual building procedures.

For those who would alter the design and prefer to try new ideas, let me give the following guidelines:

1) Keep your chute support point above and behind the model's center of gravity (CG)—balanced without fuel or chute. Lowering the support point or moving it forward to the CG will cause the model to oscillate violently when under power. Should you find yourself flying a spastic



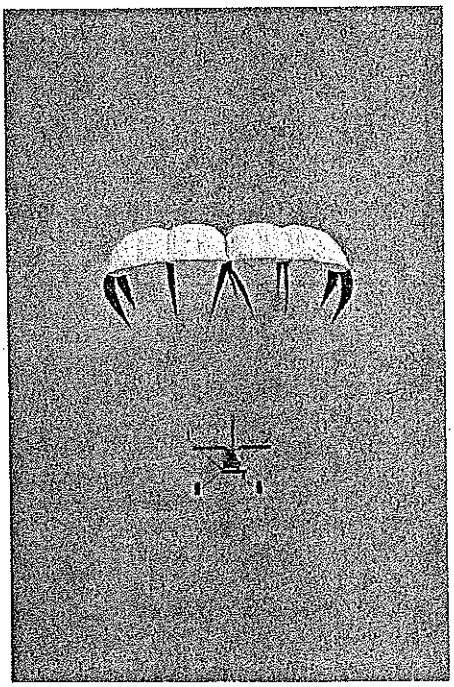


Left: The crisp nylon fabric allows positioning of the two kites on their tops as if inflated to show the zigzag stitch that holds the two together. The leading edge and six inches of the top are also stitched. Right: There appears to be only one kite in the sewing machine, but actually there are two stacked together. The zigzag stitch already had been made, and the kite was returned to the machine to show its position during the stitching. Keep the ventrals (triangular fins) out of the stitch, and watch for roll-under of the rib fabric. You just want to stitch the narrow hem of each kite and keel. With the store-bought kites, only a minor amount of sewing needs to be done.

kite. A series of wingsocks are spread apart with a fiberglass rod. The Jalbert design uses many lines to hold the shape. Both designs use the air currents for inflation. The Windbag claims performance very similar to ParaCraft. The kit is sold by Newtons Laboratories for £56.00. Because the wing is held above the fuselage on a pole, I can't help but wonder how well it can taxi or if it will tip over easily.

For those who wish to experience full-scale parafoil flight, you can purchase the ParaPlane from ParaPlane Corp. in New Jersey. This is a full-scale aircraft, classed as an ultralight, using a parachute wing. For information call (609) 663-2234. This company, well known for its parachutes, is now offering the ParaPlane for around $4,000.

The ParaPlane uses trailing edge deflection for steering just like a parachutist would. This method of steering does not work well on small kites. On a model, most of the energy intended to defect the trailing edge of the kite misaligns the fuselage instead. The kite resists being changed. That's why I used the swamp buggy method; just push the fuselage around with propwash on the rudder, and

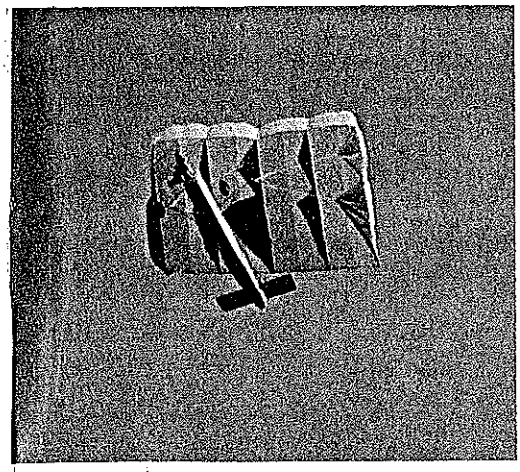


The rear view of ParaCraft that you hope to see shortly after takeoff as the inflated wing rises in contradiction to the notion that parachute wings can only come down.

spider, simply reduce power and try for a partial-power landing. Then move your support points away from the CG.

