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THIS MONTH'S COVER

features Miss Jeannie Jackson displaying a Zlin sport R/C model. The Zlin has a Hobbypoxy painted fiberglass fuselage and balsa wings covered with MonoKote. The Zlin was designed and built by Bill Stullick. Transparency by John Elgin and Paul Muehter of Glendale, California.

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From the Shop

RCM STAFF

The staff of RCM wishes to recognize and to congratulate those members of the Scale Squadron of Southern California who conceived and have conducted the highly successful United States Scale Masters program for four consecutive years.

For those who aren't familiar with the program, the following description may be informative. Thirteen scale contests were established around the country to qualify for participation in the U.S. Scale Masters Championships. Even though all of those who qualified were not able to attend the Championships each year, there has been a strong representation from each geographical area of the country. Each Championship brought magnificent scale aircraft, superb precision flying, efficient contest administration, and, most of all, an enjoyable weekend for everyone involved.

The original intent of the Scale Masters Champs was to prove that a program could be organized and conducted for the serious scale enthusiasts which would result in the selection of the scale team to represent the U.S. in the World R/C Scale Championships.

The program exists and has been proven to be workable and practical. The next step is to encourage more modelers to build models to meet the FAI requirements for R/C scale. This step will be difficult as the FAI rules are really not compatible with the existing scale activity in the USA (and several other countries). Hopefully, the delegates to the C.I.A.M. will possibly consider these differences.

Unfortunately, there appears to be some scale enthusiasts who are not in favor of the Scale Masters program for various reasons. One reason is that it only includes R/C. Another is that the program has combined the scale categories into one event. Still another is that the organizers have raised most of the financing from sources outside the hobby industry. And the list continues but any and all of the objections can easily be resolved with a bit of positive effort. This even includes the transfer of the program administration if it will more effectively meet their goals.

The most prominent persons in establishing this program are Harris Lee, Bob Olson, Bert Baker, and Bert Ayers. Their ultimate goal is really very simple, they want to see the United States as number one in R/C Scale, both in the individual and team categories. They have invested a tremendous amount of time and effort as well as a considerable amount of their personal funds toward this goal. And that can't be all bad!

While we singled out the program discussed above, our respect and gratitude is extended to all the individuals and groups who organize so many activities and events to promote R/C modeling. Without their dedicated hard work, how long would this hobby/sport last? It has to be a labor of love, the salary ain't that great. □

Cunningham On RC

CHUCK CUNNINGHAM

Gee, where has another year gone? It seems as though we were just kicking off 1983 and here it is 1984 already. If you really want to see how quickly time passes, take a look at some older issues of RCM, say five years ago. It seems like only a month or two ago that you were looking at a particular construction article, saying to yourself, "Think that I'll order those plans and build that pretty bird." The same kinda holds true for my resolutions to bring out at least one new design each year. Sometimes the designs get finished, but getting the construction article done, the pictures taken, and the plans drawn often seems to take forever. And, at times, forever never even comes. So, let me apologize to all of you who have been wondering where the plans are for the Sky Devil; they are still in rough form, I'll get 'em done someday. Most days are a bit short of hours to get everything done that I want to do and I bet that most of you are in the same fix. Your mind leaps around planning what you want to do, but suddenly mundane things like raking leaves, etc., seem to chew up the available extra hours, to say nothing of the available extra energy. Stay with me gang, I might still get everything done.

Speaking of time passing, I received a letter the other day from Eric Lord from Accrington, England. Eric started his letter September 16, **1982,** added a bit to it Oct. 2, 1982, added a bit more December 7, 1982, then finally finished it off and mailed it to me September 5, **1983.** Heck, if I started a letter, even a couple of days later I couldn't find it to add something to it. Eric was writing about experiments with the Dragonfly airfoil that I have mentioned several times. He enclosed a copy of several pages of study done at McGill University on this type of airfoil section, along with some comments about his experimentations. Eric

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The 3rd Annual Salinas Area Modelers Old Timers contest took place June 4-5, 1983. A sort of laid-back competition with the emphasis on fun. A total of 25 contestants made their way to the Borchard Ranch site for a total of 80 individual entries in 7 separate events. There were limited engine run events, fuel allotment events, and an electric powered event. A total of 159 official flights were scored during the two day contest.

FIGURE 1
DRAGONFLY AIRFOIL

hasn't experimented deeply with his model, but over a period of time he has come to the conclusion that this airfoil really works well. A repeat drawing of this airfoil section is included with this issue. Frankly, it seems to me that a real "dyed in the wool" glider guider might make a quantum leap forward by investigating this airfoil more. The copy of the study that Eric sent to me is not complete, and too long to present here at any rate, but if you are serious about looking into this airfoil, try writing to McGill University library and ask for the text written by B.G. Newman, S.B. Savage, and D. Schouella on "Model Tests on a Wing Section of an Aeschna Dragonfly." Don't ask me for an address for McGill University — Montreal, Canada is all that I know.

Speaking of letters, I received a kind offer from Bill Kawai, who lives in Japan, to translate some of the information on floats that appeared in a Japanese model magazine. I took Bill up on his offer, and he responded in record time. I haven't done as much off-water flying this past summer as I had planned to do. We didn't have our water fly-in this year and as a result I didn't get as much experimentation done as I would have liked, but in the next issue, I'll go into some of Bill's translations. He has also offered to feed information on happenings in the Japanese modeling world to the staff of RCM, so keep your eyes and ears tuned to see what's going on overseas.

This month I would really like to take the time to talk about a real problem. A problem not only to me and all of the other model designers in the world, but also to you, the guys who build the models and kits that we design. Not only will we talk about the problem, but we're going to discuss the solution.

"Okay," you ask, "What kind of a soap box is Chuck climbing upon this month?" Simple --- if you're going to build my design, and want it to fly like I tell you that it does, then, very simply, **build it like I designed it.** The same follows for every other model designer the world over. I don't mean that you shouldn't make cosmetic changes to make it look different, I've been advocating this for years. What I mean is that I suggest that the aircraft be constructed exactly as the plans show as to the relation between the thrust line, the wing chord line, the horizontal stab line, the side thrust line and the vertical stab line, plus, the weight of the finished product.

Every now and then I get a call or letter telling me that the builder's copy of one of my designs just doesn't fly right. I try to tell the modeler what the solution might be but, not looking at the aircraft, it's pretty darn hard to diagnose what the problem might be. As an example, some years ago, I received a letter telling me that the builder/flier was unable to get his Lazy Ace to take off from the ground. It would run for over six hundred feet on the ground, and never take to the air. Now, the normal Lazy Ace can break ground in just ten or twelve feet if quick take-off is your bag, so somewhere, the builder of this model went way wrong. Two thoughts crossed my mind, either he had built the wings with a tremendous amount

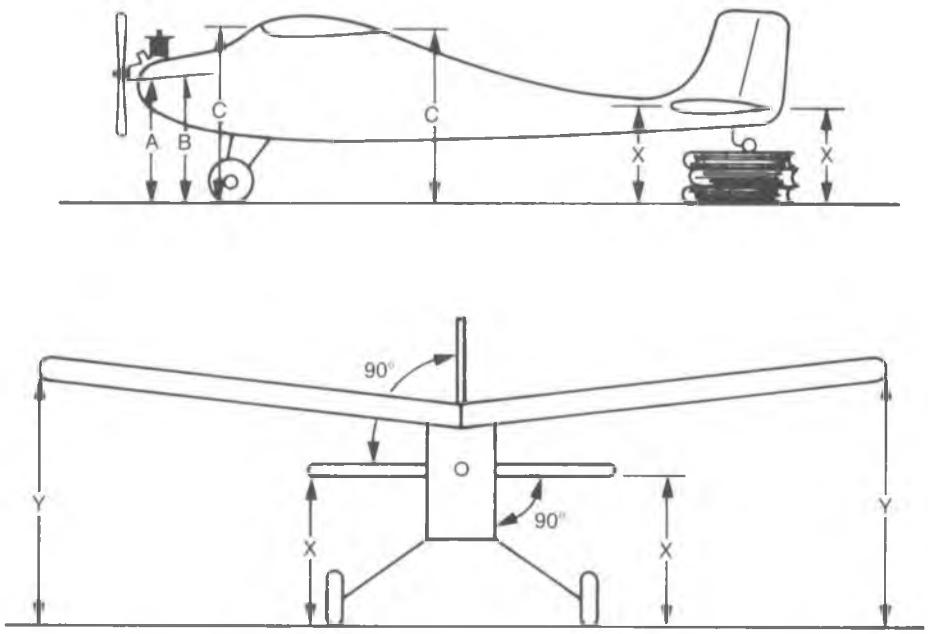

FIGURE 2
CHECKING YOUR AIRCRAFT

of negative in both of them, or that his elevator servo was not working. If you are building from either a kit or from magazine plans, then make sure that you're doing it correctly.

What really brought this to mind was something my old flying buddy, Helmer Johnson experienced. A couple of years ago another friend, who is a good builder, purchased a Sporty Ace kit and proceeded to make a really fine looking Sporty Ace. He had been flying a Lazy Ace prior to this and had lost it when his batteries simply got worked too much one day and decided to rest, taking the aircraft for a snooze also. This builder was never really happy with his Sporty Ace, really too much for him to handle. It's a much quicker flying machine than is the Lazy Ace. Helmer made him an offer for the Sporty Ace, and purchased it. Helmer, too, was never really happy with the Sporty Ace. Trimmed out for level flight, when a bit of up elevator was applied, the aircraft would suddenly jump upward. A good bit of speed was needed to keep it coming in on a landing. Helmer, possessing more models than he has time to fly, put it away for a time. Then he decided to get it out, dust it off and go flying, but since he really wasn't happy, he brought it to me to check over. "After all," he said, "It's your baby, you ought to figure out just what's wrong with it."

We'll get back to Helmer's problem later. Now, here's the important part. Every model that I build is scratch-built. I'm always working on a new design, and each model is built from rough plans and hand worked wood pieces. So, when I finish construction of each new aircraft, I take the time to set them up on a table and to check for all correct incidence angles --- and **you should do this too!** Even if you're building from a kit (as was the case with this Sporty Ace) you should take the time to check everything. Take a look at drawing number two. And, be sure that you do this checking when all construction is complete, and prior to covering your model. It's easier to make changes at this stage than it is later. Once the aircraft is covered and painted, set it up and again check it. This time, take particular care checking for warps.

Okay, you've got your pride and joy propped up on the table with books wedged under the nose or tail to bring it to level. What level? Level the horizontal stab. You can do this with either a small spirit level, an incidence meter, or with a fine ruler. I use all three. Almost all of my designs have an airfoiled horizontal stab, either lifting section, or symmetrical section. You must take pains with this type of aft end to make sure that it really is level. If you're working on a larger bird, your best bet is to put it on the floor (not a carpeted one). Make sure that the floor that you're putting it on is as level as you can find.

Back to the bird --- you've got it level. Next, take the plans and really look at them this time. Check what the wing incidence in relation to the horizontal stab is supposed to be. By this I mean what the relation is between a line passing from the center of the leading edge of the wing through the trailing edge of the wing to a line passing in the same direction through the horizontal stab. Let's assume that it should be zero. In other words, the two reference lines are exactly parallel to each other. On your blocked-up model, is this true? Measure the center of the fore and aft edges of the horizontal stab. Okay, it's exactly the same. Now, measure the fore and aft center points on the wing. (First, make sure that the ailerons on each side are exactly level, not drooped or raised.) Are they the same? If they are, you're a pretty good builder; but if they are not, which is generally the case, you've got some work ahead of you. Shim under the leading or trailing edge of the wing until you get it the way that the **designer wanted it to be.** If the wing has positive in it, then make a reference drawing on the plans to find out how much the leading edge of the wing should be above the trailing edge . . . checking all of the time against the inclination of the horizontal stab. Check the wing to see if you built the correct positive into it. Okay, now, go around to the other side of your model and see how the other wing panel checks out. Measure exactly the same distance out from the fuselage as you did on the other wing panel. If it doesn't check out the same, take the time to figure out why. Perhaps you didn't join the two wing panels correctly, or you have built in a warp. Now is the time to find out, and to take corrective action.

Check the horizontal stab on the other side, you can build in a warp here also, you know. Perhaps the wing saddle on the fuselage isn't the same as on the other side, causing the wing to be misaligned with the fuselage and with the horizontal stab. Check it out. Next, draw a simple template on a piece of typing paper to indicate the desired amount of down thrust. You can make this drawing by laying the paper on the plans and tracing through. Now, put this template against the side of the fuselage. How does the thrust on your model compare with the thrust line on the plans? If it's the same, great, go on to the next checking item; but, if it isn't, then change it. Suppose that the designer called for a couple of degrees of down thrust, yet when you built your aircraft you built in a couple of degrees of up thrust. It sure is going to make some changes in the way that your aircraft flies as opposed to the way that it is supposed to fly. Check the side thrust at the same time. Do the plans call for zero side thrust, or some right thrust. How about your model, do you actually have some left thrust built into it? The torque of the engine causes most aircraft to tip to the left, with left thrust; this tipping is magnified and can cause some very unexplained crashes. (I've looked at at least a jillion first time models, and found at least a half-a-jillion with left thrust instead of right.)

How about the vertical stab, is it square with the fuselage? Is it perpendicular with the horizontal stab? Is the horizontal stab perpendicular to the fuselage side? And, of equal, if not more importance, is the hinge line on the horizontal stab square with a center line drawn on the top view of the fuselage? If this hinge line is not square, a rolling movement to the aircraft will be imparted at each up or down command. If the hinge line sweeps aft, as on an aircraft with a swept back tail, are the sweeps both equal? If not, a rolling motion again.

Get down on your tummy (if the aircraft is parked on the floor) and check all of the dimensions that you can find. Make sure that everything is the way that the **designer designed it to be.** How about the landing gear? Is it square, or is one main wheel ahead of the other? Makes for a kinda squirrely take-off run if the wheels are out of alignment. A trike geared aircraft can overcome this, but a tail dragger has a tough time. How about the tail wheel --- does it track the way the rudder does?

When you have checked over everything on your new model, and you are satisfied that it is as near perfect as you can make it, go ahead and finish the entire aircraft. Then, before you go fly, check it again. Whoops, two very important things that I forgot to mention. Check the weight, is it just about as the **designer designed it to be,** or is it a lot more? Did the original take to the air with plastic film for covering, and your beauty is painted with latex house paint? How about balancing the wing, or wings? Place the tips of your fingers at the center chord of the wing and see if one wing tip is heavier than the other. Do this prior to covering so that you can add weight to the lighter tip. If you have a bipe, then be sure to check both wings. An aircraft with a heavy wing will tend to turn in the direction of the heavier wing tip.

Now that you've had a brief lesson in checking out your aircraft to see if it was constructed as the designer intended it to be, let's go back to the Sporty Ace that was bugging Helmer. After propping up the tail and getting everything level, I began checking the wings. Since the Sporty Ace is a biplane I removed the top wing and checked the bottom wing in place. The bottom wing had about 3/32" negative; in other words, the leading edge of the bottom wing was 3/32" lower than the trailing edge. A shim between the trailing edge and the fuselage corrected this. Then the top wing was installed and the bottom wing removed. (You can't accurately measure the leading and trailing edges with both wings in place.) Using the trusty ruler on the top wing showed that the leading edge of the top wing was almost 5/16" negative to the trailing edge. What the heck had happened? Looking more closely I discovered that the builder had not located the wire cabane struts in the correct position on the fuselage. On this aircraft the cabane design is set up as a parallelogram. If each point is in the correct place, the incidence is automatically correct. The builder had moved the forward fuselage attaching point aft of the correct location, causing a negative cast to the wing. Since both wings were negative, a casual glance wouldn't show this up, but when checking against the stab it suddenly became obvious why it

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hunted when up elevator was given. The correct set-up for this aircraft is with the wings both a zero with the stab. Everything else was checked over. Another problem was in that the tail wheel was set at an angle opposite to the rudder, so that at neutral, or slightly right on the rudder, the tail wheel was calling for a left turn. Since the Sporty Ace lifts its tail very quickly on a take-off run, this had not created quite as much problem as it might have on another model. Finally, the weight. This aircraft weighs 1 lb. more than the designed weight. One pound on a relatively small model is a bunch, it's about twenty percent overweight. Naturally, with this much overweight, a faster landing speed is needed to keep the aircraft from stalling. With the changes of wing setting, this aircraft began to fly more like it should. Not much could be done about the overweight condition, so it is simply landed at a higher landing speed.

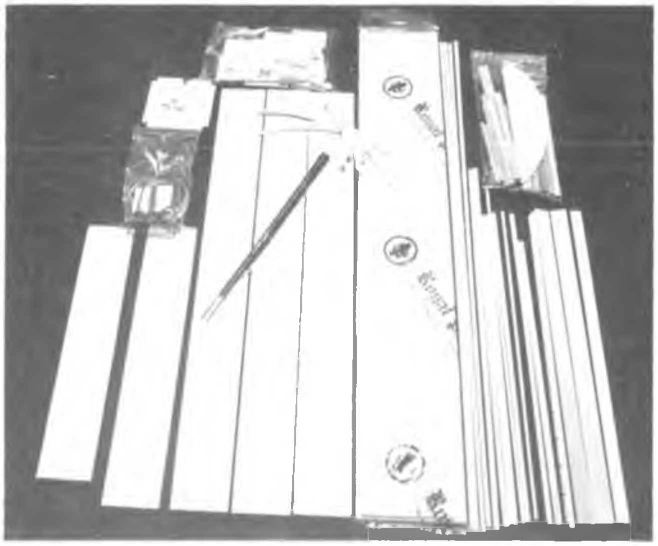
If you're building any model, you owe it to yourself, and to the designer, to make it as nearly correct as you can. If something isn't just right, the chance is about 99.9 to 1 that the trouble can be traced back to something that you have done. This is not to say that there cannot be a mistake in the original design, or on the plans as drawn, but generally these are checked thoroughly prior to ever presenting it in a magazine or in kit form.

So much for the good old soap box this month. One thought, going back to water flying, it sure does seem that if you're a serious "rise off water" pilot that you should give some thought to making your winter project a flying boat. The lake that we fly from often has some choppy waves to it, and the flying boats (all a derivation of Ken Willard's great SeaMaster) handle the chop much better than floats. I'm going to work on a flying boat this winter (at least Helmer tells me that I am) so that when spring comes and we can get back to the lake I won't be drying out my radio and engine because I caught a choppy wave on a fast touch and go and did a really super water oriented cartwheel. I keep talking myself out of building a Quadra powered flying boat but, who knows, one of those wings that are gathering dust just might find its way to the top of a flying boat hull.

Now, that I've broken the water with talk of larger engines, it's time to again mark your calendar for the middle of July, 1984 for the Seventh Annual Southwest Jumbo Fly-In. More information in the next issue. Since it's building time, get down the building board and get ready for spring --- but, when you build, take the time for a final check. □

RCM PRODUCT REVIEW

Royal Products BLERIOT



SPECIFICATIONS

Name	BLERIOT
Aircraft Type	High Wing Monoplane
Manufactured By	Royal Products 790 W. Tennessee Denver, Colorado 80223
Mfg. Suggested Retail Price	$59.95
Available From	Both Mfg. and Retail
Wingspan	51¾ Inches
Wing Chord	12¾ Inches
Total Wing Area	564 Sq. In.
Fuselage Length	47¾ Inches
Stabilizer Span	21⅝ Inches
Total Stab Area	108 Sq. In.
Recommended Engine Range	.35-.40
Recommend Fuel Tank Size	6 Oz.
Recommended No. of Channels	3
Rec. Control Functions	Rud., Elev., Throt.
Basic Materials Used In Construction:	
Fuselage	Spruce, Plywood & Balsa
Wing	Balsa and Hardwood
Tail Surfaces	Balsa and Hardwood
Building Instructions On Plan Sheets	Yes
Instruction Manual	Yes (5 pages)
Construction Photos	No (exploded view drawings)

RCM PROTOTYPE

Radio Used	Futaba FP-5-JN with 3 S-20 servos
Engine Make & Disp.	Saito FA 30 Four Stroke
Tank Size Used	6 Oz. Sullivan
Weight, Ready to Fly	76 Oz.
Wing Loading	19.38 Oz./Sq. Ft.

SUMMARY

WE LIKED THE:
Simplicity of construction, plans and exploded views.
WE DIDN'T LIKE THE:
No problems encountered.

Many scale kits are offered by Royal Products. One of these fine kits that caught my eye was the Bleriot. This good flying old timer comes in a complete, neatly packed kit with five instruction sheets, one plan sheet with exploded views. Parts, die-cutting and pre-fab were very good. This kit comes in a box 38" x 7½" x 2¾" and the only other materials a builder will need is glue, covering material (for wings and tail), and paint.

Building the model is very basic and simple and reminds us of building rubber powered kits many years ago. This model was built entirely with Hot Stuff for strength, quickness and lightness. Flying wire comes with the model but, for realism, we used some Proctor accessories: cable, turnbuckles, wheels and prop.

Construction:

To build the fuselage, simply lay out one side, Hot Stuff and remove from plans, and repeat for the other side. After removing both sides, join them as per the top view of the plans. Cover with plywood where shown. Build the motor mount from wood pieces and glue to the firewall. Be sure to fit the motor mount to your engine before using the glue. To simulate cross bracing that was used on the real plane, you can add string or fine wire between the vertical and horizontal braces. This is done aft of the plywood on the fuselage and continued all the way to the rear; do the sides, top and bottom.

Building the wing is similar to the fuselage. Lay out the ribs, spar, trailing edge and wing tips over the plans and Hot Stuff into place. The leading edge is unique in that it is a dowel. After you have this glued in place, remove from plans and sand where necessary. The wing is now ready to cover. The tail surfaces (vertical fin and elevator) are built over the plans just as simply as was the wing.

Covering:

For realism, we suggest covering the model with silk or fabric. Any suitable model covering will do. Staining the entire fuselage, or at least the aft portion, will also add realism. If you do use the stain, be sure to fuelproof. After the wings and tail are covered, paint with clear dope. The wings on the real aircraft were not painted with any color.

Engine:

The Saito FA 30 four stroke engine was used to power this model. If you haven't flown a model with a four stroke engine, you're missing something. The sound is just beautiful and folks take notice real quick. The Saito is easy to start, runs great and has an unbelievable idle. Four

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Here is another design from the famous homebuilt aircraft designer, Ray Stits. Paul Denson has created this Stand-Off Scale reproduction of the full size bird.

SKEETO SA8

By Paul Denson

Skeeto was the product of an experiment in the ultra-light concept conducted by Ray Stits way back in the middle '50's. It was developed as a lightweight, economical, homebuilt project which would cost no more than $500.00. This cost would include everything, even fabric, dope, engine, wheels and prop. The majority of the 175 lb. plane was made of wood with chromoly tubing at strategic places for safety. At this price, it was obvious that a modified, off the shelf, engine would be required.

Industrial wheels, with no brakes, were used and it was necessary at times, when taxiing downwind, for the pilot to "bail out" and stop the plane before it hit a fence or ran into a ditch. Since he weighed more than the plane, it was always stopped in time.

As designed, Skeeto had a 24 ft. wingspan which was stretched to 30 ft. when the original engine was found insufficient in the power department and a heavier engine was installed. The extra wing length helped keep the proposed loading at 3.1 lbs./sq. ft. The length was 18 ft., 150 sq. ft. wing area, 45 mph cruising, 20 mph landing, and 250 ft./min. rate of climb. No question about it, Skeeto did fly but, in every case, it was the engine that quit first, apparently one of those projects that was "born 30 years too soon." Sorry to say, after making a complete evaluation, the project was shelved in 1958 due to lack of a suitable lightweight engine and it was decided to donate Skeeto to the Air Museum in Claremont, California.

Since Sport flying is our forte, we are always looking for something that will fill this category. When we found Skeeto in a 1965 copy of Homebuilt Aircraft, we were looking for a plane that could fly low and slow, something small enough to fit into the car without take-down, low fuel consumption and need a minimum of care. Skeeto fit the bill, parasol wing for stability, small uncowled engine, big rudder and stab for quick maneuvers and, as a whole, particularly uncomplicated.

Already, we had a wing in mind and to the best of our research, the airfoil was designed by Ken Willard and made its first appearance years ago in RCM on his Showmaster. The "banana winged plane" as it has, of late, been fondly called with its .049 engine, was designed specifically for the schoolyard or other small field flying. After building and flying the Showmaster, we plotted the positions of the upper and lower cambers then enlarged the wing to its present chord and span. The wing has been used previously on a number of planes and we are very familiar with its flying characteristics, this is the main reason for its choice. We have even experimented with strip flaperons which did absolutely nothing for this fine wing. It flies so well on three channels that, even though Skeeto has ailerons, we decided to keep it simple.

With the wing already picked out, it was but a quick bunch of scratches on butcher paper that we had enough lines to build a plane. Do not ever ask a scratch-builder to borrow his plans, they do not exist or at least so no one else could build a plane from them. If it flies, then he takes all the time necessary to draw a buildable set of plans. Before Skeeto was even half completed, it was discovered that it

had the same inherent problem the full size had — **nose heaviness.** Heavier and heavier engines necessitated adding a sandbag ballast to the tail area for balance. Once, this bag was removed for patching and reinstallation was forgotten on a test flight. Needless to say, Ray had the stick in his lap the whole flight. If you look closely in one of the photographs, taken before covering, you can see a big lead weight in the tail for balance. It is a good thing our model is "stand way off" scale because we chopped a full half inch off the nose and moved the engine back as far as we could on the mount. This took out a lot of the nose heaviness but, as in the full scale, it is necessary to carry some weight in the tail. This, however, in no way affects the great way she flies.

We feel the beginner should start with a low powered engine, .15-.20, a parasol wing with lots of dihedral and one that is not too complicated to build. The Skeeto fills that bill. Not only is it easy to build but it is also a snap to fly. You experts don't let the above turn you off, it is also fun to fly, you can relax from your zoomers and play around the field at one fourth speed a couple of feet off the ground, making sudden turns without worrying about snapping into the ground. In a slight breeze, it will fly backwards with full up elevator. (P.S. you do not need a lumber yard to build it.)

We generally kit a scratch-built before starting any construction. You need a fair amount of 3/16" square balsa longeron stock, a few sheets of 3/32" balsa for wing ribs, and various other sticks and sheets for odds and ends. Pick up a couple of pieces of 3/4" T.E. stock in addition to the required 1¼" T.E. stock; this is used as shim stock when building the wing.

Pin the leading edge to the plans, cut rib notches in the trailing edge then pin it to the plans over the shim. Then merrily drop the ribs into each station. Sock them in securely with a cyanoacrylate such as Super Jet, then mist a bit of X-Cel over all to thoroughly set up the glue. Place a strip of waxpaper between the T.E. and the shim or, with Super Jet, it will become an integral part of the wing. Add both top spars and glue securely in place. Do not glue the two center ribs at this time. Leave them loosely in place until you epoxy the dihedral joint. Remove from the plans, turn upside down and add the bottom spars. To build in the dihedral, pin the left half of the wing to the plans, check, then butt the right and left halves together along the centerline. Prop up the right tip to 6½", **no!** it isn't too much, even though it looks that way. Sand off the spars until they match lengthwise and anglewise. When everything fits like a glove or even like a mitten, slap on a bunch of epoxy, it fills the gaps, and you have a one-piece wing. Check the location of your dihedral braces and remove small parts of the center rib so the braces may be epoxied to each side of the spars. Glue the center section rib to the spars and you are ready for webbing. Cut a bunch of webbing, grain up and down, from 3/32" sheet and glue it to the front sides of the forward spars only. Plane or sand the leading edge spar until it matches the curve of the ribs, then add the leading edge sheeting allowing it to overlap the leading edge spar. The center sheeting and capstrips follow; these and the leading edge sheeting go on top of the wing only. Next, add the wing tips, they keep the covering from pulling the outer ribs into deep curves. This wing is kind of different from most, it has two tabs in the lower center for the cabane and two short spars in the outer wing for strut anchors.

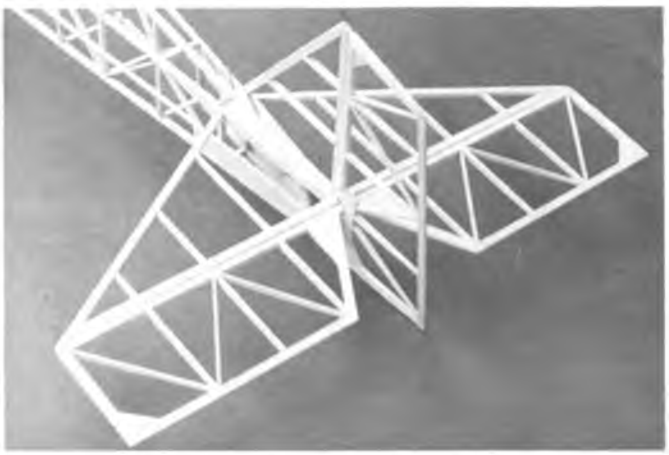
The tail is very simple and straightforward. Just pin down the proper size and length of pieces on the plans and Super Jet them in place. Because we have a belt sander, we tapered the rudder and elevator, however, it really isn't necessary. In fact, the whole tail could be built from 3/16" light sheet balsa and you would need less weight in the tail.

The fuselage is built like the old rubber jobs. Pin down the longerons and glue all the cross sticks in-between. We do not recommend

Ray Stits shown with the original full size Skeeto. A.F. Bergman photo.

Ah! yes, the amber colored 16 oz. beverage can finds its place.

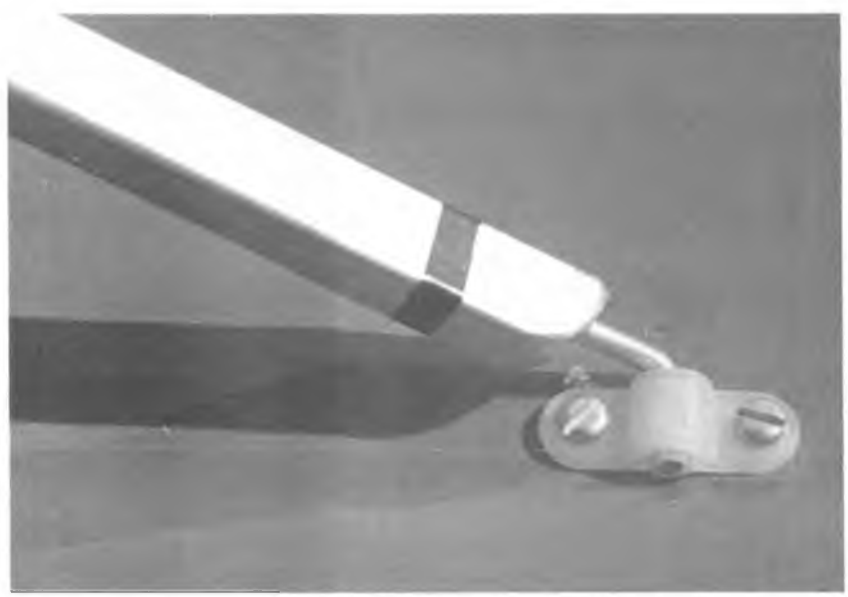
Cabane struts have wing anchors attached. Will be secured into wing.



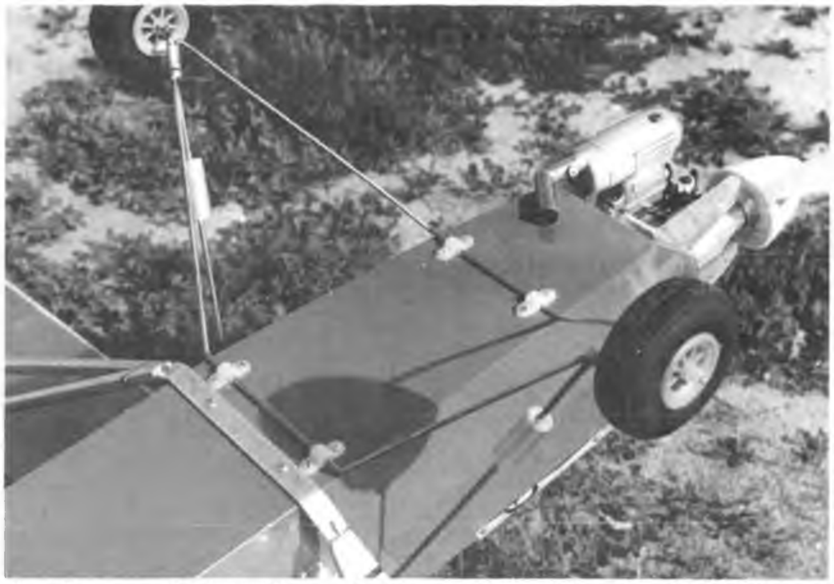
Tail ready to cover. How many pounds of lead did you say?

Round the leading edge and sand. The wing is ready to cover.

Close-up of cabane struts and landing gear side brace.



Goldberg landing gear clip used as strut terminal on wing. Note NyRod filler on end of cup hook.



Landing gear attachment lower strut brace. Note muffler extension which was later turned 90° to point down.

Paul ready for a Saturday of flying. Photo by Kenton Krauss.

Skeeto relaxes after first flight.

Skeeto looks kinda nude without trim.

Coors hatch was painted at a later date.

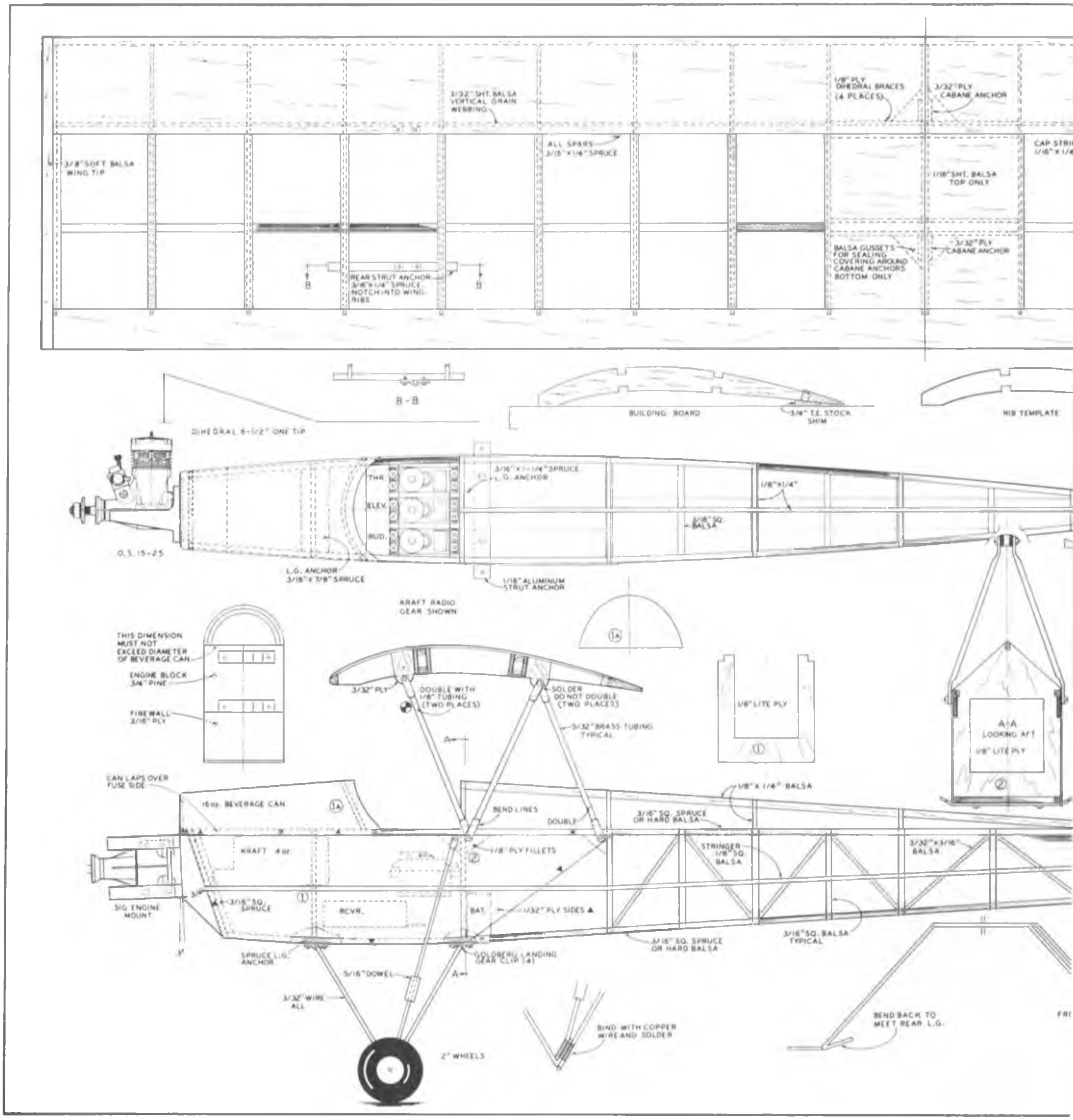
Skeeto flight shot by Kenton Krauss.

building the second side on top of the first side. If you do, and use cyanoacrylates, they will now be one and you will never get them apart. If, when you build, you are careful, the two sides will be the same. Cut the two pieces of side sheeting from 1/32" ply and glue them to the fuselage frames. **Be careful** — do not make two left sides. Why do we always caution you builders about that? No one ever makes two left fuselage sides! Oh! really --- once we built a glider from a set of plans drawn in France, would you believe it, the plans had two left wings and we built them that way before we discovered the error!

By using the firewall and Former #1 you can sort of assemble the fuselage upside down on the top view. Pull the tail ends together with a clothespin until the glue dries. Turn over and drop Former #2 in place; the compression will hold it there till the Super Jet sets. Hah! Now you are a "Jet Setter" — bad joke! All the cross members may be cut and glued in place. We put the turtledeck longeron in place, glue it at each end then, using 1/4" x 1/8" balsa strips, glue in the bracing, kind of cut and try. Just remember the old adage, "If it is too short, cut if off some more, if it is too long, throw it away," or something like that. Do not forget the ply gussets, you will need anchors for the cabane and landing gear screws.

Why the nose block? Well, it adds weight to an already too nose heavy plane. And, besides, the full size has something up front that looks like that — okay? It does give you something solid to anchor your engine mount to. We used long 6-32 bolts but sheet metal screws would work just as well.

