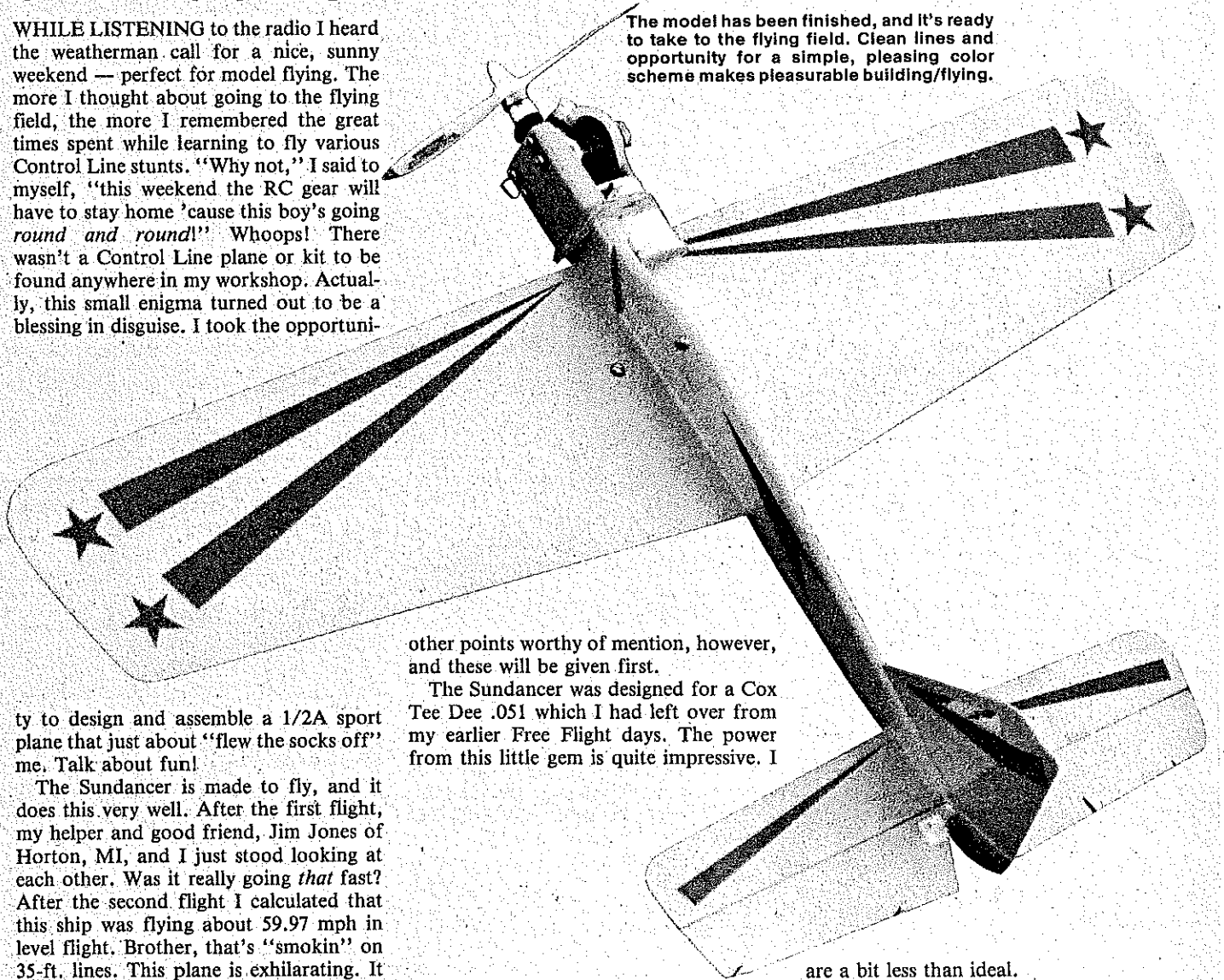
Joseph M. Nunes

Sundancer

This ½A Control Line ship can be built quickly and inexpensively. And it pays big dividends in pleasurable flying.