2) Avoid dead-stick or low-idle landings. In order to obtain flying speeds of 10 mph, you must use a smaller chute than one that would set the model down gently. A chute large enough to make soft power-off landings would only hover in calm air and fly backwards in any type of breeze. There is a desired balance between the chute size, power available to pull the chute, weight of the model, and wind speed range you can fly with. Big chutes hate wind and require more power to pull them. Smaller chutes have greater airspeed, need less power, and can handle a wider range or wind. However, with very small chutes you must keep up the landing speed, just as you would with an ordinary winged model, and limit the overall weight.

3) ParaCraft has an overall wind speed limitation regardless of the chute size. Just as you must consider the limited capability of a hot-air balloon or an ultralight to handle wind, you must also consider the capabilities of ParaCraft. Your first test flight should be performed in calm air so you can accurately judge performance



The turn procedure is simple, as this picture shows. Propwash on the rudder turns the fuselage and twists the twin bridles. The kite wings are obliged to follow the direction of the fuselage. Once airborne, the kite remains inflated even when flying downwind, but don't try to land crosswind or downwind. The wind takes over as the model slows down, and it can blow the chute into the prop—not a happy thing for the chute.

and adjustments.

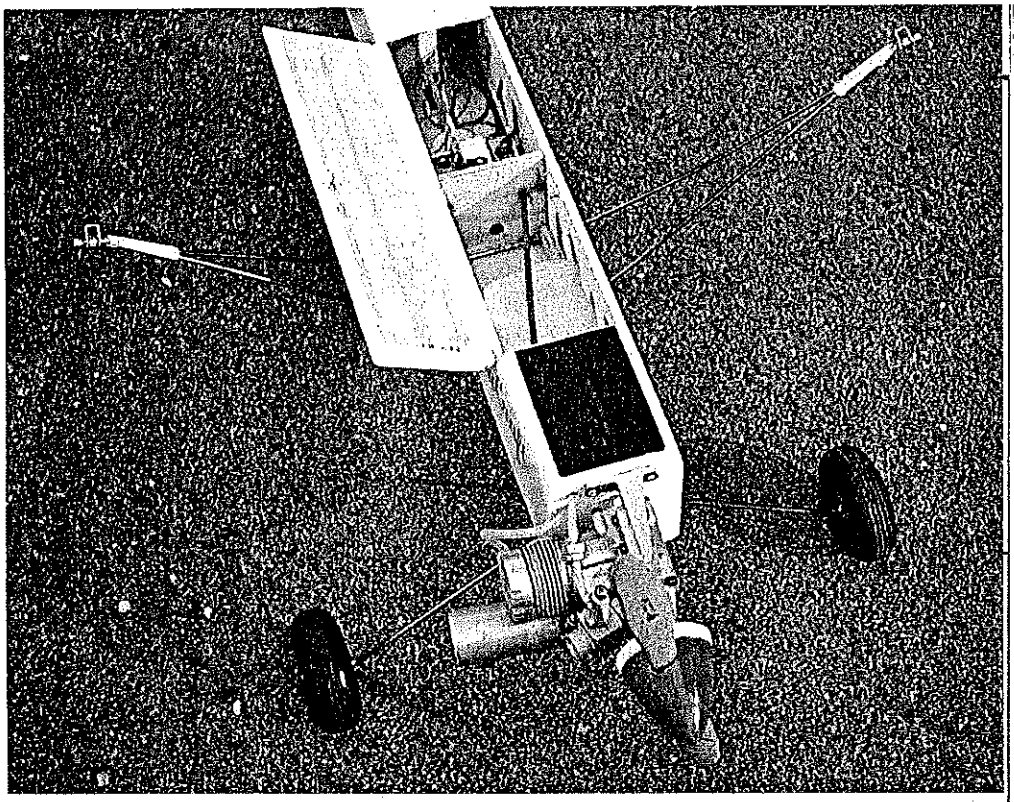
4) Avoid a tricycle landing gear, as any variation in headwind on takeoff will tip the model over. The tail-dragger design, with the mains well forward of the chute supports, will automatically pull the model into alignment with headwinds without tipping the model. Do not move the landing gear rearward.