The first time we saw a picture of Skeeto, we discovered that the cowl in front of the cockpit was actually the gas tank. That impressed us. Almost immediately, a beverage can came to mind as a perfect scale replacement for that tank. First off, we tried soft drink beverage cans, then, as the plane came to fruition and the fuselage took size in relationship to the wing, we came to the conclusion that since soft drinks only came in 12



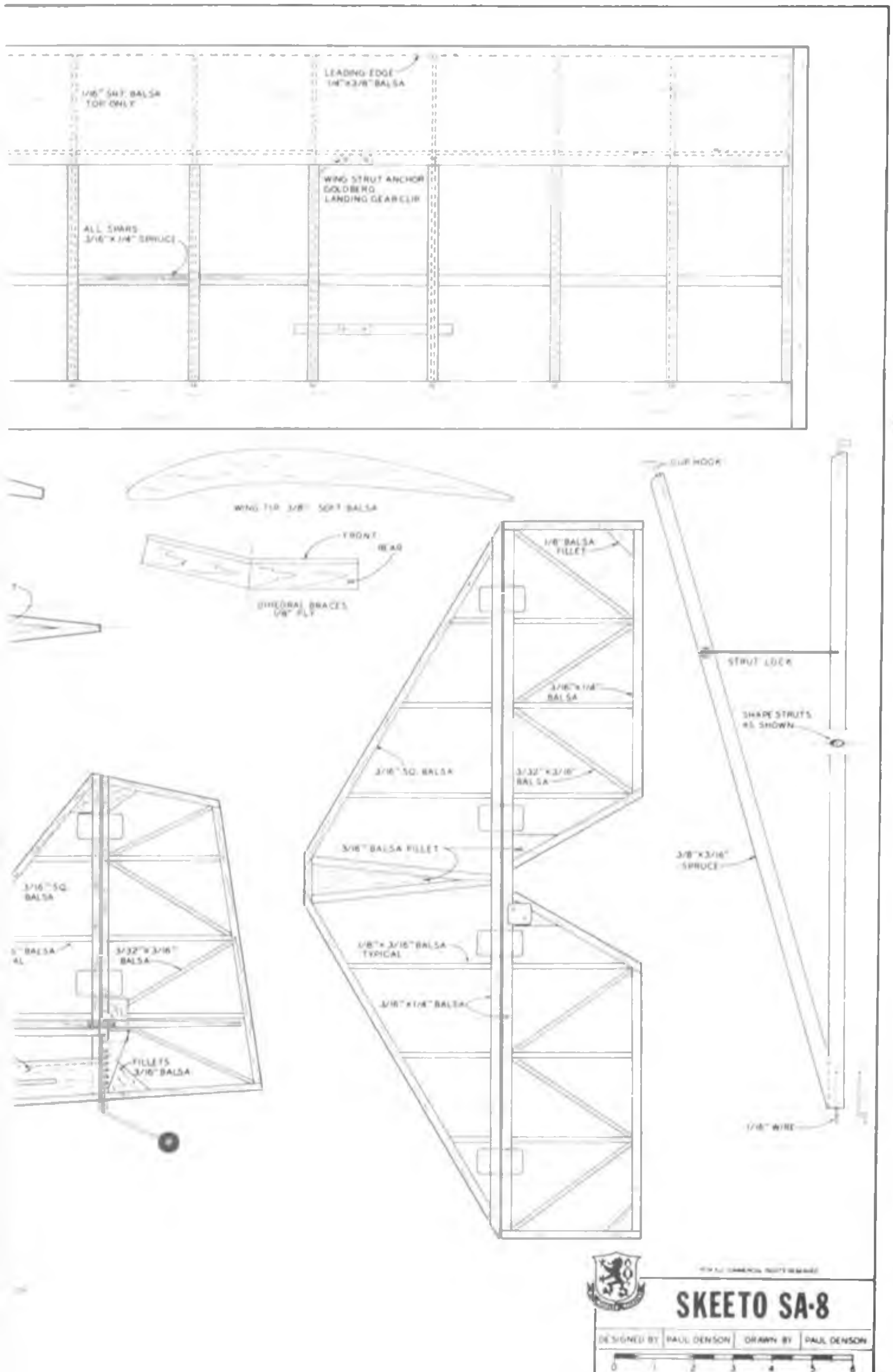
oz. cans which were too short, we would have to shift to the kind of beverages that came in the longer, 16 oz. cans.

So, for experimental purposes only, a six pack of these cans was purchased. As we cleaned out the cans we discovered that most of them had dents in the soft aluminum, which were acquired in manufacture and transportation to the local outlets. When this cowl would be painted to match the fuselage, these dents would detract from the fine finish. So, there was nothing else to do but buy another six pack of the amber beverage and proceed to empty thesh cans . . . hic! . . . like we did with the ozzhers. This time the cents in the dans were getting smaller and smaller and harder and harder . . . hic! . . . to shee . . .

Please note the way the muffler fits the bottom of the fuselage exactly. It is the precise engineering, long range planning and a lot of dumb luck that it came out that way. You might put your engine with its muffler on your favorite mount and see where everything goes, before driving home the screws. Plan ahead.

When you fabricate the landing gear, please check plans and photos; the whole thing is made from 5/32" piano wire. All three pieces on each side must be wired and soldered together as a unit. The side supports are not soldered into the brass fittings, they kind of move up and down in the tubing as a sort of shock absorber. The wheels are actually on the back wire, the front and side ones are braces.

FULL SIZE PLANS AVAILABLE — SEE PAGE 184



PLAN NO. 905

The most complicated part of the whole plane is the cabane, but if you do it this way, it is much easier than it looks. Cut the forward tubing to size (see A-A), flatten as shown, drill holes 3/16" from the ends and bend. Temporarily screw them in place on the fuselage. The rear tubing is cut 1/2" longer than the front, it is flattened and bent as was the front one. The extra 1/2" is flattened on the bottom ends. The top holes only are drilled, then they are bolted to the rear cabane anchor block on the wing. Spread the front cabane tubes and bolt them to the front wing anchor block. The wing is now mounted above the fuselage. Clamps or clothespins hold the rear cabane tubes in place on the fuselage. With the fuselage sitting on the landing gear, without wheels, elevate the tail until the top fuselage longeron is equally spaced from the building board from tail to nose. Now we are going to put in the wing incidence. Check that the front and rear cabanes have a forward-aft angle similar to that on the plans. Measure

SKEETO SA 8
Designed By:
Paul F. Denson
TYPE AIRCRAFT
Stand-Off Sport Scale
WINGSPAN
55 Inches
WING CHORD
9¾ Inch
TOTAL WING AREA
536 Sq. In.
WING LOCATION
Parasol
AIRFOIL
High Undercamber
WING PLANFORM
Constant Chord
DIHEDRAL EACH TIP
3¼ Inch
O.A. FUSELAGE LENGTH
39" (inc. rud.)
RADIO COMPARTMENT SIZE
(L) 6" (W) 3" (H) 3"
STABILIZER SPAN
18 Inches
STABILIZER CHORD (inc. elev.)
6 Inch (Avg.)
STABILIZER AREA
99 Sq. In.
STAB AIRFOIL SECTION
Flat
VERTICAL FIN HEIGHT
8 Inches
VERTICAL FIN WIDTH (inc. rud.)
7" (Avg.)
REC. ENGINE SIZE
.15-.25
FUEL TANK SIZE
4 Oz.
LANDING GEAR
Conventional
REC. NO. CHANNELS
3
CONTROL FUNCTIONS
Rud., Elev. Throt.
BASIC MATERIALS USED

Fuselage .... Balsa, Pine, Ply
Wing .... Balsa, Pine, Ply
Empennage .... Balsa.
Wt. Ready To Fly .... 48 Oz.
Wing Loading .... 12.9 Oz./Sq. Ft.

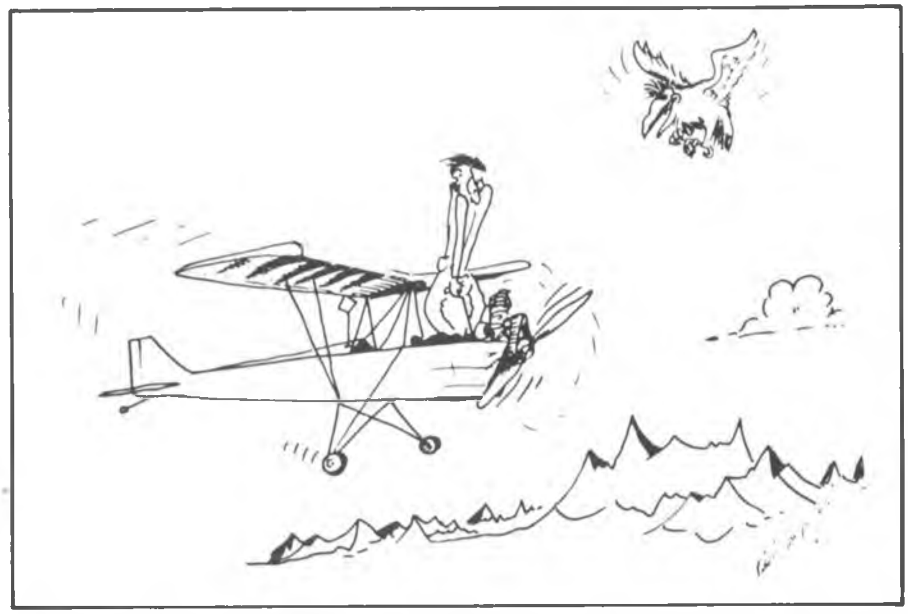
the distances from the wing's leading edge to the fuselage and trailing edge to the fuselage on the plans. By moving the back cabane up and down, these distances can be equated to that on the plans. Here is something to remember, okay? The wing does not have to be exactly, to the milimeter, as far above the fuselage as the plans show. **But it does have to have the same incidence or tilt.** So, if you do cut the cabanes a little short, the world won't come to an end. This is not an exact scale; after all, maybe ours were short too. The diagonal cabane struts are cut to length, holes drilled 3/16" from the ends, no doublers are used, solder front and rear.

Fashion your wing struts from 3/16" x 3/8" spruce or pine and sand or plane to airfoil shape. The lower attachment wire must bend up then out and be inserted at the bottom. The cup hooks should stick out about 5/8" before the bend. The bends will have to be opened up a bit to fit properly.

Check that the fuselage is level with the workbench, and the wing tips are propped so they are exactly the same height off the workbench, insert the cup hooks into the landing gear clips on the short outer wing spar. The fit is loose, we will take care of that later; remove the wing tip props. Using a long ruler, measure from the workbench to the center of the leading edge at each wing tip, this should be the same. Adjust with the forward cup hooks by turning in or out one turn at a time. Unfortunately, half or quarter turns are not available. Next measure to the T.E. centerline, this should be from 3/8" to 1/2" higher than the L.E. This is necessary washout. The small amount for incidence at the root will be a part of this measurement. Washout and dihedral give you much of your stability and reduce the tendency to snap roll at slow speeds.

For better fit and security, the cup hooks should point out from the center. When everything is adjusted, work a short piece of inner NyRod over the ends of the cup hooks. Loosen the landing gear clips and slide the cup hooks in, then tighten. To fabricate the safety wire, take a piece of 1/32" wire, bend a small loop in one end, bend the other end at right angles and cut off to about 3/16". Center this across the spar, insert the right angle into a small hole drilled into the front spar, Super Jet, then fasten the loop to the other spar with a small sheet metal screw.

The only real problem with covering is the underside of the wing. Before you start, make sure the gussets are in place around the cabane anchors. Seal your plastic covering around the perimeter of the wing as usual. Do not bear-down with your chordwise



The cartoon was drawn by EAA member Peter Carpenter of Wellington, New Zealand. He had heard about the Stits airplanes and experiments way down in New Zealand. While on this side of the world on other business he decided to come and look at some of them. The day he walked in they were playing with the original installation on the Skeeto, which was the one cylinder, two cycle job and it was rigged so the "rewind" rope starter could be cranked while sitting in the cockpit. Joking started about the merits of being able to start it in the air in case of engine failure, and if it was pulled hard enough, maybe one could keep it going by "pull power" alone. Reprinted from Sport Aviation, 1958.

stretching, just taut is fine. Work with an iron in one hand and a wad of cloth or facial tissue in the other. Go down a spar pushing down with the cloth and sealing just ahead of it with the iron. As the cloth follows the iron, it holds it down long enough for the glue to set. Seal covering to both spars in this manner. Next do the same chordwise and seal the plastic to each rib; the underside of the wing will be a grid of boxes. Now shrink each box tight. Not only will you have an undercambered airfoil but you will have an extra strong wing. Be sure to seal the covering to each rib on top, too. Cover the rest of the plane in a similar manner.

Before you ever take the plane to the field, check the Center of Gravity. Insert your forefinger into the opening between the two front cabane struts and pick up the plane. If it comes up perfectly level or just a tiny bit nose low, you are all right. If the nose points straight down and the leading edge hangs from your hand, it will fly similar to the first flight of the prototype. Not sure just where the C.G. would be, we figured a trial flight would show us a close proximity, right? Sure! After yanking it into the air at the end of the field we flew it around the flight path with full up elevator plus full up trim and the engine was roaring away merrily. Boy, did she taxi well, no bounces or attempts to leave the runway just straight and true. Okay, time to land her, cut the engine. **Yipes!** Down she came like a rock. **Flare!** Sure, with what? We had full up everything as it was. Didn't even break the prop, needless to say, she didn't roll out very far. It was a good thing we had 18" of rain here in Southern California this spring and for the first time in memory we had that stuff called tall grass (it usually grows only in the east) on our field. The adobe itself was soft, kind of like muddy cement.

Back at home, we dissected the MonoKote from the bottom 4" of the tail and into this opening stuffed a chunk of lead. While we had it open, we put on a steerable tail wheel. All of this put the total weight at exactly three pounds.

We are flying Skeeto with an O.S. .25 which isn't at all necessary. We figure, and friends concur, a .15 would be more than enough power. Most of the time, the throttle is hardly ever over 1/2 and then only when we are seeing how high we can go in anticipation of cutting the engine altogether and getting in a bit of soaring. We already have a fifteen minute dead stick, and caught a thermal in the process. We have made numerous dead stick landings and are working on enough guts to catch it in mid-air like we used to do with gliders. They have a neat, smooth nose that fits the palm of your hand. That engine up there with the dead prop attached makes a formidable reason why we haven't made a mid-air catch yet. The most fun we find with Skeeto is flying it two or three feet off the ground full length of the runway, altering height with the throttle, then pull up at the end of the field, give it hard rudder, swing around and dive back across the full length of the field again. Another fun thing is to stand at the flight line and fly the plane in circles out in the middle of the field like it was U-control. She will roll if you do it like you used to do with single channel. Put it into a shallow dive to get up speed, pull out, point the nose up then give it full rudder and she will roll around the inside of a great big barrel, kind of like a loop with a bit of rudder added. If you get into trouble, just let go of everything and that deep dihedral will get you out level and moving away, nothing to it.

We have not found it necessary to take Skeeto down on the way to the field, she will fit into either of our small compacts. Of course, there is much more room for flight box, etc., in the station wagon, but everything will fit neatly in the Tercel hatchback.

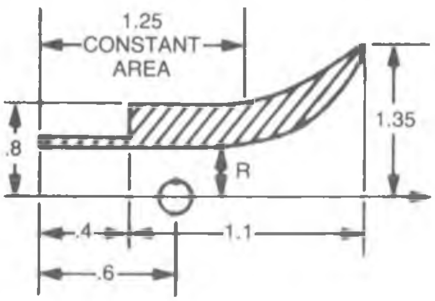
If you are looking for a plane to fly, one that is not constantly needing adjustment, one that is ready when you are, Skeeto is the one for you. We have found that when flying her, it is a relaxing interlude from our varoomers, a time we can really enjoy. Hopefully, you will also find it that way.

We would like to thank Mr. Ray Stits of Stits Poly-Fiber Aircraft Coatings in Riverside, California, for the historical background and the picture of the full size plane. □

Skeeto flight shot by Kenton Krauss.

Power Boating

HOWARD POWER



USE SUPER TIGRE SPRAYBAR ASSEMBLY WITH TWO HOLES

FIGURE 1
HIGH PERFORMANCE VENTURI DESIGN FOR 11CC ENGINES

The last couple of months we have been discussing racing engine induction systems. We outlined the basic operation of a venturi and developed equations to predict its mass flow, pressure and velocity in the duct. We also discussed spray bar contributions to the development of fuel suction and introduced the effective venturi throat area which can be used to compare the size of various carb design. We discussed how the unsteady intake flow conditions affected fuel metering and discussed how intake tube resonance can increase the flow capability of a given carb.

To increase a given engine's ability to breath, the engine tuner can mount a larger than stock carb and, in most cases, can realize an increase in performance. Last month we promised a venturi design that has proven to be better than any other we have tried on 11cc engines. This design was developed four or five years ago when Bruce Kaiser and I were trying to break the NAMBA Mono and Deep Vee straight-away records. Bruce had the Unimat lathe and made what must have been dozens of venturies before the final design was frozen. We tried various spray bar locations and graduated throat diameters so that a family of venturies were made for testing. Figure 1 shows this basic design.

TABLE 1
VENTURI CHARACTERISTICS

THROAT DIAMETER (IN.)	EFFECTIVE AREA (IN.^{2})
.40	0.063
.43	0.077
.46	0.093
.48	0.105
.50	0.117

The design features a bell shaped entry with as large an area ratio as was practical. The venturi has a constant area section and a Super Tigre spray bar was mounted as shown within this tube. We were running the engines in the 22,000 rpm range at the time. The duct length and spray bar location was designed for resonance at this engine speed. Table 1 gives an estimate of the effective throat area as a function of throat diameter for this family of venturies. We found that a throat diameter of about 0.45" resulted in maximum performance when this venturi was used on a circle racing hydro. If we made the throat any larger, the low rpm torque was insufficient to reliably leave the beach. If we used the venturi on a deep vee or monoplane, we could use throat diameters just above 1/2". At the time we felt that this venturi design was responsible for an increase of at least three to five mph in straight-away boat speed over more conventional venturi designs. Be sure to use pipe pressure when you try these large venturies on your engines.

Table 2 presents the characteristics of carburetors that come as standard equipment on various racing engines. The engine backplate carb mounting hole diameter is presented as well as the throat diameter and its corresponding effective throat area. Also presented are the characteristics of the Martin carb we discussed last month in its various stock sizes. For your further information I have supplied the resulting effective area when the 6000L carb has been bored out to the dimension noted. The effective area column shows that the Martin carb has the largest effective area of any of the listed carbs. In fact, the 9000 carb has almost 33 percent more area than the Rossi or OS7F carbs. Remember, however, that bigger is not always better. Only by trying these carbs on your setup will you be able to find the best carb for your purposes.

One of the things that seems to frustrate new boaters the most is keeping the boat's radio working. To accomplish this you must keep it dry. Even so-called "waterproof" servos can be put out of operation by a leaking radio box seal. If the radio switch/receiver gets wet you will lose control of your boat. You can place all the radio components in a waterproof compartment built into the structure of the hull. This technique is usually done when building hydros. The alternate method is to make a waterproof radio box that may be removed from the hull and may, therefore, be used on several boats. An example of such a box is shown in Figure 2.

This box was designed for use in deep vee type hulls and is made from 1/16" plywood and spruce. All parts are cut to size and the box is assembled using 5-minute epoxy. Don't use Hot Stuff or white glue here! The box is designed to fit between either 4" or 5" motor mount rails used on most fiberglass hulls. The sides are tapered to allow the normally used tuned pipe to clear the top of the box on its way to the stern of the hull. The basic box is strengthened by using 3/16" square spruce strips in all inside corner joints. Don't leave these out or your box will leak sooner or later. I use a .04" thick plastic or phenolic radio box lid that fits into a recess on top of the box. We use 3M clear pastic tape to hold the lid down and use no seals or screws. If you use light plastic, the top stays put and a perfect water tight seal is accomplished. The outside 1/4" square spruce strips strengthen the box and provide surface area for the tape to seal the lid. After gluing, the box should be given two coats of clear epoxy paint to seal all wood surfaces. The total weight of the box and a two channel Futaba radio mounted within is 12 ounces.

The photos show the general arrangement of the radio components mounted in the box. The steering servo is mounted to the back of the box on its right side. This insures that the servo pulls directly on the rudder which is normally mounted to the right of the boat's centerline. The throttle servo is mounted alongside the steering servo. The box shown in the photos was constructed by Ken Bauer of Salinas, California, for use in a 3.5cc deep vee hull. The box used Robart water tight bushing assemblies for the steering and throttle linkages. The 450 mah rechargeable nicad battery pack was wrapped in thin (1/8" thick) plastic

TABLE 2
CARBURETOR CHARACTERISTICS

MANUFACTURER	BACKPLATE SIZE (IN.)	THROAT DIAMETER (IN.)	EFFECTIVE AREA (IN.^{2})
7.5CC ENGINES			
K & B (Venturi)	.435	.344	0.041
K & B O.B.	.623	.312	0.062
OPS 45	.469	.312	0.045
O.S. 46 (4E)	.509	.385	0.078
PICCO 45	—	.312	0.058
11 CC ENGINES			
OPS 65	.550	—	—
O.S. 60 (7E)	.530	.440	0.099
O.S. 65 (7F)	.590	.440	0.099
PICCO 65	.590	.395	0.098
ROSSI 65 (Disk)	.550	408	0.094
ROSSI 65 (Drum)	—	.415	0.096
AFTER MARKET CARBS			
MARTIN 6000	.506	.310	0.0643
MARTIN 6000L	.506	.360	0.0906
	.506	.380	0.1022
	.506	.390	0.1083
	.506	.400	0.1137
	.506	.410	0.1208
	.506	.420	0.1273
9000	.506	.430	0.1332

packing foam after it was placed in a plastic bag to insure that water cannot get into the battery cells. Use only battery packs that have soldered or welded connections. Do not use boxes that have spring loaded contacts. Vibration will prematurely kill your batteries if they are used in this type of battery box.

The receiver is likewise wrapped for protection against water that may enter your "waterproof" box. The switch is mounted on a Du-Bro "Kwik Switch" mount on the right side of the front face of the box. If you use a Futaba switch be sure to enlarge the square hole in the plastic Du-Bro mount so that it matches the throw of the switch. If you don't, vibration will turn your switch off because it won't engage the internal detents. Charging is accomplished from outside the box. I use two Du-Bro 2-56 ball link assemblies that are mounted on the left front side of the box. Solder the positive charge wire to one ball link and the negative charge wire to the other ball link. Plugs and sockets tend to collect moisture and corrode very quickly. Use a TV antenna plastic clothespin type connector on your charger and it will grab the two balls and stay in place during charging.

Wire linkages made from 1/16" piano wire connect the watertight output pushrods to the rudder steering arm and the carburetor throttle arm. I never use nylon or steel clevises on these linkages because of possible failure due to vibration and stress. Use solid wire bent with a Z-bend on one end and use a 90 degree bend on the other end with a plastic retaining "swing-in" type clip for a retainer. You should always have your rudder perfectly centered when your transmitter trim lever is in neutral and the stick is centered. As a result, no adjustment of rudder linkage is ever necessary. If your boat doesn't go straight with straight rudder you should work on the hull or its hardware until it does. Don't adjust the rudder angle. You can bend a Z-bend in your carb linkage wire to provide for throttle adjustment capability. Never use a similar bend on the rudder control wire or steering loads will distort it and a loss of steering power will result. Always make the rudder linkage so that you pull to get right rudder.

This box will give you many years of service if you build it carefully. Why is it that we never have enough time to do the job right the first time but we always can find the time to do the job over when a failure occurs? It must be that Murphy was a hobbyist as well as an optimist.

In our April column we mentioned some engine hop-up ideas and issued a challenge of sort to some of the most highly respected boat racing engine builders in the country to share their secrets concerning piston and liner fits. I received the following letter from John Shannon. John has been a many time record holder in U-control speed and lately has been building boat racing engines for some of his buddies. We met John at the Indianapolis IMPBA Nationals and can attest to his ability to make his boats and engines run. I'm very pleased that he took the time to respond and to contribute his knowledge to the sport. Is there

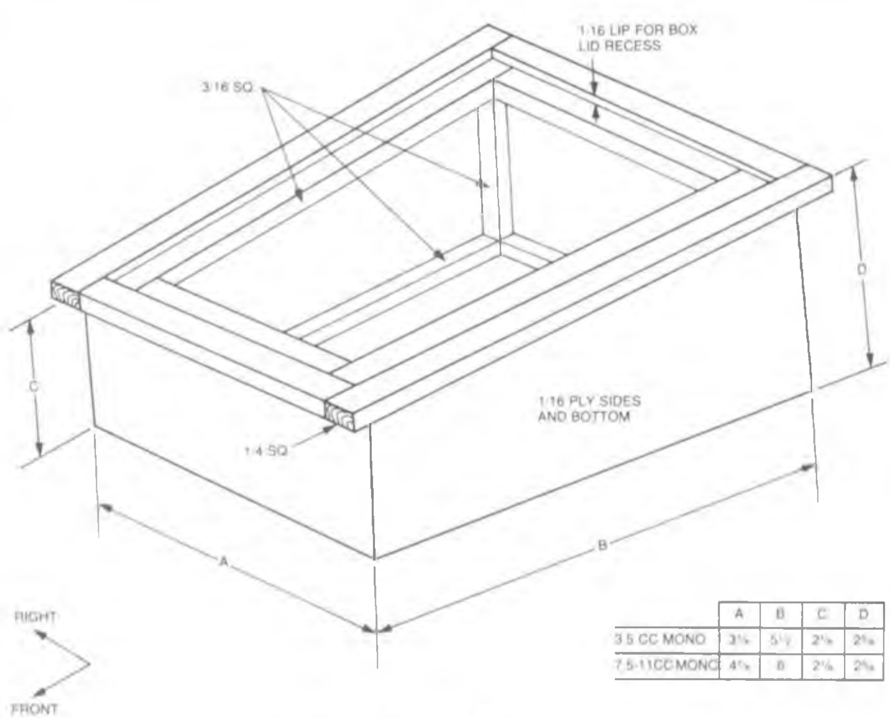


FIGURE 2
TYPICAL DEEP VEE RADIO BOX

anyone else out there who would like to follow his example? I sincerely hope so.

Dear Howard:

Well, thanks, Buddy, for putting me on the spot! You wouldn't believe the flack I've gotten because I was first on your "engine builder" list. All joking aside, I will attempt to describe how to do a little piston fittin'. I guess I subscribe to the school of "Straight is great, but it has to be the right straight!" The right straight is a fit where the piston will free-drop from T.D.C. and, yet, have an absolutely perfect seal from the instant the exhaust port closes.

The real trick is how to accomplish this type of a fit. First, you have to have the equipment to make the piston and sleeve round. Sunnen Products makes a very nice portable honing unit that can be used in your drill press and seems to do all that I've ever needed. Second, I hone a blank cylinder to use as a lap for the piston. Then I start lapping that sucker until it is round and untapered when measured with a 0.0001 micrometer. Third, I sort through my cylinder liners until I find one that the piston will start to seal as it passes the exhaust port. Then I hone the chrome in the liner until the piston will drop from T.D.C. of its own weight when the piston and sleeve are absolutely clean and oil free. This fit works well on Picco, Rossi and O.S. Max 65's, but I don't know how it will work on others as I've never built-up any others (commercial boat engines).

This type of fit may seem a little radical to most, especially those who are used to taper and tight fits. But, it is what works best for me. I also subscribe to the school that about 90% of an engine's performance is piston and cylinder fit. My experience has been that if the piston and cylinder fit is ***right,*** *the engine will run great without respect to percent nitro, timing, carb size, etc. Conversely, if it is* ***not right,*** *excess in percent nitro, timing, carb size, etc., is necessary to get a "bad" engine to have good performance; but, at a great cost in reliability and consistency. I have found that the following items all greatly hurt the* ***average modeler:***

High Nitro *— High Nitro fuel is not required to have high performance. The singular most important factor in model boat heat racing is to get a good, consistent needle valve setting. I've been setting engine needle valves with some success for 25 years and* *have always found that the higher the nitro, the harder it is to set.*

Large Carburetors — *Large bore carburetors are not required to have high performance. My 200 + mph 0.29 C.I. control-line speed engine used a 0.312 bore* **suction** *venturi with a fuel intake tube blocking it to an effective area of a 0.272 diameter hole. At 26.5K rpm it didn't have any trouble getting all the air it needed. Again, the small bore allowed me to get good, consistent needle valve settings, thus, good performance; large bore careburetors are harder for me to set.*

High Exhaust Port Timing — *The higher the exhaust port timing, the harder it is to get a good, consistent needle valve setting. If you need higher rpm's, just shorten the tuning pipe. Most people are surprised at how short I run my pipes with large props and still turn good rpm's. The trick is to not get the exhaust port so high that the engine setting becomes critical, if not impossible. I've found that if you can't go real fast with about 168 degrees or less on your exhaust port duration, something else is wrong with the engine.*

I hope this information is what you are looking for, and that it is of some use to your readers. Keep up the great work you are doing with your column.

Happy Boating,
John Shannon
Garland, Texas

We will close this month's column with a poem that we extracted from the June copy of the Marine Modelers of Santa Clara Valley newsletter.

An Anonymous Boat Poem

I love to wake up Sunday Morn
and give the world a hug.
The sun is shining — the winds are calm
I've got the "Boating Bug."

My boat, my boat, I love my boat
It's a special part of me.
Just listen to that engine purr
It's as tuned as it can be.

I guess today I'm blue and white
To heck with all the rest.
Don't even care who's at the pond
I know my boat's the best.

I've checked my fuel; I've checked my prop
I've check my turning fin.
It's time to launch my special friend
I know we're going to win.

Dead boat left — dead boat right —
I'll maneuver in-between.
Watch my moves, watch my speed
I'm the best you've ever seen!

My paint job is the best one here
The chrome parts really shine.
I've passed the others with blinding speed
My boat is movin' fine.

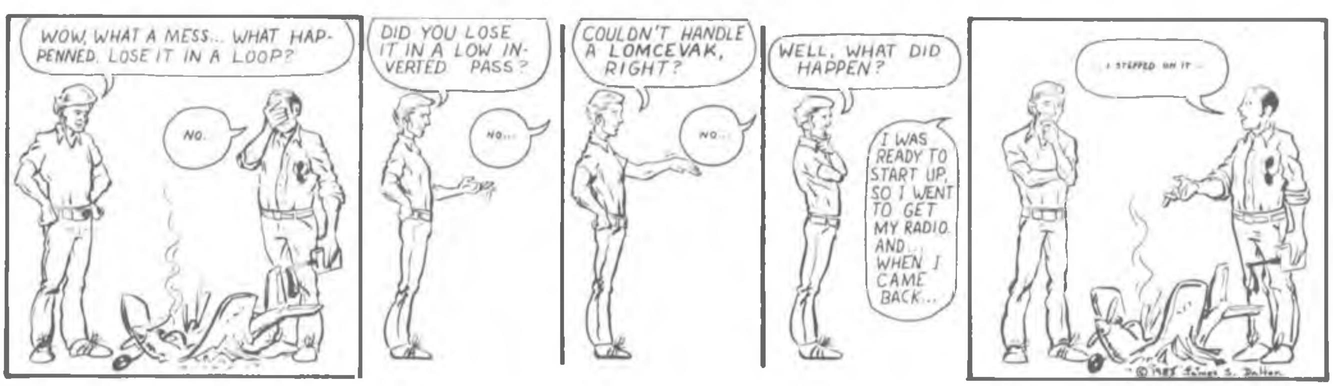
Already the sun is going down
This day sure went by fast.
'Cause I've got the boating fever
And I hope this feeling lasts!!

★

Well, that about does it for another month. Send your questions, comments, race results, etc., to the address at the end of this column. If you desire an answer before magazine publication, enclose a stamped, self-addressed envelope so I may answer your letter by return mail.

Howard Power, Hobbies Unlimited, 766 Broadway, Seaside, California 93955. (408) 394-1200. □

FLYIN' FOOLS by Jim Dalton



Sunday Flier

KEN WILLARD

PHOTO #1

PHOTO #2

When is a helicopter rotor (or rotors; see Photo No. 1) not a helicopter rotor? Easy. When it's a propeller (or propellers; see Photo No. 2).

The aircraft in the photos is the Bell XV-15. Well, actually, it's two versions of the XV-15, as you can readily see by the serial numbers.

I thought I'd start off this column with these two attention grabbing photographs, because later on you may decide to forget the whole thing and just say, "It's too complicated; I'll just go buy what's available and use it." But for those of you who want to get higher efficiency, you can do it.

Anyway, we've been having some fun with the question, "Why don't helicopter rotors have helical, or 'true pitch' blades?"

Several of you sent in letters stating your opinions. Some of them have been printed; the X-rated ones ("Ya X#&$'& dummy, here's why") have been filed for future blackmail.

There was a wide variation in the theories propounded, so it seemed like the best way to go to the man who's in charge of the Bell XV-15 convertaplane program, since he has to deal with both propeller design and rotor design, and, in addition, the compromises needed to make one blade serve both purposes.

John P. Magee is NASA's Branch Chief for Powered-Lift Flight Investigations at Ames Research Center, Moffett Field, California. I live about four miles from there, and it was easy to drive over and have a brief interview with him. The way it turned out, it wasn't so brief; our mutual interest in the subject kept leading from one item to another, and before I knew it, we had spent a couple of hours talking about propellers and rotor blades. He lead me through a complicated set of formulae related to rotor blade design which showed that in order to get the most effect out of a helicopter rotor, compromises are a must.

In summary, air moving through a helicopter rotor which is in stationary lift mode would most efficiently be moved by a "true pitch" rotor, but the minute you introduce forward motion, the angular flow that results, plus the differential speed of the advancing blade and the retreating blade, causes unequal force patterns such that the loads on a helical pitch rotor would be so high that the structure couldn't withstand them. So, the twist in the blades of a helicopter rotor is a compromise.

In the case of the propeller, flow is essentially perpendicular to the plane of rotation, except at very high angles of attack --- and even then the deviation is minimal compared to the angular flow through a helicopter rotor when in level forward flight. So, a true pitch propeller gives maximum thrust. Even in this case, some compromises have to be made if you are going to have a variable pitch, or a constant speed propeller. So far, except for a small minority, model propellers are fixed pitch --- and if that fixed pitch is constant along the blade, you've got the most efficient thrust capability.

Measurements of some commercially available model props show that some, which may be marked as a certain diameter --- say 9" --- and stated pitch --- say 5", will vary widely from the specification. Now it's easy to check the diameter --- just measure it. But what about the pitch? How do you

PITCH	1/2"	1"	1½"	2"	2½"	3"	3½"	4"	4½"	5"	5½"	6"	6½"	7"
4"	51.5°	32°	22.5°	17.2°	14°	11.5°	10°	8.8°	8°	7°	6.5°	6°	56°	5°
5"	57°	37.7°	27°	21°	17°	14.5°	12.5°	11°	9.6°	9°	8.2°	7.5°	6.7°	6.3°
6"	62°	43°	31.6°	25°	20.5°	17.3°	15°	13.5°	12°	10.5°	9.5°	8.7°	8°	7.6°
7"	65.2°	47.1°	36°	28.3°	23.2°	19.5°	17°	15°	13.3°	12.2°	11.1°	10.2°	9.4°	8.8°
8"	68°	51°	39.5°	31.7°	26.2°	22.2°	19.5°	17.2°	15.1°	13.6°	12.5°	11.5°	10.7°	10°
9"	70.2°	54.5°	43°	35°	29°	25°	21.8°	19.2°	17.1°	15.4°	14.1°	13°	12°	11.2°
10"	72.3°	57.4°	46°	37.7°	31.7°	27.3°	23.8°	21.2°	19°	17.2°	15.7°	14.5°	13.5°	12.5°

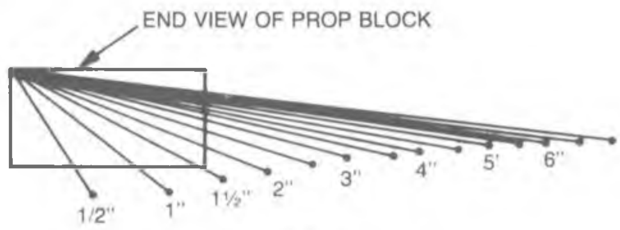


FIG. 1

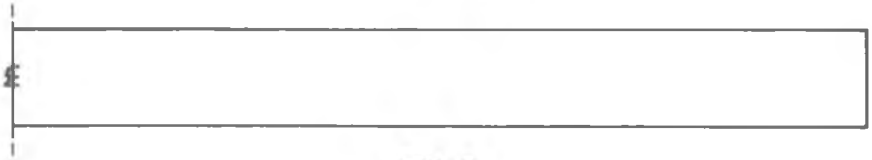


FIG. 2

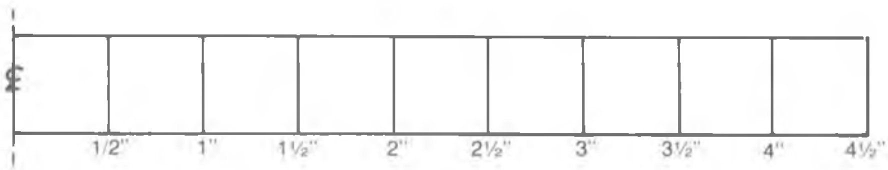


FIG. 3

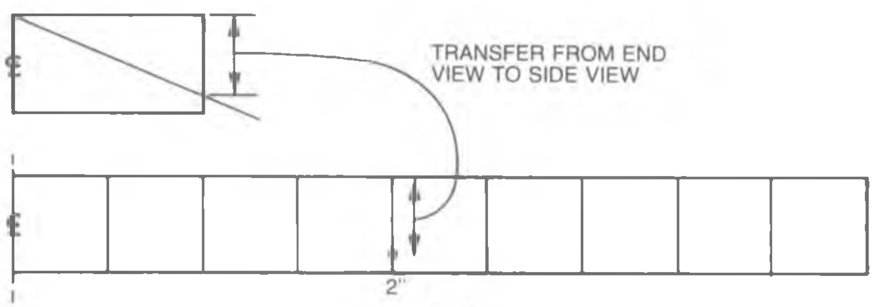


FIG. 4

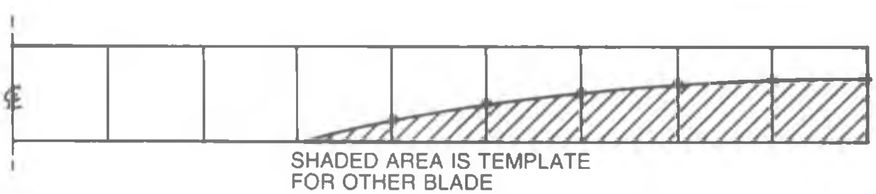


FIG. 5

determine that each part of the twisted blade will want to progress 5" forward (assuming no slip) in each rotation? Well, here's the simple formula:

$$\text{Tangent } \alpha = \frac{P}{2\pi R}$$

α is the blade angle
P is the pitch
π is the constant 3.1416
R is the radius (from the hub to tip of the prop)

Solve for the tangent of the angle, then go to to the math tables and find the angle. A lot of the current crop of hand-held calculators will do it for you.

Some forty years ago I needed a special prop. Props weren't commercially available, so I carved one to the specification I needed. It seemed like a good idea to let other modelers know how it's done, so I wrote an article in the old "Air Trails" magazine. The procedure is just as good today as it was then, so I've taken that article, rewritten some of it, and here, for your use or amusement, is how you carve a true pitch prop. The example used is for a 9" diameter, 5" pitch propeller, but also included is a table of figures for various props and pitches ranging from 4" pitch to 10" pitch.

Here's the step by step procedure:

(a) Go to Fig. 1 and, from the originating point for the five-inch pitch, draw the end view of your block as shown.

(b) Lay out the side view of one half of the prop block. This will be a rectangle 1/2" x 4½". See Fig. 2.

(c) Draw the centerline of the prop on the side view, and lines parallel to that at 1/2", 1", and 1½", etc., out to the tip. See Fig. 3.

(d) Note in the end view on Fig. 1 the pitch line intersects the bottom of the rectangle for all of the distances out from the hub up to 1½". This means that the full depth of the block, 1/2", can be used, but that the width, as seen from in front, must be cut down from 1" to the width of the bottom line of the end view which lies to the left of the pitch line.

(e) On the side view, then the full depth of the block is used out to 1½" from the hub.

(f) Two inches out from the hub, measure down from the top and place a point the same distance down as is the intersection of the 2" blade angle line with the right hand side of the end view as shown by Fig. 4.

(g) Do the same thing for all the points at the 1/2" intervals out from the hub to the tip.

(h) With a French curve, draw a smooth line connecting all points established in step f and g.