The model has been finished, and it's ready to take to the flying field. Clean lines and opportunity for a simple, pleasing color scheme makes pleasurable building/flying.

WHILE LISTENING to the radio I heard the weatherman call for a nice, sunny weekend — perfect for model flying. The more I thought about going to the flying field, the more I remembered the great times spent while learning to fly various Control Line stunts. "Why not," I said to myself, "this weekend the RC gear will have to stay home 'cause this boy's going *round and round*!" Whoops! There wasn't a Control Line plane or kit to be found anywhere in my workshop. Actually, this small enigma turned out to be a blessing in disguise. I took the opportunity to design and assemble a 1/2A sport plane that just about "flew the socks off" me. Talk about fun!

The Sundancer is made to fly, and it does this very well. After the first flight, my helper and good friend, Jim Jones of Horton, MI, and I just stood looking at each other. Was it really going *that* fast? After the second flight I calculated that this ship was flying about 59.97 mph in level flight. Brother, that's "smokin" on 35-ft. lines. This plane is exhilarating. It has good pull on the lines, and it tracks real nice. Stunts are *fast* and *fun*! It was a great payoff in enjoyment for a few dollars' worth of balsa and ply and about eight hours total in design/construction time, start to finish.

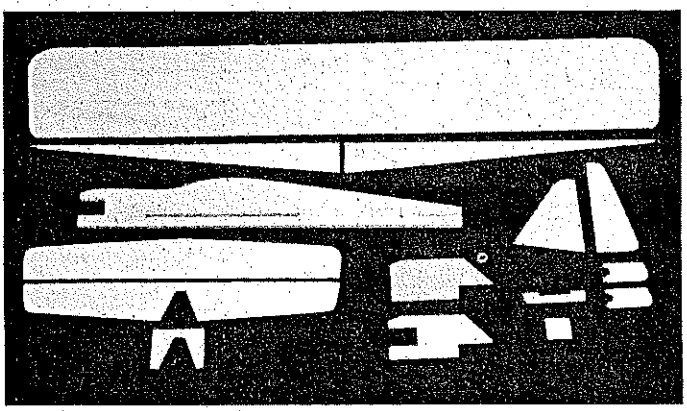
Indeed, as you look over the plans and photos, you'll note that the aircraft is quite easy to build. Simplicity can be very effective when used properly. My design criterion: If it ain't needed, it ain't there. You will find that this boils down to fast, economical construction which results in more flying time. Construction is straightforward. With newcomers in mind, building instructions follow. There are a few other points worthy of mention, however, and these will be given first.

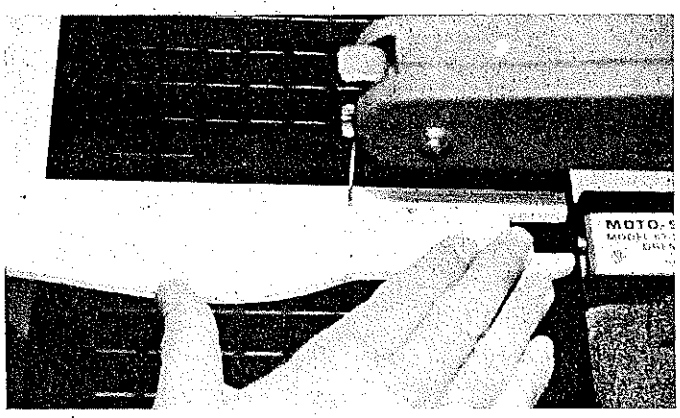
The Sundancer was designed for a Cox Tee Dee .051 which I had left over from my earlier Free Flight days. The power from this little gem is quite impressive. I would highly recommend that you consider a Cox Tee Dee, as shown on the plans, as the engine for your model. Should you want to use a conventional .049, with attached fuel tank, you can easily modify the front end of the model to suit your particular engine. The overall speed will be down without the Tee Dee engine, but the model's maneuverability will still be great.

Small rubberbands are used to secure the fuel tank to the fuselage and for securing the landing gear to the landing gear stop. This kind of mounting is quick and simple, and it provides a bit of shock resistance for those times when landings are a bit less than ideal.