5) ParaCraft tends to fly slightly nose-high. I have mounted the tank to align it level with the carb at this angle. Do not mount your engine upright. This places the carb even higher and contributes to leaning-out and overheating of the engine. In order to hover, you must raise the nose of the model, which leans-out the engine even more. It is best not to peak your engine so that this angle will not contribute to overheating. If you are flying with a .40 and cannot take off without peaking the engine, change to a more powerful engine. ParaCraft does not have a fast forward speed to help with cooling, so straining an engine in a nose-up position can quickly burn it up.

6) You should also note that flying with the nose of the model at a steep down-angle for more than a few seconds will cause the engine to run dry. There is no flying inertia to hold fuel at the rear of the tank at this slow speed.

As mentioned earlier, avoid dead-stick landings. The model will get a big bang out of them and often will cost you a prop or knock off the muffler. It seldom causes real damage but it's not a graceful way to land.

7) You may see a photo with both wings and a parafoil and get the idea to combine them on ParaCraft. Please don't. Those photos are of chute-assisted landings. Those wings are a lot of trouble for takeoff and flying. Since the model does not have enough airspeed to use wings, all the wings do is catch crosswinds and spoil your flying.



The layout of equipment in the fuselage can be varied, but the author warns that having the correct center of gravity location and hookup point are important for keeping the model under control. Large hatch allows easy equipment changes for balance point trimming.

Paul Garber, left, who is known as the Smithsonian Institution's man-about-kites, inspects the joining of airplane modeling to a familiar kite he has flown before. The ram-air kite was designed and patented by one of Paul's friends, Domina Jalbert. Garber started the Smithsonian's Annual Kite Festival, on the Washington Monument grounds, 18 years ago.

8) Be considerate of other modelers when flying ParaCraft. Because of its helicopter-like performance, ParaCraft creates a sitting target and general nuisance to pilots of conventional fixed-wing aircraft who are trying to take off and land. Please don't hover over the runway just because you have the capability.

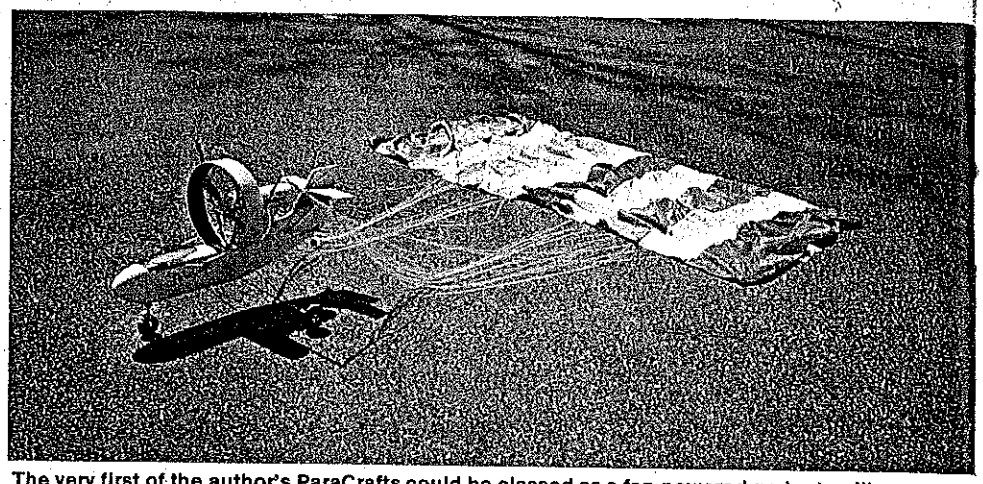
Flying. Novices and experts alike should test their new models in calm air. Expert pilots can soon increase the wind range up to 10 mph in non-turbulent air (for a wind range of 10 to 15 mph, consider using a smaller chute made from two J-5 kites).