(i) You now have a template for trimming down one face of the propeller block. This template may be used to trace on the other side of the prop block, thus saving the necessity of plotting twice. See Fig. 5.

(j) Next draw a front view of one half of your block. This will be a rectangle 1" x 4½".

(k) Draw the centerline, and lines parallel to it 1/2", 1", 1½", etc., from the hub out to the tip. See Fig. 6.

(l) The width of the blade 1/2" out from the center must be equal to the width of the bottom line of the end view to the left of the 1/2" pitch line. Therefore, with dividers, pick off this distance and transfer it to the front view of the prop block so that it bisects the centerline. See Fig. 6. Do the same for the 1", 1½", 2" distances out to the tip.

(m) With these points, sketch in a hub contour. For structural reasons it may be necessary to vary from points close to the hub. This will not seriously affect the efficiency of the propeller, however.

(n) Drill the prop-shaft hole. Be sure

to do this before carving to make certain of a true-running propeller.

(o) Using the side and top templates you have made, cut the block down to fit. See Fig. 7.

(p) Carve the rear face of the prop. To do this, cut away the wood so that when you hold the rear face toward you, the top blade, regardless of how you hold it, will have a helically curved flat surface running from the right edge of the front face to the left side of the rear face. The rear (trailing edge) of the prop should be the part that was cut to fit the side template. Leave the front (leading edge) flat.

(q) You now have a true pitch rear face, and a flat front. You can cut any blade shape you wish, and the rear face will always be true helical pitch. Make a template of the blade shape if you like and lay it on the front face of the prop. See Fig. 8. Cut the blade shape out and then carve the front face of the prop, as per Fig. 9. But don't carve too thin, as you want to get an airfoil cross section similar to Fig. 10.

There is no such thing as one best definite blade shape. The outline shown on the drawings has always proved best with my models. The thickness of the propeller blade depends entirely upon the strength desired. For the nine-inch propeller the thickness at the tips should be about 3/64" to about 3/32" at one third in from the tip to an almost circular cross section near the hub.

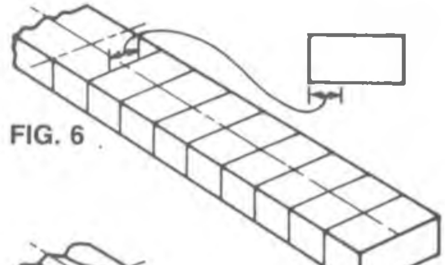


FIG. 6

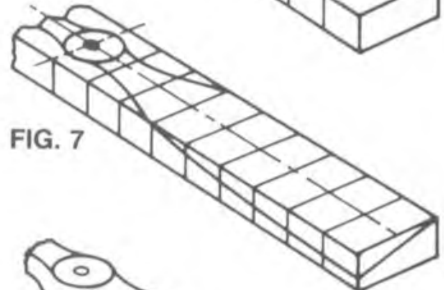


FIG. 7


FIG. 8


FIG. 9

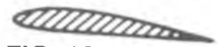


FIG. 10

(r) In carving the front face, you cut out the blade thickness down to whatever strength you desire without destroying the helical pitch. Suit yourself. A thin blade will break, a thick blade will be heavy and slightly less efficient, but will survive more nose-overs.

(s) Sand, balance, and dope the prop, and the job is finished.

Actually, this will take only about an hour and a half, so if you want to try several different pitch props, use the pitch table for whatever pitch and diameter you wish. Also, you can use any size block you care to, since the intersections on the end view of the block will establish the points regardless of the dimensions.

One thing to remember. Be sure to carve the blade angle in the proper direction for the rotation of the propeller. Pusher props have the opposite slant. Whatever you do, don't do what Wendell Hostetler did, and have both blades slant in the same direction. Honest; he showed it to me at Toledo --- a prop with one tractor blade and the other a pusher!

Just goes to show, we all make mistrakes. □

A fascination for a model design that has endured more than forty years was culminated last summer with the first flights of my R/C version of Carl Goldberg's Valkyrie. The purists will spot a few minor compromises which were made as a matter of practicality. The basic size and shape have been retained even though a deviation was made from the original structural design due to laziness and a short supply of patience.

The following description is being reprinted from a 1938 issue of Air Trails magazine:

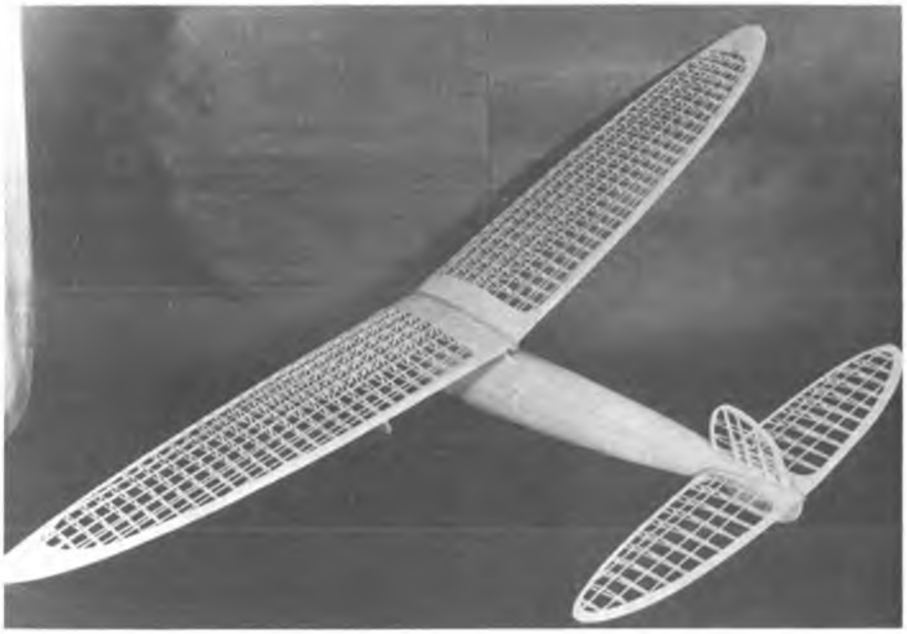
For the last eight years Carl Goldberg has been at the top of the model hobby. And this grip on the top rung is as firm now as ever. Up until last year he was content to dominate indoor flying with only an occasional try at the outdoor events. But last year he built the Valkyrie. And like most of his models it was of championship stuff. It won second place in the gas event of the 1937 Nationals with a flight of 53 minutes.

Goldberg is 25 years old. He was born in New York City. Started modeling in 1928 and has been active ever since. Several years ago he left New York for Chicago. Model records were not long in moving with him. Much of the success and enthusiasm of the Chicago builders in recent years can be traced directly to his influence. At present he operates a model shop and is helping advance the model hobby among Chicago boys.

The Valkyrie is one of the most prominent models the hobby has ever produced. It is a pleasant combination of excellent design and clever construction — proving that an ultra-streamline model could be made lightweight. Beginning in the spring of 1936, much work was spent in design. Actual construction got under way in July and continued more or less steadily to February, 1937. The first test flight was on March 7th, lasting 4 minutes. The final flight was July 11th, taking 2nd place at the 1937 National Meet in Detroit. The Valkyrie was lost in Canadian territory after 53 minutes. And that was the last news of the model. During its short life it turned in 29 flights under a wide variety of flying conditions. Fortunately, complete data and photos had been kept of the ship.

Specifications of the model are: span 10 ft.; length 6 ft.; weight with Brown Jr. (ready to fly) 4 lbs. 12 oz.; and a wing loading of about 5.85 ozs. per sq. ft.

Spiral stability was excellent because of the high center of lateral



This accurate reproduction of the Valkyrie was built several years ago by Tim Daniels, Denver, Colorado. The structure was basically 1/8" square and 1/16" sheet balsa, over 1,100 pieces in the wing. This was built before instant glue was available!

VALKYRIE

A Classic Design Of 1936

By Dick Tichenor

area. It showed the highest resistance to spiral diving, never going beyond a moderate bank. Notice that in the take-off photos, the wing tips are level in spite of the gusty wind.

Directional stability was good with a rudder area of only 6 per cent. Undercambered stabilizer worked like a charm! The more power developed by the motor, the better it held the model under control.

The thrust line was set at absolutely zero-zero. No bad effects were ever noticed because of its low position. The model flew with a variety of motors. The first sixteen flights were made on a Mighty Midget, the next four on a Gwin Aero, and the next nine on the Brown Jr. Goldberg borrowed the Brown motor from Vernon Boehle the day of the meet and lost it for him a few hours later. (Note: Boehle had a new Brown Jr. a few weeks later.)

Multispar construction is used in the wing and tail surfaces. This system makes a strong, lightweight wing — the completed wing weighed 20 ounces. Practically any portion could have been destroyed without affecting the strength of the wing as a whole. While this construction is not difficult, it is

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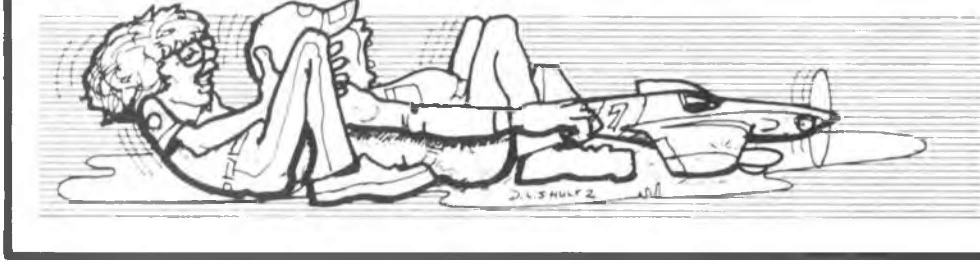
The 1938 test says, "Notice that in the take-off photos, the wing tips are level in spite of the gusty wind." Same applies to the 1983 R/C version.

Carl Goldberg and Dick Tichenor with an R/C version of the Valkyrie. The original Valkyrie was Carl's very first gas engine powered model that he designed in 1936.

Flying Lowe DON LOWE



For some time now, I have been convinced that the next significant step in model flight control systems will be some form of automatic flight stabilizer or autopilot. Development of control systems to this point has given us a tremendous advance in performance, reliability and flexibility, and all at a significant reduction in cost. I can remember a Phil Kraft comment of years ago when Phil thought that proportional control systems would cost $800; everyone would need at least two sets since one would always be back to the factory for repair. Phil wasn't alone in his conviction, but advances in circuit design, micro miniaturization and competition has made it possible to sell four channel systems for around $100!

We have also witnessed the proliferation of control functions on our transmitters (whistles and bells) to the point where we need a preflight check list and/or a flight engineer to get ready for flight.

One must understand, however, that all designs and arrangements so far are strictly "open loop" functions; i.e., a command or control function is selected without feedback from the aircraft in terms of its response to that command except visually or audibly. In other words, the pilot "closes the loop" in a fashion, the quality of which is strictly a function of his skill. For example, if we wish to bank the aircraft and hold a finite bank angle, the pilot inputs an aileron position, observes the aircraft response, and then neutralizes the aileron control to maintain that attitude. His ability to observe and estimate the desired bank angle determines the preciseness of the maneuver. Now, if we had a device on board which does the measuring for you it could do a much better job of controlling the bank angle and can automatically "close the loop" within the flight control system to maintain that attitude. In other words, with the right kind of mechanization we could fly the aircraft by directly inputting an **attitude command** instead of the current control position or **rate command.** You would fly by simply displacing the stick and holding it in position in a manner similar to controlling the steering of a car. On releasing the stick, the aircraft would automatically return to level flight. Attitude command in this fashion is a far easier mode to fly — even a rank novice can fly this mode with skill.

The most fundamental requirement for achieving automatic or stabilized flight is the development of flight motion and attitude sensors. Unfortunately, these gems are in the category of transducers, i.e., devices that sense one kind of phenomena and provides an output of another kind. For example, an attitude sensor would measure the aircraft's pitch and roll attitude and provide an electrical output in the form of an error signal which is fed into a controlling servo.

Conventional autopilots employ a **vertical gyro** to measure pitch and roll attitude. This device is a high precision gyroscope which is stabilized in free space. Aircraft motion around this space rigid device is sensed and interpreted as attitude. Since the gyroscope does not directly measure attitude, its position is updated by mercury bubbles or levels which do know which way is up. The device must be of high pecision since it must hold attitude with small change over long periods of time with occasional "updates" from the leveling device. Unfortunately, this gadget as presently available is too big, heavy and expensive for practical model use. Let me hasten to add, that a full autopilot would use a vertical gyro to sense attitude, **plus rate gyros** to sense short term motions in pitch, roll and yaw and **damp** these motions. Some autopilot systems also incorporate accelerometers to sense and control vehicle displacement in three axes. All of the vehicle attitude and motion information is mixed electronically and then provided the servos to control the flight path.

Does all of this discourage you? You might logically ask, how could we ever reduce all of this to size, shape, weight, and cost to fit model use? First of all, the damping functions, provided by rate gyros and needed on lots of full scale aircraft may be dispensed with, or reduced for, models which are aerodynamically well-damped. Let's talk a little bit about damping and its benefits. If we are flying through rough air and the aircraft is pitched,

rolled or yawed by gusts, a rate sensor (on each axis) can sense these motions and automatically reduce the motion by feeding the **short term** sensed rates back to the control servos. Rate devices used in this fashion can reduce aircraft motions **short term** but **do not** control attitude. I'm sure that most of you are aware of the increasing use of rate gyros in model helicopters to "control the tail." This application of an inexpensive rate gyro is an especially good one since the helicopter "tail rates" are usually high and can be sensed and corrected by crude devices. Let me add, that if you have never flown a model helicopter with a yaw rate gyro installed, you **must** try it since it tremendously reduces the work load and skill required to fly the chopper safely. Years ago when I and some friends were modifying and using the old Kavan gyro in our choppers, the "purists" were sneering at this "crutch." The "crutch" has now become a fixture and, as a result, chopper flying quality has improved dramatically and its use has helped encourage more modelers to fly choppers. Development of rate gyros for model helicopters use is a happening that we can build on for other applications.

Those of you who read Jim Oddino's fine column in RCM will recall his comments in the September '83 issue on application of a Kraft rate gyro to roll stabilization of his pattern airplane. If you haven't read it, be sure and do it if you are at all interested in this subject — you must be or you wouldn't have read this far! Jim basically concluded that the device seemed to help maneuvers and was particularly helpful in take-offs and landing. He hastens to advise his readers that the device **as used** does not control attitude but simply damps vehicle unwanted motions **much quicker than the pilot is able to do.** In the limit, one could install sensitive rate gyros on all three axes and the aircraft would short term stabilize in any commanded attitude and continue in that attitude hands off.

It is possible to indirectly control vehicle roll attitude through use of a rate gyro. When an aircraft is turning, a yaw rate is developed which is a function of the turning rate of the aircraft. A "wing leveler" autopilot is one in which the aircraft yaw rate is interpreted as a bank angle and corrective information is applied to the primary turn control (ailerons or rudder) to level the aircraft. The fault with this system is that a very sensitive instrument is required to sense the very low turning rates in shallow banks. Short term gusts

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Designer Mike Hollison with his Slingsby. He is now letting the model R.O.G. and it lifts off in about 15 feet and climbs out at the correct angle. He says it's the only way to go.

SLINGSBY T49B CAPSTAN

The T49B was a two-seat training sailplane built by the famous Slingsby Company of Yorkshire, England, in the early 1960's. The model is a 1/6th Stand-Off Scale version of the "Capstan," of conventional balsa and ply construction, and should present no difficulties to anyone who has built at least one sailplane before.

CONSTRUCTION

Wing:

Since the "Aquila" is the only sailplane kit the author has ever built, readers will probably recognize a strong similarity between the wing construction techniques included in that kit and those that follow here!

(1) Butt-join the 1/16" sheet bottom center section and pin over the plan. Cut the bottom trailing edge from 1/16" balsa, bevel the outer edge and glue to the center section. Sand and taper the leading edge from 1/2" x 3/4" balsa, after first splicing to the correct length if necessary (cut splice W18 from 1/16" ply). Glue the leading edge to the center section sheeting.

(2) Make the bottom wing spar from two 1/8" x 1/4" spruce strips, splicing them from the inside with a 3" long spruce strip as shown on the plan. Next, cut and taper the trailing edge aileron strip from 5/8" x 1/4" balsa, notch for ribs W9 to W16, and epoxy the aileron hinges in place. Position the trailing edge aileron strip and bottom wing spar over the plan.

(3) Cut two sets of wing ribs W1 and W1A, from 1/8" balsa, and W2A to W16 from 1/16" sheet balsa. Slot all ribs for top and bottom wing spars and ribs W1 to W8 for the sub-spar and aileron pushrod. Cut triangular wedges off ribs W9 to W16 as shown; these will serve as the aileron ribs. Glue W1 and W2 to W8 in position, using the wing root template to tilt W1 to the correct dihedral angle. Epoxy W16 in place, and the trailing edge aileron strip between W8 and W16, then add ribs W9 to W15. Make the top wing spar as per the bottom spar, and glue in position.

(4) Cut the 1/16" sheet balsa webbing and cement between the wing ribs, front and back of the main spar. Next, cut the forward wing brace W17 from 1/16" ply and epoxy between W1 and W2. Glue the 1/4" balsa filler between W2A and W2. Cut ribs W1A and W2A forward of the main spar and glue in place. Then, cut the 1/4" O.D. diameter brass tubing to length and slide between W1 and W1A, using a piece of scrap balsa to set up the correct dihedral angle as illustrated. Fill the cavity between the tube and the forward wing brace with a mixture of micro-balloons and epoxy, and glue the 1/16" ply rear wing brace in position.

(5) Glue the rear portions of W1A and W2A in place, and cement the 1/8" x 1/4" spruce sub-spar between W1 and W8. Next, epoxy a 3/4" x 3/4" x 1/4" ply square to the inside of W1 to serve as a base for the screw eye for the wing retaining elastic bands. Then cement the triangular balsa filler between W1 and W1A for the alignment pin tube. Glue the 1/16" trailing edge support strips between each rib, and add the 1/8" balsa gussets at the corner between the aileron strip and W8, and between W16 and the leading and trailing edges. Sheet the top surface of the wing leading edge and the wing center section with 1/16" soft balsa sheeting. Be sure to prop up the rear of rib W16 with 1/4" packing for the necessary washout.

(6) Install the aileron pushrods at this stage, remembering that some form of differential movement (more up than down) is preferable on a wing of this span. The original model used a disc-type servo arm with off-center holes drilled for the pushrod links, which comprised a metal clevis attached to a Du-Bro threaded coupler soldered onto a length of 1/16" diameter wire. A 90° aileron bellcrank bolted to a 1/8" ply base between ribs W8 and W9 transmitted the movement to the aileron.

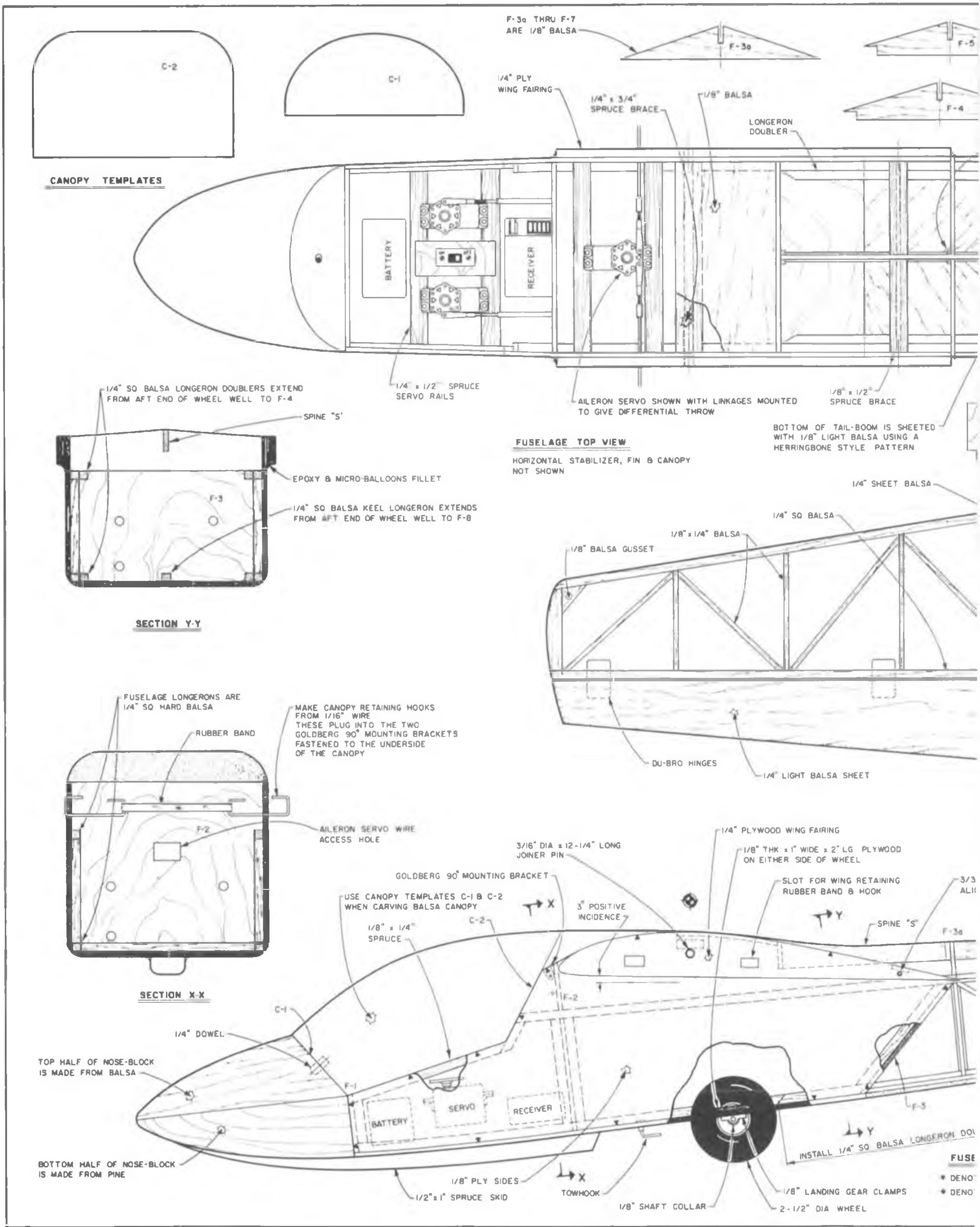
(7) Add all the 1/16" x 1/4" balsa capstrips top and botton, plus the 1/16" balsa sheet between ribs W7 and W9 on the top of the wing, slotted for the aileron pushrod. Drill W1 for the 1/8" O.D. brass tubing, cut to a length of 1¼", and epoxy into the trailing edge. Cut the 1/16" ply root rib to shape, slot and drill for the aileron

SLINGSBY T49B CAPSTAN
Designed By
Mike Hollison
TYPE AIRCRAFT
Stand-Off Scale Sailplane
WINGSPAN
107¾ Inches
WING CHORD
Root 11¼"
Tip 5½"
TOTAL WING AREA
800 Sq. In.
WING LOCATION
Shoulder Wing
AIRFOIL
Flat Bottom
WING PLANFORM
Double Taper
DIHEDRAL EACH TIP
2¾"
O.A. FUSELAGE LENGTH
52"
RADIO COMPARTMENT SIZE
(L) 6½" X (W) 5" X (H) 2"
STABILIZER SPAN
30 Inches
STABILIZER CHORD (incl. elev.)
6" (Avg.)
STABILIZER AREA
170 Sq. In.
STAB. AIRFOIL SECTION
Flat
STABILIZER LOCATION
Top of Fuselage
VERTICAL FIN HEIGHT
9 Inches
VERTICAL FIN WIDTH (incl. rud.)
7½" (Avg.)
REC. ENGINE SIZE
NA
FUEL TANK SIZE
NA
LANDING GEAR
NA
REC. NO. OF CHANNELS
3
CONTROL FUNCTIONS
Rud., Elev., Ail.

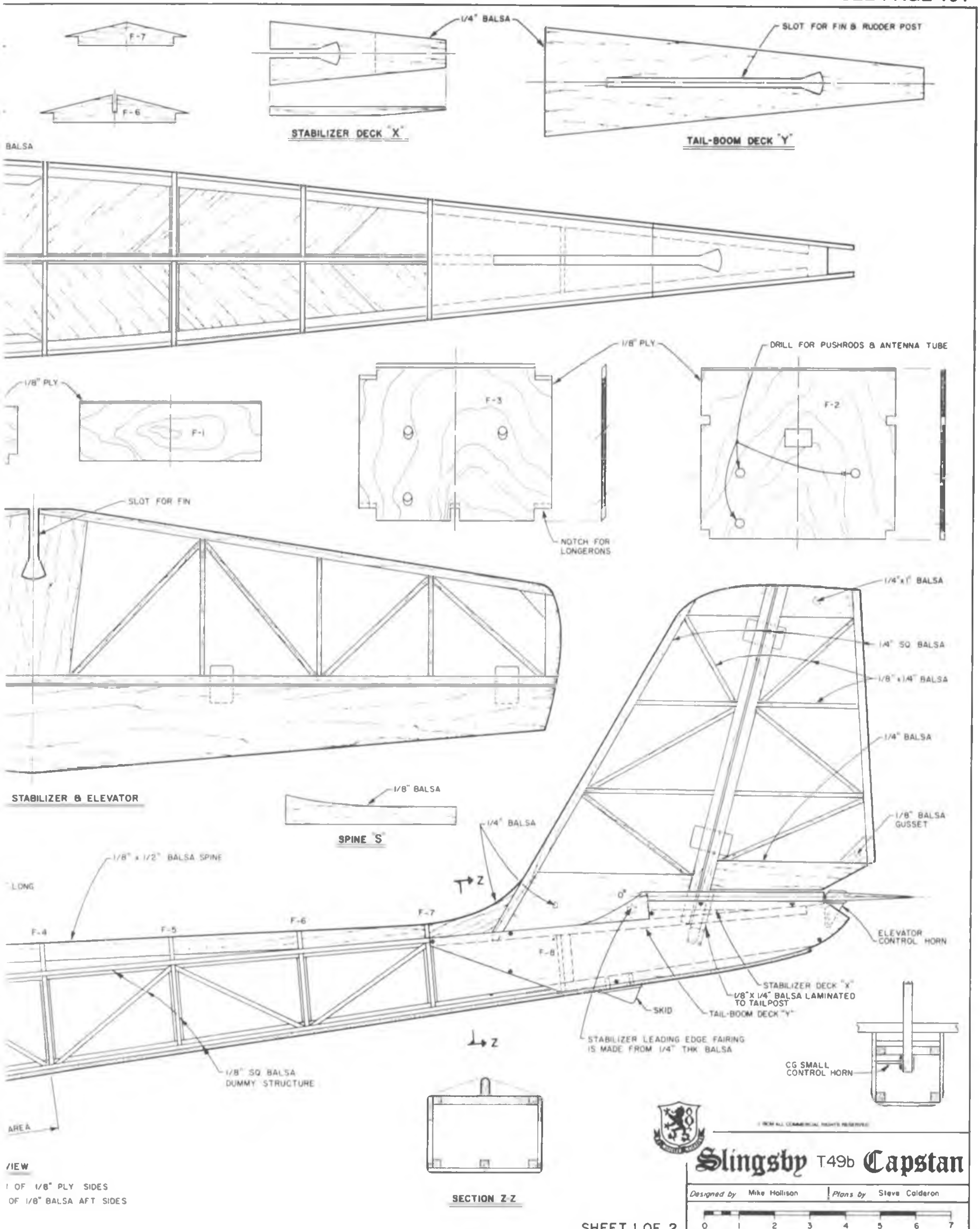
BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	Balsa & Ply
Wing	Balsa & Spruce
Empennage	Balsa
Wt. Ready To Fly	80 Oz.
Wing Loading	14.4 Oz./Sq. Ft.

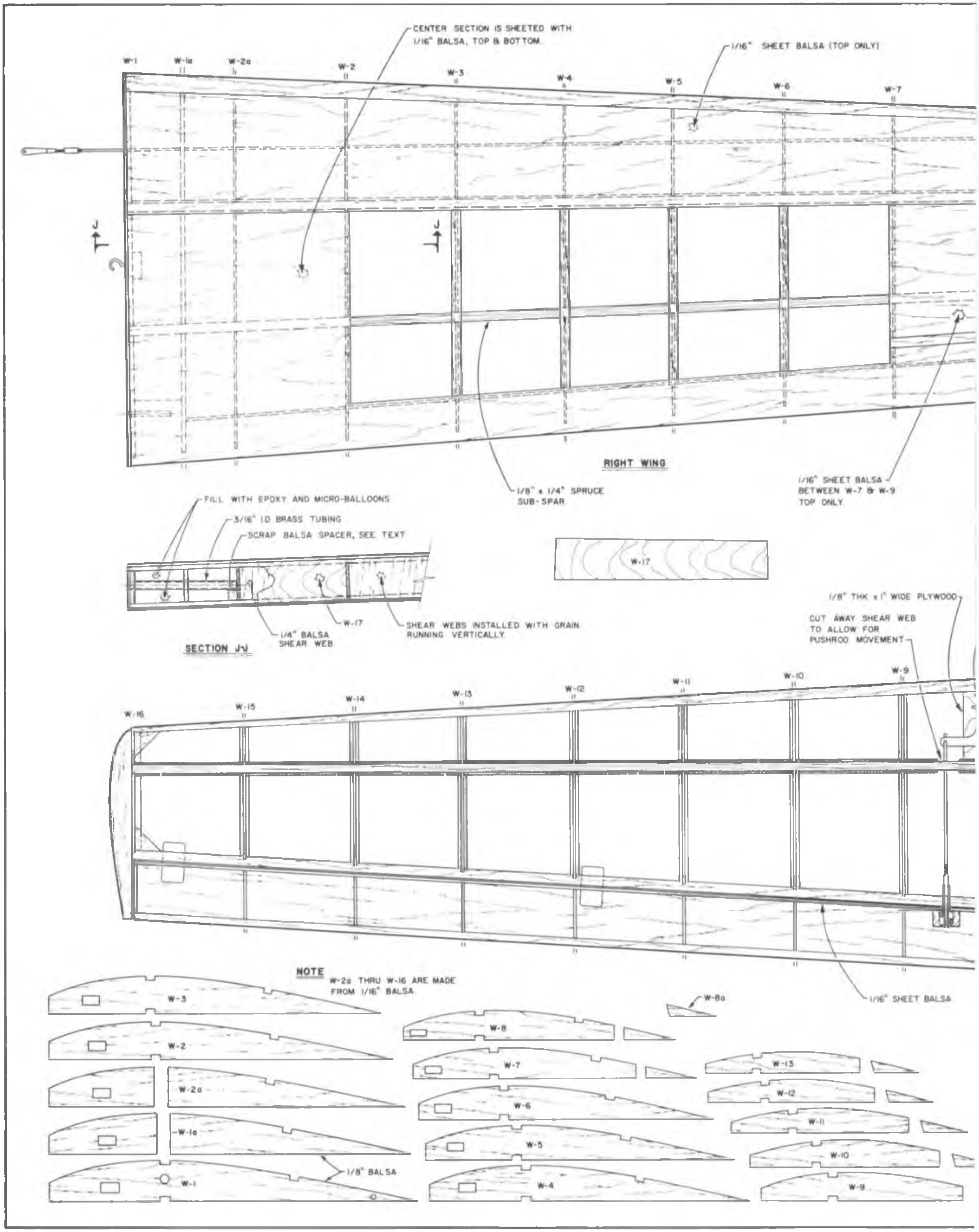
Build this beautiful one-sixth Stand-Off Scale model of Slingsby's popular two seat training sailplane. It makes a spectacular model
By Mike Hollison


F-3a THRU F-7
ARE 1/8" BALSA
F-3a
F-5
F-4
C-2
C-1
CANOPY TEMPLATES
1/4" PLY
WING FAIRING
1/4" x 3/4"
SPRUCE BRACE
1/8" BALSA
LONGERON
DOUBLER
BATTERY
RECEIVER
1/4" SQ BALSA LONGERON DOUBLERS EXTEND
FROM AFT END OF WHEEL WELL TO F-4
1/4" x 1/2" SPRUCE
SERVO RAILS
AILERON SERVO SHOWN WITH LINKAGES MOUNTED
TO GIVE DIFFERENTIAL THROW
1/8" x 1/2"
SPRUCE BRACE
BOTTOM OF TAIL-BOOM IS SHEETED
WITH 1/8" LIGHT BALSA USING A
HERRINGBONE STYLE PATTERN
SPINE "S"
FUSELAGE TOP VIEW
HORIZONTAL STABILIZER, FIN & CANOPY
NOT SHOWN
EPOXY & MICRO-BALLOONS FILLET
F-3
1/4" SQ BALSA KEEL LONGERON EXTENDS
FROM AFT END OF WHEEL WELL TO F-8
1/4" SHEET BALSA
1/4" SQ BALSA
1/8" x 1/4" BALSA
1/8" BALSA GUSSET
SECTION Y-Y
FUSELAGE LONGERONS ARE
1/4" SQ HARD BALSA
RUBBER BAND
MAKE CANOPY RETAINING HOOKS
FROM 1/16" WIRE
THESE PLUG INTO THE TWO
GOLDBERG 90° MOUNTING BRACKETS
FASTENED TO THE UNDERSIDE
OF THE CANOPY
DU-BRO HINGES
1/4" LIGHT BALSA SHEET
F-2
AILERON SERVO WIRE
ACCESS HOLE
1/4" PLYWOOD WING FAIRING
3/16" DIA x 12-1/4" LONG
JOINER PIN
1/8" THK x 1" WIDE x 2" LG PLYWOOD
ON EITHER SIDE OF WHEEL
GOLDBERG 90° MOUNTING BRACKET
SLOT FOR WING RETAINING
RUBBER BAND & HOOK
USE CANOPY TEMPLATES C-1 & C-2
WHEN CARVING BALSA CANOPY
X
3° POSITIVE
INCIDENCE
Y
SPINE "S"
F-3a
C-2
1/8" x 1/4"
SPRUCE
SECTION X-X
C-1
F-2
1/4" DOWEL
TOP HALF OF NOSE-BLOCK
IS MADE FROM BALSA
F-1
SERVO
RECEIVER
BATTERY
F-3
Y
INSTALL 1/4" SQ BALSA LONGERON DOU
BOTTOM HALF OF NOSE-BLOCK
IS MADE FROM PINE
1/8" PLY SIDES
X
TOWHOOK
1/8" LANDING GEAR CLAMPS
1/2" x 1" SPRUCE SKID
1/8" SHAFT COLLAR
2-1/2" DIA WHEEL
FUSE
DENO
DENO

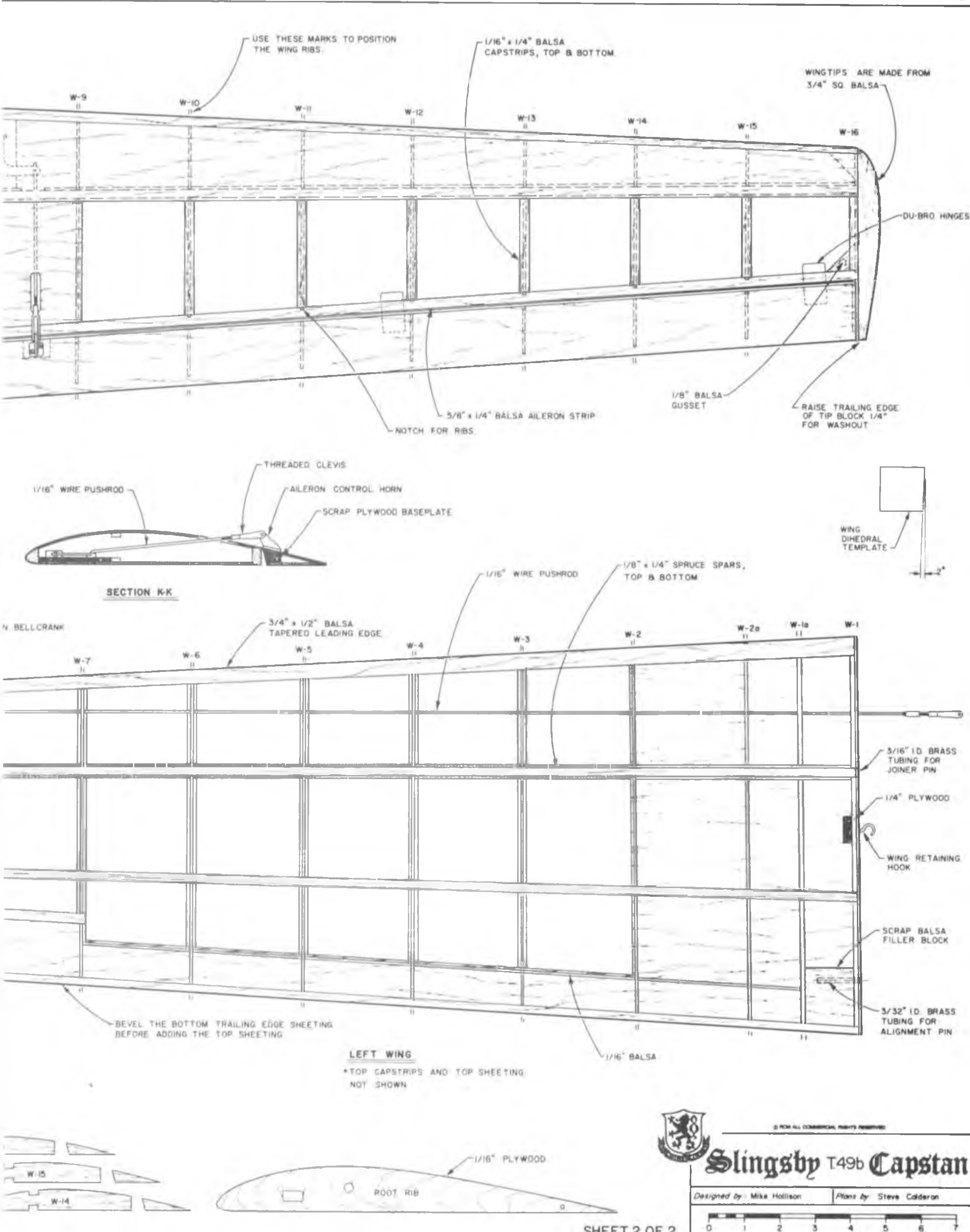
FULL SIZE PLANS AVAILABLE — SEE PAGE 184



PLAN NO. 904②

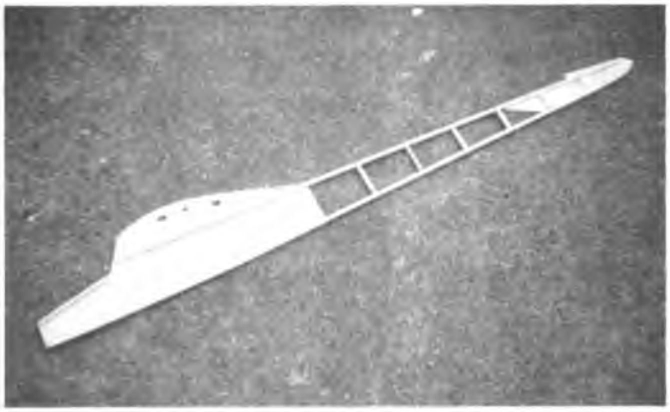


CENTER SECTION IS SHEETED WITH 1/16" BALSA, TOP & BOTTOM.
1/16" SHEET BALSA (TOP ONLY)
W-1
W-1a
W-2a
W-2
W-3
W-4
W-5
W-6
W-7
J
J
RIGHT WING
1/8" x 1/4" SPRUCE SUB-SPAR
1/16" SHEET BALSA BETWEEN W-7 & W-9 TOP ONLY.
FILL WITH EPOXY AND MICRO-BALLOONS
3/16" I.D. BRASS TUBING
SCRAP BALSA SPACER, SEE TEXT
W-17
1/4" BALSA SHEAR WEB
W-17
SHEAR WEBS INSTALLED WITH GRAIN RUNNING VERTICALLY.
SECTION J-J
1/8" THK x 1" WIDE PLYWOOD
CUT AWAY SHEAR WEB TO ALLOW FOR PUSHROD MOVEMENT
W-16
W-15
W-14
W-13
W-12
W-11
W-10
W-9
1/16" SHEET BALSA
NOTE
W-2a THRU W-16 ARE MADE FROM 1/16" BALSA.
W-8a
W-3
W-2
W-2a
W-1a
W-1
1/8" BALSA
W-8
W-7
W-6
W-5
W-4
W-13
W-12
W-11
W-10
W-9

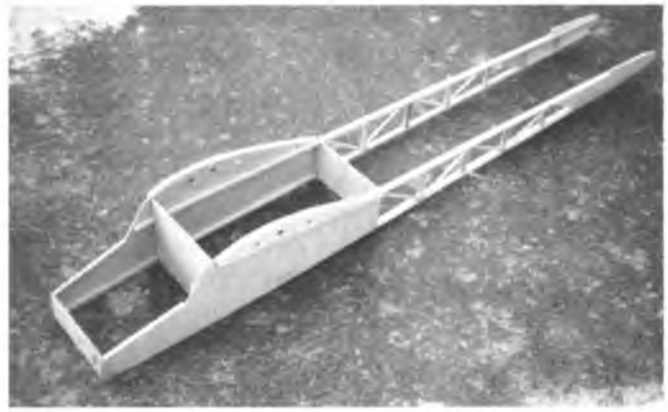


USE THESE MARKS TO POSITION THE WING RIBS
1/16" x 1/4" BALSA CAPSTRIPS, TOP & BOTTOM
WINGTIPS ARE MADE FROM 3/4" SQ. BALSA
W-9
W-10
W-11
W-12
W-13
W-14
W-15
W-16
DU-BRO HINGES
1/8" BALSA GUSSET
RAISE TRAILING EDGE OF TIP BLOCK 1/4" FOR WASHOUT
5/8" x 1/4" BALSA AILERON STRIP
NOTCH FOR RIBS
THREADED CLEVIS
1/16" WIRE PUSHROD
AILERON CONTROL HORN
SCRAP PLYWOOD BASEPLATE
SECTION K-K
WING DIHEDRAL TEMPLATE
2"
1/16" WIRE PUSHROD
1/8" x 1/4" SPRUCE SPARS, TOP & BOTTOM
N BELLCRANK
3/4" x 1/2" BALSA TAPERED LEADING EDGE
W-7
W-6
W-5
W-4
W-3
W-2
W-2a
W-1a
W-1
3/16" I.D. BRASS TUBING FOR JOINER PIN
1/4" PLYWOOD
WING RETAINING HOOK
SCRAP BALSA FILLER BLOCK
3/32" I.D. BRASS TUBING FOR ALIGNMENT PIN
BEVEL THE BOTTOM TRAILING EDGE SHEETING BEFORE ADDING THE TOP SHEETING
1/16" BALSA
LEFT WING
*TOP CAPSTRIPS AND TOP SHEETING NOT SHOWN
W-15
W-14
1/16" PLYWOOD
ROOT RIB
SHEET 2 OF 2
Slingsby T49b Capstan
Designed by: Mike Hollison
Plans by: Steve Calderon
0 1 2 3 4 5 6 7

PLAN NO. 904②



Basic right fuselage side from 1/8" ply and 1/4" sq. balsa.