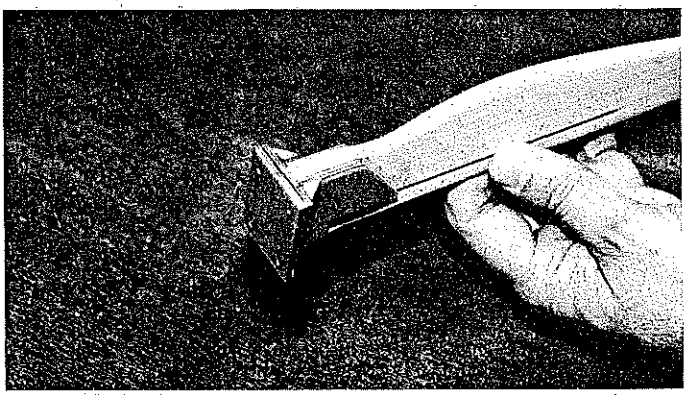
Build lightly. Sand off all excessive weight from the model. Sand all edges, especially on the wing. Go easy on use of epoxy, and be sure to wipe all excess glue from the model.

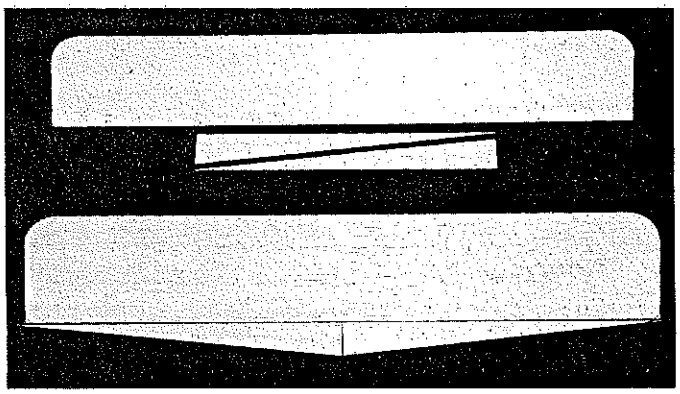
Construction. Build the model on a flat working surface. Cut out the parts with a small table-top hobby saw, such as the one made by Dremel. This will really speed up the cutting chores, especially for the plywood parts. If you do not have such a saw, use a steel straightedge and a sharp hobby knife for the balsa parts. Try to make several light cuts instead of one heavy cut when you are cutting the indi-



