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THIS MONTH'S COVER
features an outstanding Canard configuration, the Gannet, designed by Laddie Mikulasko and featured as a full-size construction article this month beginning on page 24. The Gannet has a wingspan of 55½", is powered by a .40 engine and utilizes a 4-channel radio. The young ladies are Laddie's 12 year old twin daughters, Marilyn and Beatrice. Ektachrome transparency by Helmar Voigt.

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FROM THE SHOP

Don Dewey

Usually our discussions at the flying field are about some aspect of our hobby; new planes we're building, articles in RCM, FCC changes in our frequencies and rumors about possible interference, our last flight, trouble shooting a problem for our own or another plane at the field, and so on. More recently, though, a new topic of conversation has become familiar; video tapes. But we don't mean the feature films available at your local video tape emporium or those that come in a plain brown paper wrapper. Now there are video tapes about running R/C cars and boats and flying R/C sailplanes and powered planes. There are video tapes that inform us about new products and how to use them and those that share familiar and new building and covering techniques. And, they're in full color with sound-enlivened action, limited special effects, appropriate background music and titles and credits just like the real thing. R/C has hit the big time!

After having attended several R/C shows recently with booth after booth rolling a video tape, it occurred to the intrepid, far-sighted reader concerned conscious staff at RCM that it would be helpful if we were to run a list of the video tapes that are available (that we know about) and indicate how you can get a copy. And, in addition to the listing, we'll also take the liberty to share our reactions to a few we've seen so you'll know what to expect. If you are a producer or distributor of an R/C related video tape, get in touch so we can include your creative efforts in our new video column coming soon and, perhaps print a review of it. Let us hear from you so the readers can hear from us.

★

We recently received this happy note.

Dear Mr. Dewey,

I wish to submit this poem. My husband is an R/C enthusiast and he is teaching me now how to fly the model airplanes. We have enjoyed many hours at the field together with this healthy and happy hobby.

Sincerely,
Elizabeth Robichaux

Up in the air — so high in the sky,
I race and chase the clouds rolling by.
Hawks see me and wonder what I am,
I'm free as a bird, I do what I can.

The sharp cold kiss I get from the air,
runs all over me without a care.
The things I do might not seem quite sane,
after all --- I'm a model airplane!

The following is self explanatory and has been distributed to our staff.

Dear Don:

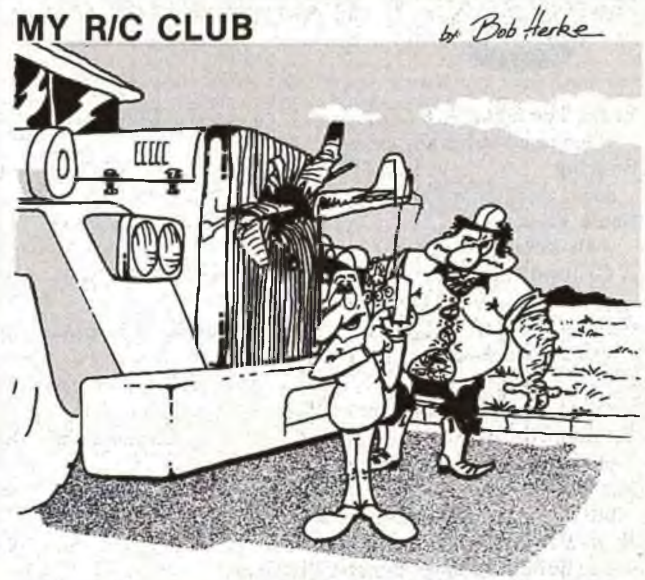
I have been a regular reader of RCM these many years and have always admired the literary style of your authors.

In order to assist you in achieving even higher literary standards, I have prepared and attached a grammatical check list. I am sure you will wish to reproduce this list as a handout for your current and aspiring authors.

All the author need do is carefully follow the examples shown to create an article which will live forever in the minds of the readers. After all --- isn't this the intent of every author?

A bit of fun I thought you would enjoy.

Sincerely,
Irv Allison



. . . OK! — beam me up, Mr. Spock . . . Mr. Spock! . . . Mr. Spock? . .

Grammatical Check List

Don't use no double negatives.
Make each pronoun agree with their antecedent.
Join clauses well, like a conjunction should.
About those sentence fragments.
When dangling, watch your participles.
Verbs has to agree with their subjects.
Just between you and I, case is important too.
Don't write run on sentences they are hard to read.
Don't use commas, which aren't needed.
Try not to ever split infinitives.
It's important to use apostrophe's right.
Lay down and die before using a transitive verb without an object.
Proofread your writing to see if you any words out.
Correct spelling is esential.
A preposition is a bad word to end a sentence with.
All generalizations are usually false all of the time.
Incomplete comparisons are worse.
Be sure you have a clear antecedent for each pronoun so that you do not confuse him.
Parallel structure is good and more concise.
Avoid cliches even if you have to bend over backward in order to do so.
Avoid wordiness unless you have to go around all sorts of corners in order to say whatever it was you had in mind to say in the first place.

David Anderson of Burnsville, Minnesota, sent in a poem that is applicable to a lot of us RC'ers.

STUFF

Stuff on the ceiling and stuff on the floor.
Stuff on the workbench, there's more and more.
I look in my work shop and what do I see?
It hangs from the ceiling, it comes up to my knee.

It takes a long time to comprehend all this stuff.
I love it so much, I can't get enough.
I buy it in boxes or delivered in bags.
It comes in plain wrappers with bright shipping tags.

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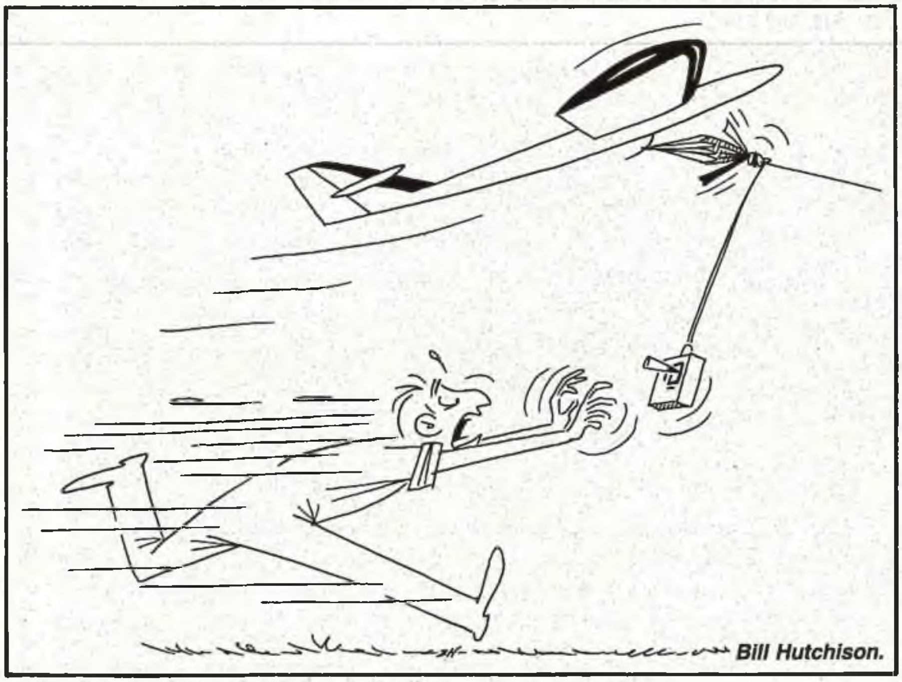
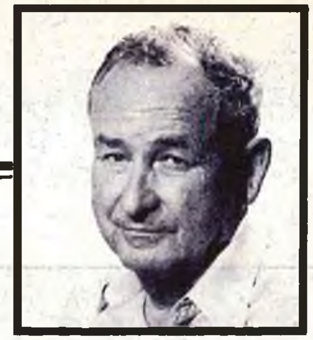
SOARING

Al Doig





It's me again. Well, in the June, 1983 issue I ran a picture of a "Solitaire" canard, built by Paul Hingtgen. At that time it hadn't flown; it still hasn't. Paul has hung it up after a couple of so called glide tests. He says it's like throwing a dead toad; it just goes plop. It has the bouyancy of a can of tomatoes. Paul says it's overweight, under winged, and the very thin chord of the forward wing has a Reynolds Number of about 4⅞. Oh well, good try.

★

From my good friend Dr. Walt Good comes a neat mechanism for feeding in a bit of down elevator when flaps are lowered. Some of the more exotic transmitters have this ability built in, or as an option, but most do not. It really helps on landing, not to have to think about the proper amount of down elevator to keep the nose from pitching up with the application of flaps. The sketch is self-explanatory and may be changed to fit the given configuration. The amount of elevator throw may be varied by changing the hole-to-hole dimensions on the coupling link. The amount of down trim required depends on the sailplane, but for an all-flying stab, about 1/8" down trim for full flap deflection is about right.

★

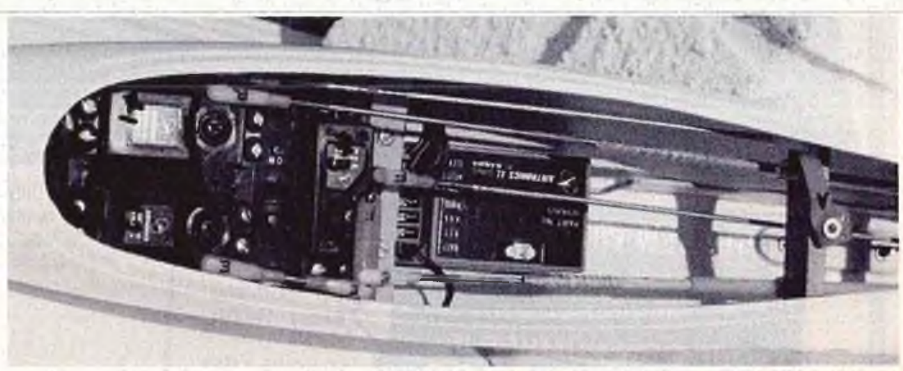
Just about now the World Championships are being held in York, England. Don Edberg, member of the U.S. team, sent a picture of his new sailplane, the "Quantum." This is the ship he will be flying at York. It is a derivative of his 1981 World Champs ship, the "Hustler." For my convenience, Don sent all measurements in metric. He just delights in making me work doing conversions. Anyway — the span is 2.5 m (98.4 in.), root chord — 26 cm (10.2 in.), area — 57.5 dm^2 (6.2 $ft.^2$), weight 2100 g dry (74 oz.), airfoil — Eppler 205. Wings are glass skins epoxied over blue foam cores using a vacuum system. Servos for ailerons and flaps are in the wing. The fuselage is homebrew molded fiberglass. Don is working on his Ph.D. thesis at Stanford University. Anyway — good luck to Don and the U.S. team!

★

A friend of mine came out to the field with a new original design. After a few flights he came to the conclusion that perhaps the rudder/fin area was a bit too small. I promised to look up the formula for the Vertical Tail Volume Coefficient. It's been some time since we talked about that (Sept. '81) and one or two of you may have joined us since then. The Vertical Tail Volume Coefficient is a rather imprecise dimensionless number that is useful for getting the area into the ballpark. The reason for the lack of precision is that a number of important factors are left out of the equation. One of these is dihedral, which drastically affects yaw stability and turning.

To find the VTVC, multiply the area of the fin/rudder by the moment arm of the fin/rudder (the distance from the C.G. to 1/4 chord point of the fin/rudder). Now, divide this number by the product of the wingspan times the wing area; all dimensions in inches. In calculating this coefficient for quite a number of popular sailplanes, all fell in the range from .01 to .03. For instance, the Camano 100 = .022, Gentle Lady = .0177, Paragon = .0157, Gemini = .0143, Olympic II = .020, Olympic 650 = .0227, Aquila Grande = .0128, and the Sagitta 900 = .019.

The effect of a larger number is to increase the yaw stability. As the fin area goes up, or the tail moment increases, a greater dihedral angle is required to prevent spiral instability. If you are designing a new sailplane and want to know how large the fin/rudder should be, select an example with about the same dihedral



Dr. Good's elevator trim mechanism in his Samun sailplane.

and fuselage side area and calculate the Vertical Tail Volume Coefficient and use the same one in your design. Or, draw one that looks right and you will probably be just as close.