To setup for takeoff, have your helper hold the chute at the top, front, outer cor-

ners. The chute should have the front ports open and look exactly as it does in flight. Aim directly into the wind. If you are off by any amount, the chute will track into the wind on release. Simply agree to go along with the wind direction for the roll-out (1 to 6 ft.), and adjust to a new heading after lift-off.

Instruct your helper to let go on your cue. Power-up to about quarter-throttle, and cue for release. The model should pull away with the chute inflated. Shut down if you spot any trouble, such as a line snagged on the stab. If all looks well, power up to full throttle, and watch the model take off. Usually, no commands are required.

If you apply too much power before your helper lets go, you will find the fuselage suspended in midair at the end of the shroud lines. There is a danger, here, if not taken care of, as the model could swing over the assistant's head and cause injury. If the assistant is made aware of the potential problem, he or she can let go as the model rises, and ParaCraft will fly from this position. Otherwise, the pilot must apply down elevator and ease back the throttle to settle the model. The tail extends beyond the stab and rudder for protection from an aborted takeoff. Rehearse the procedures again before another takeoff. Your helper must let go at the beginning of the power-up. Later, you can assist with your own takeoffs and even hand launch.



The very first of the author's ParaCrafts could be classed as a fan-powered go-kart pulling its own sun shade. The oversized chute was too much for the .40, but after reducing the chute area by 35%, the model could be flown in calm air. Attempts to steer by deflecting the chute's trailing edge were useless, as the chute stood its ground while the fuselage tilted. When all was said and done, the rudder proved to be all the steering control needed.

Once the model is airborne, you may move the controls in any combination you wish, but do not give sharp up commands, as you could fly the fuselage back into the chute. This will result in your model being wrapped and ready for burial.

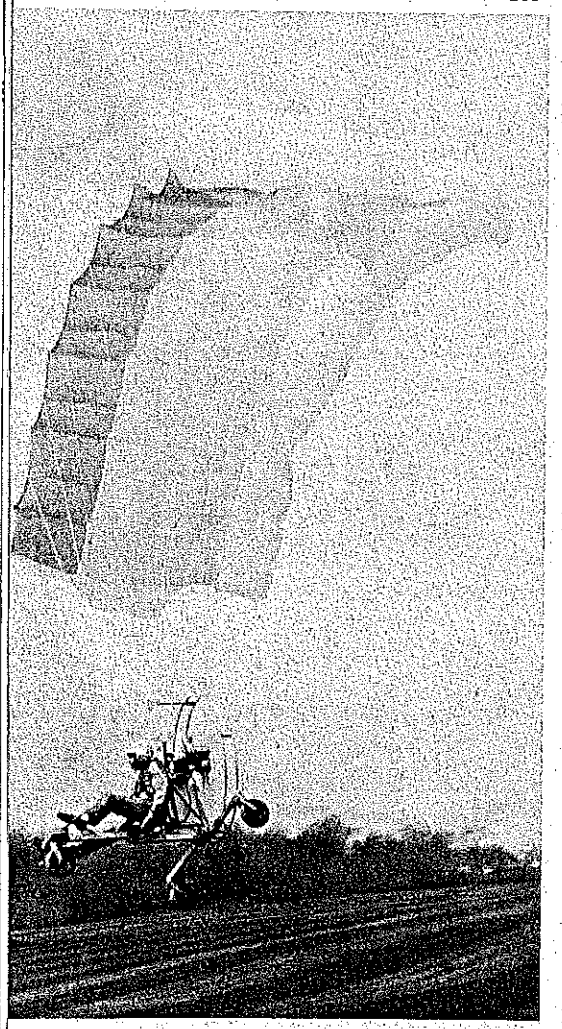
For turns, aggressively move the stick in the direction you wish to go. Add a little up to increase the turn as you would on conventional models.