Fuselage sides joined by F1, F2 and F3. Plans show F3 in slightly different position.

Tail pulled together and bottom partially sheeted.

Fuselage nearing completion — note pushrods installed.

Nose blocks have been added and shaped. This completes the fuselage.

Fin and rudder installed with linkage attached.

linkage, wing rod, and rear alignment pin, and epoxy to W1. Rough carve the balsa wing tip, glue to W16, and sand to shape.

It is advisable at this point to sand the whole structure, and to cover the wing panel with heat shrink plastic before adding the ailerons.

(8) Cut the lower aileron panel from 1/16" sheet balsa, bevel the outer edge, and position between W8 and W16. Cement the aileron ribs W8A to W16 in place. Next, cut a strip of 1/16" balsa, 9/16" wide tapering to 1/2" wide at the tip, and glue to the forward edge of the aileron sheet and the ribs. Cement a triangular balsa wedge immediately behind this strip at the control horn location as per plan, slot the strip for the aileron hinges and epoxy in place, ensuring that the whole aileron moves up and down without binding. Cut the top aileron panel to length and cement to the strip, ribs and trailing edge of the lower sheet; sand smooth, and cover.

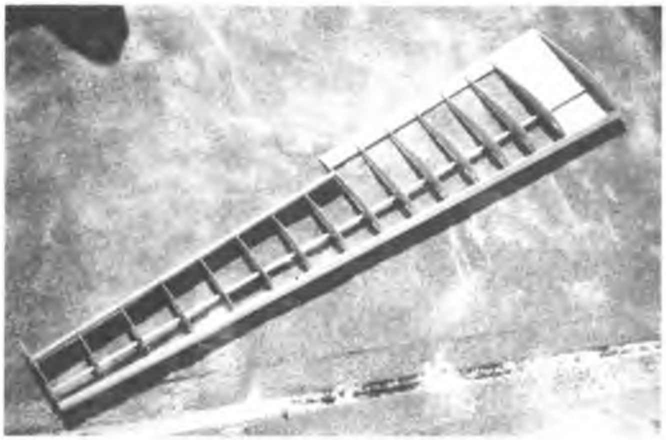
Put wing half aside, and repeat steps 1 through 8 for the other wing half.

Fuselage:

(1) The forward fuselage sides are made from 1/8" ply. Mark the wing root location and drill for wing rod tubing and alignment pin. Cut holes for the aileron pushrod and the wing retaining elastic bands.

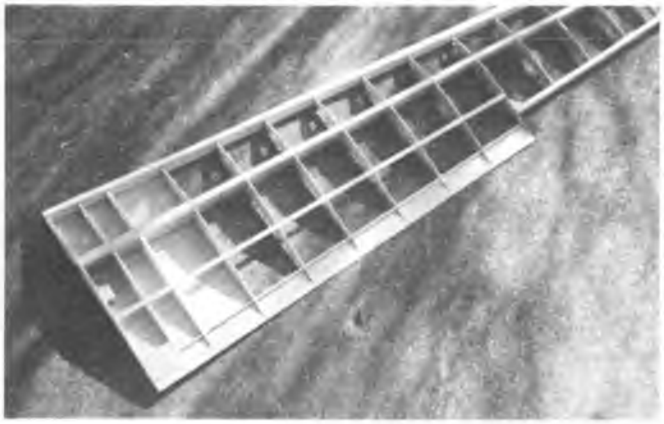
(2) Butt-join the 1/4" sq. hard balsa fuselage longerons to the correct length, and cement to the inside of each panel. Then glue the fuselage uprights in place, and add the 1/8" balsa rear fuselage side. Next, cut the dummy fuselage bracing from 1/8" sq. balsa and cement over main longerons, uprights, and diagonally between the two as shown. Glue the 1/4" x 1/8" spruce cabin strips in place.

(3) Cut two wing fairing ribs from 1/4" ply, drilling for wing rod tubes, alignment pins, aileron pushrods and elastic band retainers. Epoxy each rib to the outside of the fuselage sides at the wing root position. Add epoxy fillets back and front of each fairing.

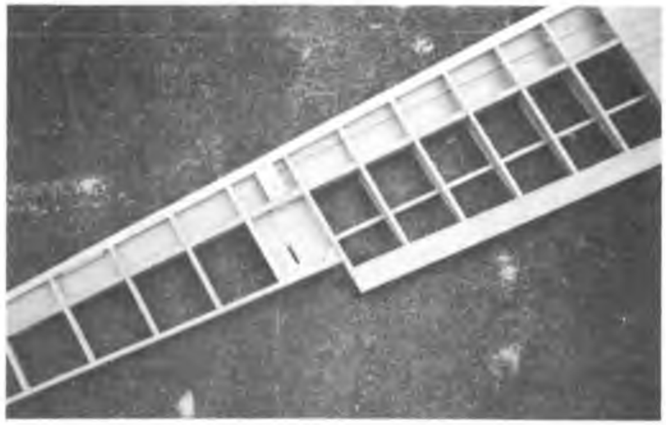


Basic wing panel assembly.

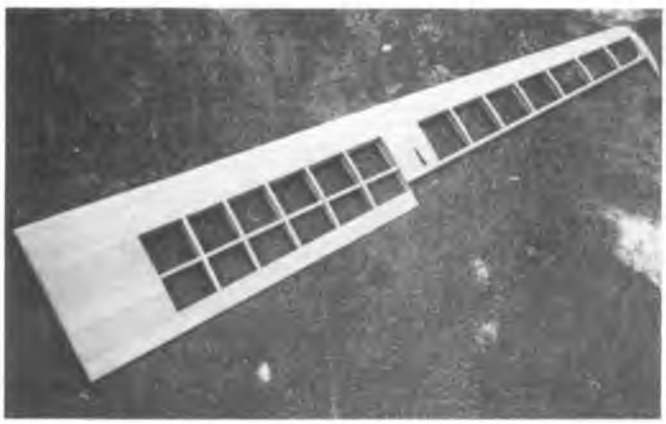
Spar box assembled with brass tubing inside for wing rod.



Center section is complete and ready for sheeting.



Bottom view of wing panel with aileron linkage installed.



Top view of completed right wing panel.

Canopy removed showing the ample room for radio installation.

(4) Cut formers F1, F2, F3 and F8 from 1/8" ply, and drill F2, F3 and F8 for pushrod and antenna tubing. Cut a hole in F2 for the aileron servo lead. Epoxy F2 and F3 between the fuselage sides, ensuring that all is square, then add F1 and F8. Cement the 1/4" sq. balsa uprights beside each former as shown on the plan.

(5) Sheet the bottom of the fuselage with 1/8" light balsa from F3 back to the rear of the fuselage using a herringbone style pattern. Cement a 1/4" sq. balsa cross brace to the inside of the sheeting directly beneath the F5 former location. Next, cut the rudder and elevator outer pushrod tubes to length and epoxy to F2, F3 and F8. Do the same with the antenna lead-out tube, sliding it between F8 and the fuselage bottom.

(6) The bottom of the fuselage between F1 and the start of the balsa sheeting is cut from 1/8" ply. Remove sufficient wood to allow for the 2½" diameter main wheel, and epoxy a blind nut in the ply at the tow hook position. Glue two 2" x 1" x 1/8" ply sheets on either side of the wheel well, and glue the ply bottom to the fuselage.

(7) Cut the top formers F3A to F1 from 1/8" balsa, notching for the 1/8" balsa fuselage spine and cementing in position. Glue the spine in place. Now, cut the 6¼" long wing joiner tube from 1/4" O.D. brass tubing and epoxy into the fuselage. Glue the 3/4" x 1/4" ply fuselage brace immediately above the tubing. Similarly, cut the 1/8" O.D. x 6¼" wing alignment tubing to length, epoxy between the fuselage sides, and add the 1/8" x 1/2" ply brace as shown.

(8) Now glue the 1/8" balsa top decking in place and sand flush with the fuselage top. Cement the 1/8" x 1" x 5½" vertical balsa brace immediately behind the decking, then add the 1/8" balsa sub-spine 'S' between this brace and F3A. Glue 1/8"

to page 198

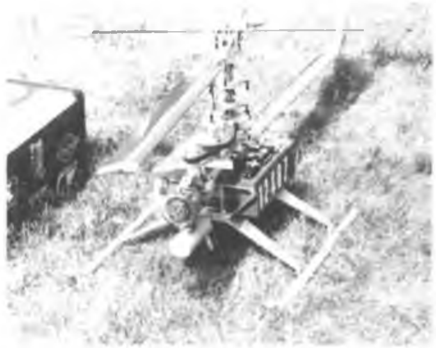
Give It A Whirl

JOHN GORHAM

Introduction

Last month we had a short column, mainly because I was on my journey from California to Massachusetts to attend the 1983 AMA Nats. I hope that you enjoyed the early and brief report of the Nats, however, which was written while enroute back to California.

This month I won't dwell on the Nats but it may be worth adding a few more photos and statistics which will give you a better feel for what went on at this largest and best helicopter Nats we've ever had. One of the events that is traditional at all our National competitions is the appearance of Faye Peoples, Jr., who always turns up with a spectacularly beautiful home-built machine. He flies it, too. In fact, Faye flew in the competition this year and placed well. You can see his machine in the photo. There is also a shot of Faye Peoples (on the right) with Tommy Knerr (on the left). Tommy Knerr is one of our stalwart helicopter pilots whose face is now familiar at nearly all the contests, at least in the East. Tommy started off with the "Cricket" and flew a Mini-Boy at the Nats. Another new personality on the heli scene of top fliers who was worth presenting to you last month, except we didn't have a photo in time, is Ralph Geese of Farrell, Pennsylvania. You can see Ralph receiving his well-deserved First Place in Intermediate level. The final photo is just to impress you that there were a lot of people there, at least a lot of transmitters. This shot is a view of the impound table. Notice



Faye Peoples' very efficient scratch-built heli. Faye is also a very efficient pilot.

Tommy Knerr (L) chats with constant competitor Faye Peoples at the Nats.

Ralph Geese of Farrell, Pennsylvania, receiving his 1st Place Intermediate award at the '83 Nats.

Heli transmitter impound at '83 Nats.

Jeff Sands, Denver, Colorado, and Tim Schoonard, Orlando, Florida, look content after a good flight.

how close some of the transmitters were to the edge of the table. I wonder how many fell off (and were put back on without the owner being told). Well, I just received a report of the Nats from the National Capitol Radio Control Helicopter Association and they provided the following statistics which were gathered by Joe Lawrence and which I thought would be interesting to you.

RADIOS	HELICOPTERS
35 — JR	21 GMP (all t pes)
4 — Futaba	19 Schluter (all types)
11 — Kraft	4 Kavan Jet Ranger
3 — Airtr.	2 Kavan Alouettes*
1 — World	3 Horizons
2 — Ace	2 Hughes (make not provided)
1 — Proline	1 Mantis
	" 1 Playboy "

*Both Sam Newhouse's!

The Trip

It would be impossible for me to cover the trip across the country and back in detail, at least within the scope of this current column since we visited so many, many places and socialized with so many helicopter fliers. Just to name a few of the major cities that we stopped in: Albuquerque, St. Louis, Memphis, Grand Junction, Philadelphia, Knoxville, Pottstown, Denver, and Little Rock. It was a very rewarding and informative trip for us and we enjoyed it thoroughly. Everywhere we stopped we were greeted by large groups of eager, and many talented, R/C helicopter fliers. I was amazed that in every major group there were at least two or three fliers who could now fly well enough to perform the AMA Expert pattern very reasonably. Just making a rough assessment, based upon the cities that we visited and the fliers that we saw, I would now believe that there are well over 1,000 fliers in the USA who have become competent in hovering at least simple forward flight with an R/C helicopter. What was the number last year, I wonder?

It's interesting to me, of course, to note that at the Nationals we took as broad a survey as we could and concluded that well over one half of the entries in the Nats had learned to fly originally on my "Cricket" helicopter. It was very rewarding to me to find this out since it shows that once a flier has mastered the simple helicopter he doesn't stop there but goes on to the more advanced types. Of course I don't know how many fliers gave up! I hope, in a later column, to give you a more detailed run-down of our trip but I don't have all the photographs back yet.

The week after the Nats was the New Jersey Helicopter Club's "East Coast Championship." The results of this are as follows, but at the time of writing I don't have any further information of this meeting.

EAST COAST R/C HELICOPTER CHAMPIONSHIP
August 7, 1983

	F.A.I. Expert	
1st	Ralph Dalusio	Competitor
2nd	Tom Dalusio	Competitor
3rd	Faye Peoples	Scratch Built
	Intermediate	
1st	Charlie Sjobeck	Heli-Boy
2nd	Bob Harris	Superior
3rd	Joe Lawrence	Kalt
	Novice	
1st	Mike Songer	Competitor
2nd	Wally Saber	Competitor
3rd	David Bickert	Superior
	Scale	
1st	Bill Cane	Kavan Jet Ranger
2nd	Charlie Sjobeck	Kavan Jet Ranger
3rd	Walt Schoonard	A.S. 355

Now, finally, to the subject that I have promised for several months — Inverted Flight.

Inverted Flight

Inverted flight of R/C helicopters seems to have come on the scene in the USA a few years ago with reports of various fliers, such as Mike Mas and Larry Jolly, doing it. However, one of the "unsung" heros of the inverted flight saga is Ernie Huber of Danvers, Massachusetts. Ernie, many of the "Old 'uns" will know, is one of the first and best R/C helicopter pilots in the country. Ernie had the ability to perform fantastic aerobatic flight way, way back when most of us were happy if we could hover a foot or two. He still does. Ernie also pioneered much of the early movie work. If you saw "Towering Inferno," several of the helicopter shots were only possible because of Ernie's flying skill. Like me, though, Ernie is getting old (aren't you, friend?) and he finally conceded at the 1983 Nats that the"young 'uns" are at last doing it better. However, one of the important things that Ernie did was the first inverted hovering, using electronic switching, in the USA, maybe in the world. Inverted forward flight was done first in Europe, and also a little later in this country, but there's a big step from inverted flight to inverted hovering. Although inverted hovering can be done without changing control directions by switching, Ernie was the first man to figure **how** to do it. He very ably demonstrated inverted hovering with his Jet Ranger at the 1979 Tangerine Contest. Ernie's first inverted hovering using this technique was done in October, 1979.

We mention Ernie's achievements in this column since he certainly never received the proper credit for a tremendous piece of pioneering work.

Today, of course, many fliers are doing the inverted "thing." My bulletin board is studded with photographs of many fliers hovering their helicopters inverted. We include a few here for you to see and, in particular, the one of the three helicopters all hovering at the same time may impress you. The gentlemen concerned are Bill Curtis, Ralph Geese and Dave Davis. Another photo that may interest you is that of Jeff Dunham of Waco, Texas, who is a well-known ventriloquist. Jeff started R/C helicopter flying a couple of years ago. He is now a very accomplished flier and can certainly fly and hover his machine inverted, as you can see. (I wonder if Jeff's machine tells him what to do while it's flying?)

One of the features of inverted flying is, of course, that the machine has to be set-up much more meticulously in order to have the controls work right "both ways up." This, I found, has forced many of us who have tried inverted flight to be much more careful and precise in our control set-up, which, in turn, has improved our "right way around" flight. So, one bonus, at least, which results from trying inverted flight is a

Ernie Huber doing the first inverted hover November 10, 1979.

L To R: Dave Davis, Ralph Geese and Bill Curtis do a little formation flying at Canton, Ohio. Photo courtesy of Modelers Haven and Canton Repository.

Bruce Tempe flies two at a time in Saudi Arabia.

Bruce takes on four with two Xmtr's. Now we know he's good with the camera. Makes an interesting possibility, however!

Jeff Dunham, ventriloquist and R/C heli pilot, with his R/C helicopter "Dummy."

See, even the "old man" cannot only write about it, he can do it too!

better machine the right way up and maybe a wiser pilot, too.

Before you fixed wing boys scoff and remind us that you don't reverse your controls as we do, I'd like to come back and say that you don't have to hover, either. In addition, you can reverse your lift vector simply by changing the angle of attack of your airfoil a very small amount. We have to change our lift vector a very large amount using mechanical linkages or electronic wizardry. Although it is perfectly feasible to fly and even hover a helicopter **without** reversing controls (except collective pitch, of course), it does require a great deal of skill since hovering demands constant and correct control inputs.

So, if you want to join the inverted flight club, you must first decide if you want to do it the hard way or if you want to reverse your controls as most of us do.

Okay, now that you've decided that you don't want to do it the hard way, then here's an opinion of at least one flier (me) on how it can be done using electronic switching. The method described in this column is the one adopted by most of the experts I know but it is, of course, related to the "Competitor" helicopter which I fly and which has the necessary large range of collective pitch. It also normally uses five servos (one each for throttle and collective) which are needed. Other makes of helicopters will differ slightly but the general principles will remain the same so I'm sure you can interpret any of my figures into those required for your own particular helicopter (and nearly all the collective pitch machines will do it).

First, then, let's define the basic requirements needed so that you can decide if you want to go further on our "incredible journey."

REQUIREMENTS FOR INVERTED FLIGHT

(1) Collective Pitch.

(2) Large enough mechanical collective pitch range — at the very least 15 degrees total.

(3) Separate collective pitch and throttle servos.

(4) Special transmitter which will switch all the necessary functions with one switch.

(5) Zero coning angle on the rotor head (preferably, or at least, a very small coning angle).

(6) A fuel system which will run inverted (unless you want to autorotate inverted).

(7) A tail rotor gyro would be nice — it works both ways up.

(8) An iron nerve and a stubborn resolve.

Note: It's also an advantage to be able to electronically shape the collective pitch curves, both right way up and upside down, although this is not necessary.

Regarding the need for collective pitch, one of our photos this month shows Bruce Tempe, in Saudi Arabia, apparently hovering his two "Crickets." We don't believe it, Bruce, you must have some photo magicians out there!

So far as the fifth channel is concerned, this is necessary for inverted flight (as you can see) unless you are willing to go to a lot of mechanical complexity. Figure 6 shows that you should have a separate servo for your throttle control and another one for your collective pitch control. These cannot be "Y" connected together as they sometimes are with a dual installation of this nature, but they must be plugged into the throttle and one of the auxiliary channels. On most transmitters that claim to be helicopter transmitters, there will be an 'invert switch' and moving this switch will enable you to do all the reversals that you need. You might note that this switch is in different positions on different transmitters and, in the one that I used, it was quite a long switch at the back of the case which was easily accidentally moved. How many of you out there have accidentally flipped your switch while flying the right way around and had literally less than one or two seconds to recover (if you did at all) before the helicopter dove into the ground simply because it had a very fast and powerful negative lift vector all of a sudden? What I actually do with my switch is to chop it off with a pair of cutters so that it is sharp and short and that keeps me from moving it accidentally. Other fliers move the switch to a position where it is not easily reached. Do be careful, however, because the switch can catch you out in flight and even when you're about to make another flight. If the switch happens to have been moved to the wrong position and you don't notice it, you'll have the embarrassing experience of smiling at everybody, opening the throttle and then watching your helicopter screw itself hard into the ground simply because the invert switch was set to 'invert.' These new radios are nice but they sure need watching.

Now there are some other general requirements which relate to inverted flight. First of all, many of the experts are now flying with a Center of Gravity ahead of the main rotor shaft, rather than on it as we have been accustomed to doing in the past. I fly with the Center of Gravity around 1/4" ahead of the main rotor shaft. Robert Gorham flies with it even further forward than that. He says that there is an advantage to this in forward flight and aerobatics and little or no disadvantage in the hover. I was skeptical of this point at first but now I am becoming a firm advocate of "slightly forward C.G." rather than "exactly on the mast" which has been our practice in the past. Darn these kids, how do they know so much?

Now, let's consider some of the basic principles of inverted flight.

Basic Principles of Inverted Flight

Figure 1 shows the control directions of a helicopter when flying the "right way up." The arrows indicate the normal way that the controls operate — right roll, left roll, tail rotor right and left and cyclic pitch nose up and nose down. By the way, this diagram is for a helicopter where the flier "flies the nose"; that is to say, right rudder or tail rotor command makes the **nose** move to the right.

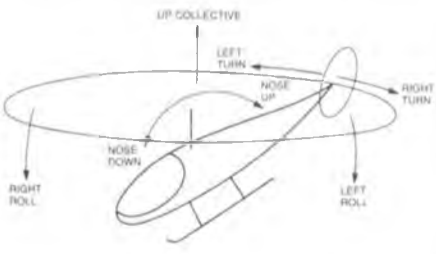


FIGURE 1
CONTROL DIRECTIONS 'RIGHT WAY UP'

Now let's look at the way the controls change when we are upside down. Figure 2 shows what happens. You'll see that tail rotor reverses (left becomes right and right becomes left), nose down becomes nose up and nose up becomes nose down. Up collective, of course, reverses and becomes down collective. Roll, however, stays the same. So that means that we must have our collective pitch, our tail rotor, and our cyclic pitch reversed if we want our control senses to be the same inverted as they are the right way up.

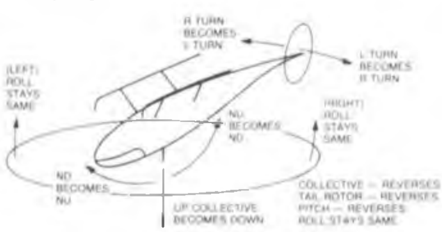


FIGURE 2
CONTROL DIRECTION UPSIDE DOWN

Now another factor of inverted flight has been the phenomena which many of us have noticed — that we need less pitch angle on the blades for inverted flight than we do the right way around. I'm sure there's going to be much controversy on the reasons for this and I've already had some

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heated arguments in this regard. There seems to be no disagreement, however, that less is required — about one degree less for symmetrical blades and two degrees less for semi-symmetrical. During discussions on this subject with a well-known full size helicopter aerodynamicist, he concluded that a probable reason is that the air flow, when the helicopter is the right way up, accelerates from slow to fast as it moves through the blades. The faster moving air then exits, and turbulates over the helicopter's structure thereby "spoiling" the lift to some extent.

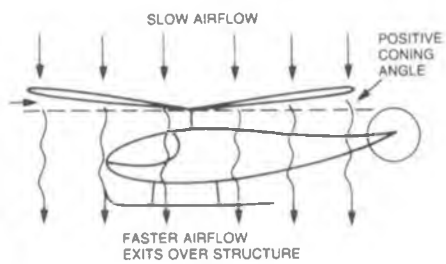


FIGURE 3
AIRFLOW ACCELERATES ON PASSING THRU ROTOR BLADES

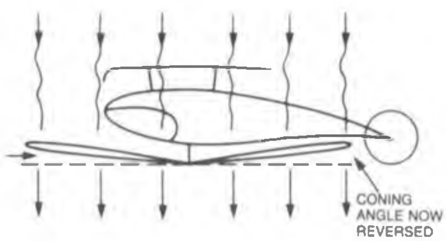


FIGURE 4
FASTER AIRFLOW EXITS CLEAN

When the helicopter is inverted, the faster air flow can obviously exit more cleanly and this could account for an improved efficiency of the rotor blade system. However, I'm not too sure about this theory but I don't know of any other that really fits. Figures 3 and 4 show the way the air flow changes. You will also notice in the diagrams that the coning angle has **reversed** from the positive coning angle which is often used for flying the "right way up." This is the main reason why a zero coning angle is preferable. Naturally, of course, if there is a positive coning angle there will be much more blade bending in inverted flight. But, provided the positive coning angle was small in the first place, this shouldn't give any real problem.

Handling Qualities and Stability

Now let's look at the handling qualities and stability aspect of inverted flight. Those of us who have achieved inverted flight have been surprised at the apparently similar handling characteristics. One would expect, with the C.G. above the lift vector instead of below, that the

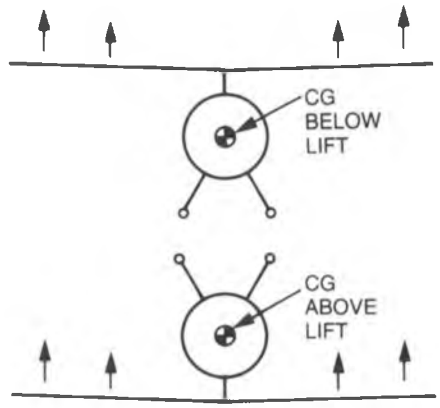


FIGURE 5
CG POSITION CHANGES

helicopter would be very much less stable; in fact, maybe unstable (see Figure 5). This doesn't seem to be the case although it seems that we have to be a little bit more active when hovering (might be just shaky fingers, too!). The forward flight characteristics are very similar. Even in the hover it is not as difficult as one might think. The main difficulty with inverted flight, nearly everybody agrees, is getting used to the almost obscene sight of your helicopter sitting upside down in front of you or in the air ahead of you. That's quite something to get used to although, again, after a few flights it begins to seem quite normal again.

Let's Do It

Now let's go on to how inverted flight is actually done and what the good and bad points are. First of all, it's very much like doing your first autorotation, or even your first forward flight. It's scary and you have a right to be scared. Not until the helicopter is actually upside down can you really have any idea if it's going to be okay. Whereas, when you're flying the right way up, you're at least taking off from a stable platform (the ground) and if things don't seem right you can always come back down again. When you go inverted for the first time, of course, you're much higher and it ain't so nice landing upside down. Most fliers who can achieve inverted flight normally make sure that their helicopter is set up correctly so far as reversal of pitch is concerned and then they do a half-roll with about half throttle. As the helicopter becomes fully inverted, the switch is flipped and you are now ready to cruise around inverted.

The first thing that you should note (real fast) is whether your engine will stay running or not. If you've got too much pitch inverted, then the engine will labor and sound like it's going to stop any second. If you have too little pitch the engine will scream. Either way, you should immediately recover by doing another half-roll, flipping the switch (don't forget!) and then come back down to earth to rest and recover for a while. The main rotor blade pitch must now be adjusted and the whole thing tried over again. So, up in the air again, climb to maybe 150' to 200', half-roll onto your back and again check what happens. If the engine now seems to run reasonably (not too rich) and the rotor blades haven't changed their speed too much, you now run into your second potential problem. If you haven't got your trim changes right in cyclic pitch fore and aft, or even if you have, you may be faced with the spectacle of your helicopter starting to pirouette around the sky upside down.

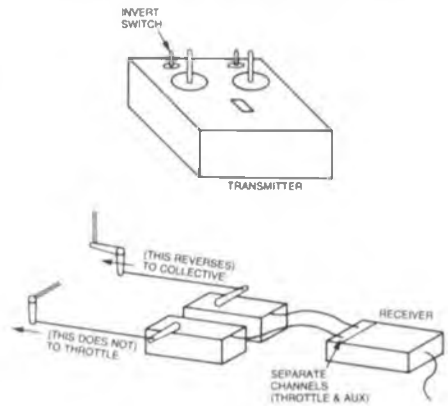


FIGURE 6
ONE SWITCH DOES IT ALL

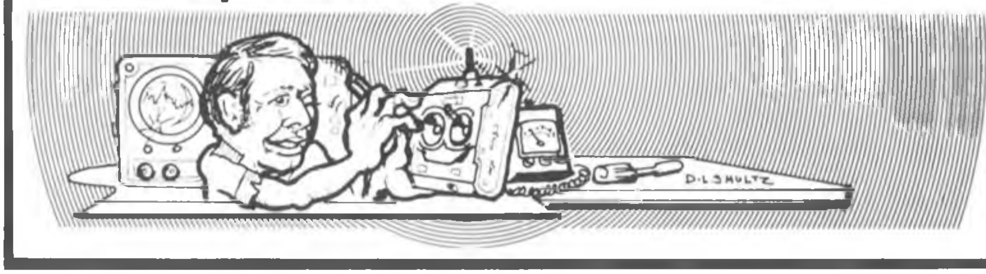
There are two things you can do at this stage. The first, of course, is to recover the right way up again, which is a little difficult when you're pirouetting around but do this the best way you can, flip the switch and come back down for another nice long rest. But now that you've read this article you'll know that what you're really observing is a helicopter slowing down to zero (or less) forward speed and just starting to pirouette as a result. This, of course, can happen in normal forward flight but you learned how to overcome this when you first started forward flight. The solution is exactly the same. You must realize that in inverted flight more forward cyclic is needed to maintain the same forward speed so, as soon as you are on your back, you must be ready with some forward cyclic to make sure that at least a positive value of forward air speed is maintained. This will completely eliminate the spinning around problem that we just described. Now that you are flying upside down you'll be absolutely amazed that you can climb and dive and turn exactly like you did the right way up. The biggest problem, as we said earlier, is getting used to the look of the thing.

However, assuming your engine is now running right (and you'll probably need several flights to get this setting correct) you should then carry out the following: At around 100' to 150' make sure you have some excess power left in order that you can **climb** if you want to. This is important before you take the next step of trying out inverted hovering. When I did my first inverted flight I omitted this step and, having got down to the hover, found that I didn't have enough power to climb out. It's very humiliating to be in an inverted hover and finally have to land inverted simply because you didn't have enough power to climb out. So make sure you check that you do have enough power to climb and, assuming that you do, then keep doing slow circles, coming down lower and lower until you come in towards the hover just like you would the right way up. Once you've got the helicopter in front of you, you will find that it will hover quite steadily but it will be a little bit more difficult to control; not outside the abilities of the average pilot, however. (This is when the gyro can help.)

The first time I hovered in front of me I didn't stay there very long, believe me. I yelled loudly to one of my nearby friends to grab the camera and shoot and then I rapidly got back up in the sky again, flipped round the right way around, landed and did no more flying for the rest of that day. Now, however, I don't find inverted flight a problem at all except for those two checks which we have discussed and which I believe are essential **every time** you do an inverted flight. These days, of course, not only can fliers fly and hover inverted but they are also doing all the aerobatics from the inverted position. In fact, one of the tricks of one of the young fliers I know well, is to take-off, shoot up to about 30' then roll into inverted flight from the hover and then climb out. Imagine that!

Well, that's about it for this month. I hope that all of you will find that the foregoing information helps you take the plunge. It's really not too difficult but there are certain steps that you must take and I've tried to describe those at least that I know of. There are still some more subtle adjustments concerning the trim settings of the helicopter and I'll cover this topic next month. Anyway, good luck to you and please let me know the results and any photos that you care to send in. □

Radio Spectrum JIM ODDINO



Servo Primer

After reading a letter I got concerning the column covering pulse code modulation in the October issue I decided it might be good to review just how our conventional R/C servos work. While we are at it we'll try to give you all the terminology and tell you what to look for in a servo.

The function of the servo is to convert the decoded electrical signal out of our receiver into mechanical output to move a control surface. We want this action to be proportional, that is, we want the output to respond to the input in a linear manner. For example let's ignore everythig in-between the control stick on a transmitter and the servo output arm. A standard stick moves about ± 30° and a standard servo moves about ± 45° in response to that stick motion. (Trim will usually add another ± 5°.) We can say that the output is proportional to the input and that the system transfer function is 45° output for 30° input or 1.5 deg./deg. If we move the control stick one degree we expect the servo to go 1.5 deg.

In a piloted airplane this transfer function can be set with a mechanical linkage. In an R/C airplane we must code the input in an electrical signal, transmit it, receive it, decode it and convert it to mechanical motion proportional to the original input. We can use a number of encoding schemes but in recent history almost all systems use pulse width modulation as the input to the servo. Pulse width modulation (PWM) implies that the information is in the width of a pulse. For example, neutral control stick might give 1.5 milliseconds out of the decoder into the servo. We would then want the servo to be at neutral when the pulse width is 1.5 msec. Full stick might yield 1.95 msec or a change of 1.95-1.5 = .45 msec. If we want the servo to go 45 deg it must move 45 deg./.45 msec = 100 degrees per millisecond or .1 degrees per microsecond. I want to emphasize that I'm talking about the amount of angular output measured in angular degrees for a given change in the input pulse width. I am not talking about the rate or angular velocity the output arm moves. That will be a function of motor, gear train and voltage and will be on the order of 200 degrees per second.

A simple block diagram of a servo is shown in Figure 1. Let's trace a signal through it. We'll assume a neutral (1.5 msec) input pulse and assume the output arm is at neutral. The input triggers the reference pulse generator whose pulse width is a function of the voltage on the feedback pot. When the output is at neutral the reference pulse width will also be 1.5 msec. The output of the reference generator is then compared to the input pulse. In this case they are equal and there is no output from the pulse comparator and nothing moves.

As long as the input doesn't change, the servo sits at neutral. Now let's give it full control stick which gives us a 1.95 msec input and let's assume that a longer pulse drives the output clockwise. All servos are not set up this way and in fact most manufacturers will sell "reversed" servos so you can have your choice. The first time the 1.95 msec pulse gets to the servo the comparator will output a .45 milisecond pulse to the CW pulse stretcher. The reason for the pulse stretcher is that a .45 msec pulse to the motor would barely get it moving. What we want is to get the motor turned on full bore because we have a large error signal. We would like full voltage to the motor until it gets near 45 degree rotation. Therefore, we must stretch the pulse so that it is at least as long as the frame time, that is, until that servo gets another input pulse of 1.95 msec. This might be as long as 26 msec (JR system). As the output approaches 45 degrees we must shorten the pulses to the motor or it will overshoot, and finally when it gets to 45 deg. we need some deadband sot that it doesn't oscillate. The ideal pulse stretcher might have a characteristic transfer function similar to Figure 2. We want the output to move if the input error, that is the difference between our input pulse width and the reference, is as small as 1.0 microsecond. However, we don't need a very long pulse, on the order of one to two msec (called minimum pulse), to the motor because the servo only has to move .1 degree in order to drive the error back to zero.

With errors on the order of 20 to 50 msec, we would like to get full torque which means full voltage which means pulses to the servo at least the length of the frame (26 msec in our example). So much for the pulse stretcher, probably the toughest part of the servo to design. The motor drivers can be thought of as switches and what you want here is minimum on resistance so that your power goes into the motor not the switches. The motor and gear train and feedback pot are self-explanatory but probably what separates the great from the not so great servos as almost all have good electronics these days. What you want is minimum backlash or slop in the gears, a fast low inertia motor and a rugged linear feedback pot. The block called damping is required to keep the servo from overshooting and oscillating and changes the apparent reference pulse width depending on the rate the motor is turning. The reference generator is simply a one shot with the width controlled by an input voltage, in this case from the feedback pot. You would like it to be linear so that you get the same amount of change in output for a given change in input anywhere within the total range. You might be surprised to know that Kraft's domestic servos and JR servos are not linear. It doesn't mean they are bad, but it is surprising that they haven't gone to a linear one shot.

In summary, our servo performs the function of converting an electrical signal, in our case a pulse with variable width, to mechanical position, in most cases an angular rotation although there are some servos with a push-pull action. The important terms are as follows:

Resolution — The smallest increment that can be controlled. It is measured in angular degrees at the output (.1 deg. or .1% is good resolution). You might also refer to the smallest input change a servo can resolve as resolution (1.0μsec is good).