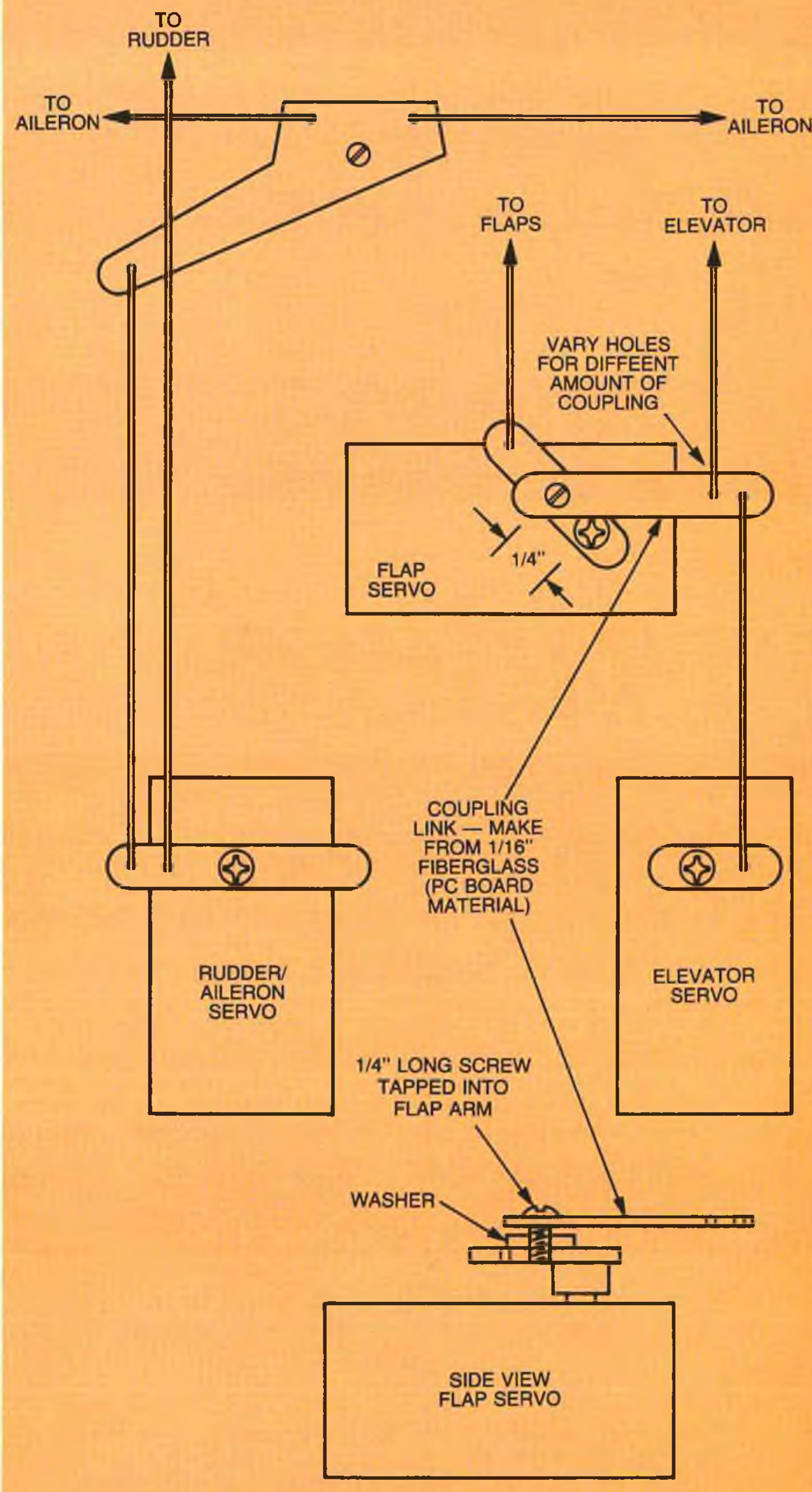
★

Speaking of rudder adjustment, I ran across an interesting bit in the May/June, 1983 issue of the Portland (Oregon) Area Sailplane Society newsletter, edited by Tom Culmsee. The article, called "Whatstrings?" by Jack Pitcher went as follows:

It should come as no surprise to any observer of the soaring scene that there has been a great proliferation of aileron equipped sailplanes the past several years. What may not be so apparent, however, is the extra amount of thought and effort that must go into getting one of these animals properly trimmed for flying. Over and above the normal attention paid to C.G. placement, rudder and elevator trimming, etc., is a new requirement to find the proper combination of rudder and aileron throws to produce coordinated turns during thermal flight. For our purposes, we may define a coordinated turn as one in which the tail follows smoothly behind the nose, producing neither skidding or slipping motions. A skid occurs when too much rudder is applied for the amount of aileron deflection used. This yaws the tail to the outside of the turn radius. Conversely, a slip results when too little rudder throw allows the tail to drag to the inside of the turn. Either condition results in sideways airflow over the fuselage, consequently increasing drag and reducing climb rates.

So, how do we observe and correct these situations? We can borrow a very simple and effective device commonly used by full size sailplane pilots. It's called a yaw string. On full size sailplanes these consist typically of a short piece of yarn, one end of which is taped to the centerline of the windshield. The remainder is allowed to flow freely in the slipstream. So long as the yaw string is flowing straight up the windshield, the pilot knows that airflow over the fuselage is straight and no skidding or slipping is occurring. If the yaw string drifts off to one side, the pilot knows that aileron or rudder corrections are required. These yaw strings are quite sensitive and show small changes in fuselage yaw angle long before they show up on conventional turn and bank instruments in the cockpit.

I recently installed a yaw string on my Camano for a series of test flights. I taped one end of a length of yarn on the bottom of the fuselage, on the centerline, immediately behind the towhook. I chose the location behind the towhook for safety reasons as I did



MECHANISM FOR INTRODUCING DOWN ELEVATOR TRIM WHEN FLAPS ARE DEPLOYED (WALT GOOD'S SAMUN SAILPLANE)

Don Edberg and his Quantum. He will fly this ship in the 1983 World Champs in York, England, in August.

Cal Postuma, Coopersville, Michigan, lives dangerously with a limbo through the goal post.

not want to take a chance on the yarn fouling in the towline or hook. The yarn was then stretched along the bottom of the fuselage to the tail and cut off at the rudder. The yarn is taped in place only at the forward end, the rest flows freely in the airstream. The next step, of course, is to fly the airplane and observe the position of the yaw string during various conditions of flight. If the sailplane is properly trimmed, we would expect to see the yaw string flowing down the centerline of the fuselage at all times. If, during a turn, the string was observed flowing to the outside of the turn, we would know that the sailplane is slipping and more rudder or less aileron throw is required. Conversely, if the string is on the inside of the turn, a skid is occurring and less rudder or more aileron throw is needed. We can also use this opportunity to adjust the control sensitivity while adjusting the turn coordination. If a slip is occurring, indicating the need for more rudder and we feel that the controls are already too sensitive, we have the option of instead reducing the aileron throw and leaving the rudder alone. The point here is that we can adjust either combination of control surfaces to achieve the desired results. An added benefit of this testing is that we can tell if what we have been presuming to be straight and level is indeed straight and level flight. If the yaw string is displaced to the side during straight flight across the field, we have a problem and some changes will be required to both aileron and rudder to get the wings level and the fuselage flying straight again.

Early in my test flights, several limitations of this technique became apparent. They all have to do with visibility. It's simply impossible to see the yaw string above 150 to 200 ft. In the failing light of calm evenings, it's even tougher. This means that meaningful test observations will have

to be taken at lower altitudes and during the brightest part of the day. I tried both light and dark colors of yarn of various sizes and found it easiest to see the larger diameters of white yarn under most conditions. I found that flying back and forth in a straight line directly over my head was the best technique for observation. I tried to initiate all turns while flying either toward or away from myself. I was then looking directly down the centerline of the fuselage where the deviations of the yaw string could be easily seen. Seeing and remembering are two different things, however. It might be helpful to have a friend take some notes of the conditions as you call them out so they can be more carefully analyzed later. Use caution when flying at low altitudes. You don't want to become fixated on the yaw string and fly into the ground or some other equally hard object.

The test flights I flew worked well, confirming some suspicions I had about the trim of my plane. It also showed up some problems I had not even thought to be in existence. I had felt that my Camano was slipping in turns and sure enough the yaw string was consistently displaced to the outside of the turn, when turning in either direction. Curiously, the slips were fairly consistent regardless of whether the controls were deflected or not. Several times, after once establishing a turn, I would return the stick to neutral and allow the plane to continue to turn on its own. The angle of slip remained about the same. I felt that C.G. placement might have something to do with this so I tried a few flights with the C.G. moved well-forward. I had hopes that this would force the tail up higher in a turn and reduce the slip angle. This seemed to have no effect on the slip, however, so I'm still trying to figure out this piece of the puzzle. Another observation that proved surprising was that as the turn was initiated and the control stick first moved to the side, the yaw string would swing quickly to the inside of the turn and then move across to the outside of the fuselage as the turn became well-established. This can be attributed to different moments of inertia around the roll and yaw axes. The rudder can yaw the short fuselage at a higher rate than the wings can be rolled by the ailerons, hence causing the momentary skid until a turn is established. This condition was also present on roll-out from turns. The yaw string, already on the outside of the turn, would swing even further out as opposite control was applied, once again indicating excessive rudder throw initially.

It's probably not possible to find one combination of control throws that will be right for all angles of bank and all conditions of flight. However, it should be readily apparent that the use of a yaw string during the early test flights of any coupled aileron/rudder sailplane can yield valuable data about its trim and allow us to more quickly make progress toward optimum flying. We can now make a very good qualitative judgement of just how good or bad things are. Do we really need all this work? Judging from the strange motions exhibited by many aileron ships, it appears that many fliers just are not doing their trim job properly. Or, perhaps, they just do not concern themselves with such matters. The yaw string method will pay off in better performance and easier thermaling for your sailplane.

Being the curious type I couldn't wait to rush out and try what my flying buddies dubbed the "G String Experiment." I taped the yarn to the bottom of my 2 meter K-Minnow. I also put a pair of strings on the underside of the wings, half way out. The first problem I had was, as Jack said, visibility. It was a very dull day and visibility was poor anyway. Observations had to be made at very low altitude. Further, the yarn I chose was bright orange. I thought this would show up against the black underside of the wing. Not so: it was almost impossible to see at any altitude. My observations of the fuselage string were exactly as Jack's. The yarn would swing to the inside of the turn as the turn was initiated and then swing to the outside. It was interesting that a yaw string on the fuselage of a polyhedral Sagitta 900 would swing quickly to the inside of the turn, then align itself along the center of the fuselage. On a couple of flights I moved the strings on the underside of the wings to the tips. If you want to see what tip vortex looks like, try this. It looks like a belly dancer twirling the tassels in different directions.

Anyway — as soon as I locate a pair of binoculars I'm going to go at it again while making adjustments to the aileron/rudder ratios. I'm sure Jack would appreciate hearing from anyone who has tried similar experiments.

Catch you next month, all being well. Howzat!

□

SCALE VIEWS

Col. John deVries

Scale Exhaust Systems and Silver Soldering

Ain't it always the way? You put together a column, complaining that nobody offers "AMA spinner nuts," and then, a couple of weeks later Tom Runge of Ace R/C, Inc., sends you a new catalog. And, right there, in black and white, Tom tells us that he now stocks Granite State R/C Products, amongst which are **five** different sizes of prop shaft protectors! Oh well! For $2.49 you can get one that'll fit almost any engine you have!

This month's column was inspired by Allen Graber of Long Beach, California. As you can see in the photos, Allen's been busy building a Brown B-2 racer, in quarter scale. He's taken the old Hal Osborne drawings and, very skillfully, added R/C structure to them (since the drawings are, primarily, outlines and cross sections). His efforts represent the highest plateau of scale scratch building --- because he has had to do what a designer accomplishes. The only difference is that he started out with drawings that were full sized for the model he's building.

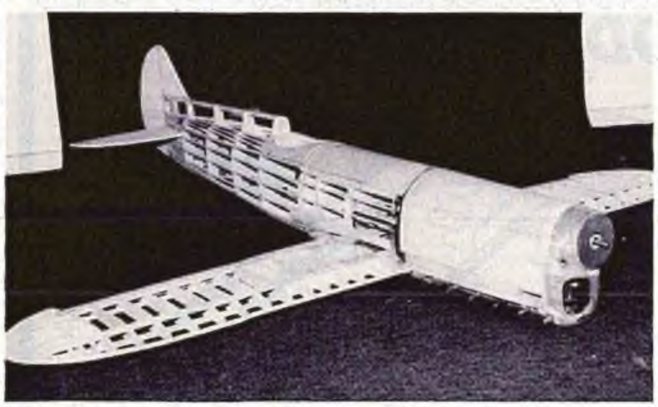
Mr. Graber's balsa and ply work are most commendable and, when he gets the model covered and painted red, the underlying structure will truly represent "Miss Los Angeles." But, he's going that extra step, by adding a scale exhaust system. It's his first experience with silver soldering --- and it appears to be turning out very well. The Menasco Super Buccaneer engine in Larry Brown's original racer had six cylinders, each with an individual exhaust pipe. That's what Allen has duplicated in his model --- six pipes, albeit feeding the exhaust from his Webra .91 single cylinder to the outside.

Scale exhaust systems truly identify the real scale craftsmen among us. Of course, if you're building a Pitts Special or a Christen Eagle, there are twin tailpipe exhaust systems readily available at the better stocked hobby shops. Some manufacturers, with a bit of cajoling and the offer of a bit of cash, will undertake to build you a scale exhaust system for, say, your Spitfire or Mustang. You'll need to provide them with some pretty exact drawings of the tailpipes you need or things'll never fit properly. For the more exotic models though, you're on your own when it comes to making a scale-like exhaust system.

One of the simpler installations doesn't take too much time and effort. If your model requires two externally visible pipes and you're using a Tatone muffler, you can lead the silicone tubing from the muffler to one of the two scale pipe locations. The other can be simulated with a simple hunk of tubing --- and it'll act as an extra hot air exhaust area from the scale model engine compartment. Cowled radial engined models often can use this very simple system.