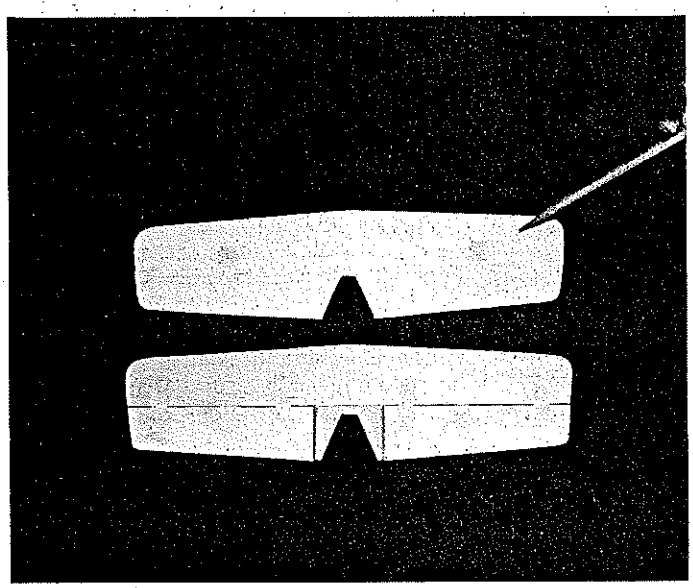


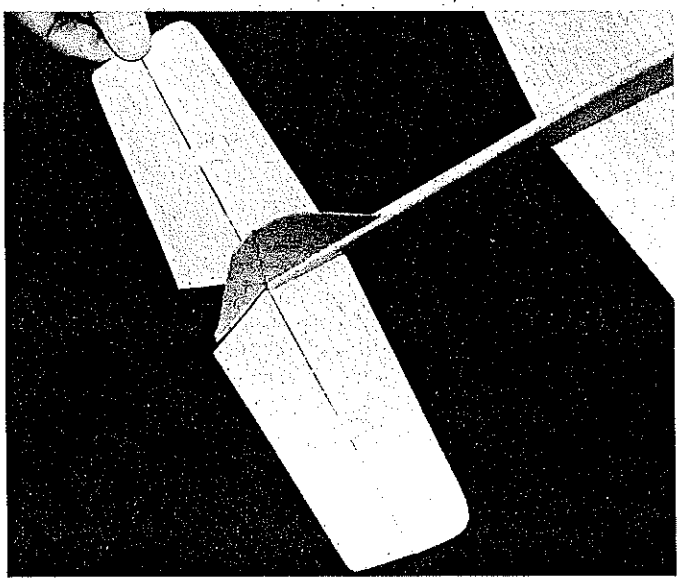
Left: The basic pre-cut parts for the Tee Dee version. Make your own "kit" first for fast, easy construction. Right: A Dremel table saw was used for easily cutting the wing slot in the fuselage blank. Note the pre-drilled ⅛-in. holes at the front and rear of the wing slot.





Left: Front end for the tank-mount .049 Cox engine. Only the front needs to be changed. Note the triangle stock which runs from top to bottom behind the firewall; adds much strength. Right: Basic wing component layout. Top portion of the pic shows the required pieces. Follow the directions in the text to obtain minimum balsa waste for the parts. Bottom of photo shows the correct location of the pieces.





Left: Completed elevator/stabilizer unit, top and bottom views. Note the ply doubler on the elevator bottom and narrow gap at the hinge line (author used cloth hinges). Right: Installed tail feathers; elevator must clear the rudder for proper movement. Remove any excess glue.

vidual parts. Use a coping saw for the plywood items. Take your time, and be careful.

Epoxy refers to the 5-min. type, such as the Devcon brand. Cyanoacrylates (CyA) refers to the thin and thick types, such as Carl Goldberg Jet and Super Jet.