For landings, set up your approach upwind, and reduce power to about half-throttle. ParaCraft settles faster vertically than conventional models, so don't cut the power to idle. At about 5-ft. altitude, apply up elevator to raise the nose for a three-point landing. Moderately increase power if the model is descending too quickly, and reduce power if it hovers. Expect the model to land with some forward speed unless the wind equals the flying speed. Not all landings will be helicopter-like.

If you get into near-vertical hovering position, do not cut the power suddenly. Instead, apply down elevator to send the fuselage forward. A sudden drop in power in this position will cause a pendulum effect. If you're close to the ground, then the pendulum swings only once. You get the idea; don't drop the model on its tail! Beginners take note; many who are surprised by the fuselage pulling up from too much power often cut the power. Remember to apply down elevator and fly the model forward. Reduce the power slowly.

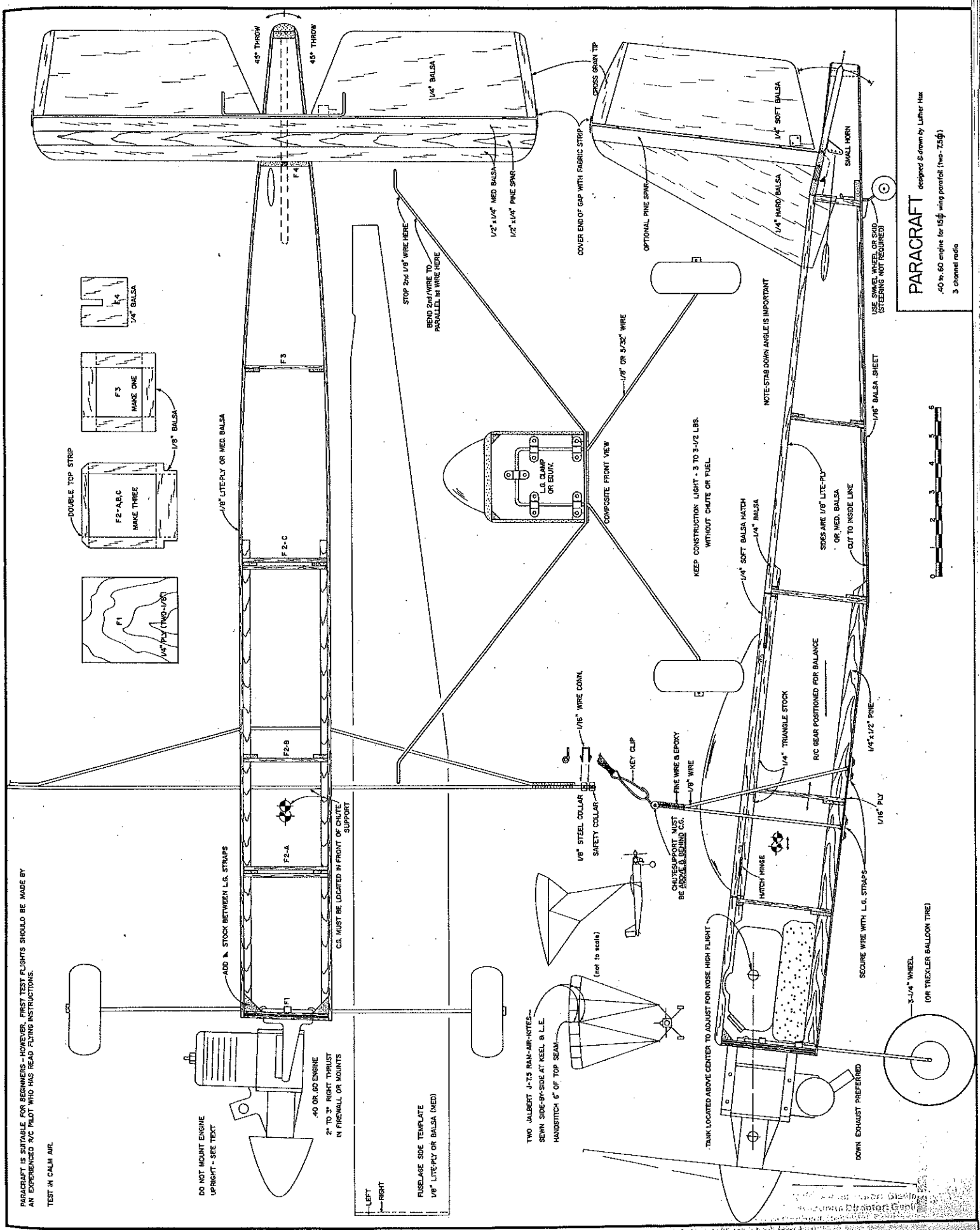
Use a wood prop. This kind is less likely to cut up the chute in case one of your bouncier landings causes the chute to settle over the engine. ParaCraft is extremely