Multiple exhaust tubed scale subjects are more difficult to handle, and frequently require that a manifold (exhaust collector and distributor) be made --- as in Allen Graber's case. You'll note that he solved his problem by making a single tubing manifold, the length of his "scale engine" and then silver soldered individual pipes to it at six scale locations. You'll also note that he used a flexible tube and some hose clamps to connect his engine's exhaust pipe to the exhaust manifold. Although the flexible tubing has to be anchored to a silver soldered intake tube on the manifold, notice how neatly everything fits into the nose of the Brown B-2, a very restricted space. High temperature silicone tubing works well in this sort of installation and Tatone offers some flexible, jointed steel tubing if you prefer a metal connection.

My alter ego, Col. Art Johnson who shares this column with me, has a very interesting solution to the custom exhaust problem. His Quadra-powered Republic P-43 uses common **plumbing** fittings to channel the exhaust overboard. It does take some time, measuring copper nipples and other bits and pieces at the plumbing supply house or hardware store, but the price is right (inexpensive). Don't expect to find plumbing fittings that fit **your** model



Although they appear to be made of solid balsa, Allen Graber's Brown B-2 tail feathers are fabric covered open structure. A beautiful construction job, Allen plans on making a fiberglass mold for Miss Los Angeles' wheel pants. Good scale subject — long nose, fixed gear and a lot of wing area!

Allen Graber's first "go" at silver soldering --- the exhaust system on his scratch-built Brown B-2 racer from the Osborne drawings. Engine is a Webra .91. Note the flexible connection between engine and manifold. Allen has "re-done" the front of the cowling since this picture was taken --- to duplicate the scale cooling holes shown in Kerka's Brown B-2 drawing.

The ultimate silver soldering and brazing job — the scale landing gear George Fishcher built for his big Chester's "Goon." Gear retracts aft and the legs end up parallel to one another inside the fuselage of his model. Silver soldering and brazing make the gear sturdy enough to carry a model twice the weight of the Quarter Scale "Goon!"

So that's how he gets all of those engines started!"

exactly! You will have to fit things together, do a bit of hacksawing, filing and fitting --- and silver solder the components together to make a functional system. In case you goof a bit, not to worry! Good hardware stores carry what is usually called stove cement (or oven cement), a black, sticky substance that hardens when heat is applied and will fill small holes in home-made scale exhaust systems. Also, there are heat resistant tapes that, together with stove cement, will maintain the integrity of an exhaust system.

How do we go about making a scale exhaust pipe system? Probably the best way is to build it "in place." To do this we should have the model completed to the point where the engine's installed and most of the structure around it is in place. In this way, it's easy to visualize the three dimensional space available for the installation. Then, too, with the engine mounted on the firewall we've established one of the two important locations for the system --- exactly where the model engine's exhaust pipe is located. The other important location, of course, is the scale position of the exiting exhaust pipes.

Our first concern should be the decision as to whether or not we have a straight shot from model engine exhaust to exhaust manifold --- or if we must use a flexible, heat resistant connection. Next, we have to decide how to attach the connecting pipe to the muffler or plenum of the model engine. Often we can drill the muffler and insert a stub tube into it --- or, if there's enough room behind the engine, connect directly to the tail pipe. One of the better ways to make this connection is to use a Tatone plenum which includes several possible connecting points to be drilled out for a custom installation. A lot of the hardware and tubing associated with tuned-pipe installations can be adapted for our use.

Our third concern is the manifold, its size and material. If you want to go first class, acquire some stainless steel tubing for the manifold. Common steel tubing will probably do as well and may be better from the silver soldering viewpoint. Copper and brass tubing manifolds may also be used. "Size" the manifold so that all of the scale pipes may be attached to it. You may have to use **two** manifolds if your model has exhausts on each side of the fuselage (like the before mentioned Spitfires and Mustangs). The manifold(s) doesn't necessarily **have** to be circular in cross-section (as a tube). In fact, in some installations, you may have to squeeze a circular tube along its length to an oval cross-section in order to clear the model's structure.

Probably the most difficult scale exhaust installation results from aircraft like the B-25 "Mitchell" --- a radial engined, cowled bird with individual exhaust stacks for **fourteen** cylinders. The key to duplicating this system in scale is to produce a circular manifold from which all of the exhaust pipes "sprout." An electrical "conduit bender" may be just the tool for bending a circular manifold. Happily, clearance for the manifold **behind** the model's engines is usually available, within the cowling.

Assembling a scale exhaust system is not all that difficult. Because we're dealing with a lot of heat, however, we strongly recommend the use of **silver solder** to hook all of the components together. And, we **don't** mean the stuff called silver solder that comes in a tube --- or is designed for low temperature application. We're talking **real** silver solder that usually comes in wire form (about 1/32" in cross-section) and a real silver solder flux. Chances are that we're also talking torches, rather than soldering irons too, because silver soldering temperatures are pretty toasty --- in the 1200° range. I've been using a common hobby shop oxygen and butane Micro-Torch for ten years and find it does a more than adequate job of model-sized silver soldering chores. If you have a choice, opt for a water soluble flux. Over time, the flux tends to dry out --- but it's easy to add a drop or two of water to reactivate it. Of course, you can go hog wild and get a jewelers' brazing torch, with its big cylinders or use a propane torch for silver soldering (Wellers, for example) --- but that's kinda like overkill for the things we'll be soldering.

Soldering scale exhaust tubes to the main manifold is relatively easy. Cut the scale-sized tubes (steel, brass) to length plus about 1/8" and file one end to fit the outer diameter of the manifold. Prop things in place (I use asbestos blocks --- after putting on my face mask and protective goggles) and apply a bit of flux to the joint after making sure both bits of metal are very **clean.** Heat up the joint with your torch and note that the flux starts to bubble. When the two parts have reached soldering temperature, touch the joint with the silver solder wire. **The** big point here, as it is with **any** soldering job, is to **heat the parts to be soldered,** not the solder!

If you've gauged the temperature correctly, the solder will flow and make a beautiful fillet between tube and manifold! Very little solder will be necessary. If things don't **flow,** dab on a tad more flux, reheat the joint and wait for the "magic moment" when the fillet forms. Continue on down (or around) the manifold, adding the necessary pipes until all are soldered in their scale spots. Remember, things are H-O-T --- so give 'em a chance to cool between pipes! Then --- drill through the scale exhaust pipes into the manifold.

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A GROUNDCHECKING GUIDE

By
Jonathan N. Young

The Sun Fli 4 had given me 2½ years of pure unadulterated fun and satisfaction --- until now. Just a few short hours ago, the old bird was perched on its racks in the basement awaiting another blissful day in the sky. But now it lays upon the ground in disarray --- tail feathers here, wing parts there, and fuselage fragments everywhere. The engine is 6" under and the heart of the bird — the radio gear — is strewn about in so many pieces. Wires are disconnected or severed; battery, servo and receiver cases are fractured and split open. I check the pulse with a hopeful nudge of the transmitter sticks but nothing happens. So I pick up the wreckage and salvage what little there is left in one piece --- wheels and landing gear. Later I will pack up the radio system and send it off to the manufacturer for repair. Then I'll inspect the engine to determine what replacement parts are needed and whether it would be less costly to purchase a new one.

Sounds expensive? It sure is! I've already checked into the engine and estimate that it will cost at least $30.00 to replace the sheared off carburetor and the bent cylinder sleeve. The piston may be out of round too, and will add to the cost. (It looks like another new engine has to be added to my dream list which I provide annually to my wife prior to my birthday, Fathers Day, and Christmas.) My guess is that the radio receiver and at least two servos will have to be completely replaced for a tidy sum of about $100.00. Yes indeed, it was a costly proposition to crash that old bird!

Well, the same scenario, which I've presented and which actually happened to me, probably replays itself with different actors almost every weekend at the club flying field. But it doesn't have to happen to you. It probably wouldn't have happened to me either if I had listened well just one more time to the symptoms of fatigue which the Sun Fli had been exhibiting.

So how do you avoid the same situation yourself? It's easy --- just groundcheck your airplane thoroughly between flying sessions, range check your radio at the start of each session, and watch your plane closely as you fly it again and again.

Many strange and exciting near accidents had befallen the Sun Fli in the past couple years which probably would have been avoided had I followed these procedures. And, perhaps, the final crash need not have been if I had followed those rules. Well, they say experience is the best teacher and I am living proof.

Item: In the middle of a not so eventful flight at about 100' altitude, something fluttered away from the plane. Quickly the flight became quite eventful! I landed, rolled the Sun Fli to my feet, and discovered that the fuel tank hatch was gone. Did I not tighten it enough after my last look at the tank? No, upon finding the hatch cover I discovered that the hardwood crossbrace to which the hatch was screwed became unglued from the fuselage sides. The hatch was still securely screwed to the brace. It was a classic case of fuel soaking into anywhere it could. I re-glued the brace and ensured it would stay put by "doweling" it to the fuselage sides with short pieces of toothpicks and epoxy. At the same time, I performed similar preventative maintenance to the firewall; this time with 1/2" lengths of 1/8" diameter dowels through the fuselage sides and into the 3/16" firewall. A thorough groundcheck might have revealed the loose crossbrace. Luckily I was not distracted enough by the fluttering hatch cover to lose control of the Sun Fli. I'm just glad the hatch cover came loose before the engine and firewall did!

Item: My usual ten minute flight was drawing to an end per my stopwatch so I proceeded to a landing pattern. Downwind and base were fine and I turned for final approach. Fifty feet away and five feet off the deck I was close enough to realize that my nose wheel was gone! I decided to slow the plane and landed as softly as I could in the dirt to the side of the paved runway. The plane settled in a cloud of dust, but luckily the nose gear didn't rip out or cause the bird to flip. As I walked to the plane, my first impression was that a wheel collar worked loose and released the wheel. Wrong. I flipped the plane over and learned that the 5/32" gear had broken at the elbow. The wheel, collars, and the axle portion of the one-piece nose gear had broken off in mid-air without my noticing. This undoubtedly must have been a defective nose gear which finally fatigued after numerous repetitions of stress on take-offs, landings and taxiing. But maybe a thorough groundcheck just might have revealed the weak gear and avoided the emergency landing and the risk of severe damage to the plane.

Item: At approximately the six minute mark of another enjoyable flight, the engine sagged and sounded vaguely different. Recognizing the loss of power and air speed, I set up for a landing. This time the landing was routine with no surprises. I surmised that the engine was probably too lean or perhaps the fuel filter became clogged. Wrong again. As I rolled the plane to my feet I noticed the O.S. Max 25 muffler was dangling at the fuselage side. Upon close inspection I learned that only the fuel line for pressure from the muffler to the fuel tank was holding the muffler on. I thought what you probably are --- that one of the strap screws worked loose due to engine vibration? But no, still closer inspection indicated that the strap fatigued at the elbow to the

screw plate. Both ends of the strap were still securely screwed to the muffler! Could a thorough groundcheck have turned up this weakness? Maybe, but it's fortunate that the muffler stayed attached to the pressure line for two reasons: (1) I didn't have to buy a new one, and (2) the sudden loss of the muffler could have seriously affected the C.G. of the plane.

Item: Over a period of several weeks it seemed that more and more up trim was required to maintain level flight. Fuel penetration in the forward part of the fuselage could definitely have been adding nose weight to the plane. In order to neutralize the trim tab on the transmitter, I decided to adjust the clevis at the elevator control horn. Lo and behold --- upon disconnecting the nylon clevis from the control horn I found that two things were occurring: (1) the clevis post had worn away to about half its original diameter, and (2) the hole in the control horn had also worn away and had become enlarged. Both led to excessive play in the elevator and, due to the "weather vane" effect, required more and more up trim over time to maintain the elevator at the same position for level flight. A new clevis and control horn soon eliminated all the slop. Again good fortune was on my side because that clevis could have been gnawed away until failure and left the Sun Fli in the wild blue with no place to go but down yonder.

Through all of these experiences I concluded that many strange and mostly logical things can happen to a plane as it ages in time and logs flight after flight. While some occur due to building techniques, there are also quite a few manufactured parts which apparently can wear away or grow weak and fatigued from constant vibration, motion, and applied loads. It pays to groundcheck that faithful old plane between flying sessions and maybe as frequently as between flights.

Apply some loads to critical members such as the nose (or tail) and main landing gear. Check that collars are secure and mounts or straps are tightly screwed down. Maybe you'll even want to check the landing gear wire too, in case yours could be as faulty as mine.

Grab hold of that engine and twist and pull on it. If fuel soak has weakened the firewall joint or vibration has loosened the engine mount screws, it would be much safer and cheaper to find out now rather than 200 feet above ground. Next, yank on that muffler or tuned pipe to assure yourself that it is firmly attached.

Then check all of the plane's control surfaces to be sure all hinges are intact and that linkages don't have any slop. Replace worn parts such as clevises, horns, and hinges. Yes, I've even had to replace some nylon hinges on the Sun Fli's ailerons because the nylon cracked at the hinge post. This could have occurred on landings with one wing tip low. (And yes, I did install nylon wing tip guards.) But just maybe the extra stress caused by slightly misaligned hinges could have been the cause, too.