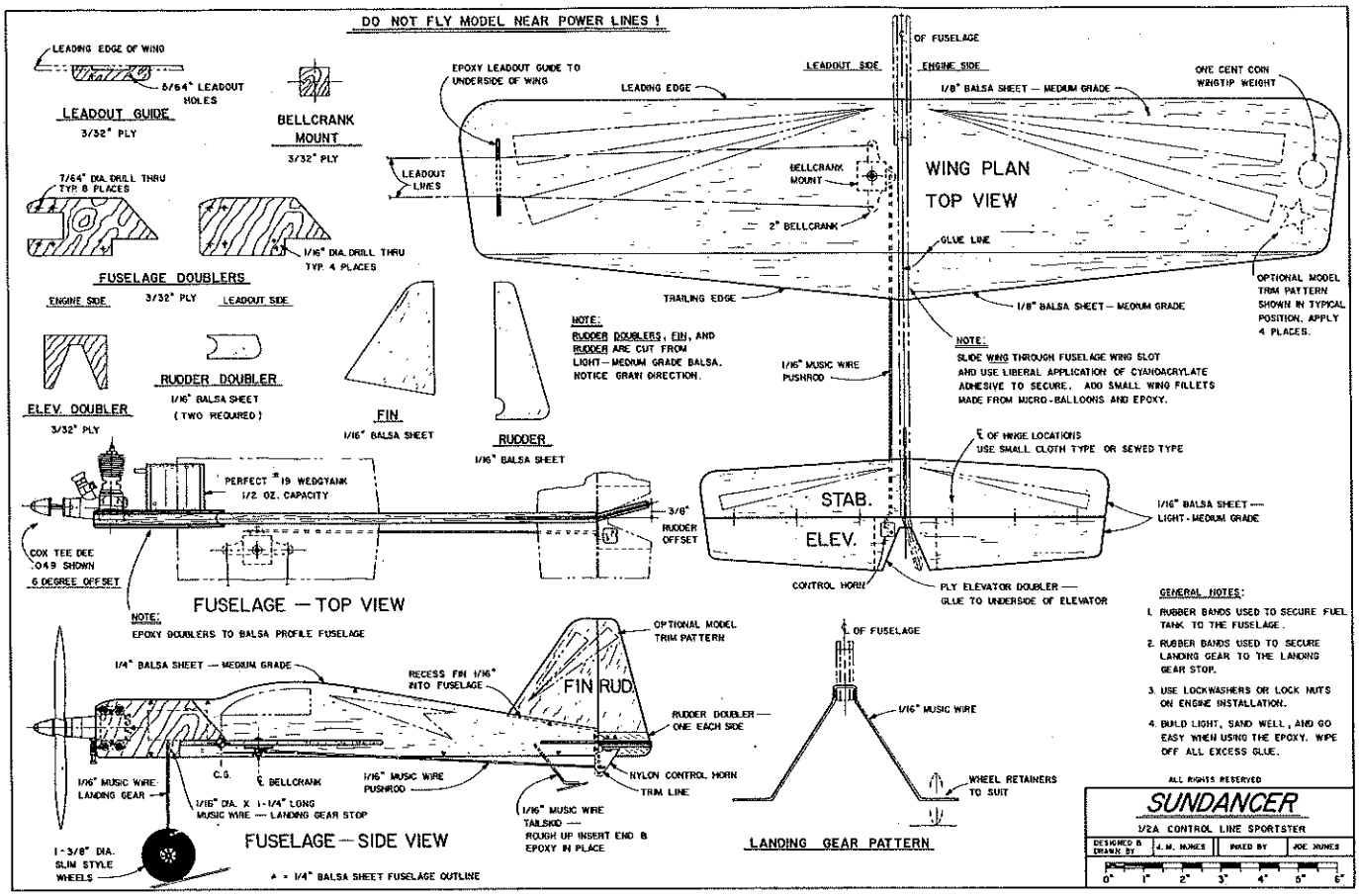
Wing. Select a nice, straight ⅛ x 4 x 36 balsa sheet of medium grade. This should have no splits, soft spots, etc. The wing leading section is cut in one piece. Place a wing tip of the plan over the balsa sheet, locating it close to the end of the sheet. Mark (I use a dressmaker's pattern wheel, connecting the dots with a pen) and cut out this main wing section.

From the remaining rectangular piece of balsa sheet, cut a piece ⅛ x 1¼ x 11½. Take your pen, and draw a diagonal line from corner to corner. Cut the trailing edge pieces from this balsa sheet.

Glue the two trailing edge pieces to the main wing section, making sure the wing is flat and there are no gaps in the mating edges. Use an awl to first poke holes in the mating edges, and then glue with an acetone-based cement, such as Ambroid. Use the double-gluing technique. Apply a liberal coating of cement, and wipe off the excess; allow the glue to dry thoroughly. The use of an acetone cement instead of CyA will allow the wing to be sanded smooth more easily than the hard glue line that is common to CyA.

Cut the opening for the lead-out guide. Locate the position of the bellcrank

Full-Size Plans Available . . . See Page 180



mount. Sand the wing thoroughly, and round all the edges.

Epoxy the lead-out guide to the bottom of the wing, wiping excess epoxy from around the plywood guide and making small fillets as you go. Make sure the guide is at a right angle to the wing. Let it dry thoroughly.

Indent one side of the plywood bellcrank mount with an awl (this will make the glue bond stronger). Place the ply mount at its proper location on the bottom of the wing, and mark around it with a soft pencil. Again using the awl, poke holes into the balsa wing surface without going clear through the wood. Glue the mount to the wing with epoxy, wiping excess glue from around the mount and making small fillets at the same time. When completely dry, locate the center of the mount; drill a hole through the mount and the wing. (Use a back-up board for the drilling to avoid tearing up the wood where the drill goes through.) Do not install the bellcrank yet.