Deadband/Hysterisis — The difference in output position for a given input going in one direction

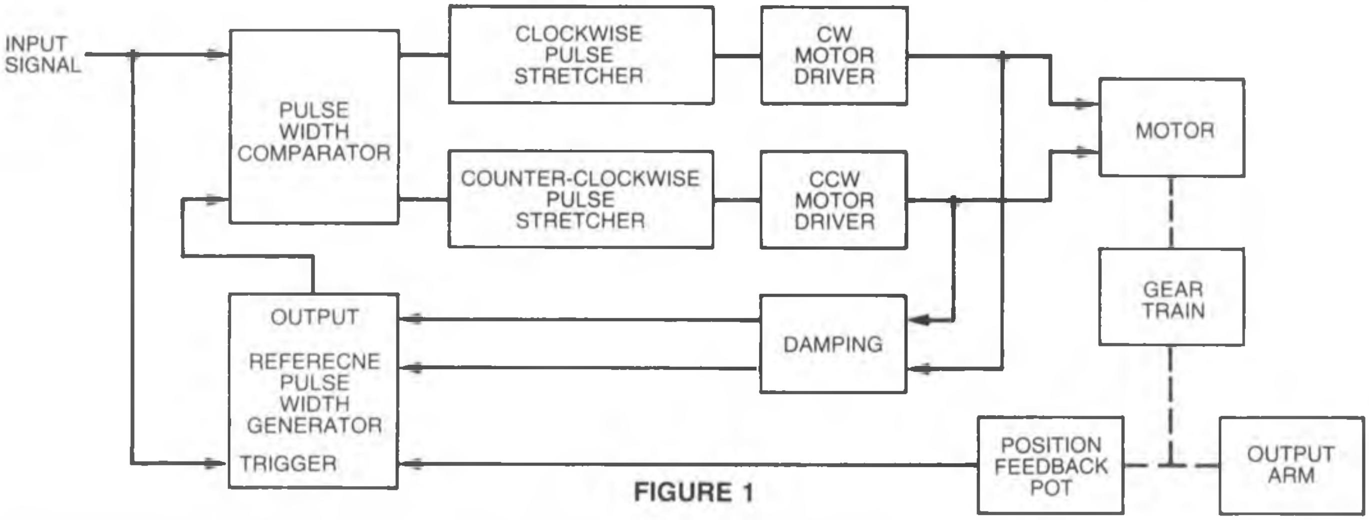


FIGURE 1

versus the other. (2 µsec is good).

Minimum Pulse — The shortest pulse to the motor (one to two milliseconds gives smooth response but it is important that the pulse to the motor gets long quickly as the error increases or the servo will be soft around neutral. See Figure 2.)

Backlash — Slop in the gear train. (Zero degrees is good).

Damping — The ability to get to a position quickly without creeping up on it and without overshoot.

Linearity — When the output moves exactly the same increment for a given change in input over the entire range.

So check your servos against those numbers and see how they shape up. I bet most won't.

More On Pulse Code Modulation (PCM)

Given that background on servos I thought you might be interested in the following letter I received which was referencing the October column.

Dear Mr. Oddino,

I am not, as you are, a radio electronics expert, but I do have an engineering degree, I do have a general understanding of electronics and computers, and I do own and use a business computer with sophisticated software which includes the word processor output you are reading. From your time to time comment I have the feeling some of the masses out there do not give you proper credit for your contribution to RCM. I am not one in that I probably enjoy your column as much as any in the publication. I happen to be a former Air Force jet fighter pilot, and for obvious reasons enjoy reading material that updates the state of the art as relates to jet model aircraft. I always enjoy learning about new and better electronics for radio controlled model aircraft, and if a vote is needed asserting that any advances that add to simulation of the flight of full sized aircraft is good for the sport, you have mine.

Okay, it doesn't take a computer owner, with some knowledge of how the black box works, very long to detect some flaws in the material you presented in your latest RCM column. First I make these obvious changes to content:

Decimal 128 in binary is 1000 0000 as stated (spacing for clarity).

Decimal 256 in binary is 1 0000 0000 (cannot be expressed in 8 bits).

Decimal 640 in binary is 10 1000 0000.

All reference to 256 as decimal number should be 255, neutral would be 127, and 0 decimal would be throttle off.

Your Kraft servo is not a ducted fan Rossi tuned pipe engine, and consequently cannot turn 21,667 rpm. The servo moves .13 degrees per millisecond (.001 seconds), not microsecond (.000001 seconds).

There, that wasn't too bad, was it, but some factors of the above changes do play havoc with the results you reported. The most difficult problem arises when we update servo movement. The Kraft servo (I hope) moves only .00013 degrees per microsecond. This leads to .00065 degree steps in your example. According to the given data out of the receiver you only have 1.275 total milliseconds for 256 steps. Therefore,

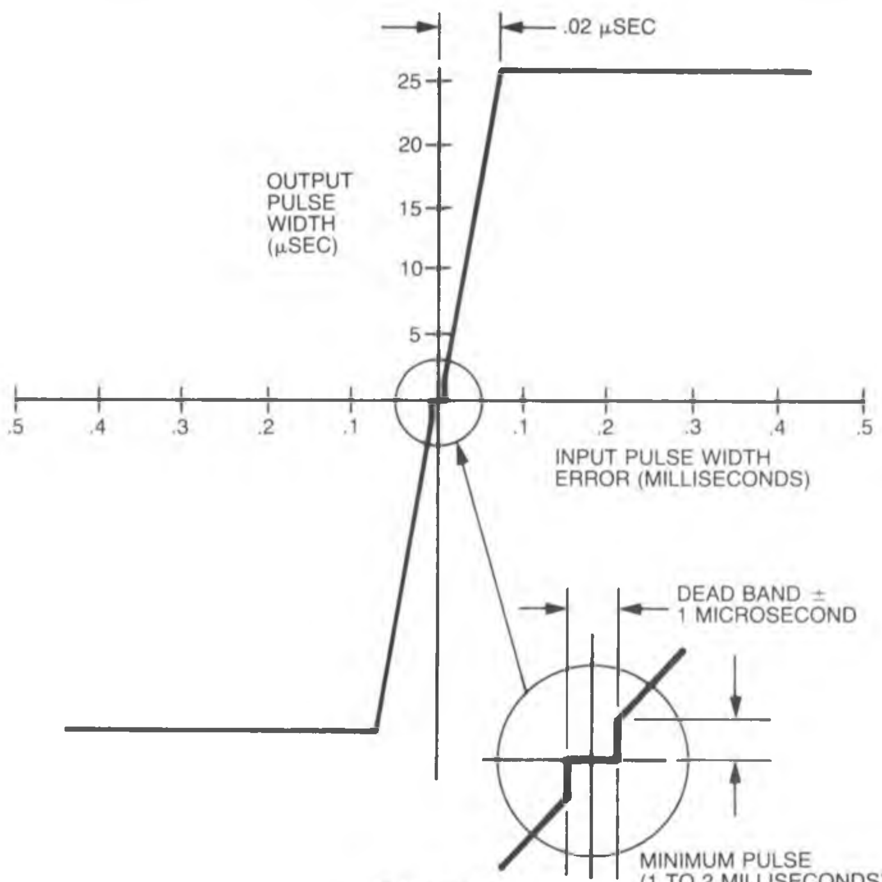


FIGURE 2

multiplying the .00065 degrees per step by 256 total steps should produce total servo travel in degrees, but .166 degrees total servo travel is just not going to get the job done. For that matter, even using your original figure gives 166 degrees travel and that doesn't jibe with the 100 degrees of travel by definition. What has happened is that you have compared apples with oranges, and here in Florida they are not considered equal. The pulse width variation in PPM systems that you describe in the beginning of your column as 1.5 plus or minus .5 milliseconds implies total pulse width variation is one millisecond. Your servo data states that servo movement is .13 degrees per millisecond. It seems obvious then that we can not equate pulse width variation in milliseconds with servo movement in milliseconds. The Kraft servo makes the total 100 degree movement in .75 seconds (approximately).

In PPM systems one millisecond of pulse width variation causes this 100 degrees travel by means that you and I know so I needn't go through the process, but the pulse width variation (in milliseconds) only serves to create the output voltage that proportionally drives the servo motor. Mechanically, the servo happens to take in your example 750 milliseconds to produce full travel. If, as you say, a good servo motor can react to one microsecond of pulse width variation, and since 1000 microseconds produces full servo travel, it follows that the servo is non-proportional to the extent of .10 degree steps in a mechanical sense. This compromise to a theoretically exact proportional output voltage looks smooth and undoubtedly is smooth servo movement. For the German PCM system described the derived value for *degree steps is .39 (same basis of 100 degrees servo travel). This value does not change as it results from setting the 256 discrete output choices a proper increment to produce the necessary 100 degrees of servo travel.*

Decoding back to pulse width increments to drive normal servos does not alter the situation as each discrete choice must be assigned .39 milliseconds in order to attain the 1.0 milliseconds of pulse width variation that is then made to drive the servo 100 degrees. These 256 steps take a total of .75 seconds actual time so 33 degrees of servo travel would only take a quarter of a second, and if this occurred in 85 distinct steps I wonder if it really could be noticed. Granted, by a factor of four we have lost servo travel resolution over the PPM system, but in the quarter of a second elapsed can I tell the difference between 85 and 330 discrete movements. I don't have an answer having never seen, of course, the PCM system.

Name witheld by request

Well, that letter deserves some comments. Our reader is correct on the binary numbers. The eight "ones" should have been labeled binary 255 not 256. However, it does correspond to position 256 of the servo. The confusion exists because the first position in a system numbered in binary is zero not one. For example a two bit word can have four values, but the values would be labeled 0, 1, 2, 3, and not 1, 2, 3, 4. You can also argue where neutral is. I guess in an eight bit system 127 is close enough, but it is actually between two numbers, and can't be encoded. Our reader is also correct on the binary number for 640. There were a few more typos in the article. On the top of page 154, a "per" got left out. It should have said .10 degrees per μsec and a few lines later we mentioned a deadband of .5 μsec, which should have been 5.0 μ. I hope there weren't any others.

I'm sure many of you can see that our reader got confused when I talked about a servo moving .13 degree per microsecond. He thought I was talking about the angular velocity of the output. I should have clarified it. Although it is interesting that later in the letter he did establish that a 1.0 millisecond change in input drove the servo through its 100 degrees. If we divide 100 degrees by one millisecond we get .1 degree per μsec. We also confused him by discussing Kraft servos which move .13 deg. per μsec around neutral and micro prop systems which have a change in pulse width of 1.275 msec. The Kraft system has a change of about .95 msec from one extreme stick position to the other and as I said is not linear which means it doesn't move .13 degrees per microsecond near the end of its travel. That's why the numbers didn't come out.

Anyway, our reader does agree the eight bit PCM system has lost resolution by a factor of four and that is the point I was trying to make. He is also right in the fact you wouldn't see this if you put in a sudden command to move 33 degrees. The servo would drive to 33 degrees as fast as it could and stop. The problem arises when you drive the servo real **slow.**

If you tried to drive it at .1 degree per second (now I'm talking about output angular velocity) you would see it move in steps of .5 degrees instead of .1 degree. As I said originally, you might not be able to tell the difference in the air.

However, don't worry. Ten bit systems now look feasible. Intel has a new micro processor chip that has an eight channel multi plexer and 10 bit analog to digital converter built in. The progress is astounding.

Before closing this month, I thought I might bring your attention to the radios used at the 1983 R/C aerobatic team finals — the Masters as we call it. It looks like eighteen of the top twenty used JR servos. Now I'm sure

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SOME PROPOSED R/C CLUB FLIGHT RULES

OR

HOW TO LIVE WITH ALL THOSE NEW FREQUENCIES

By Jack E. Duff

For the past few years the Canton Ohio R/C Club has sponsored a Giant Scale Fly-In each summer. Thanks to a club membership consisting of such people as Bob Campbell (of B-29 and Hollywood fame), Clancy Lintner (Ohio Superstar and his 15½ ft. Shrike) and Dick Roush (of Roush Mfg. "The Engine People") this has been a pretty popular local attraction. In 1982, however, disaster struck when a frequency control mix-up occurred, causing a crash during the festivities. This, together with the advent of the new frequencies, pointed up the need for a complete reappraisal of flight control rules at our club. After all, if you can't stay out of trouble with the limited channels of pre-1983, it's pretty obvious that with the addition of the new frequency slots something in the way of a new approach was needed.

Always being willing to stick out his neck, the author volunteered to study the various problems and make some proposals for the club to consider. The results seem to have turned out to be quite acceptable to both beginners and old-timers alike and, hopefully, will allow maximum enjoyment of the new frequencies with a minimum chance for disaster in the air.

With the thought in mind that other clubs might be studying this problem as well, the writer decided to submit an article to RCM covering the proposed flight control rules and the associated hardware. Perhaps it will start a wider interchange of badly needed new ideas on a tough subject (maybe even leading to a standard set of AMA flight regulations for all clubs to follow).

In the past, almost all clubs have used some sort of a tagged clothespin system to designate frequencies or fliers. In the "Subtractive" system, the flier **takes** a frequency labeled pin from a flight control center, while in

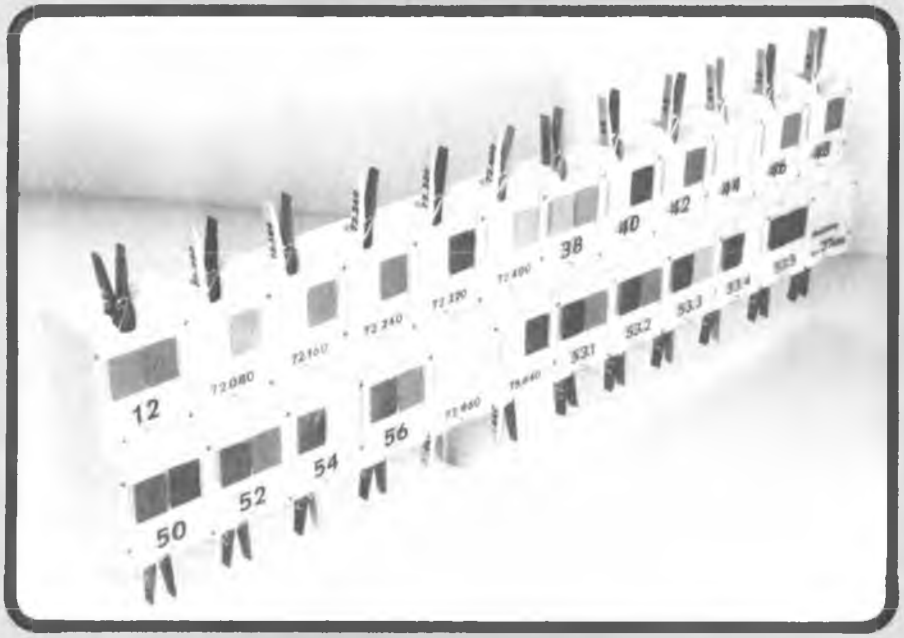


FIGURE 1

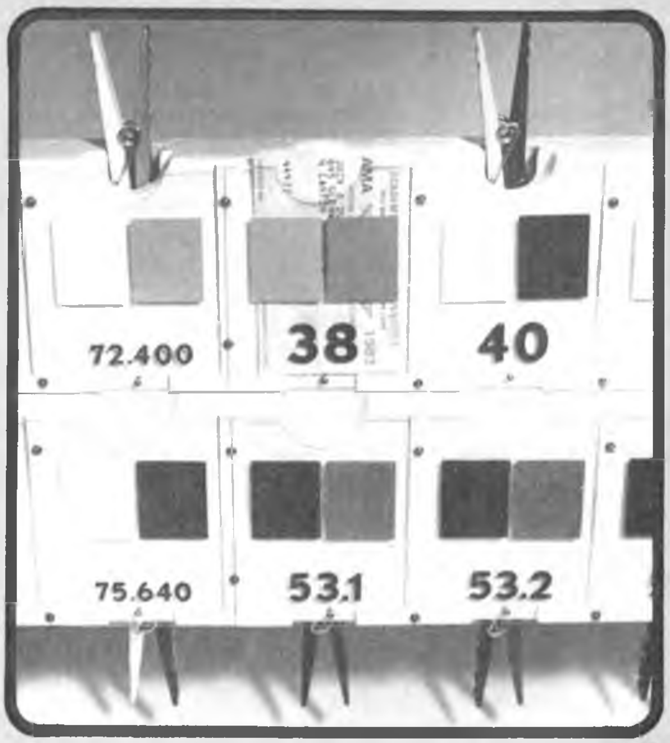


FIGURE 2

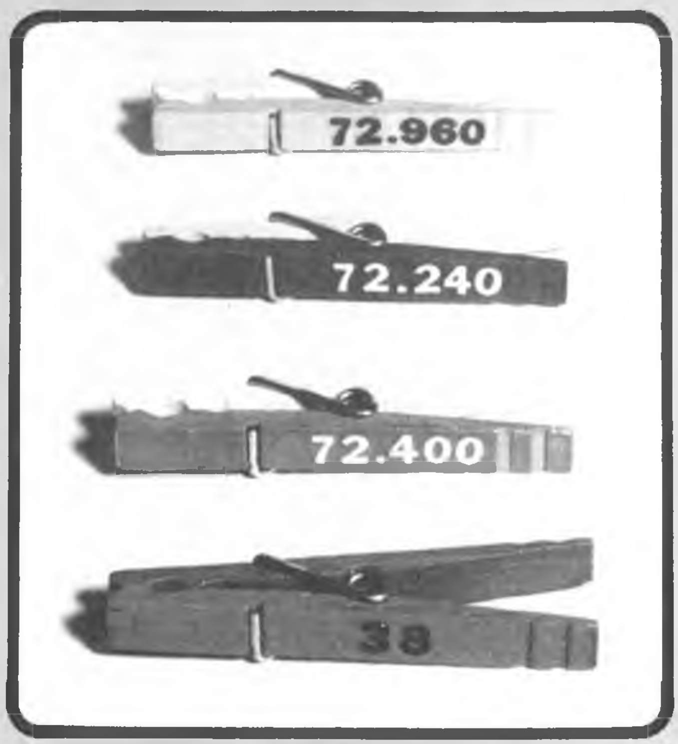
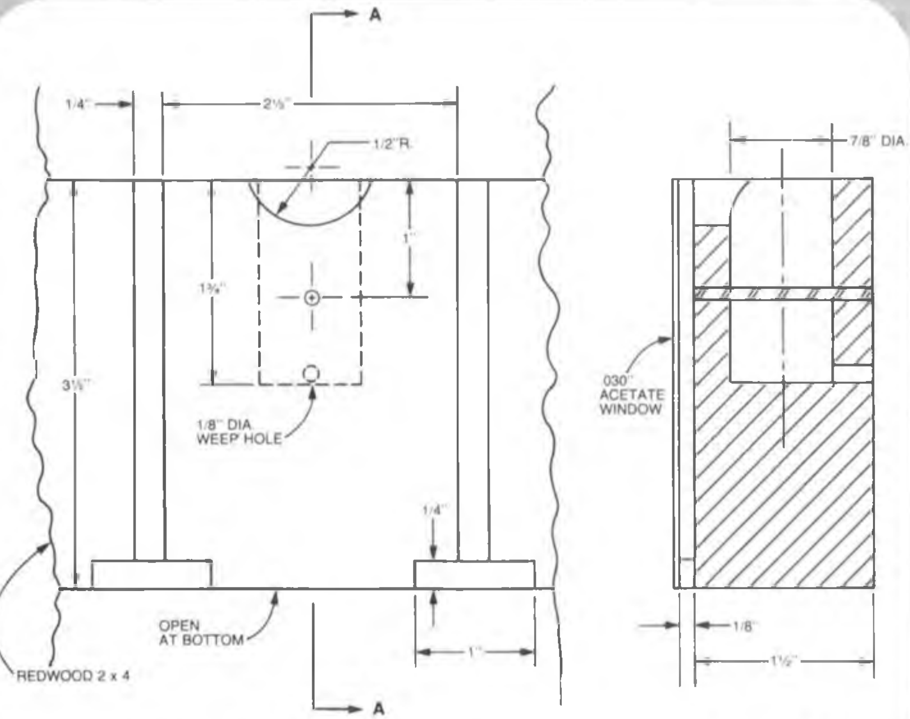


FIGURE 3



UPPER FREQUENCY POCKET DETAILS   FIGURE 4   SECTION A-A

the "Additive" one he **places** a pin (his) on a frequency designated peg at the center. Both systems have merits, both have disadvantages and, while these systems have worked after a fashion, they have both exhibited enough weaknesses that the writer felt a new approach, combining the best features of each, might result in a safer and, hopefully, a more nearly foolproof arrangement. Let's first consider what the basic problems seem to be:

With the first system these questions occur: Who has the pin? After checking the flight control center, if the frequency pin is missing, it's sometimes tough to tell what the actual situation is. Is someone flying? Is someone range checking out of sight of the flight line? Is someone taking a break with the pin in his pocket? Or did someone take the pin home on their transmitter last weekend and forget to return it? It can be a real can of worms on a busy day to try to figure out what's going on and how to get in line for the next turn on that channel.

Also, who is responsible for monitoring flight operations? If the club has such an officer, what happens if he is not at the field? Someone responsible should, if at all possible, always be on hand if flying is going on. And, finally, when a pin disappears do you make up a new one? (Look out if the old one comes back, it's what happened to us!) Do you have to poll the whole club membership to find the old pin? Again, who has the responsibility?

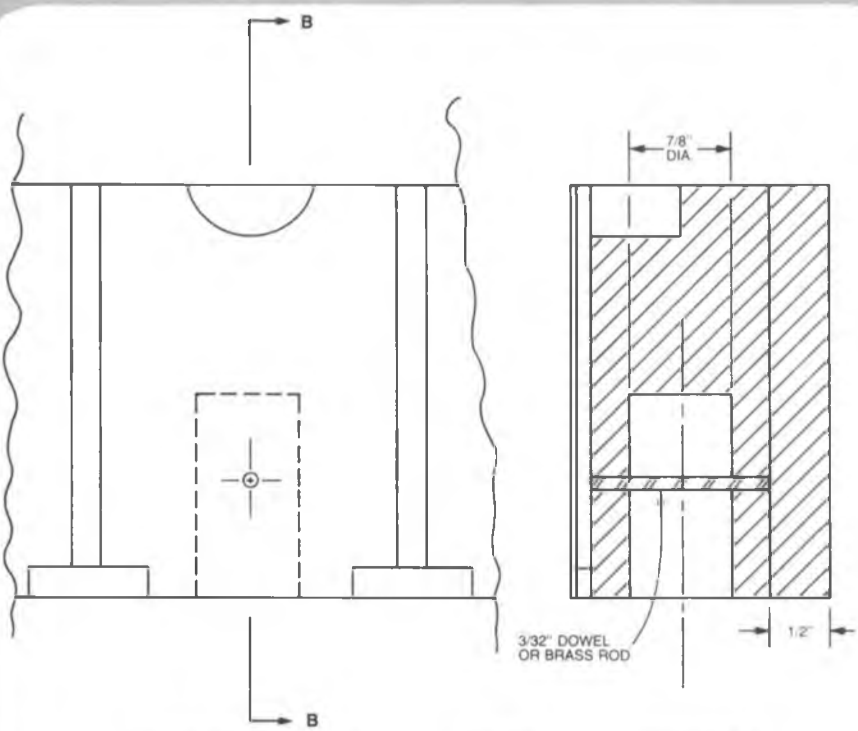
With the second or "Additive" system some of the drawbacks include: If your club hosts many contests, it is a very difficult system to use since many visitors must be accommodated and supplied with pins. In ordinary operation, however, its worst problems seem to revolve around carelessness in usage such as putting your pin on the wrong frequency peg on the control board or forgetting to use your pin (there is no visual feed-back of seeing a pin on your antenna) and again, of course, who is responsible for monitoring the system?

Well, to make a long story short, the following equipment plus just five basic rules seem to cover most of the above problems; see what you think of it.

Let's begin with the hardware as it is the heart of the whole proposal. Figure 1 is a photo of the finished Flight Control Board. Figure 2 is a close-up showing more detail, while Figure 3 shows the frequency pins that are used with the board. The Flight Control Board then is designed to work in the following manner:

Provide a receptacle for the frequency pins. Each pin is marked as to frequency (for the old channels) or by channel number (for the new ones). Each pin clips into a location on the Board again identified as to frequency or channel by both color patches and frequency or channel numbers. Associated with each pin receptacle is a pocket which is sized to hold three AMA cards. This pocket, shown in detail in Figures 4 and 5, is faced with a transparent window. On the front of this window appears the channel color code and channel frequency or number.

Note the needed pockets can be assembled in whatever manner is most convenient. We opted to do it with 12 pockets side by side above 12 more pockets side by side immediately below (note the frequency pins can't fall out of the lower assembly, even though their holes are inverted, because the pins **clip** into place). The



LOWER POCKET DETAILS   FIGURE 5   SECTION B-B card pockets still, of course, open to the top. Figure 4 is the figure showing the dimensions and detail of the top row of card pockets and pin receptacles while Figure 5 is the detail of the lower pockets. They differ from the upper ones only in the drilling of the frequency pin pockets from below. Note also, on our board, the lower row is brought forward 1/2" by adding a 1/2" x 4" board to its back. This allows both to be joined together at the rear but provides finger clearance to insert and remove AMA cards from the bottom pockets.

The photos of Figures 1 and 2 show how colored MonoKote patches and rub-on numerals are used to identify each channel pocket. Please note that the MonoKote and numerals are on the face of the plastic sheet so that they'll still be visible with an AMA card in the pocket. A light coat of clear lacquer protects them from the weather.

Now for the rules covering flight procedures and how the board and pins are to be used. As you will see, the final system is both "additive" and "substractive." This gives us the advantages of each approach with the weakness of each minimized. A frequency pin is "subtracted" from the board but an AMA card is "added." Also the use of the AMA card as the "additive" means no extra gear is required for visitors or contests.

Club Flight Rules

(1) Every member of the club is **the** Official Flight Control Officer.

(2) On arrival at the field the first duty after unloading is to place the transmitter in the Field Impound Cabinet.

(3) When ready to fly or test, only if the frequency pin is available, take pin, place on transmitter antenna and place your AMA card in the Flight board pocket. If the pin you wish to use is gone and an AMA card is already in the pocket, place your card behind the last card in the pocket. (What, you forgot to bring your card? Tough luck! No card, no fly, no exceptions.)

(4) No more than five aircraft flying at one time. Even with a free pin, if five planes are in the air, wait until one lands (or crashes) before taking off.

(5) Immediately when finished flying (or testing), return pin to board, retrieve AMA card and return transmitter to the Field Impound. If one or more cards are behind yours notify the next card owner in line after you that the channel is available.

Comments on the Rules

Rule 1. Making everyone responsible for rule observance is primary to the success of any flight control system. It means that all club members must be aware of, and agreeable to, the rules and solves the problem of the missing Flight Control Officer. Everyone is charged with the responsibility of immediately acting if a deviation is spotted.

Rule 2. Stay out of trouble. If your transmitter is in the Impound Area it can't get turned on inadvertently.

Rule 3. This of course, is the basic rule of the five. It must be followed at all times (even Tuesday morning at 10:30 a.m. when you are the only flier at the field. Who knows someone with a hot Tx may arrive while you are out chasing a downed plane). Note also that the placing of cards in sequence in the frequency slot on the Flight Board allows for the orderly taking of turns in the air. First come, first served and no more arguments as to who follows who to the flight line.

Rule 4. Strictly arbitrary. This is what we will try this year to see how it works. Maybe you'll want to try a different number. Please let us know how it works out if you do.

Rule 5. Be polite. Please let the next man know that it is his turn. And note, if you forget and take the frequency pin home with you, your AMA card will still be on the board and will know who you are!

Well that's it. Stay tuned in and we'll give you a report this fall on how things have worked out for us and if you have other ideas on this or other systems please write. This is one area where all of us can use all the help we can give each other.

The above article was actually written and submitted early in 1983 to RCM. The Canton Ohio R/C Club has, therefore, had a full season of exposure to the new rules and procedures by this time and with the delay of publication it will allow me to add a report on how it has served us this year.

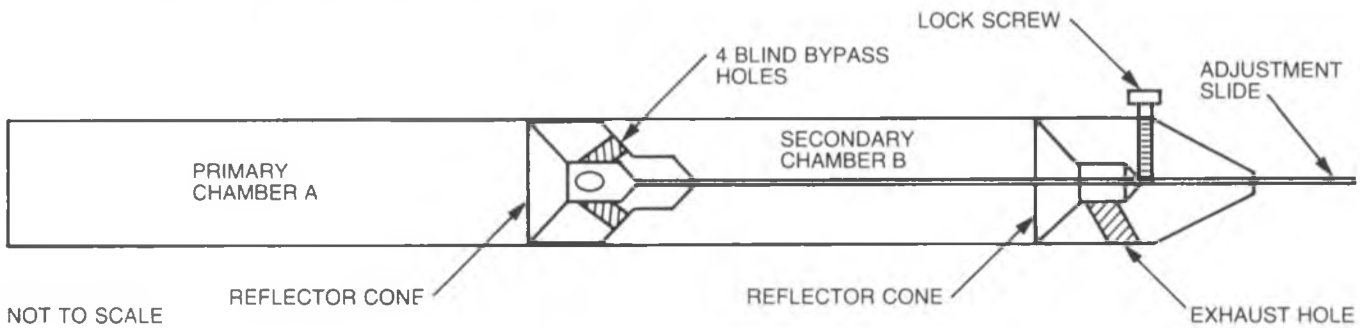
Let me begin by stating that it has been an unqualified success. All frequency pins are still on the board with not a single loss or pin absence during an active flying season. No frequency interference problems from improper handling of transmitters has occured and aside from plastic coating (laminating AMA membership cards) it has not required any unusual procedures by club members or visitors. In short it has worked very well. I think, however, the best indication of its success has been the move by several local clubs, who have seen it in operation, to adopt it for 1984.

So have at it! It should make a good club project for those cold snowy days that will soon be with us. May it serve you all as well as it has us.

Jack Duff, WA8OCO

Engine Clinic

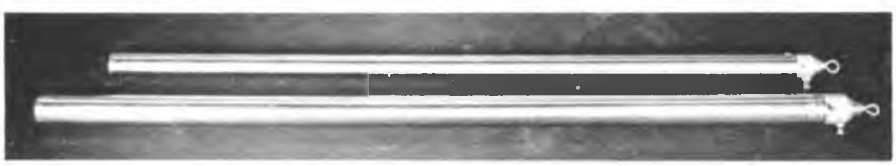
CLARENCE LEE



PEAK-POWER-PIPE

Many articles have been written over the years on the theory and operation of tuned pipes both by myself and other columnists. It was thirteen or fourteen years ago that I was first flying an E.D. Power Pipe on my Cliff Weirick designed "Candy" and everybody was asking, "What the heck is that?" Although tuned pipes had been in use on U-control speed models for many years, few modelers had put them to use on R/C models. Kevin Lindsey, in England, was the first to market a broad range tuned pipe strictly for R/C use. Over the years tuned pipes have become pretty much standard equipment on competition pattern engines and their size and shape pretty well-standardized. However, it did take quite a while for modelers to accept the tuned pipe as something that could quiet the engine noise and at the same time give an increase in power. Modelers always seem to be a little reluctant to accept something that is different.

In 1981, Cliff Rausin, of Condor Hobbies, introduced the Australian "Magic Muffler" to the U.S. hobby market. The Magic Muffler worked on the same principle as a tuned pipe but was of more compact size, being just a little larger than a conventional muffler. The Magic Muffler was intended as a strictly "bolt on and go" device without the usual trial and error tuning that one must go through to achieve maximum performance from a conventional tuned pipe. However, not being able to adjust or "tune" the Magic Muffler will sometimes result in the engine not



Wally's tuneable Peak-Power-Pipes. Closeup shown for detail and size reference. See text for complete description and test results.

"coming on the pipe" with a given engine/fuel/prop combination. Resorting to a smaller diameter propeller that would let the engine turn at a higher rpm on the ground would usually solve the problem but, if you wanted to stay with a larger propeller, there was no way of adjusting the Magic Muffler for this operation. However, if you do prop your engine to get it to operate in the rpm range of the Magic Muffler, they really do work extremely well as many fellows know.

This past summer I received a package in the mail from Wally Van Heeckeren, of Australia, with something different in the way of a tuned pipe that Wally had been making on a limited production basis for modelers in Australia. At first appearance the tuned pipe appears to be nothing more than a 3/4" diameter piece of steel tubing 21" long with a long piece of 1/16" wire sticking out the end that could be moved in and out. I must frankly admit that at first I thought this was some kind of a put-on, so I went about testing the pipe with a bit of skepticism. Again, this was a case of not initially accepting something that differed from what would be considered standard because of its different appearance. I am sure others will share this same feeling when first seeing what Wally calls his "Tuneable Tuned Pipe." However, do not let first appearances fool you. As I was quite surprised to find out, Wally's Tuneable Tuned Pipe really works.

For testing I used a K & B 6.5 reference engine I have that has been modified for California style Quickie 500 racing. The engine has a .315

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Wally Van Heeckeren's Double Eagle with Peak-Power-Pipe.

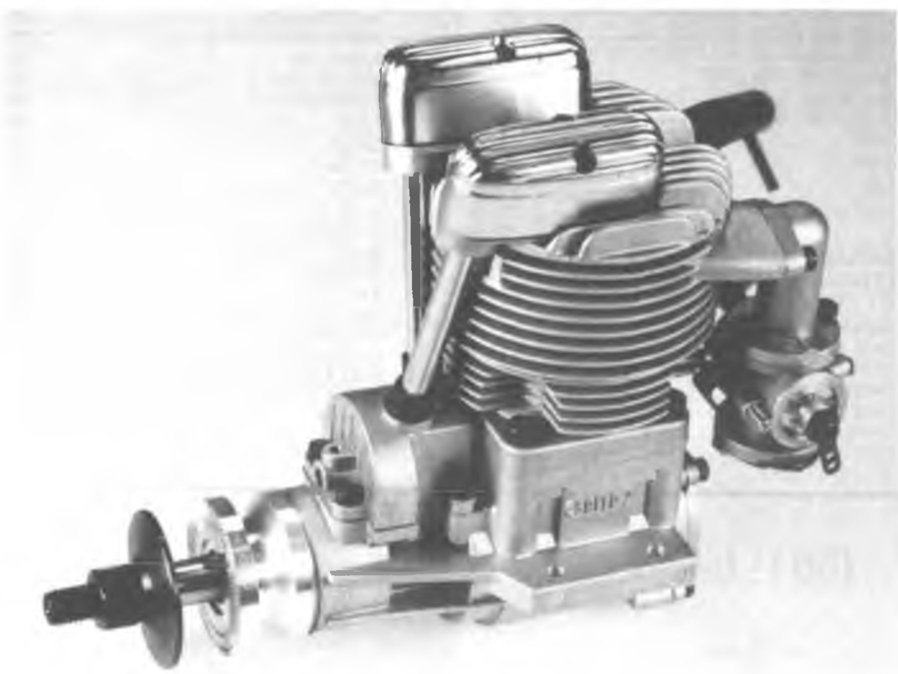
carburetor intake diameter and a K & B 6.5 rear rotor Formula I piston/sleeve with mini-pipe timing (165° duration). With a 9/6 Power Prop and 15% nitro fuel, this engine will normally turn 18,000-18,200 rpm with an open exhaust. With the Tuneable Tuned Pipe installed and adjusted for maximum rpm, the engine would now turn 19,200 rpm. A solid gain of 1,000 rpm. I next removed the piston/sleeve with the 165° exhaust duration and installed one with an exhaust duration of 172° intended for use with a tuned pipe or Magic Muffler. The engine would now turn 19,500 for a total gain of 1,3000 rpm. This is about the same gain I can get with the Magic Muffler but a couple hundred short of what can be had with a full length tuned pipe. I should point out that with the 172° exhaust timing the engine will not turn in the 18,000 range with open exhaust as it will with the 165° duration piston/sleeve. When you raise the exhaust to the 172° figure you also have to use a tuned pipe or Magic Muffler but that is the purpose of raising the exhaust to begin with.

The Tuneable Tuned Pipe was next tested on a K & B .61 with conventional exhaust timing. The engine had been given my blueprint treatment and PDP modification. The engine will normally turn 12,800-13,000 with 15% nitro fuel and 11/7 Rev-Up prop with open exhaust (the engine normally runs with a conventional muffler). With the Tuneable Tuned Pipe the engine now turned 13,800 for a gain of 800 rpm. It is easy to see that with a pipe timed sleeve, an increase of over 1,000 rpm could be expected. This is a test I will have to make at a later date as I did not have a pipe timed piston/sleeve that had been broken-in to install in the engine.

Although the Tuneable Tuned Pipe works on the same principle of pressure waves as a conventional double coned tuned pipe resulting in a supercharging effect to the engine, the actual operating principle is somewhat different.

The pipe is divided into two separate chambers which we will call primary chamber A and secondary chamber B (see drawing). The two chambers are separated by a sliding reflector cone that is attached to a wire extending from the end of the unit. Moving the wire in or out moves the reflector cone and tunes the pipe to the engine. Once maximum rpm gain is achieved the wire can be cut off and locked in place with the set screw provided for this purpose.

Quoting directly from the "How It Works" sheet that accompanies the pipe --- *"The exhaust pulse travels down chamber A and reflects off the center plug or reflector cone. Here two things happen: (1) The pulse is reflected back towards the engine, and (2) the exhaust gasses are transferred via bypass holes to chamber B creating a second pulse which travels down chamber B. This pulse arrives at the end plug where two things again happen: (1) The exhaust gasses pass to*



The new Saito FA-120 four stroke is a real power house. The design concept follows that of a highly successful line of smaller displacement four stroke engines. The FA-120 is available from Hobby Shack and selected hobby shops. Watch for an upcoming report on this engine.

STATEMENT OF OWNERSHIP MANAGEMENT AND CIRCULATION (Act of August 12, 1970: Section 3685 Title 39, United States Code)

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I certify that the statements made by me above are correct and complete.

Patricia E. Crews

the air through the exhaust hole, and (2) the pulse is reflected by the end plug and travels back to the center plug which is so designed that it does not reflect but transfers the pulse to chamber A. Meanwhile the initial pulse has traveled back to the engine where it behaves as a supercharger and the engine goes through one cycle and produces a second pulse. This pulse travels down chamber A to the reflector cone where again two things happen: (1) The cycle repeats as before, and (2) the pulse is met by the pulse coming back from chamber B. Now the fun begins! When the pipe is tuned to an engine so that the two chambers A and B are the same length from the piston face to the center plug, or reflector cone, and from the center plug to the end plug, the two pulses arrive at the center plug at the same time and join forces to form one high amplitude pulse which travels back to the engine. This is the peak power setting. The RPM range over which the peak power setting operates is relatively narrow. When the pipe is tuned to an engine so that the center plug is forward of the center (chamber A is shorter than chamber B), the pulse arriving from chamber B arrives at the center plug later and follows the pulse from chamber A back to the engine. The pulse has now been stretched to the lower rpm side. This means that the engine will remain on the pipe as you throttle back or as the engine loads up in a vertical maneuver. This is the 'low end power setting.' When the pipe is tuned to an engine so that the center plug is behind the center (chamber A is longer than chamber B), the pulse from chamber B arrives at the center plug before the one from chamber A. This stretches the pulse towards the high rpm end. This means that as your engine unwinds it stays on the pipe. This is the 'high end power setting'."

So much for the technical description of how the Tuneable Tuned Pipe works. In actual application this all boils down to installing the pipe on your engine. With the engine running you gradually move the sliding wire adjustment inward until the engine hits maximum rpm. It was my experience that as you move the sliding wire in, there is a change in mixture adjustment so you may have to readjust the mixture as the engine picks up rpm. When maximum rpm is achieved, lock the set screw and the remaining length of adjusting wire can be cut off. However, it is recommended that a little excess wire be left for future adjustments in case you want to retune for different fuel or prop.

This is the basic adjustment and as far as I went with my testing.

Maximum performance from the Tuneable Tuned Pipe is obtained when the two chambers A and B are the same length. To do this you measure the distance from the center plug to the end plug (chamber B). Then cut either the pipe or header pipe so that the distance from the piston face to the center plug (chamber A) is the same length as chamber B. I haven't given this a try as yet as I still have a few other tests I want to perform with the pipe on other engines. I will have to give you a report on this phase of tuning in a later column.