Don't leave anything to chance because that could be a costly mistake. Be sure your wing hold-down system is firm. If your plane has wing dowels, see if they are still glued in tight. Check for cracks in the fuselage at the dowel holes. If any have appeared, add another gusset to stop the crack and strengthen the area. In the case of wing bolts, inspect the hardwood mounts for a firm hold on the fuselage. And check the bolts too, especially the nylon variety. Shortly before the Sun Fli's demise I had to replace one such bolt because the threads were stripped from so much usage.

Last but not least, routinely inspect the interior of the fuselage. All the radio gear must be secure in there. It's virtually impossible to check after every flight, but do check after each flying session that the receiver and battery pack have not shifted. The servos should still be mounted firmly with screws or servo tape. There's usually not much trouble in this department unless fuel has soaked this far back into the fuselage and caused servo rails to come loose. It's possible, especially if fuel can penetrate through wing saddles and switch holes.

Another place where worn parts can occur is the servo arms. They are nylon like control horns and similarly the holes can enlarge over time. If you use clevises to hook up to the servo arm then the clevis post could be worn also.

So now you think you've investigated every possible spot on the plane for signs of fatigue. You've pulled here and twisted there, and everything appears to be intact and flightworthy. Maybe you're right. I felt the same way just prior to the swan dive of my Sun Fli. Everything that I could see seemed intact, but that's where I erred.

Item: After all checks were positive, I taxied old faithful out and took off. After a few passes to trim for straight and level flight, I then proceeded to put the Sun Fli through its paces — loops, consecutive rolls, 4-point rolls, inverted flight Cuban Eights and Split S's. Everything went fine until the **final** Split S. The first half of the maneuver went well through the pull-up and half roll to inverted attitude. With up elevator command, the plane topped out and proceeded to the dive portion of the maneuver. But at the straight down attitude, elevator response was lost and efforts to pull out of the dive with either full up or full down command were to no avail. The Sun Fli weather-vaned straight down to "terrible firma" and the first paragraph of this article described the aftermath.

Where did I err? I had checked that plane on the ground completely as far as all parts I could readily **see.** None of those parts caused the crash. Upon close examination of the wreckage, I found what I think led to the crash, and it wasn't a part I could "readily see." The elevator pushrod system which was hidden in the aft fuselage had apparently failed in flight. The 1/16" wire between the hardwood pushrod and the servo output arm showed signs of bending at about its midpoint prior to yielding rather than the clean break that a hard crash would cause.

This crash was really my own fault. The Sun Fli had showed signs of the impending pushrod failure on at least one prior flight. On that particular occasion the plane was in a shallow dive to make a low pass over the strip when elevator flutter occurred and the dive became progressively steeper until I idled down. With the pressure on the elevator reduced, the plane responded to up commands but now needed full up trim to fly level. I landed and adjusted the clevis on the pushrod to regain neutral trim on the transmitter. But that's all I did. At that point someone smarter would have realized that one of the 1/16" metal links in the pushrod system **must have** bent in order to require the retrim. The bend in the wire must have progressively worsened and weakened until it finally broke in that last Split S maneuver. Without taking apart the pushrod system, I doubt that a groundcheck would have revealed the weakened wire to me because it simply was enclosed in that inaccessible rear part of the fuselage. I distinctly remember pulling and pushing on the elevator surface prior to the last flight and it did not seem to yield under pressure to me. But my real "Waterloo" was in not understanding the symptoms of fatigue that the Sun Fli exhibited to me — the elevator flutter and retrim required.

I hope these illustrations of my experiences have impressed upon you that you can never overcheck your

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GANNET

By Laddie Mikulasko

From the designer of the Force 1, comes this neat canard. It flies just as well.

Over the years, I have seen several models of canards in magazines and always wanted to design and build one of my own.

The one thing which prevented me from doing it was that I didn't know how the Center of Gravity was calculated.

Finally, in one of the modeling magazines, there was an article on canards, with a set of figures for the calculations of C.G. I immediately made some sketches of models for .40 size engines, picked the one I liked best, and made a set of working drawings.

The model was built in a short time, and the day came to fly my first canard. I was a little worried about locating the C.G. as calculated, but all I could do was give it a try. So, I taxied the model onto the runway and gave it full power.

The take-off was nice, and the model appeared to be stable, so I made a turn showing the model's unusual shape in full view.

I explored the canard's capabilities, doing loops, rolls, split S's, and so on. I was pleased with how easy it was to fly. Though different in its handling in some ways, it has no bad habits or hang-ups.

I built three versions of this model, making some minor modifications to improve the looks and speed up construction. The model is fast and easy to build.

So, if you think that this is a model that you would like to fly, read on.

CONSTRUCTION

Study the plan. All parts are numbered, and in this article will be referred to by number.

Cut out all of the parts. Drill all holes where shown.

To speed up construction, I use cyanoacrylate glue on everything except the firewall and landing gear mounts.

Stabilator, Elevators, Fin, Rudder:

Trace the outlines of these parts on medium-hard 1/4" balsa and cut them out. Round the leading edges and, in the case of the elevators and rudder, taper them from leading edge to trailing edge as shown on the drawing. Make the slots for the hinges. Bend and silver solder the horn and torque rod for joining the elevators, or purchase a suitable commercially available unit (40).

Sand all the surfaces to a satisfactory finish; it is easier now than after the model has been assembled.

Fuselage:

Trace the outlines of the fuselage sides (25) on 1/4" medium balsa, and mark the locations of all the bulkheads (26, 27, 28 and 29), and the slot for the stabilator (34).

Cut out half-bulkhead (28) from 1/4" ply, and mount a steerable nose gear bracket on it.

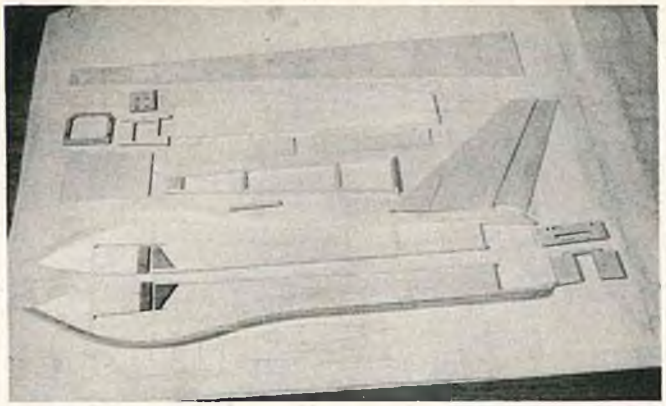
Cut out stiffeners (30 and 31) from 1/8" ply, as well as the bulkhead (29). In this bulkhead, pre-drill the holes for the NyRods for the ailerons, rudder and throttle.

Next, take the two lengths of 1/2" triangle stock (24) and approximately every 1/2" make a cut about 3/4 way through. This is done, as shown on the plan, to make it easier to form to the contour of the fuselage side. When this is done, glue them in place on both fuselage sides. Make sure you do one left and one right. If you use cyanoacrylate glue, you can hold down the triangle stock and shape it around the curves with one hand and, with your other hand, glue it as you go.

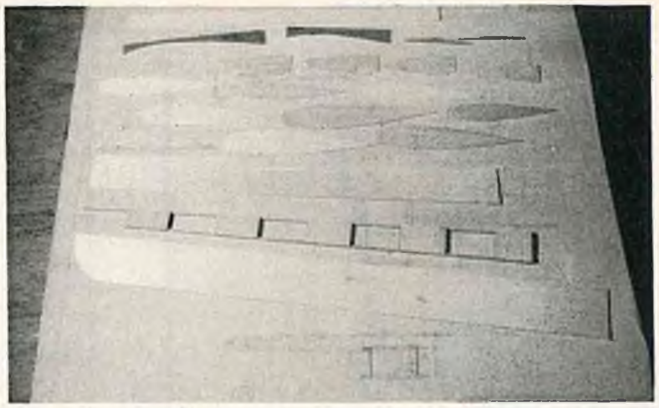
Glue on stiffeners (30 and 31) to the fuselage sides. Because the bottom of the fuselage is flat, you can build it right on top of the drawings from here on.

Position the left and right fuselage sides upright on the plan, and glue in the bulkheads (26, 27, 28 and 29). When they are glued in place, take a flat sanding block and go over the top of the fuselage lightly to level the triangular stock. Now, with the grain cross-wise, glue on the top sheeting (23) from the nose right to the extreme end of the fuselage.

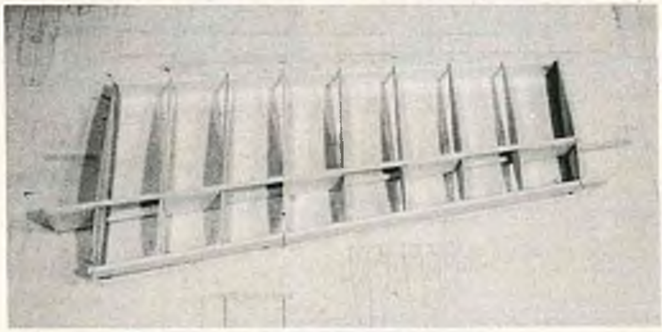
Turn the fuselage upside-down and glue on the bottom sheeting (23) from



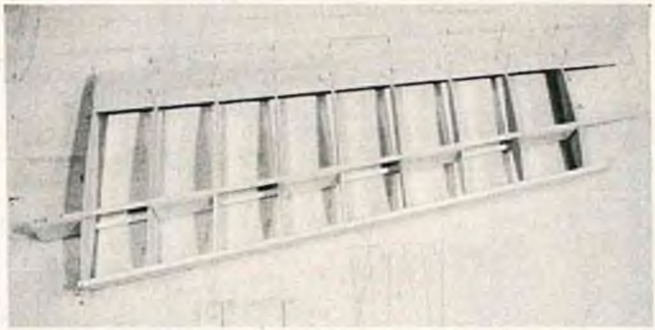
Picture showing all the pieces needed for building the fuselage. Notice that the left and right fuse sides have the triangle stock glued on, and the plywood pieces have holes drilled in them.



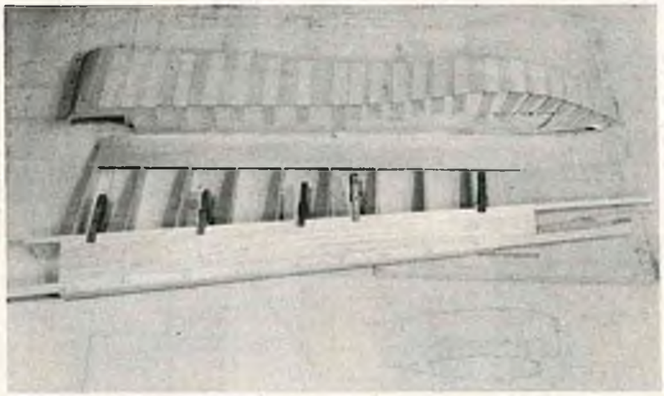
All parts cut out to make the wing halves. Note that the main spar is already glued together. Dark colored pieces at the top are part of the cradle to support W1 and W9.



One wing half, being built on top of the cradle.

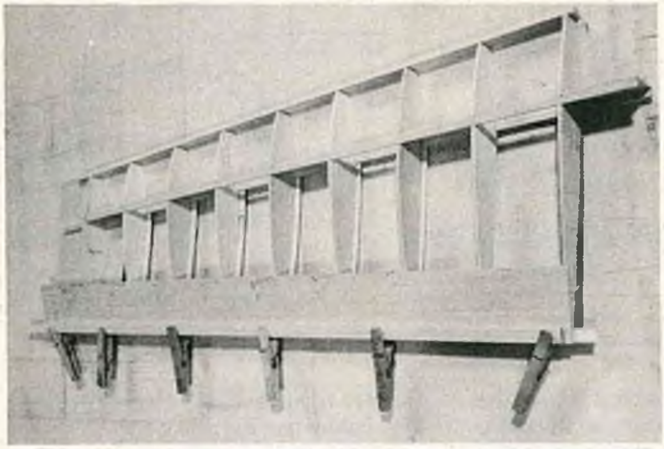


Trailing edge sheeting is glued on.

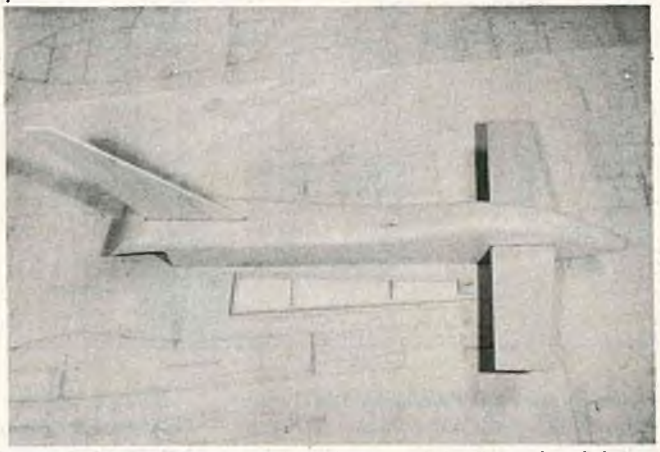


Top leading edge sheeting is added. Fuselage is shown with top sheeting being glued on, after all the bulkheads are in place.