Continued on page 178



Anyone who would like to hop aboard a full-scale version should check the text for information on the ParaPlane, the latest craze in ultralights that can be carried to the flying field in the trunk of an automobile or equal.

The second ParaCraft was a breadboard designed that seemed too ugly to fly. However, the half-inch plywood fuselage and scrap tail surfaces, with exposed radio gear and tank, were functional for positioning equipment and surviving crashes. Once the best dimensions were discovered, this one was returned to the scrap heap from which it originated.


PARACRAFT designed & drawn by Luther Hix
.40 to .60 engine for 15# wing parafoil (two-75#)
3 channel radio
45° THROW
45° THROW
1/4" BALSA
CROSS GRAIN TIP
1/4" SOFT BALSA
SMALL HORN
F4
1/2" x 1/4" MED BALSA
1/2" x 1/4" PINE SPAR
COVER END OF GAP WITH FABRIC STRIP
OPTIONAL PINE SPAR
1/4" HARD BALSA
STOP 2nd 1/8" WIRE HERE
BEND 2nd WIRE TO PARALLEL 1st WIRE HERE
USE SWIVEL WHEEL OR SKID (STEERING NOT REQUIRED)
F4
1/4" BALSA
F3
MAKE ONE
1/8" BALSA
DOUBLE TOP STRIP
F2-A,B,C
MAKE THREE
1/8" LITE-PLY OR MED BALSA
L.G. CLAMP OR EQUIV.
COMPOSITE FRONT VIEW
1/8" OR 5/32" WIRE
NOTE-STAB DOWN ANGLE IS IMPORTANT
1/16" BALSA SHEET
F1
1/4" PLY (TWO-1/8")
F2-C
KEEP CONSTRUCTION LIGHT - 3 TO 3-1/2 LBS. WITHOUT CHUTE OR FUEL
1/4" SOFT BALSA HATCH
1/4" BALSA
SIDES ARE 1/8" LITE-PLY OR MED. BALSA CUT TO INSIDE LINE
F2-B
1/16" WIRE CONN.
KEY CLIP
1/4" TRIANGLE STOCK
R/C GEAR POSITIONED FOR BALANCE
1/4"x1/2" PINE
1/16" PLY
F2-A
1/8" STEEL COLLAR
SAFETY COLLAR
FINE WIRE & EPOXY
1/8" WIRE
CHUTE SUPPORT MUST BE ABOVE & BEHIND C.G.
HATCH HINGE
ADD 1/4" STOCK BETWEEN L.G. STRAPS
C.G. MUST BE LOCATED IN FRONT OF CHUTE SUPPORT
(not to scale)
SECURE WIRE WITH L.G. STRAPS
F1
TWO JALBERT J-73 RAM-AIR-KITES— SEWN SIDE-BY-SIDE AT KEEL & L.E. HANDSTITCH 6" OF TOP SEAM
TANK LOCATED ABOVE CENTER TO ADJUST FOR NOSE HIGH FLIGHT
3-1/4" WHEEL (OR TREXLER BALLOON TIRE)
DO NOT MOUNT ENGINE UPRIGHT - SEE TEXT
.40 OR .60 ENGINE
2° TO 3° RIGHT THRUST IN FIREWALL OR MOUNTS
DOWN EXHAUST PREFERRED
FUSELAGE SIDE TEMPLATE
1/8" LITE-PLY OR BALSA (MED)
LEFT
RIGHT
PARACRAFT IS SUITABLE FOR BEGINNERS - HOWEVER, FIRST TEST FLIGHTS SHOULD BE MADE BY AN EXPERIENCED R/C PILOT WHO HAS READ FLYING INSTRUCTIONS.
TEST IN CALM AIR.