Tail. Cut the components from a 1/16 x 3 x 36 balsa of light-medium grade. Note the grain direction shown on the plan for the various parts. Sand and round the corners. Place the fin on a flat surface, and glue the rudder to it with CyA at the proper offset angle.

Attach the rudder doublers with thin CyA, one on each side, to the lower bottom of the rudder piece. Sand the fin/rudder unit.

Trial-fit the elevator and stabilizer together. Make sure the mating hinge line has no gaps. Use masking tape to hold the parts together, one side at a time, and sand the elevator and stabilizer as a unit. Round the edges.

Cut out and finish-sand the plywood elevator doubler. Indent the mating surfaces with an awl, preparatory to gluing. Attach the doubler to the underside of the elevator with thick CyA. Sand the unit well, making sure the leading edge of the plywood doubler is beveled so as to allow

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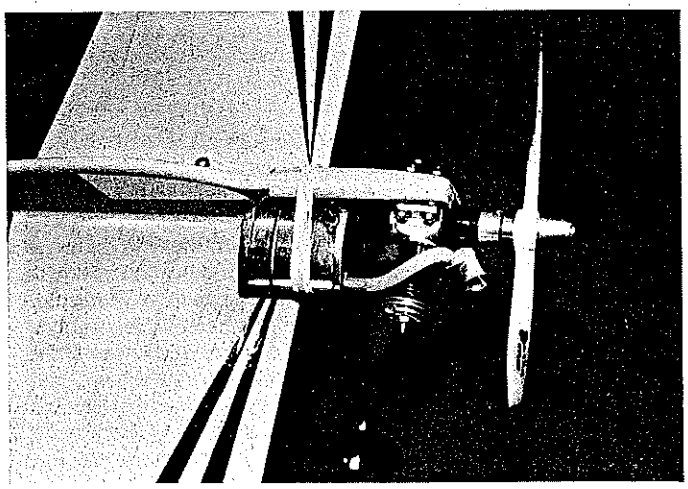

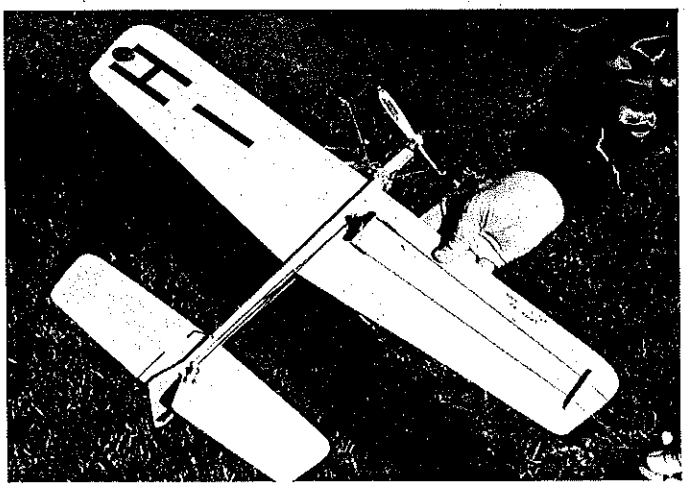

Left: Side-mounted Tee Dee has minimal frontal area for low drag, clean appearance. Rubberbands hold on the wedge tank for easy mounting. Right: Underside is clean and uncluttered, though controls are in the open for easy access and adjustment. All photos by David M. Kirk.

reported that they worked better than the Taipan, although not as well as the carbon fibre props. They're now available, and for a buck you can afford to give away a little bit of performance. More later on how they work out.

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CL Navy Carrier/Perry

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flights around the country. A total of 41 Class I/II and 59 Profile flights were recorded from contests which occurred during the summer months. Only those flights for which timing data were available were used. Flights were ranked by flight score (landing and scale points were not considered), by high speed times, and by low speed times to form some statistical data which might allow each of us to see how we stack up against Carrier modelers in the rest of the United States. The percentile rankings should be interpreted as follows: a 90 percentile flight score (or high/low speed time) would be better than 90 percent of the flights used for the analysis; the 67 percentile score is better than two thirds of the flights; etc.