Fuselage is shown with all the bulkheads in place, ready for bottom sheeting. Notice the nylon nosegear steering block in place.



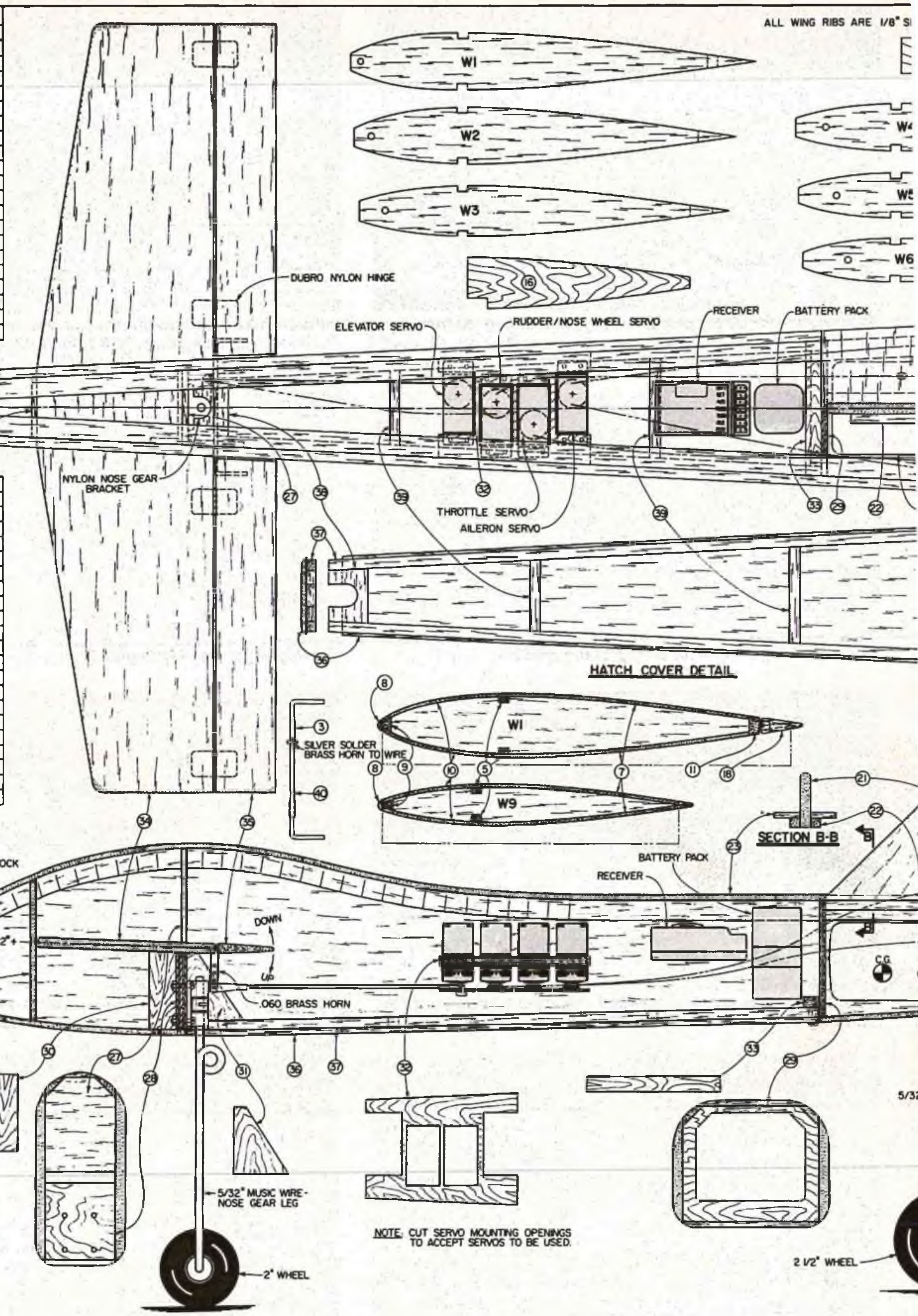
Bottom trailing edge sheeting is put on. Note: the picture does not show it, but the wing is sitting on top of the cradle, which has now been trimmed down, by the thickness of the top sheeting. Don't forget the NyRod for your antenna, installed in one wing half before sheeting is complete.



Fuselage has been sanded to shape and the fin and stab have been glued in place.

PARTS LEGEND

	SIZE	MATERIAL
1	1/4"	PLYWOOD
2	1/2" X 3/4"	BALSA
3	3/32" I.D.	BRASS TUBING
4	1/8" SHEET	BALSA
5	1/8" X 1/4"	SPRUCE
6	1/8"	PLYWOOD
7	3/32" SHEET	BALSA
8	1/8" X 5/8"	BALSA
9	1/4" X 3/4"	BALSA
10	3/32" SHEET	BALSA
11	1/4" X 1"	BALSA
12	1/4" X 3/4"	BALSA
13	3/32" SHEET	BALSA
14	3/8" X 1/2"	HARDWOOD
15	1/16"	PLYWOOD
16	1/16"	PLYWOOD
17	1/16"	PLYWOOD
18	1/2" SHEET	BALSA
19	1/4"	PLYWOOD
20	1/4" SHEET	BALSA
21	1/4" SHEET	BALSA
22	1/4" SQ.	BALSA
23	1/8" SHEET	BALSA
24	1/2" Δ STOCK	BALSA
25	1/4" SHEET	BALSA
26	1/8" SHEET	BALSA
27	1/8" SHEET	BALSA
28	1/4"	PLYWOOD
29	1/8"	PLYWOOD
30	1/8"	PLYWOOD
31	1/8"	PLYWOOD
32	1/4"	PLYWOOD
33	1/4"	PLYWOOD
34	1/4" SHEET	BALSA
35	1/4" SHEET	BALSA
36	1/8" SHEET	BALSA
37	1/4" SQ.	BALSA
38	1/4" SHEET	BALSA
39	1/4" SQ.	BALSA
40	3/32" DIA.	MUSIC WIRE
41	1/8" SHEET	BALSA
42	3/32" X 1/2"	BALSA



the nose to half-bulkhead (28), and from bulkhead (29) to the extreme end.

Make the hatch cover (36) out of 1/8" balsa, with its 1/4" inside frames (37, 38 and 39) and, when done, insert it in its place on the fuselage.

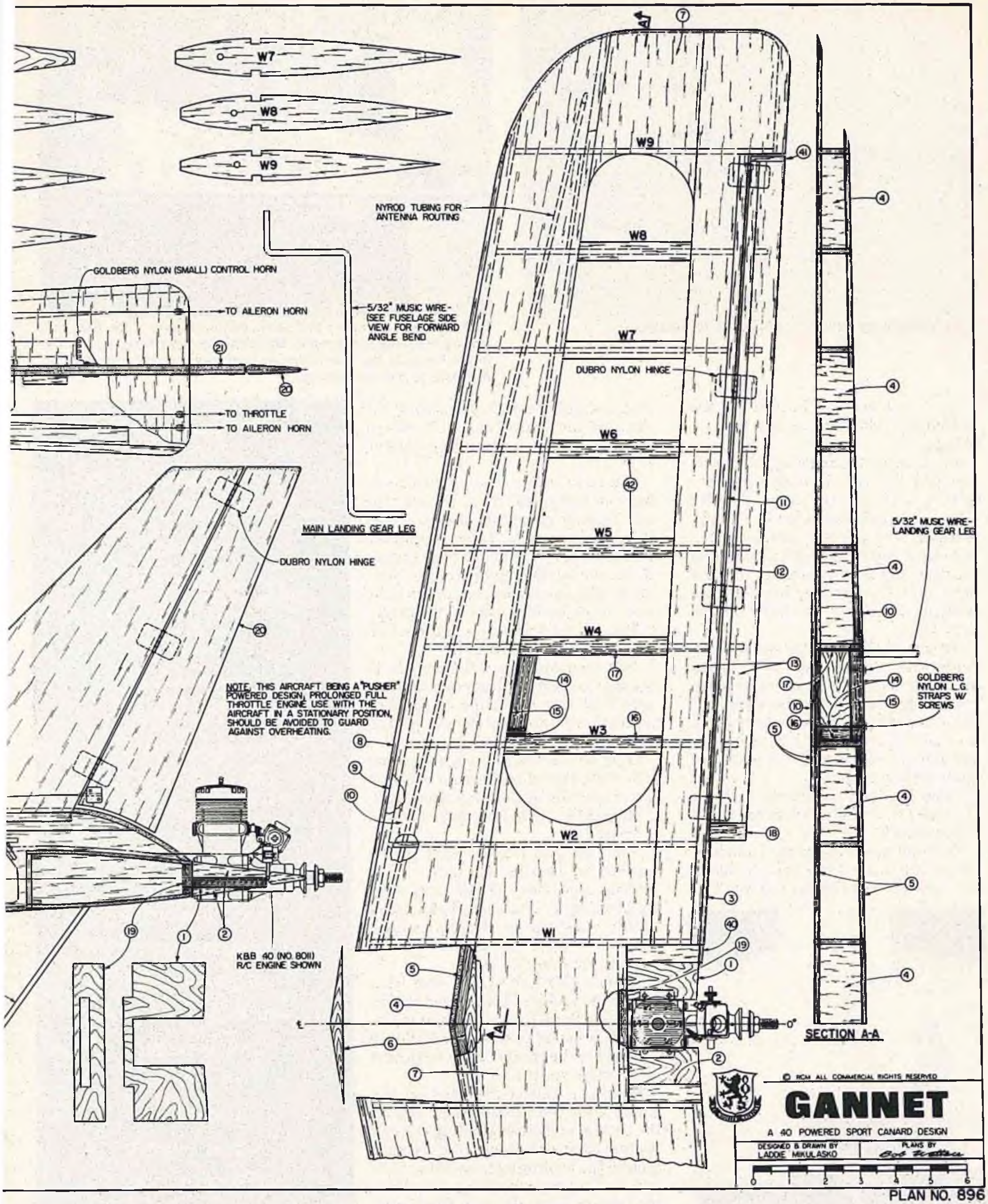
Now, I suggest that you round the fuselage corners as shown on the plan, and then sand the whole fuselage to a smooth, fine finish.

In the top sheeting (23), at the rear of the fuselage, cut out the slot for inserting the fin (27). Glue the fin into the slot in such a way that it extends 1/4" below the top sheeting (27).

On the inside of the fuselage, glue the two fin supports (22). See section A-A on the plan for detail.

Next, insert the elevator control horn assembly into the stabilator slot,

FULL SIZE PLANS AVAILABLE — SEE PAGE 194



and then the stab (34) itself. With the fuselage sitting upright on the building board, make sure that the stab is level with the board as well. Now glue it in.

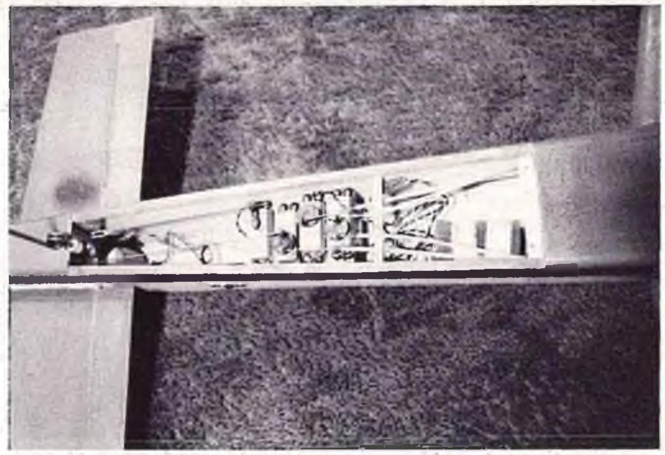
At the tail end, make a 1/2" hole in the side of the fuselage where the antenna will pass through into the wing (if you decide to locate it internally, as I did).

Glue in the 1/4" plywood block (33) for the hatch hold-down.

Leave the installation of the servo rails (32) until the aircraft is completed, as you will probably need to move your equipment around to adjust the C.G.

The broken lines from the servo rails to the control surfaces are only suggested routes; you may want to change them to suit your equipment.

Completed wing, ready for gluing on to fuselage.



Bottom view, showing the radio compartment. Note that the servos are offset, so that the rods clear the other servo arms. The cross brace to the rear of the servos was added to anchor the NyRods, to prevent flexing.

The area behind bulkhead (29) should be fuelproofed at this time.

Wing:

First, build the spars right on top of the plan. The spar is made out of two 1/4" x 1/8" spruce strips (5) and vertical grained webbing (4). Start by pinning the spruce strips to the building board and joining them together with the webbing, making sure that the spacing between the webbing is exactly as shown in the drawing.

Trace all of the ribs, with their centerlines marked, on 3/32" balsa sheet and cut them out. If you decide to run the antenna inside the wing, as I did in one of the models, make holes in one set of ribs, as shown in the drawing, to accommodate a length of outer NyRod tubing.

From 1/16" ply, cut out rib doublers (16 and 17), and glue them onto ribs (w3) and (w4).

To build the wing true, I made a cradle out of the scrap balsa to block the root and tip ribs up square. The cradle should be placed on top of the drawing and secured so that it will not move while the wing is being built on it.