Many of the advantages of the Tuneable Tuned Pipe are quite obvious. The size (diameter) makes it far more adaptable to "in the fuselage" type of installations. The sliding wire adjustment means you no longer have to tune the pipe to the engine by trial and error cutting and checking rpm. By leaving the adjusting wire a little long you can tailor the pipe to changing conditions such as different props, amount of nitro, extreme changes in weather conditions, etc. An added benefit seems to be an improvement in the idle characteristics. This is evidently due to higher back pressure within the pipe helping to keep the glow plug hot much the same as the old exhaust baffle that many engines used in years past before the muffler became more popular.

Noise level is about the same as a conventional expansion chamber muffler --- possibly a little louder than a muffled tuned pipe. Enclosed within the fuselage, it is very quiet.

As with the Magic Muffler, my old friend, Cliff Rausin of Condor Hobbies, is importing the Tuneable Tuned Pipe into this country. A slight change in name has been made for the production pipe and it will now be known as the WvH Peak Power Pipe. WvH standing for Wally Van Heeckeren the designer and developer. The pipe will work on engines from .25 cu. in. through .90 cu. in. although I would guess that it will work best on engines in the .40-.60 size range. The retail price is $29.95 but Condor Hobbies will have an introductory price of $24.50. You can order direct from Condor Hobbies, 17835 Sky Park Circle, Suite E, Irvine, California 92714, or through your local hobby dealer who can, in turn, order from Condor Hobbies.

Pictured along with the .25-.90 pipe is a smaller version for the .19 size engines. This pipe is not in production yet. If enough interest is shown for the .25-.90 size pipe to justify tooling and production costs, then Condor Hobbies will, in turn, import this pipe at a later date. The .25-.90 pipe can be used on the smaller displacement engines but due to the size of the exhaust openings you will not get as great a performance increase. The size is also somewhat larger than actually necessary for a .15-.19 size engine.

I was really impressed with the performance and ease of adjustment of the WvH Peak Power Pipe. I am sure any of you fellows wanting to give one a try will be also. As simple as it appears, it really does work.

★

I have been getting quite a few letters lately from readers regarding problems related to the four stroke engines. So we will finish up the column this month with three letters having to do with four stroke engines.

Dear Mr. Lee,

Thank you for all your fine articles on model aircraft engines. I have found them both interesting and informative.

I currently have an O.S. Max .40 four stroke engine and am flying a Balsa USA Swizzle Stick 40, using an 11/4 Zinger prop, and Sheldons 5% synthetic fuel.

The owners manual for the engine states the engine will turn up to 10,000 rpm's. My problem is that after starting the engine and "tweaking" the needle valve for 9,800 to 10,000 rpm (using a Thunder Tiger tachometer) and flying for 7 or 8 minutes if, I begin to try some touch and goes the engine usually sags and quits about 30 seconds after breaking ground again. I have tried to richen the mixture a couple of "clicks" but many times it does the same thing. Recently we have flown in 85° to 90° temperatures. Could this be a factor? The engine is beam mounted in an upright position. Would it help if the engine were side mounted?

The owners manual also states that the top of the fuel tank should be 1/4" to 3/8" above the needle valve and mine is about 1/4" above.

Just as a point of information, for a long time we could not get this engine to turn more than 8,500 to 9,000 rpm so we tried a couple of things first. We unhooked the line from the tank vent to the pressure adapter and the rpm **increased** *markedly. We then started to experiment with props. We tried everything from a 10/7 Airscrew to a Top Flite 11/4 and Zinger 12/4, and found the 11/4 worked best all around.*

Using an 11/4, we also tried a tank of Red Max 10% ***4 stroke fuel*** *and found no more than 100 rpm difference on the top end rpm.*

Thank you!

Sincerely,
Dick Heil
Eagan, Michigan

You have made an assumption in regards to the operating rpm of your

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O.S. Max .40 four stroke that is not correct and one that many fellows seem to make. The manufacturer lists the maximum rpm limit of the engine as 10,000 rpm. However, this does not mean that the engine should be run at 10,000. This is similar to the mistake fellows make in regards to the horsepower rating of an engine. If a manufacturer rates the engine at 1.6 h.p. at 17,000 rpm, it does not mean that the engine will turn the prop used for flying, such as an 11/7, at this rpm. And yet fellows write to me all the time wanting to know why their engine will not turn 17,000 with the 11/7. The same thing pertains to the 10,000 rpm limit of the O.S. .40 four stroke. This is the maximum rpm at which the engine can be run before valve float occurs. It does not mean that the engine is necessarily supposed to be operated at this rpm. Your O.S. .40 would be a lot happier operating in the 8,500-9,000 rpm range. You are just trying to get more power out of the engine than it is capable of delivering. Your propeller size is okay but, in the process of trying to get more power out of the engine, you are probably running it a lot leaner than you should and it is going to overheat — especially in hot weather. Instead of just backing off a couple of clicks, richen the mixture until you hear the engine slow 300-500 rpm from maximum. This assures a richer, cooler running mixture. This will most likely end your sagging problem.

You mention unhooking the line from the tank vent to the pressure adapter. The fitting on the back of the crankcase is **not** a pressure adapter. This is for venting the crankcase only and should never be connected to the tank vent. On the upstroke of the piston, air is drawn in through this fitting and on the downstroke expelled. No positive pressure is formed. Connecting this fitting to your tank vent would result in negative pressure in the tank as the fuel level dropped the same as if the tank vent were plugged. As you found out, this also affects the rpm of the engine. A lot of fellows have made this same mistake. Reading the instructions that accompany the engine explains this.

The difference between 5% nitro, as in your Sheldon fuel, and 10% nitro in the Red max would only account for a couple of hundred rpm in a two stroke engine and even less in a four stroke. Four stroke engines do not respond to

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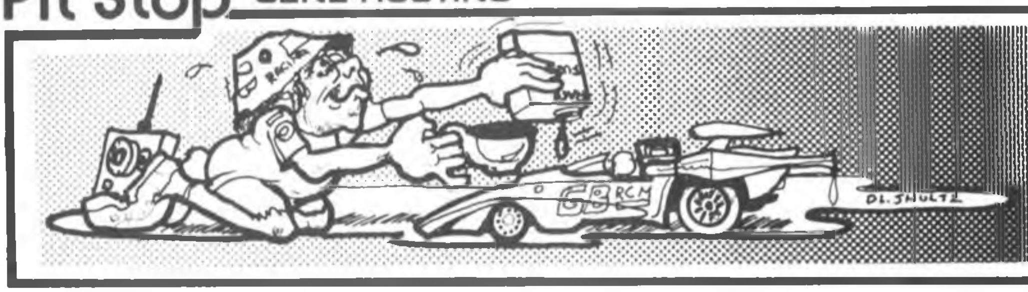
Pit Stop GENE HUSTING



1983 ROAR Nationals
1/12 Electric & 1/8 Gas

The 1983 ROAR Nationals was held at the Ranch Pit Shop Raceway in Pomona, California, and was sponsored by Sanyo. With over 320 1/12 electric car and 160 1/8 gas car entries, this was the biggest Nationals ever.

The Ranch Pit Shop of Pomona, California, was the site of the 1983 ROAR Nationals, which was sponsored by Sanyo. Right here, we would like to thank Sanyo for their fine continued support of R/C car racing. Gil and Janet Losi, the owners of the Ranch Pit Shop Raceway and their hard working crew did a super job of continuing to improve the track and facilities for this race. The track boundaries were freshly painted, as well as the track boards. Additional lights were installed, and even the restrooms were completely redecorated and are first class. This is certainly the finest racing facility in the USA.

1/12 Electrics

With over 320 entries, this was by far the largest electric class we've ever had at the ROAR Nationals. There were three classes being run, Production, Stock, and Modified classes, as in the past, but this time, no expert or factory racers were allowed to run in Production class. The intent was to have a class where the amateur racer could have a chance to win, similar to the Super Stock class with the gas cars.

Production Class

Although these were amateur class drivers, they were putting as big an effort into winning as anyone and their driving was excellent. Qualifying was a duel between Robert Bartlett and Steve Toland and when it was over Robert was Top Qualifier with 24 laps in 8 minutes 11.1 sec. or 8:11.1 but Steve was only a tick away at 24 laps — 8:12.4, and the fastest lady driver in electrics, Kerry Cavazos was 3rd with 24 laps — 8:20.2.

Production "B" Main

Francisco Saenz held off a fast charge by Bill Dell and opened up a lead, but then Steve Salisbury slowly overtook Franscisco for the lead, then right near the end Steve's batteries dumped and Francisco regained the lead and won with Steve 2nd, Bill Dell 3rd, Gary Haskill 4th, and Tina Burch 5th. Considering Tina hadn't raced in a year, that's quite an accomplishment.

"B" MAIN PRODUCTION RESULTS

1 Francisco Saenz	6 Devore Fortney
2 Steve Salisbury	7 Mike Tobey
3 Bill Dell	8 Jon Anderson
4 Gary Haskill	9 Spencer Bond
5 Tina Burch	10 Craig Hilton

Production "A" Main

Steve Toland must have wanted this win awful bad, because when the green flag came up he was off in the lead running by himself. Robert Bartlett and Kerry Cavazos were having their own private race for 2nd place, while pulling away from the rest of the field. Steve went on to an impressive win setting a new record with 25 laps in 8:20. Robert and Kerry swapped places a number of times, but at the end Robert had 2nd with Kerry 3rd.

Steve Toland, on the left, isn't really from England, as his shirt might indicate, but maybe it helped him to win the Production Class. Second place went to young Robert Barlett, with 3rd place going to the fastest lady racer in electrics, Kerry Cavazos.

"A" Main Production Results

1 Steve Toland	Associated
2 Robert Barlett	Associated
3 Kerry Cavazos	Associated
4 Billy Johnsen	MRP
5 Bob Dewald	Associated
6 Bill Shaffer	Associated
7 Fernando Belair	Associated
8 Jeff Deacon	Associated
9 Tara Belair	Associated
10 Gary Evert	MRP

Stock Class

In this class Modified cars are allowed, but motors must be stock ROAR approved 05 type motors. For this race the motors were supplied by the Race Director. Besides the racers from all around the country we also had Jimmy and Wayne Davis and Nigel Hale from England to race with us. These guys were also at the Winternationals and did very well in the "A" Main there.

It looked like a fast 25 lap qualifying effort would be what it would take to make the "A" Main. But Mike Lavacot wanted to make sure, so he turned 26 laps in 8:06.8. Mike Toland followed with 26 — 8:17. Then on the last round Joel Johnson put it all together to edge Lavacot with a 26 — 8:05.1 for Top Qualifier honors.

"B" Main Stock

Boy, when you look at the list of drivers in the "B" Main, it looks more like they should all be in the "A" Main. Kent Clausen, Ralphie Burch Jr., Gary Kyes, Jimmy Davis, Tyree Phillips, Frank Killam. But that just shows how tough the competition was. It only took a second or two to miss a main.

This "B" Main was one of the more exciting races of the day. Randy Tentschert jumped in the lead with Kent Clausen and Jimmy Davis in close pursuit. Kent and Jimmy swapped places back and forth letting Randy get a good lead. Finally Kent got away from Jimmy and took out after Randy, at 7 minutes he almost caught Randy, but he hit a dot. He closed in again and on the last lap it looked like he would take the lead, but Randy kept the inside line and took the win with Kent one foot back in 2nd and Jimmy Davis 3rd.

"B" Main Stock Results

1 Randy Tentschert
2 Kent Clausen
3 Jimmy Davis
4 Tyree Phillips
5 Terry Ballard
6 Ralph Burch Jr.
7 Frank Killam
8 Mike Hamilton
9 Gary Kyes
10 Steve Toland

"A" Main Stock

The cars were lined up in a grid start with Joel Johnson and Mike Lavacot in the front row. At the start, Joel jumped in the lead with Mike right behind. Mike was about one foot behind Joel and they both had about the same power and looked about equal on the track, so there was no way Mike could pass Joel, unless Joel gave him an opening. Then, at the 2 minute mark, Joel went a little wide coming out of the sweeper and Mike tucked inside to take the lead. I think this must have surprised Joel, because he hit the next two dots which gave Mike a 40 foot lead.

For the next 4 minutes it stayed exactly like that. Joel couldn't make up any time on Mike. All the other drivers in this race moved over and let the leaders go by, which is as it should be, even though they're also racing for a position.

Mike Toland was running good in the beginning but he hit a couple dots, letting Bruce Hickman and Terry Rott slip by. Then at 6 minutes the improbable happened! Lavacot had a comfortable 40 foot lead and as he was going around the sweeper, his car all of a sudden spun out and got stuck in the boards. He had gotten too low and was on the new paint which was very

Joel Johnson did it all! He was Top Qualifier and won the Main events in both Stock and Modified classes. Joel drove perfectly the whole week.

Mike Lavacot came close, and was even leading the Stock Main at the 6 minute mark, but he had to settle for 2nd place this time.

Bruce Hickman always seems to be up at the top in the big races and here he took 3rd place in the Stock Main.

slippery. By the time a marshal got his car, Joel went by and had a 40 foot lead. Joel didn't make any more mistakes and went on to take the win with Lavacot 2nd, Bruce Hickman 3rd and Terry Rott 4th.

"A" MAIN STOCK RESULTS

1 Joel Johnson	Delta
2 Mike Lavacot	Associated
3 Bruce Hickman	Associated
4 Terry Rott	Associated
5 Wayne Davis	Associated
6 Doug Kott	Associated
7 Mike Toland	Associated
8 Gil Losi Jr.	Associated
9 Kevin Orton	Delta
10 Bob Hayes	Associated

Modified Class

The speed picked up here with the modified motors. Joel Johnson set the pace in qualifying with 27 laps in 8:17.9. This was closely followed by Bruce Hickman with 27 — 8:18.5 then Tony Neisinger, who had all kinds of radio problems in Stock class, turned 27 — 8:23.5 with Mike Lavacot following with 27 — 8:31.

The next round, Tony Neisinger turned 27 — 8:11.5, with Terry Rott following in 27 — 8:13.9. Lavacot turned 27 — 8:17.9 then Joel Johnson took Top Qualifier honors with a 27 — 8:10.9.

Modified "B" Main

With all three drivers from England in this race, you could believe it was going to be exciting. Wayne Davis and Tyree Philipps fought it out for the lead with Tyree finally getting the lead. Tyree kept the lead for quite a long time, then he got stuck in the boards and Wayne took over the lead, with Nigel Hale in 2nd spot. Meanwhile, Jimmy Davis, who got a bad start was now passing cars and finally worked up to 3rd spot. Wayne took the win with Nigel in 2nd and Jimmy 3rd, making it 1, 2, 3 for England!

Modified "A" Main

This was the fast one. The grid had Joel Johnson on the pole with Tony Neisinger alongside, and Mike Lavacot and Terry Rott in the next row. Joel took the lead with Tony in 2nd. Lavacot got drilled in the first corner and his car wouldn't turn left. Terry Rott's diff was too loose and he didn't even make it to the first corner. The rest of the cars were bunched together.

Joel and Tony started pulling away from the field. Then at about 3 minutes Frank Killam got through the pack and started closing in on Tony. Tony had about a 40 foot lead, but Frank was gaining a few feet a lap, and at the 6 minute mark he passed Tony to take 2nd spot.

Frank was now about 30 feet behind Joel and gaining a few feet each lap. It looked like it was going to be a photo finish. Then Frank's batteries dumped and Tony started to close in on Frank. On the last corner Tony passed Frank to take over 2nd with Joel winning. This made it a double win for Joel.

Tony Neisinger drove a super race in spite of having radio problems, and took 2nd place in the Modified class.

Frank Killam is another racer who is always up near the top at the big races and this time he got 3rd place in the Modified Main.

MODIFIED "A" MAIN RESULTS

	CAR	MOTOR
1 Joel Johnson	Delta	Trinity
2 Tony Neisinger	Delta	Delta
3 Frank Killam	Associated	Checkpoint
4 Mike Toland	Associated	Reedy
5 Bruce Hickman	Associated	Checkpoint
6 Kevin Orton	Delta	Delta
7 Terry Rott	Associated	Reedy
8 Gil Losi Jr.	Associated	Checkpoint
9 Mike Lavacot	Associated	Reedy
10 Ralph Burch Jr.	JoMac	Trinity

1/8 Gas Class

This year the Nationals were divided into two body classes — G.T. (coupe) and Can Am (sports), and also into two chassis classes — pan and Open or suspension. Drivers could enter the pan or the suspension class but not both.

G.T. Pan Class

Gary Kyes was the class of the pan cars. He was the only Expert driver in this class but he had enough competition to keep him honest. Gary was Top Qualifier with a run of 12 laps in 4:06.1. Francisco Saenz was closest to Gary with a 12 — 4:13.

G.T. Pan "A" Main

Francisco Saenz appeared to have the most power and held the lead for about 6 minutes until he touched the boards on the straightaway and chunked a tire making the car spin out easily. Gary Kyes took over the lead and went on to an easy win with Jim Jones taking 2nd and Saenz holding on to 3rd.

G.T. PAN "A" MAIN RESULTS

1 Gary Kyes	MRP
2 Jim Jones	Thorp
3 Francisco Saenz	Associated
4 John Hodgson	MRP
5 Joe Tentschert	Associated
6 Mike Vickers	Delta

I heard a rumor that they're going to tell Gary Kyes that he doesn't have to come to any more Nationals. They'll just send him his trophies automatically. Gary has won more National Championships than any other two drivers you can think of. This time he added the G.T. and Can Am Pan Class trophies to his collection.

Brad Donovan surprised quite a few people by being Top Qualifier in the Can Am Pan Class and then finishing 2nd to Kyes. He's going to be good.

Francisco Saenz, on the right, is receiving one of his two trophies from Gil Losi Sr., for his two third place finishes in the G.T. and Can Am Pan classes.

G.T. Open Class

In the Open class you could run a pan car or a suspension car, but almost everyone in this class runs a suspension car. To add a little variety to the racing, the G.T. class was run backwards on the track, compared to the Can Am class. The G.T. cars did look pretty tricky on the track.

G.T. "B" Main

John Thorp had a close race with Dean Brown for the lead, but John held on to win with Dean 2nd and Rick James 3rd.

G.T. "B" MAIN RESULTS

1 John Thorp
2 Dean Brown
3 Rick James
4 Bill Campbell
5 Gus Gustarson
6 Frank Wong
7 Al Vega
8 Ross Kloeber
9 Kevin Orton
10 Peter Barana

Associated developed a two speed transmission for their RC500 cars for the long straightaway in Carnoux, France, at the World's Championships. Due to numerous requests it will be available to everyone shortly.

G.T. "A" Main

Ralph Burch Jr. was Top Qualifier in the G.T. class with 13 — 4:09.5. Tony Neisinger followed with 13 — 4:14.3 and Gene Husting had 13 — 4:17. These were the only three cars to turn 13 laps.

The start of the "A" Main, I was lucky enough to get a good start and a slight lead while the rest of the field was getting untangled. But I could see the black car of Ralph Burch slowly closing up the gap. I only had the lead about 4 laps when I had to pit to richen up the carb. Ralph then had the lead with Dana Smeltzer close behind, followed by Tom Wong.

Ralph's lead started to grow. Dana was still 2nd, but now Tony Neisinger had moved into 3rd. Ralph continued to lead and won the G.T. class by 2 laps over Dana, who was 3 laps over Tony in 3rd. Ralph made it look so easy, never making a mistake. He had to feel pretty good with this win, especially after his bad luck in electrics.

Ralph Burch Jr., on the left, takes Top Qualifying honors and wins the G.T. Open Main, with Dana Smeltzer in 2nd place, followed by Tony Neisinger in 3rd place.

G.T. "A" MAIN RESULTS

	CAR	MOTOR
1 Ralph Burch Jr.	Associated	Lee-K & B
2 Dana Smeltzer	Associated	McCoy
3 Tony Neisinger	Delta	Picco
4 Gene Husting	Associated	Lee-K & B
5 Tom Wong	Delta	Picco
6 Chuck Wiggins	Delta	Picco
7 Mark Miranda	Delta	Picco
8 Ron Paris	Associated	Paris-McCoy
9 Gil Losi Jr.	Associated	Paris-McCoy
10 Barry Grossenbacher	Associated	K & B

Can Am Pan Class

It looked like Kyes might have some competition after all in this class, as Brad Donovan was Top Qualifier with 13 — 4:19.5 and Francisco Saenz was next with 13 — 4:21 and Kyes was next with 12 — 4:03.2.

Can Am Pan "A" Main

There is nothing like experience as Gary Kyes simply drove flawlessly to win the race by 6 laps as Brad Donovan and Francisco Saenz fought it out for 2nd with both of them finishing on the same lap with Brad in 2nd and Francisco 3rd.

CAN AM PAN "A" MAIN RESULTS

1 Gary Kyes	MRP
2. Brad Donovan	Associated
3. Francisco Saenz	Associated
4. John Hodgson	MRP
5. Heinz Meyer	?
6. Ben Bullock	MRP
7. Mike Vickers	Delta
8. Jay Kimbrough	Associated
9. Bill Prather	Thorp
10. Troy Blanton	?

Can Am Open Class

This is the big class. The most popular class. And for some reason the first day of qualifying was 106 degrees. But this didn't stop anyone. Tom Wong was the first driver to turn 13 laps with a 4:17.5. I lowered that to

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When writing to RCM for answers to your questions, please send a self addressed stamped envelope for a prompt rely.

13 — 4:09.7 and in the next heat Rich Lee topped it with 13 — 4:05.7.

Curtis Husting then lowered it to 13 — 4:05.3, which was the best time turned on Friday. On Saturday the temperature rose to 110 degrees. Dana Smeltzer came close to Curtis' time with a 13 — 4:05.7. Finally Ralph Burch Jr. lowered it to 13 — 4:02.3 to take Top Qualifying honors. There was one round left and Curtis came close with a 13 — 4:04.3, but not quite close enough.

The start of the "B" Main doesn't look too bad yet, but at the first corner it really gets exciting.

Can Am Open "B" Main

Sunday it cooled off to 106 degrees for the mains. A typical summer Pomona day. But everybody was ready for the big ones.

The cars were lined up for the "B" Main and Ruben Serrano started to pull away from the field. Ruben led for 16 laps until he tapped the wall and bent his muffler. Roger Curtis then took the lead and drove a flawless race even though ROAR President, Joe Sullivan, was chasing him trying to catch up. But Roger took the checkered flag with Joe 2nd and Paul Dionne, down from Canada, taking 3rd.

CAN AM OPEN "B" MAIN RESULTS

1. Roger Curtis	6. John Thorp
2. Joe Sullivan	7. Butch Kloeber
3. Paul Dionne	8. Bob Mathisen
4. Ross Kloeber	9. Barry Grossenbacher
5. Ron Paris	10. Ruben Serrano

Can Am Open "A" Main

They didn't use a staggered start for the gas mains as they did for the electrics. We had ten cars lined up alongside each other so the first couple corners get very crowded. I was in about the middle of the pack by the 3rd corner, with Ralph Burch Jr. alongside, when we bumped which knocked Ralph upside down and into last place.

It looked like Tom Wong and Rich Lee got the good start, with Tony Neisinger and Kevin Orton following. Meanwhile, from the back of the pack Ralph Burch, Jr. was starting to pass cars. By the 1st pit stop, Ralph had the lead. Wong was now running 2nd with Rich 3rd. Tony was 4th and Kevin 5th.

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CAN AM OPEN A MAIN RESULTS

	LAPS	QUALIFYING	CAR	MOTOR
1 Ralph Burch Jr.	97	4:02.3	Associated	K & B-Lee
2 Kevin Orton	93	4:11.1	Delta	Picco
3 Tony Neisinger	93	4:13.8	Delta	Picco
4 Rich Lee	93	4:05.7	Associated	K & B-Lee
5 Tom Wong	92	4:06.9	Delta	Picco
6 Curtis Husting	89	4:04.3	Associated	K & B-Lee
7 Dana Smeltzer	85	4:05.7	Associated	McCoy
8 Rick Templin	81	4:14.4	Delta	Picco
9 Gil Losi Jr.	62	4:08.8	Associated	Picco
10 Gene Husting	40	4:09.7	Associated	K & B-Lee

My own car started off great in the race and then became undriveable with incredible oversteer. It was due to some new front tires we were trying and they simply had too much bite. Gil Losi Jr. and Dana Smeltzer had the same tires on their cars and they were having the same problems. I finally pulled my car off the track, because I was getting in the way of the other drivers, Gil and Dana tried to continue in the race, but it was hopeless.

Add another one. Ralph Burch Jr., on the left, wins the Can Am Open Class by 4 laps over Kevin Orton in 2nd with Tony Neisinger (again?) in third. Tony is very consistently fast.

Meanwhile, Ralph was flying. There was nobody that was even in the same race with him. So the rest of the guys were trying for 2nd, which was held by Tom Wong. But at the 15 minute mark, Tom ran out of fuel and Rich Lee took over 2nd. Rich held 2nd spot for about 5 minutes, but when he came up to pass another car he didn't pick the right spot and got knocked upside down, and Tony Neisinger took 2nd followed by Kevin Orton in 3rd.

Ralph was now 3 laps ahead and going for more! And he was making it look so easy. The car was never sideways — it was just going faster than everyone else's. I could hear his dad Ralph Sr. telling Ralphie, "Take it easy, you don't have to be going that fast." And Ralphie replied, "I'm just cruising." I'd like to be able to cruise like that.

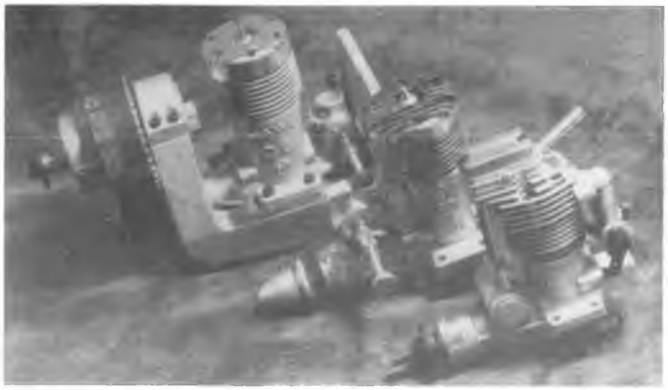
Tony and Kevin were having their own race for 2nd. They were both running the same speed and they must have swapped positions ten times during the race. Rich Lee was running faster than them, and he would catch and pass Orton but then he would hit a dot and spin out and have to make up the time again.

Ralph was now 4 laps ahead! On the last lap Rich tried to pass Tony, but hit a dot instead. Then Tony tried to pass Kevin, but Kevin's car got awful wide, so it ended with Ralph off in the Twilight Zone somewhere, Kevin and Tony in almost a photo finish, and Rich 5 feet behind.

Ralph Burch Jr. has sure had an incredible year. He won the Florida Winternationals and the McCoy race. He had the two fastest qualifying rounds at the World's Championships in Carnoux, France, and led the beginning of the race, until fuel problems dropped him out of the race. And now he won the GT and Can Am ROAR Nationals! He's certainly the one to beat. □

Scale Views

COL. JOHN DE VRIES



Line-up of suitable-for-scale engines. O.S. Goldhead in "Maximizer" belt drive — works well but drive shaft "wanders" because it's used to tension belts. Old "work horse" Enya 60 in the middle has seen service in three scale models --- good engine. New O.S. 40 four-cycle on right has yet to be run --- but is expected to perform well in a scale ship.

K & B 40 with a Slim-Line muffler. A good "meat and potatoes" scale engine. This particular example was installed in Jack Cole's Jemco AT-6 pylon racer. Engine's reliability is a big plus for scale applications.

Scale Power

Nope, this isn't Clarence's column. Nor do I want you to get the idea that yours truly is an engine expert — no way! But, a while back, my compadre, Art Johnson, discussed at length those features that are desirable in R/C transmitters used for scale model flying. I'd like to parallel his effort and talk a bit about engines and what makes them suitable for R/C scale models. A glance at the ads in this magazine, or at our local hobby dealer's showcase, and the dilemma will become readily apparent. There are, literally, hundreds of engines to choose from when it comes to the decision of which **one** to use in the latest scale model. If you add to the total the semi-antique engines resting somewhere in the home workshops all over the country, the number becomes mind-boggling! And, many of the available engines will be eminently suitable for scale model use. Conversely, there are the screamers designed for racing models or high speed pattern ships that are totally inappropriate in the nose of a scale model.

In choosing an engine for **our** purposes, there are some characteristics to look for. First, our model with all of its scale details, will probably be heavy. In other words, the wing loading will be up there. So, it stands to reason that we'll need an engine with plenty of power. In fact, if we're building a kit model and the kit manufacturer recommends a range of engine displacements as being suitable, we'll probably choose an engine at the top end of the suggested range. For example, if the kit is listed as needing engines from .25 to .40 cu. in. displacement, we should give primary consideration to a .40. With throttle control, we can always come back on the "go-stick" (throttle) if the large engine has too much poop! There's a hidden advantage in choosing an engine from the high end of the suggested range of displacements. Usually, the larger engine will be **heavier** — and make the balancing of our scale model that much easier. Better a heavy engine than inert lead!

A second consideration in choosing an engine for a scale R/C model is to find one that will turn a scale-sized propeller. Translated, this means that

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IMAA Chapter 90 President, Doug Hathaway's Starlet --- plans by Jerry Nelson. Flew well but the landing gear was wiped out in a "low landing." Bird was easily repairable.

Dale Alyea, District 9 IMAA representative, built this big CAP. Quadra in the nose.

Larry Henderson of Bokeelia, Florida, has taken a Royal kit of the 310 Q and modified it to the K model. Powered by two Fox 45 BB R/C engines and retract system by Rhom-Air. Over five months of work with a little to go. Yet to be flown.

Lamar Steen of Denver designed it, Tony Paul built a model of it. Under-powered with a Quadra, Tony went to a Kawasaki that really motivates this big 'un.

it is more desirable to have an engine with good low-speed **torque** rather than one that develops a lot of "horses" in the 15,000 to 20,000 rpm range. You need a healthy amount of "twist" to turn a big prop — and make a relatively heavy scale model scoot down the runway. In order to turn a scale-sized "club," we'd like to suggest to your consideration either a diesel, diesel conversion (of a glow plug engine) or a four-stroke cycle engine.

Diesel fuel may not be readily available in your neck of the woods and you may have to scrounge up its components and mix your own. But, it's well-worth the trouble. Diesels are almost ideal for scale applications because they can be "lugged-down" with propellers much larger in diameter than their glow plugged displacement equals. If you've ever built a model of an airplane that had a big, round radial engine, you'll know what I mean. We want a good part of the prop to extend beyond the cowling. Diesels will let us do it without complaint.

Of course, the "latest word" in model engines are the four-cycles. They're multiplying with a speed that puts rabbits to shame! I must admit, the last couple of engines that I've bought had pushrods and rocker arms. Why? For the same reason that we recommend diesels for scale R/C models — the four-bangers have the ability to swing a scale sized propeller at the speeds we require. For example, the OS .40 four-cycle calls for a 12/5 prop as **normal** compared to a 10/6 that the K & B instruction sheets recommend for their glow-plugged .40.

Displacements being equal, a four-cycle engine will have a bit less power than its glow plug counterpart. Depending on which engines are being compared, the glow plugger will show a 20% or greater horsepower edge. But, the four-cycle engine will have a torque advantage, and that's what we want. If you took our comments about "scale sound" to heart from a few columns ago, the noise of a four-cycle more closely parallels the "real" sound of a "reciprocating engine equipped" airplane!

The third consideration in choosing an engine for a scale bird should be **its physical size.** No joke! Even though the "rule book" allows us to hang our cylinders out in the breeze — and says that the muffler may do the same without any reduction in static scale points — the true scale builder and flier is very much inclined to **hide** all of the ironmongery. Despite dire warnings about overheating engines stuffed in scale engine compartments without enough airflow to blow the sweat from a gnat's eyebrow, most of us want to keep our power plants hidden. Even to the extent of cobbling-up a radiator and water cooled engine head. Just recently, I was faced with an engine size problem. My bride had given me a beautiful Tartan-single for my birthday. Yea, it was kind of "suggested" to her, but she's a good kid and got the Italian engine for me. Anyway, it sat around for a while — I was designing a scale model for it. But, horrors — when the drawings were all done, the Tartan didn't fit! Oh, there was plenty of room for the mount and the cylinder, but the carb stuck out the side of the cowling! Real ugly! And, there was no way I could change or reposition the carburetor. Thanks to a **very** compassionate hobby shop dealer (who **really** needed a Tartan for his own model!) I was able to swap my birthday present, in part, for an Enya 90 four-banger. I dropped a fractional horse in the exchange, but the Enya fits the model like it was made for it! And I didn't have to re-design the model to 1/3rd scale. So — check the physical dimensions of the engine that you intend to use in your scale model. You might not have as kind a hobby dealer as I do.

There is a fourth consideration when it comes to scale engines. Can the engine be geared or "belted" to provide for a lower propeller rpm? The idea behind gearing or belting, of course, is to turn a big propeller relatively slowly while the glow plugged two-cycle engine behind it screams its little heart out and produces lots of "horses." Of the two alternatives, the **geared** engine is the better choice for a scale R/C model. Once properly meshed, gears seldom come adrift or require adjustment. There are some frictional losses in the gear train but they're minor compared to the advantage of turning a big propeller, slowly. And, you can buy geared engines and gear trains off the shelf for many power requirements.

Prop drives, with belts, perform the same function — slowing the prop rpm down while developing max h.p. with a two-cycle. Some of them may give you installation fits because of the positioning of the various drive components. Some of them are inclined to throw belts or require

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frequent belt replacement. And, like geared engines, prop drives often exhibit weird locations of their thrust lines. In order to locate the prop in its scale position, it'll be necessary to lay a drive unit over the drawings of the model being built (both top and side views) and made **very** careful measurements **before** drilling mount holes in the firewall. The extra weight of a drive or gear case is a balancing "plus" because of its **functional** nose weight.

Finally, if you don't want to go on one of the more exotic routes with the power plant in **your** scale model, we'd like to suggest that you consider a "sport engine." Nothing fancy, there are a host of such engines gracing your dealer's shelves. Something like a "meat and potatoes" K & B .40, an O.S. .30, a Fox .35, with an R/C carb, or an Enya .60 side-port. I have one of the latter (an Enya .60) that's older than most of my kids. It's been in three scale models; the last, my Berliner-Joyce P-16. The head is covered with cooked-on "goop" (gotta clean it) and the needle valve is a bit shaky in its threads. But, inside, it looks like a sparkling jewel, and does that baby run! It's a good "scale engine."

What we're suggesting you **avoid** for your scale models are the "hairy-chested" .60's (unless they're belted or geared) and the many powerful, snarly **racing** engines. They have their places in the R/C scheme of things — but **not** in scale models.

Models Of Airplanes As They Never Were

From the big modeling shows like Toledo, MACS and WRAMS to local mall displays, there seems to be a tendency among some of the scale model fraternity toward "models of airplanes that never were." Oh, the models represent real aircraft all right. They **look** like Mustangs and Spitfires and Corsairs and Cubs. But their builders have gone completely overboard in finishing them! They are **too perfect!**

This may sound a little strange, coming from someone who is devoted to the perfection of duplicating airplanes in miniature form. After all, the closer the model comes to representing its prototype, the better, right? Without question! But aren't we doing scale modeling a disservice by producing models with glistening paint jobs infinitely better than any produced by airplane factory workers? The craftsmen at Beech, Waco or Stinson produced fabric covered airplanes with colorful Berryloid finishes. But, you can still see the "grain" of the fabric through their hand-rubbed paint jobs. Not so with many models of the same aircraft! The "fabric" areas on many scale R/C models looks like there's an underlying **metal** surface.

Art Chester's "Goon" in Quarter Scale. Designed by George Fischer, who also designed a scale retract system for the model. Model was built "backwards" — the fiberglass fuselage exterior was completed first and then the structure to connect engine, wing, gear and tail feathers was built to fit inside! A 90 for power and a foam wing.

We all know how much work it takes to finish a model. Sanding, filling, sanding, sanding and more of the same. Thus, the sheer craftsmanship of some of these "show models" boggles the mind! But, is it worth the effort to produce an "Airknocker" (Aeronca) that looks like it's metal-covered? Don't think so! Many of these show pieces will never serve their intended purpose — to fly under radio control. There is too much labor and time invested to ever trust them to the vagaries of flight. Although there may be receivers, servos, batteries and engines installed, daylight will never show beneath their wheels. It's kind of sad, in a way. We may be developing a class of "static display only" models. And, they cost a fortune to build. Thousand dollar **shelf models?** Don't know about you, but that's too rich for my blood!

Although we're **not** advocating it — and, it's only a **suggestion** — but wouldn't it be a good idea if the scale R/C model show promoters asked for "proof of flight" for models entered in their static contests? Something to prove that the models shown have served their practical purpose? A certificate of flight or a photo of the model airborne — we're not talking about extensive flight testing programs or that a scale model has been used all last summer as a Sunday flier. Just that the model at hand got up and down, essentially in one piece, under radio control. Seems logical, somehow.

Catch-Up

Leo Ford of Lakewood, Colorado, read our "bit" about using trunk lid torque rods for scale landing gear struts. He confirms that it works but suggests another source of springy steel — the **bows** that upholsterers use to hold "headliners" in place in automobiles. He says it seems to be just the "wire" to use, particularly for lighter applications. And, the bows are cheap, at auto wrecking yards.

Dorance Dean of Seattle, Washington, was looking for some small router bits — to make scale-sized routed wing spars. We suggested that he put the arm on his dentist for some old "bits." Even after they're no good for drilling teeth, the bits work great in the old Dremel. The best ones for our use are the spherical ones — a little ball on the end of a shaft. They "cut" in most all directions.

At Toledo, I picked up a brochure for

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SILENT POWER

Jim Zarembski

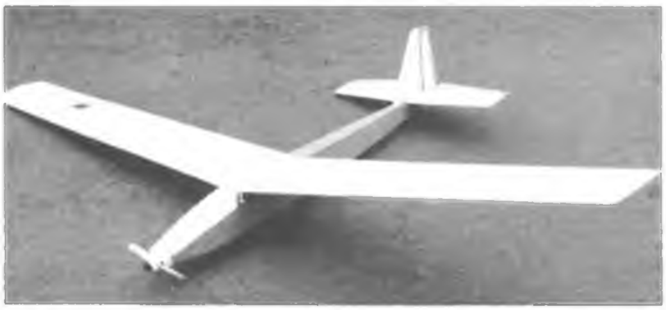
Over the course of the last few years there have been a number of reports about electric power in Germany, Belgium, England, and even Mexico. What about Japan? It would seem logical that with the large population and small land area of Japan that electric power would be a natural. In addition, Mabuchi, Sagami, and Igarachi, mass producers of fractional horsepower DC motors, are located in Japan, not to mention Sanyo with their line of nicad batteries.

In an attempt to uncover what I hoped would be an interesting expedition into the unknown, I began a series of letters to modelers in Japan with Dick Kidd's help. We finally made contact with Larry Hoffman who lives in Tokyo and is an avid RC'er who has dabbled in electric power.

To my disappointment, electric power primarily consists of flying foam ships, the same one's imported by Kraft, Cox and Airtronics over the past few years. To Larry's knowledge, there is only one balsa construction kit available, the E-Fly by Pilot. Let's hear what Larry has to say.

Dear Jim,

Bam! Another flying field bit the dust . . . And so it goes in Japan, where R/C has flourished for many, many years. Now, as it appears to be the world over, progress spells new development and the construction boom is driving modelers up the tree as



Japanese E-Fly built by Larry Hoffman of Tokyo. See text for details.