A look at the differences in percentile rankings shows that, in general, Class II ships outperform Class I models. Considering the number of combined events in some areas, a modeler faced with a choice of building either a Class I or a Class II model might be ahead to build a Class II model; first.

I also ran correlations between high and low speeds, and between overall score and both high and low speeds using a rank-difference method. In the Scale classes, there was little correlation between ranking based only on low speed and ranking based only on high speed. This indicates that trade-offs between high and low-speed performance are common. It may also indicate a change in design philosophy, with larger models appearing (trading high speed for better low speed), but with a large proportion of older models still in use.

The high/low correlation in Profile is much higher. This is probably a reflection of the fact that Profile models have always been larger and couldn't grow to the same extent that Scale ships could. It may also indicate that modelers willing to devote the time to good low-speed performance are also working to improve high-speed scores.

In all classes, high-speed ranking correlated very well with overall (flight score) ranking, but the best match was with the middle and lower scores. In other words, a great high speed didn't guarantee a high overall score, but the worse high speed became, the lower the overall placing was likely to become, as high speed score began to dominate total flight score.

A look at the top 12% of the overall scores showed quite a different relationship. In *every* case, the low speed was also in the best 12%. Also, within each of the top 12% groupings, flight score ranking and low speed ranking were either identical or varied by no more than one place. The message seems clear—a very good low speed will almost guarantee a very good flight score. The range of low speed scores that constituted the top 12% grouping were: 108 to 160 seconds in Class I/II; and 143 to 227 seconds in Profile.

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Sundancer/Nunes

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the elevator to function properly when attached to the fuselage.

Fuselage. Note the small triangles on the plan. These indicate the actual outline of the profile fuselage. Mark and cut the fuselage from a sheet of ¼ x 3 x 36 balsa, medium grade. Make sure there are no cracks, splits, etc., in the balsa.

Mark the wing slot area on the fuselage blank. Drill a ⅛-in. hole at each end of the slot area. Connect the tops and bottoms of those holes, front to back, with a line. Then cut the balsa from the slot, being careful to keep your cutting blade at a right angle to the fuselage side. Similarly mark and remove the wood from the stabilizer slot.

Mark and remove wood on the rear, top fuselage area to make a 1/16-in-deep recess slot that will receive the fin. Try not to make this slot any wider than needed so as to ensure a good parts fit.

Cut out the plywood fuselage doublers. Locate the holes on the outside face of the doublers. Use an awl to make indentations on the *inside* face of each doubler and the mating balsa fuselage area. Epoxy

the ply doublers in their correct positions, and clamp or rubberband them in place until dry.

Drill the engine mounting holes, landing gear hole, and landing gear stop hole. Use a back-up piece of wood to avoid a splintered exit hole. Drill through the engine area now, while the fuselage can be laid flat. Keep the drill at a right angle to your work.

Sand and round all corners. Fuel proof the engine area with epoxy.

Assembly. Slide the main wing through the fuselage wing slot. Be sure the wing is positioned at right angles to the fuselage — both vertically and horizontally. Take your time with this installation, and get it correct. When satisfied, give a liberal application of thick CyA to the joint area. I like to apply this to one side at a time, letting it dry, and then doing the other side. Allow this to dry undisturbed, then make small fillets around the wing/fuselage connection with micro-balloons and epoxy. Wipe the excess fillet material from the model, and let it dry.

Drill holes through the elevator ply doubler for the control horn. Hinge the elevator to the stabilizer using either small cloth hinges (as I did) or with your own sewn hinges.

Insert the elevator/stabilizer unit into the fuselage slot. Make sure this assembly is both horizontally and vertically square to the fuselage. When satisfied, use CyA for attaching to the fuselage.

Trial-fit the fin/rudder to the rear of the fuselage. Open up the elevator cutout, as required, to ensure ease of elevator movement. Bevel the rudder doublers with a sandpaper-covered dowel for this step. When satisfied with the fit and alignment, attach the fin/rudder unit to the fuselage with thick CyA. Be sure to sand the bottom of the rudder to match your fuselage; secure with thick CyA.