Engine installation and aileron hook-up are shown. As stated in the article, engine rotation can be reversed by rotating the front housing 90 degrees to the left. This enables the use of 'normal' propellers.

Cut out the sub leading edges and draw centerlines on them. Position the sub leading edges (9) on top of the cradle's front edge. Insert all of the ribs into the spar and place the spar in its proper location on the cradle. Now, all the ribs should be lined up with the ribs on the bottom view of the plan.

The rib trailing edges must sit on the rear edge of the cradle.

Now, you can glue all of the ribs to the spar and sub leading edge, making sure that the centerline of the ribs meets the centerline of the sub leading edge.

Glue on the trailing edge sheeting (13). Note that this sheeting is in one piece; ailerons will be separated later.

Glue in the NyRod for your antenna, if desired.

Sand the sub leading edge to the contour of the ribs and glue on the leading edge sheeting (10), and wing tip sheeting (7). Note that the sheeting at the wing tip on the top surface extends beyond rib (9), but on the bottom stops on rib (9).

Remove this half of the wing from the cradle and build the other half in its place. When the second half of the wing is finished to the same building stage, trim the cradle by the thickness of the wing sheeting.

Place one half of the wing on the cradle with the existing sheeting on the bottom and, after sanding the sub leading edge to the contour of the ribs, glue on the leading edge sheeting (10), and trailing edge sheeting (13). Trim the trailing edge sheeting flush with (w1). Do the same thing with the other half of the wing. Glue on the leading edge strip (8) to both wing halves.

Next, the ailerons will be separated from the wings.

First, draw the lines on the trailing edge sheeting (13), outlining the

GANNET

Designed By:
Laddie Mikulasko
TYPE AIRCRAFT
Canard
WINGSPAN
55½ Inches
WING CHORD
9¼ In. (Avg.)
TOTAL WING AREA
486 Sq. In.
WING LOCATION
Rear of Fuselage
AIRFOIL
Symmetrical
WING PLANFORM
Swept Back
DIHEDRAL EACH TIP
None
O.A. FUSELAGE LENGTH
34¾ Inches
RADIO COMPARTMENT SIZE
(L) 15" X (W) 2½" X (H) 3"
STABILIZER SPAN
19½ Inches
STABILIZER CHORD (inc. elev.)
5¼ Inches (Avg.)
STABILIZER AREA
94 Sq. In.
STAB AIRFOIL SECTION
Flat
STABILIZER LOCATION
Front of Fuselage
VERTICAL FIN HEIGHT
10¾ Inches
VERTICAL FIN WIDTH (inc. rud.)
5¾ Inches (Avg.)
REC. ENGINE SIZE
.40 Cu. In.
FUEL TANK SIZE
10 Ounce
LANDING GEAR
Tricycle
REC. NO. CHANNELS
4
CONTROL FUNCTIONS
Rud., Elev., Ail., Throt.
BASIC MATERIALS USED

Fuselage	Balsa, Ply, Spruce
Wing	Balsa, Ply, Spruce
Empennage	Balsa
Wt. Ready To Fly	**80 Oz.**
Wing Loading	**23 Oz./Sq. Ft.**

ailerons. Cut them out and, on the wing, glue in 1/4" balsa sub-spar (11), and on the aileron, 1/4" leading edge (12). Cap the ends of the ailerons with 1/8" balsa at the tip and 1/2" at the root.

The next step is to join the two wing halves.

First, cut out the engine mount (1), from 1/4" plywood, along with the firewall (19). Glue the firewall to the engine mount.

Place the two wing halves on top of the plan, with the tips supported at the same height, and glue in the engine mount assembly to the ribs as shown. Glue in the top and bottom balsa blocks (2), to give the engine mount more support. At the same time, glue in the top and bottom braces (6) to hold the spars together at the wing joint.

Now, glue the webbing (4) between the ribs (w1), and fill in the center section sheeting (7) on the top and bottom.

Glue on the capstrips and wing tip sheeting on the bottom.

Glue in the plywood landing gear block supports (15) between ribs (w3) and (w4), followed by the blocks (14) themselves. The blocks should be slotted beforehand for the piano wire gear.

Sand the whole wing, as if it were ready to cover. Now you can glue the wing to the fuselage, making sure that it is aligned properly.

Insert the NyRod for rudder, ailerons and throttle.

The model is now ready for finishing, using your favorite covering and finishing method.

Final Assembly:

Using 5/32" piano wire, make up the main and nose gear legs, according to the drawing, and install them.

Install the control surfaces and glue in the hinges.

Mount the engine and use the batteries and servos to balance the model. Glue in the servo tray (32). The receiver should be located close to the fuel tank so that the antenna can go straight into the wing.

To fly this model, you need a pusher propeller, unless you have an engine with a removable front housing (O.S. .40 FSR, etc.). In this case, you can rotate the front housing 90 degrees counter-clockwise. This will enable the engine to run backwards so that you can use normal tractor props. This was suggested to me by a modeler from Singapore who built a Delta model, Force 1 that I designed previously (see RCM March 1982).

I did try it on the other model and it works fine.

The fuel tank is setting further from the motor than normal, but no problems have been encountered. The clunk should be located in the middle of the tank, using tubing as flexible as you can get.

Flying:

This model is no pattern airplane. It was designed as something "different" to fly. If you can fly a trainer, you can fly this ship with no problems. It is good for flying the majority of maneuvers. You may find the aileron roll rate a bit slow.

The aircraft will not spin unless you move the Center of Gravity back by 1/2" or more; then, watch out! If you have never seen a flat spin, just try flying the model with the C.G. at its aft position; then you will get one, but you had better have a lot of height, because the only way that I could get out was to hold down elevator for a long, long time. The nose dropped slowly and the model went into a spiral from which it could be brought into level flight.

Good luck with your Gannet, and happy flying. □

FLYING LOWE

Don Lowe

I just returned home from a month's business trip testing RPV's in Maryland. While there I was able to attend an AMA Executive Council meeting as Chairman of the new AMA Safety Committee. Also, I was able to get in a little model flying with Joe Solko of the PGRC Club in Maryland. That club has one of the nicest model flying facilities I've ever seen --- nice, big, intersecting paved runways, taxiways and ramp area, plus a shelter.

The PGRC is a very active club with lots of interest in Q-500 racing these days. I had a lot of fun flying Joe's "Yellow Fever" and bought a kit for myself --- looks like the fun way to race. I used to race Formula I and II, but quit because it simply required too much time and effort along with pattern flying. I like to fly all types of model aircraft --- even helicopters. I've been flying a Baron 50 since Vegas and it's fun. Flew helicopters a lot of years ago.

My attending the AMA Council meeting was intended to "feel the pulse" of the Council in regard to the activities of the AMA Safety Advisory Committee. You are aware, of course, that John Preston writes a very fine Safety monthly article for *Model Aviation* magazine. We certainly hope to work with John and possibly provide some material from time to time for his article. Where appropriate, I'll probably cover safety in this column. The Safety Committee is supposed to be advisory, hopefully expert in nature, to the AMA Council. Any material of this nature should be addressed to the AMA Headquartes for distribution.

Speaking of Headquarters; the new AMA building in Reston, Virginia, is **beautiful** and something we have needed for a long time. It has a personal interest to me since I feel it had its Genesis at Hutchinson, Kansas, years ago, but then that's another story. It took lots of discussion; lots of looking at alternatives, including Springfield, and Wilmington, Ohio, but at last it is a reality, and it is really something of which to be proud. If you are ever in the Washington, D.C. area you should certainly stop and see this unusual triangular shaped building, designed with modeling purposes in mind by John Hunton, architect and a modeler.

Safety:

All model flying activity is intertwined with safety. The most common cause of AMA insurance claims is related to the model engine and that necessary thrashing component, the propeller. Hands are cut by it; bodies are pierced by it, etc. Every modeler can show you scars from prop bites. I've seen some very serious results of flesh meeting the prop. AMA would be very happy if every modeler would either use a starter, chickenstick or, at least, a protective glove. Then you **must** stay out of the prop's plane of rotation in the event it sheds a blade and treat it with great respect. Always pick your props with care --- be especially careful that the wood grain is good through the entire prop. I personally feel that prop manufacturers should have to replace props with poor wood grain and/or grossly out of balance props. A pattern engine can shed a blade turning 13,000 plus on the ground, and 17,000-18,000 in the air. How many of you have shed a blade in the air? It is instant disaster, even worse, to do it on the ground with your jugular in the way! So be careful with the beast. When cranking up, it would be best to have someone holding the airplane for you, especially the big ones --- they develop lots of thrust at low rpm's and having it chopping into your legs or worse, can ruin your whole day.

Here are a couple of comments to possibly save some slashed fingers/hands when cranking those high compression types, especially the popular ABC set-ups: **Never** try to crank it through if it's loaded, it will surely bite hard. Best bet is to pull it through (hang on tight) and feel it "bump"; then slap it backwards against compression --- not through compression. Always pull it through and let it "bump" between each slap --- it is much safer that way. I always start my glow Twin Tartan by flipping through (without fire!) until it is loaded. (I check this by pulling through and feeling a "double bump" --- the cylinders don't fire exactly simultaneously when doing this, then I slap it backwards against compression to start.) I would **never** try to flip it through to start, especially if it is loaded --- it can really cut deep if you do this. I know of at least one modeler who sold his Tartan because it was such a beast to start --- hard on fingers. For restarting, if it is warm and lean, flipping it through may be okay. Incidentally, the Tartan requires lots of torque to start it with a starter if this is your approach. I made a starter for mine out of a Go-Cart starter. ABC's need lots of torque for starting, also due to the very high compression. Another good idea is to take sandpaper to the prop leading and trailing edges, especially those plastic types with sharp edge flashings. This can help prevent those minor cuts. One final suggestion: get yourself a good leather glove for your flipping hand; your fingers will thank you for it.

Noise:

Engines and props not only create thrust but they make noise; probably the largest contributing factor to loss of flying sites. The FAI requires a noise limit of 105 db when checked at one meter from the aircraft. This grew out of bad experience in Europe with high population density and small airfield/population separation. On the average, we are better off in this country in this respect, but it is not at all uncommon to have occasional gripes from neighbors due to the noise, and sites have been lost because of this.

For the first time ever, the FAI noise limit will be enforced at this year's pattern Masters Contest to be held at the Rough River Dam State Park in Kentucky. Noise will also be checked at the NATS. Masters contestants must meet the noise criteria or be ineligible for the Internats team. The World Championships, in Pensacola, Florida in October, will require each contestant to meet the noise level criteria or be disqualified.

Tests have been made previously at NATS and Masters competitions. The competitors were also tested at the World Championships since 1977. No one ever failed to meet the requirement, primarily due to the manner of testing & some competitors cheating their way through. Ed Izzo is Chariman of the AMA Noise Committee and Ed and others have been designing and testing for noise.

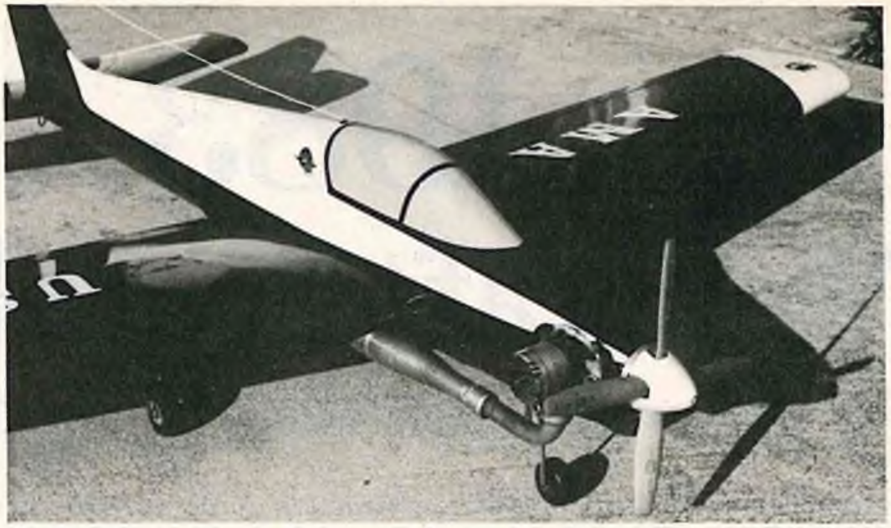
I've been doing some testing recently, using a Radio Shack Realistic sound meter. Ed and I agree that the major culprit for typical

pattern planes is the prop --- in particular the propeller tip speed must be kept below certain limits. This matches very much the findings by government agencies in this regard.

Using a good muffled tuned pipe usually takes care of engine exhaust noise, especially the non-flow through variety (you can't see daylight looking through the pipe). Results show that a typical 11" prop turning 13,000 plus on the ground won't hack it. I've measured over 110 db turning 13.5 plus.