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While a complete photo-study of every display is not feasible, the photographs with this article are representative of the varied and wonderful collection seen at the museum.

When you come to visit the Aero Space Museum, open every day except holidays, take a leisurely journey through aviation history. There are so many things to see. Some displays have audio-visual podiums which explain on the screen and in voice the history of the subject. Such memories they invoke! A visit will surely increase your knowledge of aviation.

ParaCraft/Hux

Continued from page 98

forgiving of errors, but learning the basics gives even the novice a chance of a good first flight.

If you are flying in a strong wind and you find the model drifting backwards and beyond your control, reduce the power, and let the model parachute down. The more you try to fly back against a strong wind, the higher the kite will rise.

Ready to build one? Let's buy the kite wings first. ParaCraft uses two Jalbert J-7.5 ram-air-kites. They are available at kite stores around the country. A friend who is a member of AKA (American Kite Association) or has a copy of *Kite Lines* can assist with locating nearby kite stores. If local shops are not available, you may order by phone from my source, The Kite Site, in Washington, DC. The phone number is (202) 965-4230. You may order using a charge card or request an order form for mail purchases.

The cost of the kites (1984) is approximately $3.00 each for the J-7.5. With $3.00 for shipping, that's a total of $69.00 for the two you will need. If you wish to experiment with a smaller chute for the .40-size model for a higher wind range, order the J-5, also. They are approximately $16.00 each, which will add $32.00 to your order. If you must choose between the two chutes, order the J-7.5, and try the smaller chute later.

For repair work, I suggest you buy a foot or two of rip-stop nylon tape (with adhesive backing). Get several colors, such as yellow and white. This is an excellent repair material for the chute. After applying the tape, you can stitch it in place. To match colors, use permanent marker pens.

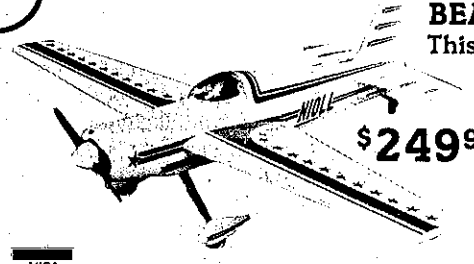
Fly your new kites on 50- to 100-lb.-test nylon line in a mild breeze before using them on ParaCraft. This will help remove the creases and relax the fabric. When the kites arrive, they appear to be permanently pressed in the folded position. You should also acquaint yourself with the parafoil's performance. Notice that they have a strong pull—and remember not to try to fly two of these on ParaCraft on a windy day. Use gloves when flying this size of kite to prevent line burns and cuts.

To attach the two kites to each other, place the kites side-by-side (rib section to rib section) as shown on the drawings. Line up the bottom keel hems, and fold back the (triangular) ventrals, lines, and remainder of the chute fabric. Set the sewing machine for its longest stitch and a wide zigzag.