Do all surface filling, repair of dings, and final sanding. Finish your model as you like. I painted mine with dope and used a self-stick trim sheet for the highlights. The original trim pattern is shown on the plan for your use, if desired.

Form the landing gear to shape, and cut the landing gear stop to size. Insert the landing gear through the fuselage and the landing gear stop into its position. Rubberband them together. Attach slim-type wheels and your favorite wheel retainers. Make sure the wheels rotate freely.

Bolt the bellcrank to the mount. Attach the nylon control horn to the elevator doubler; shape and attach the pushrod. Shape and glue the tailskid to the bottom of the fuselage with epoxy.

Attach braided cable control line lead-outs to the bellcrank, thread through the ply lead-out guide, and make the ends into finished loops. Glue the outboard wing-tip weight in place with thick CyA.

Pre-flight check. With your model balanced as shown on the plans, check to see that you have an equal amount of up and down elevator movement. Select the control horn hole that provides the control response you want.

Eyeball the finished model from all angles. Check to make sure nothing is warped or lopsided. Be critical as you look over your work. If anything looks as if it could use a bit of extra work, do it before going to fly.

Flight time. Take your completed Sundancer, flight lines, handle, battery, and fuel and head out to your favorite flying site for some fun. Don't be surprised if fellow modelers walk over to admire this plane, because it has character. It won't let you down when you are "doing your thing" in the air, either. Just be sure that your flight lines are good and that your engine will offer consistent runs. Oh, take plenty of fuel. . . you might be flying the Sundancer for quite awhile. This bird wants to fly, so get out there and have a ball!

I'm very pleased with the results I've had with this model, and you will be, too. Fly safely, and tell someone new about model building and flying.

Bill of Materials

1—¼ x 3 x 36 Balsa sheet, medium grade.
1—¼ x 4 x 36 Balsa sheet, medium grade.
1—1/16 x 3 x 36 Balsa sheet, light/medium grade.
1—1/32 x 6 x 12 Aircraft plywood.
1—1/16-in.-dia. Music wire.
1—2-in. Bellcrank unit.
1—Flexible lead-out cables.
1—Small RC nylon control horn.
2—1¼-in.-dia. Slim-style wheels.
4—Wheel retainers.
1—Perfect #19 Wedgtank, ½ oz.
1—.049/.051 Engine and prop.
4—Engine bolts w/lockwashers or lock units.
Adhesives (epoxy and cyanoacrylates), hinge material, small fuel tubing, finishing paints or coverings, and small rubberbands.

Stunt Design/Rabe

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(using the shortcut across the grass). Wouldn't you know it, at that slow speed the rudder is nearly useless. When rolling out a Mustang, you must carefully control pitch attitude and rate. If you let the tail settle slowly, residual rudder effectiveness will hold it. If you hold the tail up too long, then let it drop rapidly, brakes will be required to stay on the concrete until the locked tail wheel takes over and the roll-out gets easy again.

What has all of this to do with CL Stunt? I don't know about your airplanes, but mine always got light on outsides. This suggests to me that left yawing gyroscopic precession is stronger than the simultaneously-occurring right yaw from "P" effects. I'll admit that precession from a ½-oz. prop on a 3- to 4-lb. airplane probably doesn't supply a lot of yaw force —but, first, I don't think much yaw is required to noticeably reduce tension on outsides; second, I don't think that "P" effect is much noticed in a Stunt ship.

Why? "P" increases with increasing angle of attack because as the angle to the relative wind increases so does the differential thrust of the ascending and descending blades of the prop. A full-size plane may reach a large pitch angle to the relative wind when slowed to near stalling or during accelerated pitch maneuvers. See Fig. 1. "P" will be large when angle of attack is large. Most Stunt ships, however, have large full-span flaps which dramatically reduce the body angle to the relative wind while the "effective" angle of attack approaches stall. See Fig. 2.

In full-size planes, the stall angle is always approximately the same whether that angle of attack is reached by slow flight or by maneuvering loads. If the