One approach is a multi-blade prop smaller in diameter. What this does is provide the necessary load and blade area while reducing the tip speed due to reduced diameter. There is nothing magic about multi-blade except diameter reduction. You could take a very wide blade larger diameter prop and cut it down to say 10" and get similar results. An approach I have been playing with (carefully) lately is four blades --- yes, using two notched 11" props cut to about 9½" diameter. This idea came from friend, John Mee, of South Africa. They had to meet the criteria in S.A. for their Nationals competition where they selected their International team. John says he and a friend tried everything until the successful 4-blade approach. Let me caution you up front that cutting blades at the hub can be hazardous and if you do it you should **proceed with caution!** In my test, I selected props from some that Max Daley (custom props) made for me which **all have excellent wood.** Then I **milled** the props about 1/3 way through for a tight hub fit. Then I glued the props with Super Jet. I have not had a failure; in fact, I broke one blade in a landing over-run and it did **not** break in the hub.

Typically, running a 4-blade in this manner, the rpm is **down** to 11,500 to 12,500 static. This in itself **reduces** the centrifugal load about 1/3 when compared with 14,000 static. This also means that the pipe must be run much



Don's 4-blader on Phoenix 8 is very quiet. Be sure and read text before attempting this for yourself.

longer to tune to the lower frequency. Undoubtedly, revised engine porting and long stroke would be best for this operating range. However, using a 4-blade 9.5", 7¾" pitch prop in this manner without any engine changes except extended pipe flies my 8½ lb. Phoenix great, and the noise reduction is fantastically pleasant! At times I can even hear the wind rushing over the ship (drag!).

The 105 db limit seems to be wisely set, since, as the noise climbs above this level, the sound gets most unpleasant. Try this sometime with a db meter or without. Run your engine with an 11" prop and check sound at 10,000-11,000, then increase it to 14,000; what a difference. And when you get in the air and it unwinds to 17,000-19,000, the neighbors have reason for complaint.

Notching the props the way that I do staggers the blades; this doesn't hurt performance; in fact, it may help. If you have an engine with a long enough shaft, simply install two unnotched props. It is not important that the blades be at exactly 90° either; balance isn't affected. Lazair of Canada runs two props on their ultra-lite in parallel without separation. They claim to have run the props at 90° all the way down to parallel without a significant change in performance. They went to the two props to keep diameter down when they incorporated larger engines in their bird.

My results with the 4-blade on the Phoenix shows about 102-103 db at full throttle. It is amazing how much quieter this sounds in the air. Remember, if you try this, **be careful** in picking your props and in notching; do **not** go half way through the hub. Then be careful in flipping the beast since those blades come around a lot quicker! Also, do not put any part of your body in the plane of rotation (good practice for any prop) when running it at high rpm's. I definitely would not do this with plastic props since I feel they generally have smaller safety margins than good wood props. Also, wood does not fatigue and is not notch sensitive.

One additional thought on prop selection. Choose higher pitched props since rpm is down. If you want to fly at the same airspeed, then you must use more pitch at the reduced rpm. Anything below 7½" pitch is probably too low. I've only tried 7¾" pitch, but these are **true pitch** props. For example a 7¾" pitch Rev-Up is actually less than marked. It seems to be a game that some manufacturers play to make you think their product is much better. Rev-Up is a good prop design, but choose their higher pitches like 8" for example. I would think the Zingers would work well also since they are fairly true pitch and have narrower blades. Incidentally, my friend, John Mee of S.A., used two Rev-Up 11" x 7¾" props on his 8½ lb. Saturn. He static tached about 12.5 and he claims the ship seemed to have the thrust required (he flies at 5,000'-6,000' altitude). □

ENGINE CLINIC

Clarence Lee

At the time of this writing (April) the flying season is getting underway in most parts of the country. Or at least fellows are starting to get their equipment ready for the flying season which will be well underway by the time this column appears in print. Being in the engine business I almost hate to see March and April come around each year as it means all the crashed and worn out engines from last season coming in for service. The majority are naturally needed the following weekend for the first contest of the season, etc. What really makes your day is when some fellow will call and want to know when he can expect his engine back that hasn't even been received yet. Some fellows forget that the U.S. mail does not always deliver overnight and packages from the East Coast, especially the Southeast, often take up to two weeks to reach the West Coast.

Along with the increase in engine repairs, the mail to this column also increases considerably. In fact, I usually receive enough letters during the spring to last through the balance of the year. Fellows that have had their letters run in the column will know that sometimes letters sent in early in the year will not be run until later in the year due to the mail load at the time. However, if a letter is going to be held for a while before publication, the writer gets a personal reply shortly after the letter is received. I mention this as some fellows have been surprised to see their letters run many months after they were originally sent in. Bear in mind guys that if I get thirty or forty letters in a month I can only run six or seven of the ones I think are of most interest each month. Others are held for succeeding months when the mail load is lighter or, as often happens, I get a pile of letters that are of major importance to the writer but not of that much interest to the readers. Or letters that have been answered over and over again in the column. This is why it takes a lot of letters to keep the column going. So keep them coming guys.

In the April Engine Clinic a reader sent in a letter wanting to know what properties allowed castor oil to carry off heat better, how film strength was determined as he did not know of any tests for determining film strength, etc. At the time I asked any of the petroleum engineer types out there who would be more knowledgeable in this field than myself to let us know how the film strength of oils can be measured. Last month I ran a letter that explained the physical properties of castor oil that made its lubrication qualities better than the synthetics at higher temperatures. However, the method of determining film strength was left unanswered.

This month John Wolf, who is an Amsoil dealer in Pennsylvania, sent in the following.

Mr. Lee,

In response to the synthetic versus castor oil question, there **is** *a test called the Folex wear test. It consists of two "V" blocks clamped around a shaft. It is hydraulically controlled and automatically measures gauge load until the shaft stops rotating or breaks. It is recognized by the ASTM, API, and SAE. A drill press-like device, used by some oil companies, is* **not** *an approved method. You are certainly correct about viscosity. Gear lube will probably run the Folex test better than engine oil but will not protect an engine very long.*

The API has determined five basic oil functions: cool, clean, lubricate, seal, permit starting.

There are five basic two cycle oils: petro, glycol, castor oil, Diebasic acid Ester, and polyester. The jet engine oil is polyol ester — very expensive. Note the difference. Glycol, which is used in model glow fuel, is a relatively poor lube; it does keep down the varnish but also attracts moisture.

When dealing with gasoline engines, synthetics perform very well and run at lean mixes.

Part of the problem is "synthetic" has a broad meaning. It can vary from adding a small amount of fortifier, to a carefully manufactured product. There are synthetic hydro carbons, silicones, as well as petroleum mixes. You are also right --- you almost need a degree to understand it all, there is a lot more info on this.

John Wolf
Bernville, Pennsylvania

Thanks John, I knew there was a test but did not know the technical name for it. I can remember in years past (maybe they still do) representatives for Wynn's oil used to put on demonstrations at auto shows, etc., using a similar device to demonstrate the advantages of adding Wynn's oil to motor oil. Pressure was applied until a ball rotating on a shaft started to squeal. Wynn's oil was added and the squealing stopped.

Our second letter this month is a little long and asks quite a few questions. I normally prefer to run letters that ask only one or two questions but this letter covers questions that many other readers have sent in. So, rather than answer four or five individual letters, we will let this one letter do the job.

Dear Clarence,

I always enjoy reading your column and always wanted to write and ask some questions. Here goes:

(1) I have a Veco .61 that's old, but it's still a powerhouse. When it's running full bore it scares me. It's a 1968 or 1969 model, I think. It has two rings on the piston. The head has been damaged and the glow plug threads have been stripped out from long usage. Where can I get another head for this engine? I don't think a helicoil would be practical.

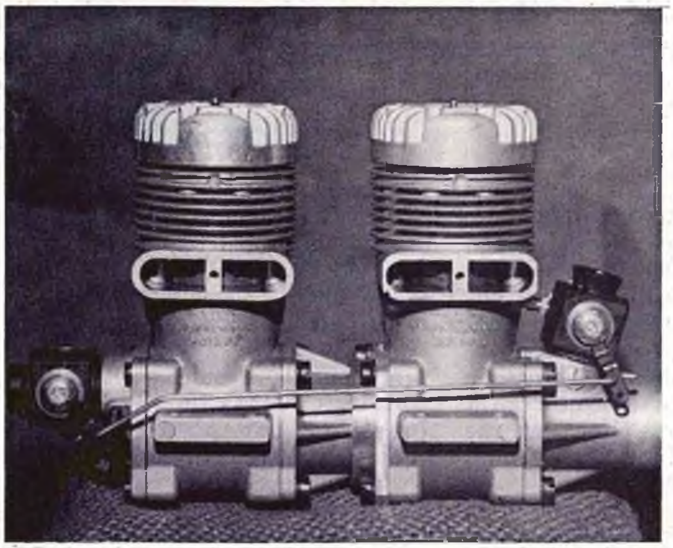
(2) I have a later model Veco .61, a 1970-71 model. It has one Dykes ring pinned to the top of the piston. This engine idles fairly well with a Perry pump and carburetor. Do you think these engines would hold up if they were dieselized? They will be used for sport flying only.

(3) I am using an Enya .45 in a Goldberg Falcon 56 Mark II. A lot of engine for said aircraft, but it's a heavy plane. The engine won't idle except with a full tank. That's the problem. The cause of the problem is; tank far too low. I have a Robart Super Pumper, and that's the answer. This engine has no crankcase back cover. Now, how can I install a Robert Pumper on this engine? Can I drill through the mount lug or intake passage?

(4) I have a McCullough Husky engine that I want to put in a 1/4 scale plane. This engine has caged roller bearings front and back on the crankshaft. Isn't this a more or less undesirable feature on any engine? I don't think roller bearings can take the thrust loads like ball bearings. This engine has the spark plug in the top of the head at an angle and it sticks up too high, making a modification of the cowl necessary to clear the lead at the connection to the plug.

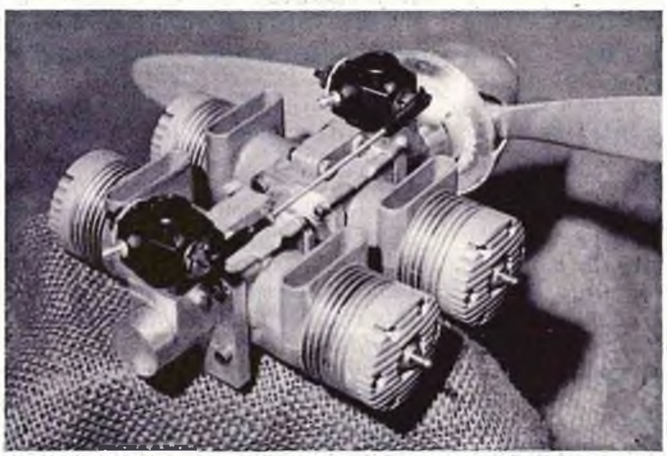
Is there some standard procedure or

Dick Hoff of Weldon California, who owns a machine shop producing aircraft missile parts, likes to spend his hobby hours building multi-cylinder engines. Pictured are a few of his projects.

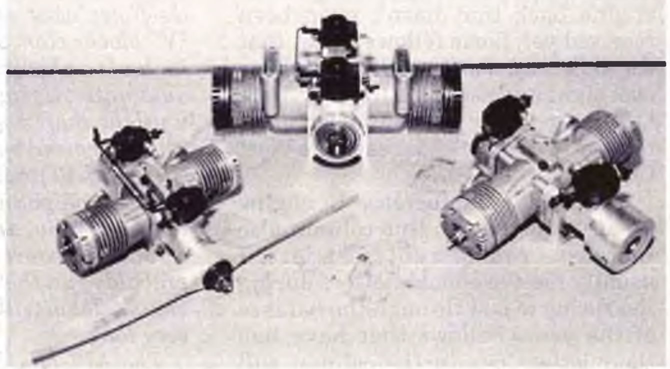


S.T. 1.42 cu. in. inline twin made from two S.T. .71's.

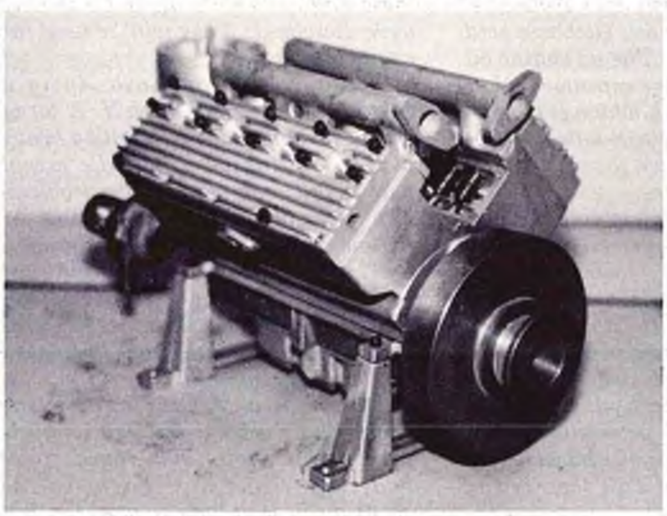
S.T. 1.2 cu. in opposed twin made from two S.T. G-60's.