Assemble the two hems starting at the leading edge. The left zig should enter the fabric, and the right zag should fall just outside the hem. Triple-knot the thread at both ends of the hem. Next, set the machine for a straight stitch, and sew the leading edge of the two chutes together. Center your stitch between the factory stitch and the edge of the fabric. Again, triple-knot both ends of the thread.

Lastly, attach approximately six inches of the top of the kites together. It is not necessary to join the kites all the way down the top edge. Most people will prefer to hand-stitch this, as it is quite difficult to do on a machine. Use large stitches over the manufacturer's stitches, and triple-tie the ends.

Check all seams, hems, and the leading edge intersections for loose threads or open stitches. Once under air pressure, these seams can come apart. Snug all the knots on the bridle lines, and apply a small piece of folded tape to prevent



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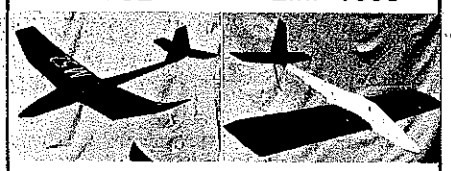

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loosening of the knot. Fly the kites in a mild breeze, and see if all the ventrals are under equal pressure. Shorten a bridle line ⅛-in. at a time if its ventral is flapping in the breeze. Mild vibration of a ventral is normal, and usually no adjustments are required.

Place key clips through the bridle loop. Key clips can be found in variety stores on belt straps for key rings. This provides a quick hookup. To help with solving tangled line problems, I suggest a different colored line be tied between the two bridle clips. Wrap and tie a colored line around one bridle loop just above the key clip. Allow an extra two inches more line than the distance between the chute supports to wrap and tie the other bridle loop. When you find the bridle in a tangled mess, simply follow the colored line through the mess for the proper route to untangle it.

During test flights of ParaCraft you may find that the chute flies misaligned, twisted slightly to one side of the direction of flight. Check for this alignment with the model flying upwind. Correct the alignment by lengthening the rear ventral line on the side that leads (or shortening the rear ventral lines on the side that follows)—about ⅛ in. at a time. It usually takes less than ½ in. Your choice between the two adjustments depends on which does not create looseness in the other ventrals. Note that this alignment problem, or even a closed-up cell, has very little effect on flight and should be no cause for alarm.

Once the adjustments are made, you can secure the knots with a pliable glue such as R/C-56.

If the chute becomes soiled or oily, it should be washed to protect the fabric from damage. Use warm water and mild liquid soap (or Woolite) in your bathtub. Do not use a washing machine. Keep the lines from tangling by tying the chute clips together, and run a line up to a towel rack. Agitate the chute with your hands or lift and dunk the chute while holding it by the trailing edge. A wet chute is very heavy and must be handled carefully to prevent seam damage. Never lift a wet chute by the shroud lines.

After a final rinse, lift the chute by the trailing edge, let the water drain off, and hang it on a line. When just damp, you may fly the chute for final drying and shaping. Do not pack a damp chute in a sealed bag (this includes a chute flown in damp or humid air). Do not expect all fuel stains to disappear. There will always be an oily appearance to these stains, but after washing the fabric should not be sticky or as heavy.

Building the fuselage. The overall appearance of the fuselage is unique, but building isn't unusual. Begin by cutting out all the parts illustrated and bending all wire pieces.

Glue the stab strips together. Complete all tail surfaces, and temporarily hinge the elevator and rudder.

Assemble bulkheads F-2 (a, b, c). Attach ¼ x ½ pine longerons and triangle stock to the fuselage sides. Attach the landing gear to the firewall with clamps or wire. Install blind nuts for the engine mount. Place the fuselage unit upside down over the top view drawing. Glue the bulkheads in place, working from the front to the rear. Turn the fuselage over. Attach the top ¼-in. balsa plank, shape, and sand. Do not apply glue in the hatch area; glue only the front and rear areas. Cut a slot for the rudder in the top plank. Glue on the stab and then