Quick Change hatch on bottom of E-Fly. It doesn't appear that a hatch cover is used.

old sites are lost and new ones harder to find.

Yet, look at the local parks on any Sunday and you will find hand-launch gliders and rubber power in abundance. What this means, of course, is that ***Silent Flight*** *is accepted . . .*

How this relates to electric power is another story. I, myself, have flown electric power at two choice locations used by the rubber powered fraternity with no problems at all. But why don't others? Simple, most are convinced electric power is not advanced due to the limits on flight times. Nuts, it's being done in the States and in Europe, so why not here?

Japan produces great motors from people like Mabuchi, a world-renowned small motor manufacturer. Sanyo is getting to be a household word for rechargeable batteries. As far as I am concerned, the problem lies in the lack of kits for this facet of our hobby. My count puts it at four makers of kits, one of which requires the ultra-small servos to make it fly, and then with the very, very short flight times.

Boiling it down to the nitty-gritty, there are really only two makers of kits for electric power, and their total line amounts to four models! Now, that is not what can be called an incentive for getting into electrics!

So what is it going to take? Just like any phase of our hobby where advancement into choppers, 1/4 scale, ducted fan, etc., was attempted, it will be up to a few devoted fans of silent flight to develop original designs and show others the feasibility of this method of flying R/C planes. This will certainly help those fliers who are darned tired of traveling long distances to enjoy this great hobby/sport as local fields will becomes accessible once again.

I, for one, intend to do whatever possible to make this a reality. I trust the kit makers will see the value in this form of flying and follow up with a wider range of kits and associated supplies. With this, Japan will step on the world bandwagon and bring ***Silent Flight*** *to the forefront as a viable and valuable element in our hobby.*

In order to properly give you the story on electric powered flight in Japan, I called the Kyosho and Asahi companies asking for pictures of their planes for you to use in your article. Kyosho sent some. However, in talking with the Asahi people (they make the ACOMS radio system that is serviced in the U.S. by Altech Marketing, Inc., Fords, N.J.), the conversation developed into them sending a kit, radio and chargers for me to build, test fly and write a short article for you.

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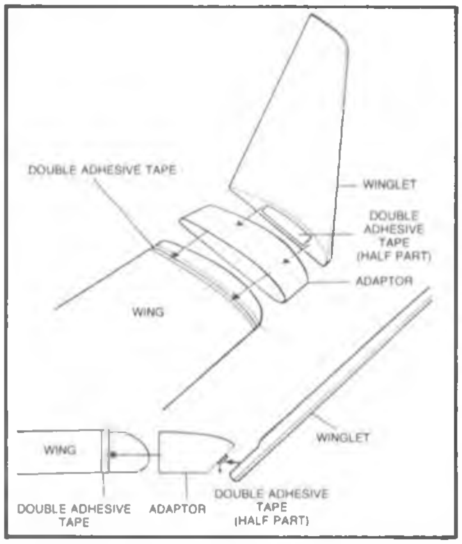
Larry Hoffman with ACOM's Sirocco.

Sirocco broken down for transportation. The pretty model is reminiscent of the Cox Sportavia, but mid-wing allows easy hand launch not attained with low wing sailplanes.

Winglets on Sirocco. This is the first kit the author has seen with winglets.



Detail of winglet installation on Sirocco from instruction manual. This approach could be easily adapted to many current models.

Michael Lemaire of Redlands, California, with Astro Cobalt 15 powered Bird of Time.

The ACOMS Sirocco Electric-Powered R/C Motor-Glider Kit By Larry Hoffman

Having built and flown a balsa-made electric powered glider kit a couple of years ago, it was with a feeling of great anxiety for the chance to make a comparison with a styrofoam kit, when my ACOMS Sirocco arrived.

Some background first: The ACOMS radios are made by the Asahi Tsusho Co., Tokyo, Japan. Their first introduction to the hobby market was through sales in Europe. A maker of specialized communications systems, they decided to enter the hobby using their expertise in the field of electronics with a low cost line of R/C systems.

From this start, they developed two kits for the novice in the hobby to build and enjoy, a Cessna-type and the Sirocco.

***Construction** of the Sirocco is really a simple job of assembling a few parts. The styrofoam molding is quite accurate and parts go together easily and with a perfect fit. The body halves come glued together with hard plastic firewall and tailwheel fittings already in place.*

The motor and geared-down 3:1 mechanism screws to the firewall mount that has built-in right thrust — no guesswork there! The motor is held in place with rubber bands to prevent serious crash damage. The plastic cowling is held in place with two screws that makes a close fit with the body for a neat appearance.

The nose wheel mount consists of two

Contestants in Astro Flight Sula Electric Contest. All ships are Electricus. Front (L to R): Larry Jolly, Bob Boucher, Dennis Brandt, Roger Roth. Rear (L to R): Bill Boss, Dan Fink, Rich Schramek, John Brown.

Bill Boss with his Astro Cobalt 05 powered Electricus, 7/4 Rev Up prop.

hard plastic pieces that sandwich the body and are held in place with four screws. The pre-bent landing gear/wheel fits into a slot and is secured with a single screw. A plywood servo tray epoxies to a molded body mount and receiver/motor switches fit into appropriate holes pre-cut at the factory.

The tail feathers are made with hinges molded into place and require only decals and installation of control horns; epoxying to the body takes only a few minutes. The wing, too, is quite simple to put together; thus, for the accomplished builder, this kit should take no more than a few hours to assemble.

Since I am a real loser when it comes to painting and decorating a plane, I gave the decal placement work over to my son, Kenji, since his artistic talents far exceed mine. The result is a very nice looking model with a very scale-like appearance.

***Flying** the Sirocco for a novice without the add-on wing tips will not be easy as this plane has the tendency to tip stall if speed is not maintained. The first flight was with a battery not fully charged, but with sufficient power to set trims and get a feel for the controls. Minimum throw should be used for the beginner pilot as this plane reacts nicely and crisply to command.*

After charging up a spare battery using the quick charger, the plane flew between three and four minutes and gained a respectable height. However, the day it was flown was a poor one for checking the Sirocco's thermaling capacity: it was quite cool, the humidity very high (it rained before tests were complete) and the only signs of thermal activity were a few "bumps" on the way up.

With a little nose weight, I feel the Sirocco will make an excellent slope soarer for the sports-minded flier. The short flight time does not make it a contender for serious fliers; however, as mentioned above, the easy construction and added stability with the optional wing tips make this plane a good starter for the novice to the hobby.

I believe this does it for now. Take care and keep in touch. I hope to start making formers and such for the RCM WASP if time permits. You got me hooked on electrics for the moment, so it's going to be a toss-up between this and my love for thermaling . . .

Ciao,

Larry Hoffman
Tokyo, Japan

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Thanks, Larry. We certainly must be thankful to the dozen or so pioneers in Silent Power in the good ole U.S.A. who have propelled electric modeling to terrific heights in the past ten years.

Of particular interest in the ACOM's Sirocco are the winglets (see photo). What would winglets do for an Electricus?

Bob Boucher of Astro Flight sent in a letter covering the SULA (Soaring Union of Los Angeles) electric powered sailplane contest held June 19, 1983.

Dear Jim,

Here is the long awaited report on the Astro Flight sponsored SULA electric contest. The contest was held at the Magnolia School site in Santa Ana because the SULA field was temporarily closed for an International bicycle race being held there.

We had twelve entries flying ten Cobalt 05's, and two Leisure 05 motors. We used the AMA proposed seven-cell rules: a 1-minute motor run and a 7-minute glide with man-on-man scoring. The tie breaker was a single flight, last man down wins. This was a bad idea since they stayed up almost one hour and finally agreed to come down before the receiver batteries quit! A 1-minute precision was declared, and the top two pilots, Rick Schrameck and Dennis Brandt, went for it. Rick Schrameck won by one second . . .! The next time we will try a 30-second motor run or maybe a 15-second motor run because these babies get so high on 1-minute, they can't fall to the ground in 5-minutes.

By the way . . . ***all models were Larry Jolly's Electricus.*** *This made the contest sort of a one design, but this was by accident, not by intent.*

After the contest, we all retired to the local hamburger palace to discuss the future of electric flight. These guys were interesting, and are interested in trying to get on the U.S. team for the 1984 Championships in Germany. They are young guys in their late 20's and early 30's . . . a good sign.

Last week I gave a presentation of Silent Power at a local power club with over 100 members. There were only ***three guys there who did not have white hair,*** *and one of those was* ***bald!*** *We need some new young blood in R/C.*

The top five places were as follows:

1. *Rick Schrameck — Electricus, Astro 05 Cobalt, 7/4 Rev Up, 7 Sanyo, 1200ma.*
2. *Dennis Brandt — Electricus, Leisure 05 Ferrite, 7/4 Rev Up, 6 Sanyo, 1200ma.*
3. *Roger Roth — Electricus, Astro 05 Cobalt, 7/4 Rev Up, 7 Sanyo, 1200ma.*

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The winners, Left to Right: Roger Roth, 3rd; Rich Schramek, 1st; and Dennis Brandt, 2nd.

JMGlascraft Electri-X aerobatic ship designed for 05 systems. Uses glass and foam construction.

4. *Bill Boss — Electricus, Astro 05 Cobalt, 7/4 Rev Up, 7 Sanyo, 1200ma.*
5. *John Brown — Electricus, Astro 05 Cobalt, 7/4 Rev Up, 7 Sanyo, 1200ma.*

By the way, this was Bill Boss' first electric plane . . . he is an expert glider flier and good builder.

At the bull session, we all agreed that a 30-second run would be needed, at least among experts. Maybe a novice group could use 1-minute, but to these guys, it was too easy.

Larry also flew his new Interceptor, which will soon be kitted. It flew very well.

I tested the new Sanyo Red 800 mahr batteries, called "cut off cells." They seem to be just as powerful as the 1200 mahr cells and weigh about 60% as much. They will be available from Astro Flight at the same price as the larger 1200 mahr cells.

Astro has labored for about nine months, and is about ready to give birth to a pair of beautiful twins . . . the Astro 10 and Astro 15 ***super Ferrite motors!*** *The 10 turns a 7/4 Rev Up at about 14,000 rpm on seven cells, and the 15 turns the same 7/4 at 16,000 rpm on twelve cells. They should be at your favorite dealer soon.*

Also, our assembly line is now in mass production, and we are shipping Cobalt motors each week to dealers all around the world. The 05 motors and the 15 motors are in full production, while the 40 and the 25 are in limited production — but will be in full swing by September.

Life tests indicate 350 hours of brush life — or thousands of flights between brush changes. This can be easily done in a few minutes; you only need a screwdriver.

You can tell your readers — some of whom have tried in vain to telephone over the past few months — that I, and my trusty servant Igor, have been busy

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in the laboratory with various secret tests and black magic, and have not been able to come to the phone. We would not be able to hear the phone anyway, since during life tests, the snarl of the Astro 40 turning a 10/5 at 12,000 rpm's is quite loud!

What's next?

Well, our new gear box for the 05 sold out two batches. New ones are coming soon, as well as a modified version for the Cobalt 25 and 40.

That's about all for now.

All the best,
Bob Boucher

Finally, in the correspondence area, Mike Lemaire of Redlands, California, sent a nice letter about his Astro Cobalt 15 powered Bird of Time.

Dear Jim:

I decided to motorize my large Bird of Time to get away from the glow plugs, fuel, noise, etc. Silent power seemed the way to go, so I contacted Astro Flight, Inc., in Venice, California, and asked for their advice.

They recommended their Challenger Cobalt 15, geared 2½:1 with a 13/8 Geist folding prop and 12 cells 1.2 ah, or direct drive with 8/4 prop.

I had to cut the nose off the Bird and modify it to fit the motor in. After positioning the motor, I locked it in with strips of spruce epoxied to the sides, front and rear of the motor area.

A micro switch was installed to turn the motor on and off, operated by a servo with one arm that pressed against the switch plate. After completing the modification on the Bird, it came out at 4.45 lbs. That gave it a wing loading of 10.35 ounces per square foot.

The Bird flies very well and will run the motor five to six minutes on one charge. It will climb about 1500 feet on a two minute motor run, then cutting the motor off, I start searching for those beautiful thermals.

It is so nice to launch the Bird so quietly, beautifully and really enjoy the thrill of silent power.

I am presently working on an original sailplane with canard wings and stall flaps on the wings that will outfly anything in the sky. It will be silent powered, 120" wingspan, 7.30 ounces to the sq. ft.

I will send you the pictures and performance data about November.

Best regards,
Michael Lemaire

On The Horizon

John Fotui of JMGlascraft, 30820 Mayflower, Roseville, Michigan 48066, has announced the "Electri-X." This a 65" wingspan glass fuselage, and foam wing sport aerobatic ship designed for 05 systems with 6 cells 1.2 ah. The prototype Electri-X has a

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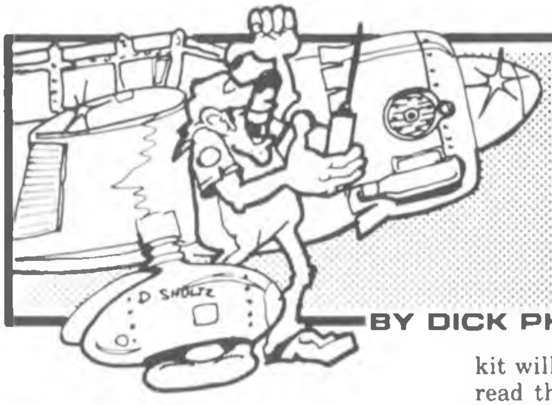


BIG is Beautiful

BY DICK PHILLIPS

Within the industry which supplies us with all the good things we need to build and fly model airplanes, and particularly in that segment of the industry that supplies the **big** builder, smaller firms are the rule rather than the exception. Many of our suppliers are "basement" or "garage" operators; cottage industry, if you like, and are, therefore, small operators. Many get into the business under-capitalized and some get into business without any business background and are not able to properly manage their limited resources. Unfortunately, many of these fall by the wayside after a brief career and we then have to do without the "good stuff" they produced.

In some cases, the maker of the "good stuff" priced it too low to make a reasonable profit, thinking his costs were lower than they actually turned out to be. That "reasonable profit" is why the system works, and those who don't charge it, or who won't pay it, make problems for the system. Without the profit, it just won't work.

Sometimes things disappear from the marketplace and those of us who didn't buy when it was available spend some time trying to kick ourselves for not getting it while the getting was good. Annco retracts were a good example, as was the fine Tiger Moth kit put out by Bud Barkley in Canada. As it happens, I have one of the kits but didn't get a set of the retracts (which I should have, even without a specific project to put them in) at the time they were available.

As it turns out, there is no need to despair, they are both back on the market again, the retracts always were an excellent product, as was the kit. The retracts have stayed the same fine quality and the kit has been improved.

Some of the changes made in the "new-improved" version of the Barkley Tiger Moth are in the front end. The cowl has been modified to produce a cowl which more closely resembles the English version of the airplane, and some of the forward formers have been altered a bit. The kit will be available by the time you read this and may be ordered from: M & H Balsa, Box 520, Manotick, Ontario, Canada, K0A 2N0. Cost will be $389.00.

M & H, who have been in the balsa business in Canada for many years, also have a Fokker D-VII kit at 3" = 1' scale ready for shipment. I don't have a lot of information on this one but a note to M & H will get you all the information you want. Bud Barkley is now part of M & H and it doesn't take much of a stretch of the imagination to foresee some more good kits coming our way with Bud's talents at design once again at work. If they measure up to the fine quality of the Tiger Moth, we will have some very fine kits to look forward to.

★

Every once in a while, we get so smart that it is painful. I got too smart by half not too long ago and thought you might enjoy the results. I mentioned here some time ago that during the construction of the mono Fly Baby (Balsa USA kit) the instructions say that you must be prepared to add some tail weight when it comes time to balance the airplane. I couldn't see adding non-functional weight, so I made the tail feathers a bit heavier than normal by filling all of the openings between the structural framing with 1/4" plywood. It did wonders, made the empennage **very** strong and also **very** heavy. You guessed it, when it came to balancing the model, it was more than a little tail heavy. So much so that the easiest way out was to cut the heavy set off, make up a new set and omit all the weight. Once covered, painted and glued in place, the balance was very close, requiring only a little weight forward.

Subsequently, I decided to change from a Q35 to a Q50 engine in the Fly Baby as I had a use for a 35cc engine it had been powered with and also wanted to fly the 50cc Quadra. It didn't take a lot of change to fit the slightly larger (and heavier) engine in the Fly Baby, but, when it came to balancing it, it was quite nose heavy. You guessed it again! I once more cut the light empennage off and bolted the heavy one back in place to find that it now balances right on with no weight added anywhere! I know what you are thinking, it would have been a lot smarter to have tried the engine with the heavy tail feathers in place . . . right? Or it would have been fairly intelligent to bolt the heavy set in place for ease of changing if it ever became necessary . . . right? Of course, and that's the way they are on there now just in case I ever have to go back to the smaller engine again. Both will fly the airplane quite well, the real reason for making the change was to use the smaller engine for something else (Sopwith Pup) and also to get the Q50 in the air, more of which in a future column. Anyway, the moral of the story is to suggest that thinking ahead a little further than today is a heck of a good idea.

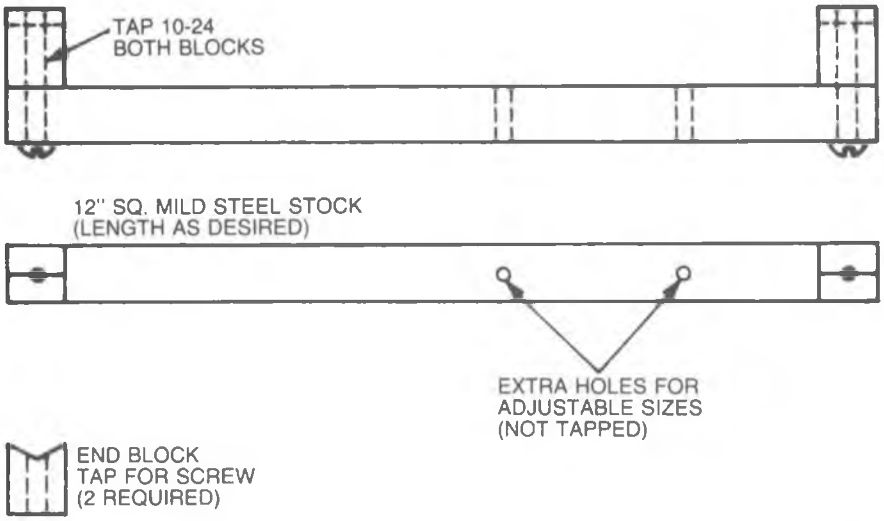
★

If you have ever made a hard landing with one of your big birds and bent the wire landing gear a bit, you'll find it is a little difficult to straighten the wire out again, especially if the gear is such that it is not removable from the airplane. The Balsa USA Fly Baby is a good example (yep, I bent 'em a little . . . just one section though). It doesn't easily come off the airplane (a good mod if you are building one, it only takes a couple of slots in the sheeting on the bottom of the fuselage to make them removable).

So, to ease the straightening of permanent mounted gear, I designed and made the following tool for this purpose. It works very well indeed and takes only a short time to put together.

The item consists of three parts, a section of half inch bar stock and two notched end pieces, bolted to the bar. It can be made a little more versatile by drilling a few extra holes in the bar

Bar stock wire straightener. Simple and easily made tool is used to straighten non-removable landing gear wires on the model. Saves damaging structure trying to straighten hard wire landing gear struts. More in text.



and this then gives a variety of different lengths which can be adjusted to suit the particular gear being straightened. The dimensions are pretty flexible and can be whatever suits the material available. The end pieces should be of adequate height above the bar so as to permit overbending the wire in order to get it back to a straight piece again.

In use, the device is used with an ordinary "C" clamp. Simply place the jig over the wire to be straightened, put the "C" clamp in place over the center of the bent piece of LG wire and the jig and tighten the "C" clamp until the wire is overbent enough to spring back to a straight piece again. I cheated a little in that I took one of my "C" clamps and filed a small "U" shaped depression in one jaw so it stays on the wire. It works well. While a bit out of the ordinary, it saves damaging a model trying to straighten 3/16" or 1/4" wire while it's still on the model. Such wires are hard to get a good grip on and trying to straighten them with a couple of pairs of pliers or vice grips puts a terrific strain on the wooden parts of the model. A half hour with a hacksaw, a drill, a file and a tap suited to the available bolts will make it up and, while you won't use it very often, it sure beats any other way to straighten wires you can't get off the model. You could even cut a long slot in the bar which would permit positioning the movable jaw anywhere along its length, but that's a good deal of work to try by hand. Several holes spaced out along the bar will work quite well.

Landing gear wire being straightened with "C" clamp and home brew jig. Over-bending the wire allows it to spring back to original shape. Fixture could be longer for larger models. (#2 is 4 inches longer.)

★

While in Iowa last August to attend the IMAA Festival at Ida Grove, I took a little extra time and drove over to Montezuma for a visit with Hazel and Maxy Hester at the Sig plant there.

Having built three models of Hazel's Clipped Wing Cub (two of the smaller version and a Quarter Scale), I was particularly delighted to have had the chance of a short flip in the airplane with Hazel at the controls. Bob Nelitz and family were visiting at the same time and Hazel spent the better part of a couple of hours making sure everyone got a ride, especially the kids, myself included. It was something special to have had the chance of a flight with that fine lady and in such a well-known airplane.

Over a couple of days we had the chance to spend time with Maxey and Hazel, to have a good tour of the Sig plant and to meet many of the people who turn out all that good stuff. It was a surprise to learn how much of what comes in the well-known Sig boxes is made right there in the factory. They do all their own printing, including the Sig catalogue, do most of their own picture taking, cowl molding and including cutting their own balsa. It was quite interesting to be able to follow the raw balks of balsa coming in one door right to their departure as finished model material at another.

Much of the machinery involved in producing those kit parts has been invented, developed, and made right there as well. If you thought modelers were ingenious, you should see what the manufacturers can do when they put their minds to it.

To Hazel and Maxey, a large thank you for a very fine visit which will be remembered for many years. There are rumors that there will be more large kits from Sig; I, for one, look forward to them.

★

I had a package in the mail recently and inside it I found what looks to be one of the most realistic full figure pilots I've seen. It's a 1/3 scale civilian pilot figure and is very lifelike. The figure comes in two parts allowing its use in total or the use of the upper torso and head (one piece) as a pilot bust. Feet on the lower half of the body are positioned to fit rudder pedals and the right hand is shaped to fit over a control column. Poly S or equivalent paints may be used and the full figure weighs 15 ounces. It's made of a flexible plastic material and could be set up to fit in almost any 1/3 scale cockpit. At $19.95 plus $2.00 P & H it's a good deal. Painting instructions are included and a very lifelike looking pilot is possible. No flying helmet, sunglasses or cap are provided but any good scratch builder would be able to add such touches as were necessary for added realism.

1/3 Scale pilot figure from William Hawke. Very realistic civilian pilot figure will soon be followed by several other sizes and types. More in text.

Scheduled for production before the year is out are: 1/4 scale civilian, 1/5 scale civilian and 1/5 scale WW II Navy. The latter being just the thing for your Ziroli Corsair or F8F Bearcat in Navy colors.

If one of these will fit your bird, drop a line to William M. Hawke, 7148 Lasting Light Way, Columbia, Maryland 21045. Considering his interest in models, what could be a more appropriate last name than the one he already has?

★

Another handy little item to come along recently is called Speed Stix produced by Precision Sanding Tools

More Speed Stix, handy sanding sticks in a variety of sizes and shapes. Versatile sanding accessories can be very handy around a small airplane factory.

(2930 Skyview Ave., Pueblo, Colorado 81008, (303) 542-6200.) These are wooden dowels and sticks coated with a particularly durable abrasive in 100, 120 and 180 grit. That's coarse, medium and fine to those of you who don't read numbers! They cut through balsa and the soft material we use like a hot knife through butter and are shaped so as to provide a tool that will do most any of the fine sanding jobs we are so often faced with. They look as if they'd do a particularly neat job on shaping fillets and that sort of thing. They come in a wide variety of sizes, as can be seen in the accompanying photos, and should add a very useful tool to your arsenal. The grit is well-bonded so their use on the softer materials should be long lived. I don't have prices, but a word in the ear of your local hobby shop proprietor or an SASE to the above address should get you any information you'd like. Precision Sanding has even color coded the ends of the stix so you won't have any trouble finding the right grit for the job you're engaged in. Looks like a good addition to the stock of hobby tools we all find so useful.

★

As you read this, we're at that time of year when another flying season is on the horizon. There will be contests, fun-fly's and rallies to go to, Sunday afternoons to go out and just bore a lot of holes in the sky and good friends to spend time with at the flying field. Despite the many years I've spent in and around this hobby of ours, I still get the anticipatory quivers about this time of year. There's usually a new bird waiting for the weather to improve enough to fly, often there's a late bloomer from last year that's only got a few flights on it and, in the northern parts of the country, we've usually had winter up to here and it's great to be able to look forward to spring.

Toledo is just around the corner and there will be a new crop of "good stuff" to see, handle, admire, and buy to make things easier, better or less expensive. New friends to be made and lots of hangar flying to be done. It's a great time of year, a great time to be alive and involved in this hobby.

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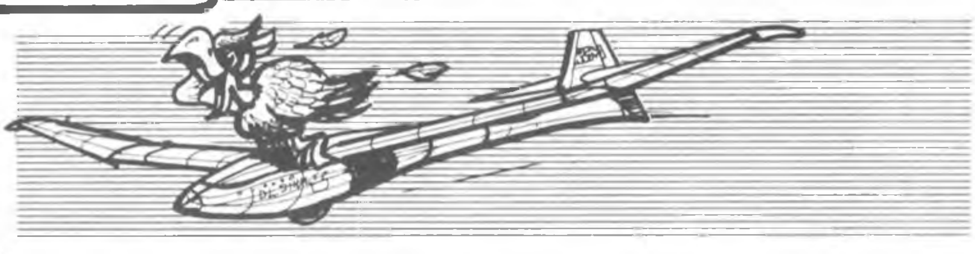
Soaring AL DOIG



Winch retrieval system built by Clarence Nikkel, Bakersfield, California.

Bicycle rim turnaround — winch retrieval system by Clarence Nikkel, Bakersfield, California.

How's this for mechanized scoring? NSS Soar-In 1983, Bakersfield, California. Harland Simpson's computer and program being manned by Penne Madsen, age 11 in foreground, Robbyn Madsen, age 15 middle and Niki Skaggs, age 13 in rear. Fathers are members of S.S.J.S.S.

Gee whilikers, where did the year go? Seems like we just celebrated last Christmas.

Glitch Department — On the first flight of the NSS Soar-In this year, just as my K-Minnow got off tow, I got a very unwelcome full down-elevator. The ship went into a vertical dive, tucked under, and came out inverted. There I was at 30 feet upside down. Of course, I got out of the air as quickly as possible even though this meant a downwind landing at twice the speed of the Bombay Express. A check with the hand held CB rig operating showed no problem. The next flight was conducted with fingers, eyes and legs crossed; no problem. The rest of the nine flights went off only with problems that could not, without stretching the truth, be assessed to the radio.

On my next ham radio contact with Dr. Walt Good, I related my experience. "Funny thing," he said, "I had the same thing happen to me. Except my ship had enough elevator authority to do three outside loops. When I put the radio on the bench for examination, I found an intermittent connection on the elevator potentiometer in the transmitter."

I told Walt I'd check my transmitter, but with the chances of lightning striking twice in the same spot, I put the idea in back of my mind. The next week I was out ready to test fly a new sailplane when I thought, "I'd better just check the darned thing." I went to the car and took the back off the Airtronics Championship Series transmitter. Looking at the elevator potentiometer, I was astounded to see that the solder tab on the back of the RF meter was laying on the solder tab of the elevator potentiometer. It was not quite in contact, but a slight twist of the case and contact was made. It was no problem to bend the meter tab out of range. I probably would never have suspected this cause of a glitch that had all the appearances of a random and brief case of interference.

★

Clarence Nikkel (Rt. 9, Box 401A, Bakersfield, California 93309) is inventing again. If you will recall, Clarence put together the winch anti-backlash device seen in the June, 1983 issue of RCM. This gem is not only simple, but works very well. Now, Mr. Nikkel has come up with a winch retrieval system that also works very well indeed. The system consists of two drums actuated independently by a lever. The actuated drum reels in the line. The other drum runs freely, paying out line. Tangles are prevented by one of the anti-backlash gizmos on each drum. The line runs out to a bicycle rim turnaround and back to the other drum. A frisbie is fastened to the line to act as a carrier for the parachutes. By actuating one drum or the other, the frisbie can be zipped from the winch turnaround back to the winch. Motive power for this particular system is a gasoline engine. The business end of the retrieval system can be located either at the winch or the winch turnaround. If it is located at the turnaround end of the field, one person can both run the retrieval system and hook the parachutes to the frisbie for return to the winch. One retriever will serve two winches. If only one winch is served, there is a simple way to automatically hook the parachute to the frisbie, thereby eliminating one

Savage and Son Of Savage. All the aerobatics you could ask for on two channels. Larry Fogel photo.

Mark Rebeck holding his Son Of Savage --- quite an 11½ ounce handful. Larry Fogel photo.

person, but this presents some logistic problems and is not so foolproof.

With this system, a relatively large contest can be run using just two winches. The real advantage of this retriever over some others is that the retrieval is completely separate from the winch system. There is no

Mark launching the SOS at Torrey Pines. Larry Fogel photo.

auxiliary line that the sailplane must carry aloft during the launch. I've seen this one work and once set up and aligned, it worked flawlessly all day. Though the contest was small, 12 entries, there was never a time when there was no winch available. In fact, things zipped along so fast that what was supposed to be a two day contest was finished in one, with time to spare.

★

Just had a telephone chat with Cliff Weirick of Airtronics. I'd heard a rumor that Airtronics was going out of the kit business, which would be a real shame. Cliff said absolutely not. They have moved the kit manufacturing to San Dimas, California, separated from their new headquarters building in Irvine, California (16191 Construction Circle W., Irvine, California 92714). He assured me that they were going to continue to produce quality kits with no plan that he knew about, to discontinue. He also said Airtronics was about to start shipping FM radios. I'm not quite sure what FM radios are going to do for sailplaners but I guess they are a big improvement in reduction of noise generated in power ships and especially helicopters.

I just received a letter from the bard of Torrey Pines, Dr. Larry Fogel. As one or two of you may recall, Larry once wrote a Soaring column for another model magazine. Larry gets worked up something wonderful over slope sailplanes. He falls in love over and over again. He's found a new one, and here is what he says.

If "big is beautiful," then "small is super." For example, just watch Mark Rebeck fly his new Son of Savage in the

Installed Novak NER-25 receiver without case, 100 ma battery pack, PC board switch and two World Engines S-22A servos. Neat! Larry Fogel photo.

lift at Torrey Pines. The maneuvers are unbelievable.

Mark's been flying for the past seven years (about 35% of his life!) and demonstrates eye-hand coordination appropriate to his age. After gaining a pack of experience flying sailplanes at Kite Hill, Laguna, California, he designed the Savage, a swept-wing, two channel (aileron/elevator) ship that floats in light air and becomes super agile in noticeable lift.

The 70" span wing has a very modified Eppler 374 airfoil, thinned for greater speed; with the high point moved forward to improve the low-speed performance. The fully sheeted foam core has a spruce leading edge and is covered with MonoKote. Full length ailerons induce some of the gyrations. A built-up stab takes care of the rest. For strength, the fin is part of the built-up fuselage and there's room for up to 16 ounces of ballast. Without that extra weight, it's ready to perform at 32 ounces. Here's a docile aileron trainer plane.

The advent of inexpensive reliable mini servos suggested the Son of Savage. This 3/5 version of the original Savage spans 42" and weighs only 11½ ounces, ready to fly . . . and at that weight, a hard landing isn't very hard. As expected, the tail moment is slightly longer, and the stab is larger than 3/5 scale. Construction of the Son is the same as the daddy. You can use the snappy S-22A World Engine servos or others in the same league. The receiver can be the Novak NER-25, or the like. Mark recommends a 100 ma battery pack. That allows almost an hour and a half of flight time . . . and that's more than enough to wear you out. He carries a spare, fully charged, battery pack . . . just in case!

I've watched the Son of Savage penetrate, perform successive rolls, outside loops . . . whatever. You ought to see this bird snap roll. To learn more, contact Mark Rebeck, 31932 Calle Winola, San Juan Capistrano, California 92675; (714) 493-0843. Both planes are now available in kit form. The Savage comes with or without a fiberglass fuselage. Give

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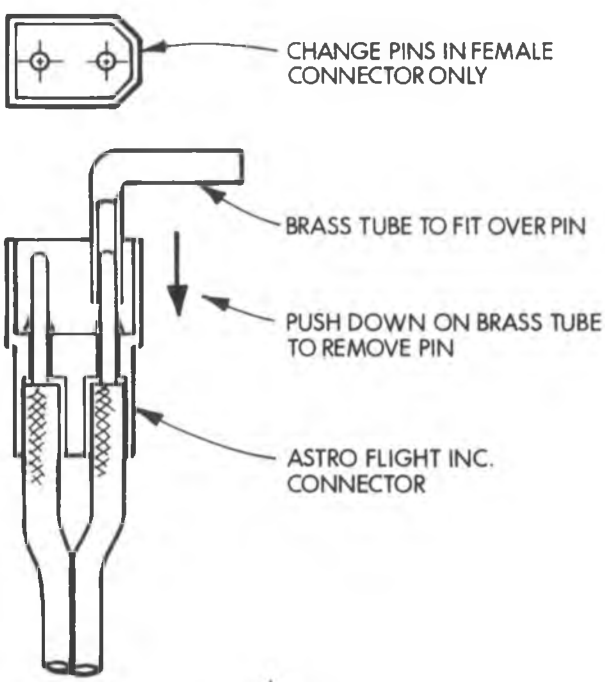
FOR WHAT IT'S WORTH

Edited By Jerry Smith

Having trouble removing dried Hot Stuff from the bottle spout? Those single edge razor blades that we use for cutting many things in the shop also have another use. The ends of the blade have little notches that can be used to pop off dried Hot Stuff, as shown in the sketch. It works every time. From Lih Russell, Los Angeles, California.

Here is a good idea for Molex connectors such as used on electric (Astro and Leisure) systems. When you need a reversible run on your motor, you must change polarity. Changing or switching wires is a chore. A piece of brass tubing fit over the female pin will release the pin. By pressing firmly down on the tube, the pin will immediately release from the connector. See sketch for graphic illustration. Do not attempt to remove the crimped wire from the pin. From George Kanakos, Willimantic, Connecticut.

IT'S EASY TO CHANGE POLARITY



★

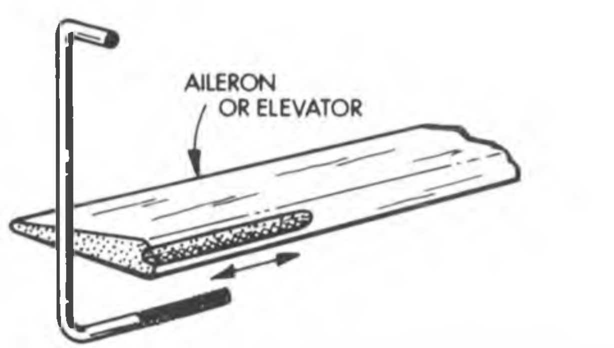
Bill Finney of Muncie, Indiana, explains that at his club's contest a couple of weeks ago, they were having trouble with the crepe paper in the limbo event breaking in the wind. One of the contestants from out of town suggested that they use an ordinary 1" roll of masking tape instead of crepe paper. It is strong enough to withstand the wind, but still weak enough to break if hit by any part of the airplane. It offers the added advantage that, if broken, it can be repaired by merely sticking it back together, sticky side to sticky side, instead of tying a time consuming knot.

★

Byron Blakeslee, Sedalia, Colorado, explains that the Dremel 4" table saw is a very handy little tool but has the reputation of the drive belt jumping off every time you start the motor. This can be easily fixed by wrapping about two turns of 1/8" wide trim tape around the wheel driving the saw shaft. The tape makes a "crown" on the wheel and automatically keeps the belt centered.

★

Dan Cler, Roanoke, Indiana, found he could save time when making a groove in his aileron for the control horn. By taking the threaded end of the wire and using it as a file and cutter in just seconds you'll have a perfect groove in which to fit the wire. The sketch shows how easy it is.



Darryl House, Magalia, California, writes about making a transfer bellcrank that eliminates the problem of routing a pushrod out the backend of the fuselage. This fitting can be purchased, however, it is difficult to find and is expensive. Hobby Lobby sells one version for $2.49. Darryl shows us how to make his version for almost nothing.

(1) Drill out a spare servo output arm (large) with a 7/32" drill.

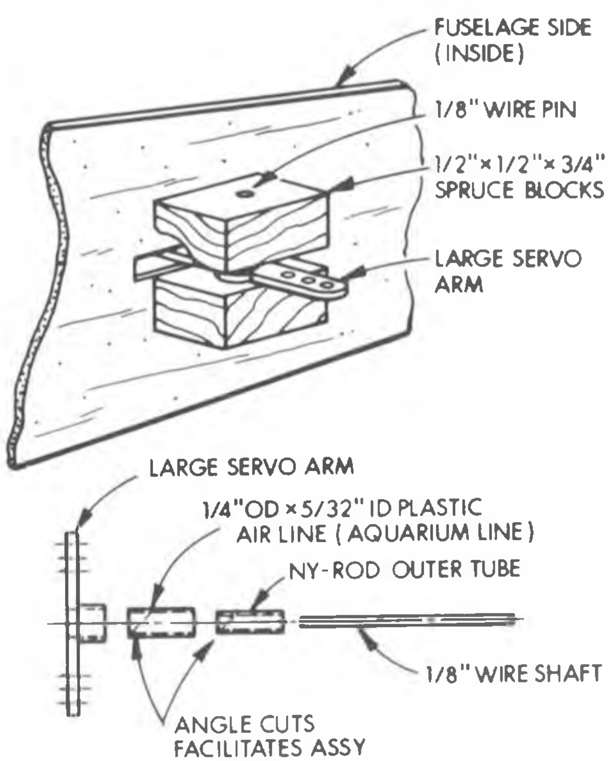
(2) Make all tubing 1/4" too long and trim flush after assembly.

(3) Drill hardwood blocks with a 1/8" drill and use cyanoacrylate cement or epoxy to hold the pivot pin in place.

(4) Slot the fuselage side as required and glue the blocks on the inside.

See sketch for further detail.

PUSHROD TRANSFER BELLCRANK



★

Jay Jagger, Memphis, Tennessee, found a great way to produce his own custom letters and numbers from Super MonoKote in a foolproof manner. He first drew the design on plain white paper. When satisfied with the design size, the reverse side of the paper was sprayed with 3M "77" adhesive. Following the directions on the adhesive can, which called for 5 minutes drying time, the design was attached directly to the MonoKote. Using an X-Acto blade, he carefully followed the lines on the design and cut it out neat and clean ready to iron on.

Attached by only the top or side, to keep the design in position, Jay used a pin to puncture the underlying surface allowing "no bubble" attachment. For extra zing, trim tape was used to outline the design providing a very professional looking job.

How many times have you needed to sand a doped surface and, no matter how carefully you do it, wind up with a small slit somewhere in the fabric where it stretches over a rib or a stringer? A tedious task, to say the least. Next time this little chore pops up, just grab some medium grade steel wool and have at it. You still don't want to really bear down on it over ribs and such, but you can get a fine, "smooth as satin" finish in a remarkably short time. Experiment with several grades of steel wool to find the best for you. The super fine stuff, after the coarser has been used, nearly polishes the dope. Brush on three coats of clear CAB non-tautening dope and allow to cure for at least 24 hours in a warm, dry environment — longer in cool or humid conditions. A good test to see if it's cured enough is to simply smell it. If you can still smell the dope, it isn't ready to sand yet.

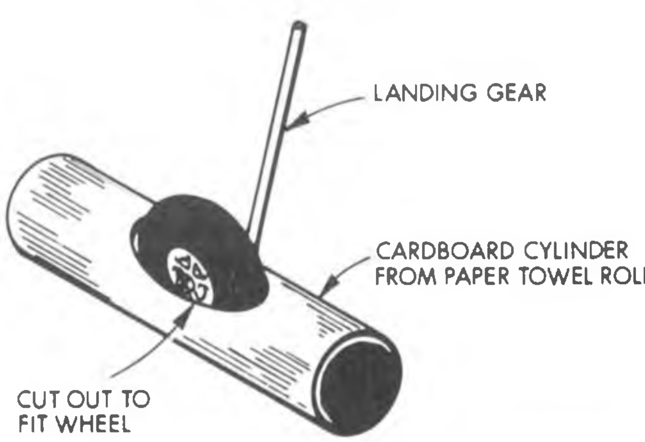
In using steel wool to sand doped fabric, be sure to protect your hands from the steel slivers. Hold the pad with folded paper towels or use a glove or other protection. You'll also find that the steel wool does not clog up like sandpaper. It just wears away but keeps right on cutting. From Bill Skipper, of Greeley, Colorado.

★

After numerous trips to the flying field with the Kadet blocked from rolling around in the back of the station wagon by the tool box, some wadded up paper towels and some 1" x 4" boards, Bob Sherrill, Dayton, Ohio, decided he needed a better wheel chock.

By using a cardboard cylinder from the center of a used-up roll of paper towels (the one from toilet paper would work just as well), Bob cut a slot in the side to fit a main wheel and — presto! — a simple, cheap, readily available wheel chock. If the slot is short enough, it sticks to the wheel and can be moved with the fuselage. See sketch.

A SIMPLE WHEEL CHOCK



Send your hints & kinks to R/C Modeler, P.O. Box 487, Sierra Madre, Ca. 91024 — win a free book from RCM's Anthology Library series if your idea is used.

RCM PRODUCT REVIEW

Powermax
DALOTEL 150

The Dalotel is an aerobatic aircraft of French design which has been used very successfully by Hanno Prettner at the Las Vegas Tournament of Champions. A smaller version of the same plane, the Dalotel 150 is being imported by Powermax, 359 Trousdale, Chula Vista, California 92010. This kit is manufactured in Austria by a company known as Roga/Prettner.

The box (5" x 17" x 45") has a beautiful label depicting the finished plane as well as the contents of the kit. Packaging is sufficient to prevent damage during its travels. Hardware parts are separately bagged. Wings are in their cores, and the fuselage is tucked in one side of the box. The big difference is the wings are already sheeted with obechi plywood, the fuselage is already completely framed, and the turtledeck is pre-built. This abundance of prefabrication makes it the easiest and quickest to build wood kit that you could want.

Parts are stamped with a number which makes it easy to find the proper piece when building. This helps make up for the lack of readable instructions (more on this later).

SPECIFICATIONS

Name	DALOTEL 150
Aircraft Type	Sport/Sport Scale
Manufactured By	Powermax 359 Trousdale Dr. Ste. A Chula Vista, California 92010
Mfg. Suggested Retail Price	$135.00
Available From	Both Mfg. & Retail
Wingspan	59 Inches
Wing Chord	10" (Avg.)
Total Wing Area	590 Sq. In.
Fuselage Length	51.5 Inches
Stabilizer Span	24 Inches
Total Stab Area	108 Sq. In.
Recommended Engine Range	.21-.60
Recommend Fuel Tank Size	8-10 Oz.
Recommended No. of Channels	4
Rec. Control Functions	Rud., Elev., Throt., Ail.
Basic Materials Used In Construction:	
Fuselage	Balsa & Ply, Spruce
Wing	Foam, Obechi Sheeting
Tail Surfaces	Balsa
Building Instructions on Plan Sheets	Yes
Instruction Manual	No
Construction Photos	Yes

RCM PROTOTYPE

Radio Used	Futaba 7FGE
Engine Make & Displacement	Super Tigre .46
Tank Size Used	8 Oz.
Weight, Ready to Fly	92 Oz.
Wing Loading	22.5 Oz./Sq. Ft.

SUMMARY

WE LIKED THE:
Pre-fabrication, ease of construction, quality of materials, appearance.

WE DIDN'T LIKE THE:
Lack of English instructions. See text.

Construction:

A 32" by 24" sheet of paper contains the vital information for constructing the Dalotel. Unfortunately, the language is German which was of no help to this reviewer. Powermax will be including an English translation in future kits. However, there were many isometric drawings showing the stages of assembly with each piece numbered on the drawing. This made it easy to build without translating one single word.

The parts quality was excellent, especially the pre-sheeted foam wing. Just glue on leading and trailing edges, wing tip ply plates, and center dowels and grooved aileron rod cover and it's finished. The fuselage comes with all bulkheads installed and only needs bottom sheeting and top turtledeck installed. Tail group parts are accurately pre-cut.

The canopy extends from the firewall to the front of the turtledeck and needed some scrap balsa underneath to act as a former. The included instrument panel also serves to add rigidity.

The cowl is of a plastic type and is easy to trim using scissors. We added fiberglass cloth using Sig slow cure epoxy on the inside around areas of greater stress.

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model comes in kit form that features rugged fiberglass construction of hull, deck, cockpit, and engine cowling, all running hardware, bearings throughout, a centrifugal clutch and a full-size master plan with complete instruction manual. Specifications are: 68" length, 34½" beam, 22 pound running weight and operation with a two channel radio. Operation is economical with the utilization of gasoline operated Pull-Start Quadra.

For additional information please contact American R/C Helicopters, Inc., 635-11 North Twin Oaks Valley Road, San Marcos, California 92069, (714) 744-7533. □

DALOTEL

from page 185

Covering:

In order to attain a light weight, MonoKote was used on the entire plane with Goldberg striping tape to accent trim lines. The top of the canopy and cowl were painted with Pactra Aeropoxy. The MonoKote went on beautifully on the obechi covered foam wing.

Engine:

The box states the engine range is from a .21 to a .61, but a .40 is the best choice. We used a Supertigre .46 with Dave Brown mount. An eight ounce tank, which Powermax also imports from England, was used.

Radio:

A Futaba 7FGE provided the electronic link and fit in the plane with room to spare. The fuselage is a little wider than many .40 size kits, although it's somewhat shallow.

Flying:

Keeping in mind that the Dalotel is meant to be an aerobatic monoplane, you would expect this kit to produce similar results. The plane does any

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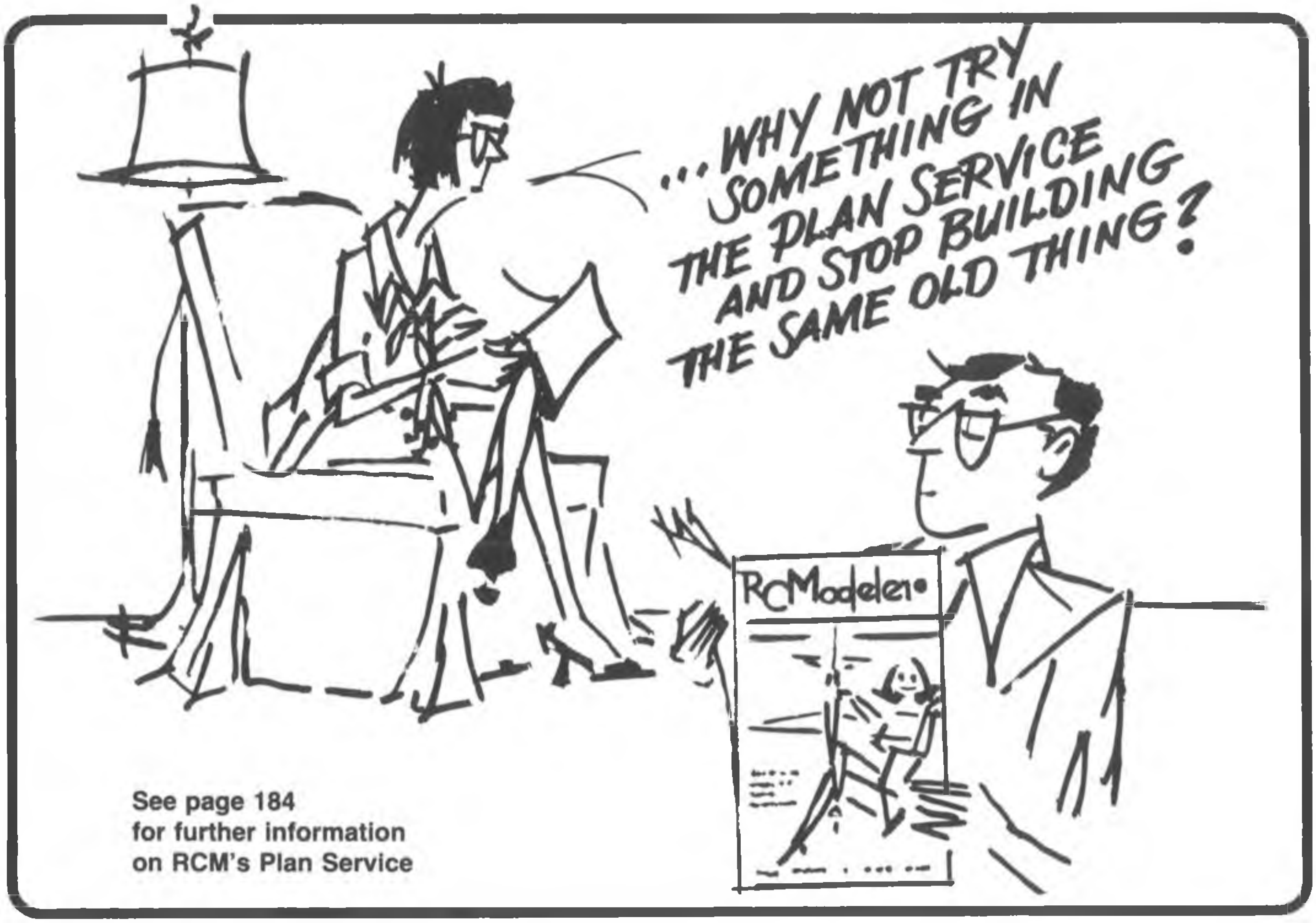

maneuver that your thumbs can tell it to do, and it does them well. Even though 8 onces of nose weight were added, it still weighs only 5¾ pounds. This makes landings easy and adds to its performance. If you want something a little different, then consider the Dalotel 150. □

SOARING

from page 179/176

your slope a break; try one of these on for size.

Sounds like a sales pitch. Oh well, I'm always glad to pass on the latest in the sailplane line. Here's another unsuspecting budding kit manufacturer entering the unprofitable world of making kits. Better buy one before he finds out he can't make them for that price — whatever the price may be.

Well, this is going to be a shortie. I'm trying to get it in the mail before leaping into a snorting 747 and flying off to the World Champs in York, England. When I return I'll have three days to get the write-up done on that event. If you see it in this issue, you'll know I made it; if not, I didn't.

Catch you next month, all being well. Howzat! □

BIG IS BEAUTIFUL

from page 175/172

Wherever you go to fly, and whatever you're flying, always keep safety in the back of your mind, check your bird **every time** before flying, don't smoke around gasoline refueling operations, don't use nicked props or unbalanced ones, stay out of the prop arc and harm's way, and be sure everyone else does too.

And, if you want about the biggest thrill this hobby can produce, help someone else get into the air with their new bird, if you're qualified to do so. Make a point of going to the guy who shows up at the flying field with a new bird and hangs around the fringes making no effort to fly. He likely needs and wants help and is a bit embarrassed to ask for it. If he can fly and you offer help, it's unlikely he'll be offended; if he is a new face, he probably wants to meet everyone anyway. Breaking the ice for him, or for the brand new flier, could just make you another friend. Always remember, friends come and go in this highly mobile society of ours, but enemies accumulate. Add a friend if you can, and, if you create a newly qualified pilot, the expression on his face when he makes his first solo landing will be worth the time spent with him! □

SILENT POWER

from page 170/150

wing area of 455 square inches and weighs in at 47 oz. with a Futaba 3-channel and three S-20 servos. This results in a wing loading of 16 oz. per square foot.

Fotui uses a 2412 airfoil at the root and a homebrew — 1½A airfoil at the tip for a good L/D and slow landing speeds. Production kits are offered for $49.95 direct from JMGlascraft. This looks like a fun way to start out electric flying next spring.

Next Silent Power

In the next edition of Silent Power I'll review the 1983 KRC Electric Fly and discuss the most successful electric models from the summer of 1983.

Good flying. □

SCALE VIEWS

from page 149/139

"TinyTools" (marketed by Byron International Corp., 117 South St., Chardon, Ohio 44024) because their TinyTools TinyLathe fascinated me. It

from page 193/116

4-cycle fuel thus providing longer flight durations on a normal 16 oz. tank.

Thanks, Clarence . . .

My best regards,
William R. Rauch
Hyattsville, Maryland

There seems to be a bit of controversy over the correct amount of oil that should be used in four stroke fuel. This is due mainly to some of the four stroke manufacturers recommending low oil content fuel and others recommending regular two stroke fuel.

I was just recently talking to Jim Morgan, who manufactures Cool Power and Omega fuels, regarding the correct amount of oil to use in Jim's four stroke fuels. Jim had, in turn, been talking to Harry Roe of World Engines. World Engines feels that nothing less than 22% oil should be used in the O.S. engines due to the cooling properties of the oil. It is always best to go with the manufacturer's recommendations, especially during the warranty period. If you should cook the engine due to running a lower than recommended oil content fuel, do not expect free warranty work on the engine. In the case of your O.S. Gemini twin, repair costs could be pretty expensive.

Most fellows are finding out, however, that about 15% oil does seem to be adequate in a broken-in engine. The lower oil content helps the idle, acceleration, and overall smoothness of the engine. With too much oil you will get uneven running with some of the four strokes. Some fellows are using as low as 8%-10% but I would not recommend doing this. How much prop you are running on the engine, whether it is cowled or out in the open, etc., all play a part.

It is always best to go with the manufacturer's recommendation — especially during the break-in period. After break-in you can try a lower oil content fuel. If the engine shows any signs of running hot, then it's best to go back to the higher oil content. Generally 15% oil, 10%-15% nitro, and the balance methanol make a good four stroke fuel for a broken-in engine. A lot of you fellows having idle and acceleration problems will find that although the 10%-15% nitro does not give much of a power increase, it does help the idle.

Dear Mr. Lee,

I recently acquired a beautiful O.S. .60 four cycle engine. In the instruction leaflet it states that a special "F" type glow plug must be used because of only one ignition per 4 "strokes" of the piston as opposed to the usual two in other common glow engines. Presumably a different type of element is used which stays hotter longer allowing for continued ignition. My question is simply — is this special plug really necessary? If so, is an idle bar also more advantageous here as in other throttleable R/C engines?

I have read your column for many years, and do all my own maintenance on engines thanks to your advice and expertise.

Yours truly,
Donald C. Clark, M.D.
Dublin, Ohio

The O.S. .60 four stroke seems to work the best with the recommended O.S. glow plug. Other four stroke engine manufacturers market four stroke plugs that also work very well but price is in the same range as the O.S. so no savings. Plugs that you would normally use in a two stroke engine seem to be just a little too cold and will not keep the fire lit with the every other stroke firing. Although some of the hotter plugs such as a Fireball hot will help the idle; they are often too hot and cause either pre-ignition or detonation and increase the tendency for the engine to throw the prop. There are other plugs you can use such as the Rossi 4-5, Enya 4-5, Saito P-3, etc. However, all are in the same price range.

An idle bar plug is not necessary with a four stroke engine due to the incoming fuel mixture coming through a valve in the head. A two stroke engine has the incoming mixture directed at the plug and the idle bar helps to keep the fuel mixture from hitting the glow element.

That does it for this month, guys. I just received a new Saito .120 FS and will do a review shortly --- possibly next month, if time permits. □

RADIO SPECTRUM

from page 98/94

some of these guys are on the "factory team" but that has to be the best comment anyone can make on which servo is best. You have to believe they are doing something right if 90% of the top fliers use those servos. I should also point out that the top two guys didn't use JR so it proves there is more to it than just having the most popular equipment. By the way, I heard Steve Helms, who finished second was flying Futaba's new PCM system.

Stay tuned. □

SLINGSBY T49B

from page 65/56

sq. balsa supports on either side of the sub-spine at these two locations.

(9) Carve the top fuselage panel behind the canopy from scrap balsa block, also the canopy itself, using sections C1 and C2 as templates for the general shape. A short length of 1/4" dowel and two Carl Goldberg 90° mounting brackets secure the canopy to the fuselage. Bend the two canopy retaining wires from 1/16" diameter wire as shown on the plan, and drill holes in the fuselage sides to align with the brackets. An elastic band holds the wire, and canopy, in place.

(10) Carve the nose block from pine and balsa, again using C1 as a guide to the cross-section. Drill a 1/4" diameter hole for the canopy retaining dowel, and epoxy the nose block to F1, sanding flush with the fuselage sides. Carve and bend the nose skid from a strip of 1/2" x 1" ply and epoxy to the fuselage bottom, and add the tail skid at the rear. This completes the basic fuselage structure.

Stabilizer:

Slot the 1/4" sq. balsa tailplane trailing edge for the elevator hinges, epoxy in place and lay over the plan. Cut the 1/4" balsa center section to shape, glue to the trailing edge and, after rounding the leading edge strips, also cut from 1/4" sq. balsa, epoxy these to the center section. Add the carved balsa tips, the 1/8" x 1/4" ribs and the 1/8" balsa gussets, sand, and cut the slot for the fin. Cover with plastic film. The elevator is then cut from 1/4" soft balsa, sanded, epoxied to the hinges and covered.

Fin:

Cut the trailing edge from 1/4" sq. hard balsa and epoxy the rudder hinges in place. Add the 1/4" sheet balsa base and tip, then glue the pre-rounded 1/4" sq. balsa leading edge in position. Cement in the 1/8" x 1/4" ribs, shape the tips and cover.

Rudder:

Laminate the bottom of the 1/4" sq. hard balsa tailpost with a 1/8" x 1/4" balsa strip. This will serve as the base for the rudder horn. Slot the tailpost for the hinges, and epoxy to the fin assembly. Cement the bottom 1/4" balsa sheet in position; then add the tip. Glue the pre-rounded trailing edge, the 1/8" x 1/4" balsa ribs and 1/8" balsa gusset; sand smooth and cover.

Cut tail-boom deck Y from 1/4" soft balsa sheet and slot for the fin and rudder post. Slide the rudder pushrod into the tube with the appropriate clevis linkage already attached. Epoxy the base of the fin into the slot, screw a short control horn onto the laminated tailpost (make sure the horn is fastened to the correct side, depending on the direction of the rudder servo throw!) and slip the clevis onto the control horn. Glue Y between the fuselage sides, ensuring that the fin and rudder are vertical to the fuselage centerline. Remember, once the fin is glued in, it will not be possible to adjust the rudder linkage!

Next, cut stabilizer deck X from 1/4" soft balsa, slot for fin and rudder post, and slide between the rear fuselage sides as shown. This will serve as the stabilizer base. Slip the elevator pushrod through the appropriate tube and attach the clevis linkage. Slide the stabilizer beneath the rudder and epoxy to X, making sure that it is square to both the fuselage and the fin. Screw the elevator control horn in place, and connect to the elevator pushrod. Now, cut the curved fin leading edge and side fillets from 1/4" balsa and glue in place.

Radio Installation and Finishing:

There should be no problem in finding room to install even the bulkiest radio in a fuselage this size. Battery, receiver, switch harness and rudder and elevator servos will fit nicely between F1 and F2, and the aileron servo between F2 and the main fuselage brace. The original model used a 'Y' connector to couple aileron and rudder action from one stick.

The fuselage, fin and rudder were covered with white heat shrinking plastic (the wings and stabilizer were red), and the canopy with grey. A 2½" diameter wheel was mounted onto the outside of the fuselage using a length of 1/8" diameter wire clamped to the bottom.

The wings are attached to the fuselage by means of a 3/16" diameter wire joiner, 12¼" long, and a 3/32" diameter wire alignment pin, 8¾" in length. Two screw eyes are fastened to each wing panel at the point indicated on the plan, and the wings held tight against the wing fairing ribs by elastic bands. Add a short tow hook and the model is ready for its first flight!

Flying:

Balance at the recommended C.G. and get a helper to launch the model on a reasonably calm day. The original Capstan, the author is happy to say, flew "right off the drawing board"; however, the model is no floater, so keep the speed up or a tip stall may result. Initial flights can be made with a standard hi-start; afterwards, use a good winch to achieve maximum height. Of course, those fliers lucky enough to have a good slope in their neighborhood could dispense with the tow hook altogether, and the author may yet try the Capstan on his local slope, probably towards the end of the flying season, just in case!

So, enjoy the beauty of scale soaring, and plan your circuits carefully, remembering the gliding instructor's words to his pupil to "land it on the first bounce, please!" □

FLYING LOWE

from page 52/50

which perturbate the aircraft in yaw are unwanted errors; also, roll inputs which do not instantly lead to vehicle yaw are unsensed errors. In spite of the above, however, the system does work and has been used on light aircraft as a very inexpensive autopilot. We have also used this approach for cheap autopilots in military RPV's (Remotely Piloted Vehicles). The best arrangements for this "wing leveler" autopilot incorporates yaw and roll rate damping also to reduce errors. If one installed a rate gyro in a model to sense yaw rate and tilted it up slightly, say 10-15°, it would also add a measure of roll rate damping. We have flown this concept in several RPV's and it works.

I recently tried the "wing leveler" concept in one of my large Ulery "Lasers." I installed a JR gyro to sense yaw rate and fed the output to the ailerons. It was hooked up in a fashion that yaw in one direction is opposed by aileron motion in the other. For example, yaw right is accompanied by roll left. In this fashion, one can still fly the aircraft conventionally, but when control is released, the aircraft will roll back to level flight.

I found in my set-up that the aileron motion was the wrong way, i.e., yaw right, roll right; so, I electrically reversed the rotation of the gyro to reverse its output. As installed, the device would level the aircraft when the gyro was tuned to full sensitivity. Recovery was slow but positive. It was apparent that more sensitivity was needed for quicker recovery, however. My next experiment will utilize a quite different rate device based on fluidic principles. This concept was developed in my military RPV project and a three axis system is now being produced for aircraft and RPV application. In its present form it is a little unhandy to use since it is designed to operate on higher voltages and is a little bit big and heavy for most models. The basic design, however, could be much smaller, lighter, and cheaper. Hopefully next time I can report on some experiments with this device. I will also cover some other approaches to autopilot design such as Maynard Hill's "electrostatic system." So, tune in. □

VALKYRIE

from page 48

tedious — there being over 1,100 individual pieces in the wing alone.

Unfortunately, there was no Valkyrie entered in the recent national meet in Detroit. Goldberg didn't have time to build a duplicate of the original Valkyrie which was lost in Canada last year.

Carl came to Mile Square Park in Southern California to observe the first flight of my Valkyrie and my happiness could in no way match the thrill that he exhibited. He had to leave immediately after that first flight but a few weeks later I invited him to meet me again at Mile Square. After watching about 5 or 6 flights good ole Carl very shyly asked if he might fly my Valkyrie. It was indeed a pleasure and an honor to watch the reunion of Mr. Model Aviation and his design of some 47 years ago. I even kept my mouth shut during that flight at times when I thought maybe he was going for altitude and/or distance records.

The completion of the Valkyrie was well-worth the time and effort involved. Just hearing the remarks and answering questions while it is setting on the ground is an ego booster. The only other thing that I can say is "thanks, Carl." □

RCM ENYA ENGINE & SUBSCRIPTION CONTEST

OCTOBER WINNERS

1st Place — Stanley H. Scott, Tacoma, Washington

2nd Place — B.E. Lebsock, Englewood, Colorado

3rd Place — C. Deyton, Bamberg, S. Carolina

4th Place — R.E. Wilson, Circle Pines, Minnesota

Bleriot

from page 23

····· stroke engines are quite different than the usual two cycle model engines. No muffler is required.

Installing the radio in the fuselage will be easier if you do so before installing the wings. There is a hatch for access to the radio compartment but if you wait until the wings are installed, the rigging will get in the way.

A 6 oz. Sullivan tank is used and, with the Saito engine, it will run sufficiently long enough. The Proctor prop was finished by referring to an article in the July 1979 issue of RCM, page 44. The Proctor items and scale prop add a lot when the model is on display.

Radio:

A Futaba FP5JN radio with the S-20 servos was used in our model. The small servos are more than adequate to fly the model and do save weight over the S-121 servos. Space is no problem as only three serves are used, rudder, elevator and throttle. The JN plugs have to be added to the servos, if you can't do it, any service center should or you can send to Futaba to have them installed.

Flying:

It is advisable to adjust C.G. as shown on the plans and follow the instructions for setting the control movement. The flying stabilizer would render the model difficult to control if set too sensitive.

If you choose to build this model, we're sure you will have as much fun and enjoyment with it as we have had. Join the four stroke modelers and enjoy the quietness as we have been doing. □

READERS EXCHANGE

TOM'S HOBBY KORNER, 113 Graniteville Rd., Chelmsford, Mass 01824. Futaba Radios: Futaba FP-4L $119.00, FP-4FG $159.00, FP-6FN $169.00, FP-6FG $195.00, FP-7FG $206.00. Enya Engines w/Muffler: 19TV $32.95, 29TV $35.95, 35TV $39.75, 40TV $55.95, 45TV $55.95, 40XTV $62.95, 60XFTV $99.95; Super Tigre .35 PDP $49.95 w/Muffler. We pride ourselves in being one of the most complete R/C Shops in the country with a vast inventory of R/C planes, helicopters, cars, boats, engines and accessories at competitive prices. Stop in for a visit or call (617) 251-4576 for fast COD service. Add $1.50 for shipping.

K & B/VECO 61 CUSTOM ENGINES hand fit and assembled by designer Clarence Lee. Now at new low prices. K & B .61 with Perry pump, muffler, and PDP mod — $103.50. Without pump — $88.20. Postage $1.90 additional. Your new K & B .61 Customized including PDP — $28.50 plus $1.90 postage. Custom versions of all engines in the K & B line including Marine at list price less 40% plus standard Customizing charge. Write for prices. Trade-in allowance for old time ignition engines or will buy outright. C.F. Lee Mfg. Co., 7215 Foothill Blvd., Tujunga, CA 91042.

WANTED — IGNITION MODEL engines, cars, prefer complete engines in good condition, paying top dollar. Bill Simpson, 7413 Via Lorado, Rancho Palos Verdes, CA 90274. (213) 377-3532.

RAZOR BLADES, SINGLE edge industrial quality... super sharp 100/$4.25, 200/$8.00, 300/$11.75, 400/$15.50, 500/$19.25. Postpaid U.S.A. Cobbie's Gifts, P.O. Box 2, Deal, NJ 07723. (201) 922-9898.

DRAG REDUCTION/STRUCTURES Handbook — Cleaner performance and stronger wings. Power or sailplanes. New airfoils, flying wings, spar/sheet strength contributions, $5.98. Eric Lister, 2214 Regina Dr., Clarksburg, Maryland 20871.

SAILPLANE DESIGNERS HANDBOOK — Clear instructions. 175 NACA airfoils plus Eppler's. How to size and locate components. Performance, stability, scale effects, $5.98. Eric Lister 2214 Regina Dr., Clarksburg, Maryland 20871.

WANTED: IGNITION MODEL AIRPLANE engines circa 1930-46, especially Elf or Baby Cyclone. Competitive prices offered. Tom Forsythe, 318 12th Ave., New Clarus, Wisconsin 53574.

O.S. PARTS IN stock, with complete inventory for many current models. SASE for list. A & M Aircraft Supply, 1801 South Crest, Carrollton, TX 75006.

WANTED — SPARK IGNITION model airplane motors, parts, kits, race cars, magazines. Circa 1930-1950. Russell Stokes, Rt. 1, Box 520, Keller, TX 76248.

HARDWARE: SOCKET HEAD cap screws, all sizes, super low prices. SASE for complete list. Example 6-32x1" only $3.84 per hundred. Lane Distributing, P.O. Box 42R, Netcong, New Jersey 07857.

PLAN ENLARGING, DOCUMENTATION photos, 3-views for 500 aircraft. Scratch-builder enlargements of Sopwith, Nieuport, Fokker, factory drawings 72" span, $26.00 rolled, postpaid. Other types, spans. Complete catalog $3.00. SPPS, 3209 Madison, Greensboro, NC 27403.

PRIVATE INVESTOR WISHES to purchase R/C companies to $1M. Confidential. Harrington (216) 779-4511.

WANTED: COMET RUBBER powered balsa kit of the Winnie Mae. Contact Dick Kidd, P.O. Box 487, Sierra Madre, CA 91024.

CUSTOM MACHINE WORK by active modeler. SASE for quote delivery. Retracts, brakes, spinners, adapters, mounts. Roy B. Stewart, RR3, Zimmerman Dr., Princeton, Ind. 47670.

FOX .36 R/C #23900 $36.97, RJL R/C 20 $24.95, Econokote $5.25, red, white, blue, orange. Jet 2 oz., Super Jet $6.25; Ace 1/2A mini foam wings tapered or constant chord $1.95, more on flyer sheet. Availability and price subject to change without notice. Send money order, certified check, C.O.D. cash only. Add $3.00 shipping & handling. Illinois residents add 5% sales tax. GTM, P.O. Box 869, Rantoul, IL 61866. Ph. (217) 893-4136.

USED ENGINES BOUGHT and traded. List 50¢. TacAero, 100 Smyrna, West Springfield, MA 01089.

TREENAILS — GOOD QUALITY bamboo, pre-made (round). Size #40 (drill) for modeling and wooden doweling. 25cm (10") long, one end pointed. Pkg of 25 — $8.95. Pkg of 100 — $23.95. (Post. incl.) Send check/money order to R.W. Cook, #302, 9903 104 St., Edmonton, Alberta, Canada T5K 0E4.

ANTIQUE MODEL AIRPLANE kits for sale, V/C and solid scale, Stanzel, Edco, Girard, Modelcraft, etc. Send SASE for list. Charlie Oehler, 13 Dogwood Dr., Smithtown, NY 11787.

BEER CAN BOMBERS — high performance, hand launched gliders from lightweight aluminum beverage cans. Two full size patterns with illustrated fabrication and flying instructions. Send $4.00 to Beer Can Bombers, Box 97A, Southeastern PA 19399.

SUPPORT AEROMODELING IN ISRAEL. Send for information and newsletter. See us at WRAM show. Friends of the Aeroclub of Israel, 147-02 29th Avenue, Flushing, NY 11354.

COMPUTER CONTROL OF SERVOS — Control up to 6 servos with your Timex TS-1000/1500 or TRS-80 personal computer. Perfect for winter projects, robotics, model actuation — experiment! Software and application notes included. Write for free information or send $10.00 for plans or $39.95 for complete kit. Satisfaction guaranteed. Fratello MicroElectronics, Dept. R1, P.O. Box 4007, Hampton, VA 23664.

QUALITY NICKEL CADMIUM sealed cells with Tabs. All types, F cells $9.50. Matched cell batteries send SASE. MAB, 1001 N. Betsy, Waco, TX 76706.

ROSSI ENGINES AT WHOLESALE prices. Write to Distribution Hq., P.O. Box 89597, Kowloon City Post Office, Hong Kong.

FOR SALE: SEVERAL old ignition model airplane engines on bid basis, send SASE to Don Howell, Box 66, Gardner, KS 66030.

ROSS .60 R/C TWIN engine with exhaust stacks, motor mounts, new $200.00. Harry Amrom, 2322 Borbeck Ave., Philadelphia, PA 19152.

FUTABA J SERIES 5-CH never flown. Complete with nicad batteries, 4 servos, charger and trays $225.00. Kraft KP5 (Tx) with (5) KPS 15II servos (2) 550 mah batteries, charger KPR7 Rx new $250.00. R. Sufforhen Gomella, 228 E. Main, Georgetown, KY 40324. Phone (502) 836-3679.

BAY RIDGE PACER KIT by Consolated, N1B, 1946, trade for 1950's kit such as Smog Hog, Mambo, Rudderbug, Rebel, etc. Dr. Austin Hill, 253 Franklin St., Haworth, NJ 07641, phone (201) 387-1491.

1980 KRAFT 6A SPORT, KPS 15's, new never used, $200.00. 1974 Kraft KP5, KPS 15's, used 1 hr., new batteries, $140.00. Both 72-240. Kits, Aquila $40.00, Wanderer 99 $20.00, Li'l Stick $15.00, House of Balsa Pitts, wheels, CB motor mount, Semco muffler $75.00. Doug Lawrence, 915 E. Palmyra St., Orange, CA 92666.

F-15 WANTED. Wanted Duane Johnson's F-15 kits, will pay top dollar. Dr. Jack Tse, 3040 Palstan Rd., Ontario Canada L4Y 2Z6.

NEW 82" TBM AVENGER semi-kit. Includes epoxy glass fuselage, canopy and plans. Plans show built-up construction. Semi-kit $139.95, $10.00 shipping. Plans separate $25.00. Best in Scale catalog $3.00. Bob Holman, P.O. Box 741 R, San Bernardino, CA 92402.

MUST GO: Closing out Kraft inventory at drastically reduced prices. Write to Distribution Hq., P.O. Box 89597, Kowloon City Post Office, Hong Kong.

BATTERY CYCLER/TESTERS. Three models to choose from. $14.95, $19.95 and $24.95. Write for details. F & M Electronics, 41 Chestnut St., Seymour, CT 06483.

BYRON A-4 SKYHAWK KIT plus OPS 65 engine rear rotor, rear exh., plus Byro Jet Fan Unit. $415.00. Save $85.00 plus all items brand new. Bob Greenall, 116 Center St., Tamaqua, PA 18252.

FORSTER IGNITION ENGINES, English and Chinese diesels, parts and supplies, Visa and Master Card. Send SASE to M & G Engines, P.O. Box 6026, Denver, CO 80206.

LEARN TO FLY QUICKLY, successfully "In the Cockpit" and "With Plane Coming At You." New novel innovative method. For information write: BEJAY, Suite 666, 3010 Santa Monica Blvd., Santa Monica, CA 90404.

RADIO EQUIPMENT EXCHANGE, Box 561, Park Forest, IL 60466. List your used radio equipment for sale. No fee for listing. Escrow available. Send SASE for details.

PROLINE 1980 COMPETITION Series 53.2 MHz, low time, no damage, like new. Just out of complete check. Perfect $235.00. W. Keating, 14704 Cranoke St., Centreville, VA 22020.

LEAVING R/C, PLANES, engines, pipes, retracts, jigs, chargers, radios, etc. Send SASE to J. Fiore, 608 Dark Hammock Dr., Ft. Pierce, FL 33450.

FOR SALE OVER 400 ANTIQUE model airplane engines. Send name and address to Jim Robertson, 35 Stonecrest, St. Joseph, MO 64506.

NEW RUSSIAN ENGINES — diesel, glow. Low price special import. Write for info to Cardells R/C Hobby, Batsmansvagen 53, S-230 10 Skanor, Sweden.

KAVAN JET RANGER never lifted off — Includes 2 extra blade sets, training and stock landing gear, Webra 61, Hobby Shack 6 channel — all brand new. Also blinking lights and instrument panel. $500.00. Ron Piercey, 242 Glacier Dr., Jerome, ID 83338, phone (208) 324-3890.

WANTED TO BUY — Pilot kit SE-5 which was by Aristo-Craft, also Sopwith Camel, Fokker. Kits produced 15 years ago. M. Baker, 118 Oakwood Rd., Cross Lanes, WV 25313, phone (304) 776-4047.

SWITCHING HOBBIES SALE! Giving up pattern flying for real sailboat. All items new, prices include shipping. Aerocomposites Eula, $115.00; Hbarn Thunderbird, $105.00; Southern Delux "glass" Atlas and Balsa Compensator, $95.00 each; OPS 60SE, $110.00, OS 61VFABC, $105.00, ST X61RE, $95.00. Lt. Col. Dick Cline, 9706 Camino Del Sol, Albuquerque, NM 87111.

JET HANGAR HOBBIES' Cougar Kit, with mylar templates and patterns. Complete and excellent. $145.00 o.b.o. George Watson, 6190 W. Mill Rd., Flourtown, PA 19031. Phone (215) 836-7338.

CHESANING R.C. CLUB'S Second Annual Super Swap Shop held at the New Lothrop School, Feb. 26, 1984, 10 am-3 pm. For reservations call (313) 638-5877 8 am-6 pm, or write Marshal Emmendorfer, 8251 New Lothrop Road, New Lothrop, Michigan 48460.

1/4 SCALE CESSNA Skylane Plans, $25.00. Picture of plane seen in June '83 R/C Modeler, page 28. Handcut kit also available $149.95. Ernest Johnson, 901 Chalk Level Rd T-9, Durham, N.C. 27704.

WANTED! MRC 710 R/C Systems. Need for parts, any condition. Send list and price wanted. John Mitchell, 25 Delano Park, Cape Elizabeth, ME 04107.

K & B 40 CHROMED CYLINDER Sleeves. Save money and rebuild time with these long lasting units. $16.00 each outright and postpaid. $18.00 with fitted Dykes Ring. Sheldon Engineering Co., 295 Jay Street, Birchwood, MN 55110.

MACHINE SHOP — Hardinge, Bridgeport, etc., includes tooling to manufacture high performance Model Airplane Engine plus parts to complete 200 engines $95,000 — sell all or part — 213/349-6232, Magnetone, Inc., 19215-H Parthenia St., Northridge, CA 91324.

DON'S HOBBIES, P.O. Box 2302, Heath, OH 43056. Enya .90 4-cycle w/m $186.95, reg. $290.00. Enya .60 4-cycle $139.95, reg. $225.00. Great Planes new CAP 21 $89.95, reg. $125.00. O.S. .61 ABC w/m $109.95, reg. $175.00. Shipping $3.50. C.O.D. Fee $1.65. Money Order & C.O.D. only. Phone (614) 522-2434.

READERS EXCHANGE
CLASSIFIED ADVERTISING ORDER FORM

NON-COMMERCIAL ads only: Commercial ads of any kind not acceptable at this special reduced rate. RATE: 15 words or less $3.50, additional words 20¢ each, name and address free. Payment must accompany copy.
CLOSING DATE: 20th of third preceding month. (i.e. May 20th for August issue, June 20th for September issue, etc.) We do not furnish box numbers. We do not bill or invoice. If you wish your ad to be run for more than one month, multiply the amount due times the months to be run.
COMMERCIAL CLASSIFIED: The rate for anybody who has something to sell on a "commercial" basis, such as retailers, manufacturers, etc., is 40¢ per word. Payment must accompany copy. Count all initials, numbers, name, address, city, state and zip.
CLOSING DATE: Same as above.

HEADING: ____________________

COPY: ____________________

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_____ Words @ Non-Commercial Rate $_____ Number of months _____

_____ Words @ Commercial Rate $_____ Total Enclosed $ _____

Name _____ Address _____

City _____ State _____ Zip _____