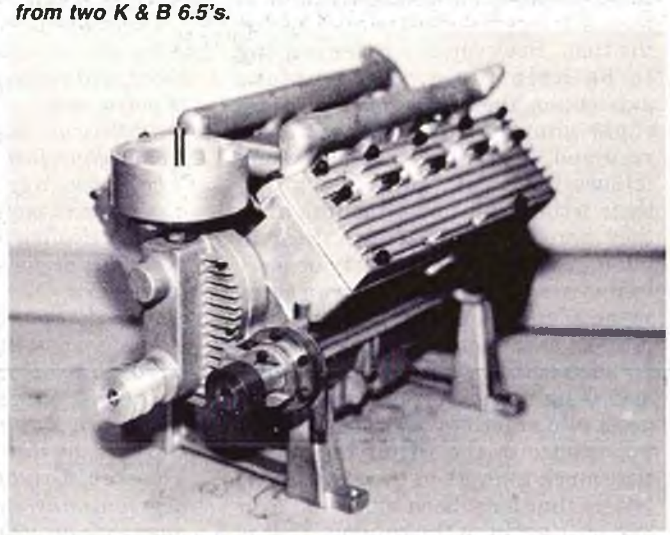


K & B 1.6 cu. in. opposed four made from four K & B .40's.



Left to Right: K & B .42 Schnuerle made from two K & B 3.5's. H.B. 1.2 made from two H.B. .61's. K & B .80 Schnuerle made from two K & B 6.5's.





Lance V-8, 1" bore x 1" stroke. Disp. 6.26 cu. in.

some way to cut the spark plug lead and splice it to make it longer so it can be rerouted? Is there any point in taking the crankcase of this engine apart to inspect it for loose metal shavings left there when manufactured?

(5) Many years ago, I acquired an Olsen and Rice industrial engine of 1 horsepower. It is complete, cooling baffles and recoil starter. If this engine were stripped down it would be approximately the size of a Fox .78. How would this engine compare to a dieselized Fox 78? Do you know of anyone who has modified an engine like this for model aircraft usage?

Keep up the good work.

Bill Whitbeck
Powhatan, Virginia

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There haven't been any of the old die cast heads for the 1970 and earlier Veco .61's available for years. In 1971 a change to a machined head was made and the 1971 head will fit. However, these are also out of stock and about as hard to find as the earlier die cast head. In 1972 we updated the Veco .61 and the head was changed to a "squish band" design. These heads will not fit earlier engines without extensive modification. Installing a Heli-coil is the only solution. I have saved quite a few stripped heads this way with no problem. I charge $5.00 including postage to do the job. Or, for fellows on the East Coast, Pete Reed, 49 Anvil Dr., Avon, Connecticut 06001, will do the job, also for $5.00 p.p.

As for converting to diesel operation — I would not recommend doing this for any Veco prior to 1972. Earlier engines did not have bronze bushed wrist pin holes in the piston and upper end of the rod. 1972 and later engines do, which will take the added loads. Incidentally, the 1971 Veco Dykes ring was not pinned. It is free to rotate.

Just because the back cover is not removable on the Enya does not mean that it cannot be drilled and tapped for the Robart pressure fitting the same as if it were removable. You can also drill and tap through the mounting lug or the bypass wall, however, the bypass wall might be too thin to do this. The crankcase can be tapped any place the wall thickness is thick enough.

If you are going to use a chain saw engine for Quarter Scale it will have to have some provision for taking the propeller thrust load. Rollers will not do this. The Husky was designed for side loads — not fore and aft. A thrust bearing or bronze washer will have to be installed to take the thrust load, otherwise you will be asking for a lot of trouble.

I would not recommend cutting and splicing a spark plug lead. It is easier to make up a new lead using regular

automotive high tension wire available at any auto parts store. If the diameter is too large you can use CB radio lead-in wire that is shielded. Any insulated wire can be used but wire with shielding which, in turn, can be grounded will help noise considerably.

As far as taking the engine apart to check for chips — I would leave it alone unless you have had considerable experience working on engines. Most fellows end up goofing things up during the disassembly /reassembly than if they had left the engine alone. However, if you intend using the engine, it is going to have to have a thrust bearing or washer installed which does mean disassembly.

The O & R industrial line of engines were discontinued a few years back. The engine worked fine for its intended use, however, for model use it did not develop much more power than a good .60. A dieselized Fox .78 would be a far better choice. The Fox .78 when converted to diesel with a Davis diesel conversion becomes a real powerhouse and has the beef to take the conversion safely.

I would forget about using the O & R. Du-Bro used the engine in their helicopter some years back. You might contact them for any information regarding conversion.

Dear Sir:

I enjoyed reading your article on the Fox Twin in April's RCM which I purchase at hobby shops. This article brought the following question to mind: What carburetor would you suggest for the Fox .60 Hawk Redhead? The original carburetor (appears to be the same as the carb on original twin) runs, but must be kept rich. It seems to be stiff compared to my K & B .40 Irvine and my O.S. Max .35. Incidentally, this engine, even though one of the older Foxes, has had very little running time on it but could be considered broken-in. It was a hand me down engine from one of our club members who preferred to stay in the .40-.45 range. I want to put this engine on a Jensen Ugly Stick.

Is the engine worth the trouble to make carburetor modifications or would I be better off applying the cost of another carburetor toward the price of an entirely new engine?

Sincerely yours,
Tony Reed
Pine Bluff, Arkansas

The Fox Hawk had the older "vane" type of carburetor. These did leave something to be desired in the way of fuel draw and idle reliability. Fox has a new barrel type MK X that will fit the engine. The MK X comes in A, B, C, and D venturi size. You would have to check with Fox as to which size he recommends for the Hawk. The Hawk was Fox's top of the line engine until he introduced the Eagle. If it is in good shape it should justify the cost of a replacement carburetor. Fox also has a carburetor adapter so that a Perry or other after market carburetor can also be installed if you want to go that route.

Dear Clarence,

First I want to thank you for your letter of last October 1981, about breaking cranks on my S.T. diesel .15 R.V. I tried using the fuel mix you suggested --- surprise, no more broken shafts! I could not, however, find the Amyl Nitrate. I have been reading your column since 1969; in fact, I've just read about 60 past issues of RCM Engine Clinic column. I have a lot of older engines that are like new so if I run into problems I read the older RCM Engine Clinic columns and get most of the problems solved.

The following is a problem I have, or it may not be a problem:

Fox Eagle .60 about 1975, Shining silver case, bushed rod, lower end. This engine has been run approximately 15 minutes on a 4 oz. tank. Short rich runs, 25% castor oil, 10% nitro, 11/8 prop. It seems to have too much crankshaft play, much more than any other ball bearing engine I have, even with lots of hours on it. As close as I can measure, it has about .012 (fore and aft movement). The front bearing does not leak or spray. How much is too much? What causes this?

The engine runs good — starts on one or two flips, run on bench over 3 ft. off ground, took back plate off, looks good inside. Also, do you know of a rear bearing that will fit a McCoy .60 that is easy to find? The original is Rear R-8 MRC, Front R-38 MRC.

Thank you,
Robert H. Stover
Colgate, Wisconsin

Glad to hear that the diesel fuel mix solved the crankshaft breaking problem. There was also a follow-up letter to your problem in the May Engine Clinic regarding using the S.T. X-15 crank.

Amyl nitrate is pretty hard to come by. It is made by the Ethyl Corp. for use in regular diesel fuel and does about the same thing as lead does in gasoline. Some of your larger chemical companies carry it but you have to buy at least a gallon. If any readers out there know of a source for Amyl Nitrate in small quantities please let us know. I get many letters asking for a source.

Now, in regards to crankshaft end play — it does not really hurt anything as long as the crankshaft does not move far enough to the rear to rub on the back plate. It is caused by the crankshaft being loose in the bearings or the front bearing being loose in the crankcase. Crankshafts are purposely made a few thousandths longer than the distance between bearing faces so that tightening the prop will not bind the bearings. If the fit of the crankshaft in the bearings is a slip fit, then you will be able to detect this end play. I would consider .012" about normal.

The front bearing can also cause this problem if it is loose in the crankcase. The crankshaft butts up against the rear of the bearing and the prop drive washer is tightened against the front. This locks everything into position. However, if the front bearing is loose in the case, the whole works can move back and forth. This should be corrected as a loose bearing can start to rotate in the case and get looser and looser, also spitting a lot of black gunk out the front of the engine. A solution is to remove the bearing and wash both it and the crankcase in acetone or lacquer thinner. Then put a film of Loctite red on the bearing and reinstall. Be very careful that no excess Loctite gets into the bearing or it will lock up the bearing making a far worse situation.

The rear bearing used in the K & B .40 (#4011) is the same as the rear bearing used in the old McCoy .60 and .49. The front bearing used on the K & B .61 is the same as the front bearing used on the old McCoy .60 and .49. Your local hobby shop can order these for you if they do not have them in stock, or write me direct at my business address (see ad in Readers Exchange).

Dear Mr. Lee,

I have been reading your informative columns for years now with detached interest since my engine problems were always the usual minor ones. Now, however, I am flying 1/4 scale planes and have had unexpected difficulties. In particular, I have been trying to fly an 18 pound Pfalz DXII, WW I biplane with a Tartan 1.3 engine. I say "try" because the so-called flights are more like controlled stalls. The problem is that if the Tartan is leaned to produce about 6500 rpm on an 11/6 prop, almost immediately after take-off the power sags and the engine finally stops, apparently due to overheating. If the mixture is made rich, the overheating is avoided but the power is insufficient. I have tried all fuel mixtures from 0-12% nitro with 10 and 20% oil and props from 17/4-18/8 with the same results. My questions are:

Would a gear reduced .90 be better? Is the Webra geared .90 good or would a belt drive be better such as the A & M

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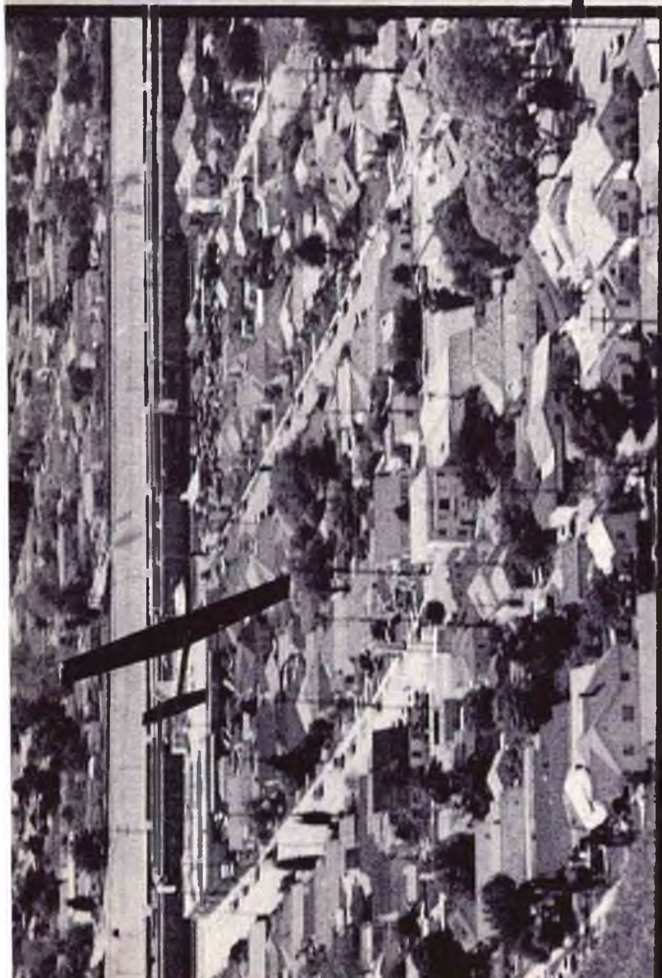
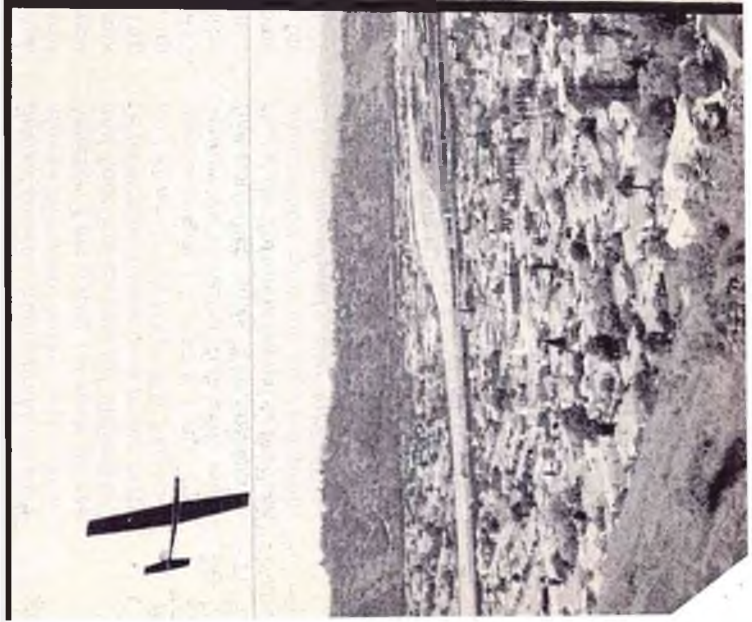


MAXIMUM

The field reaction to this one is it has to be a high wing or it won't fly. Watch it come off the tow hook!

By Bill Evans

Project "Maximum" proved to be interesting, different, long on time and very rewarding. The rewarding part is the product, a good looking (first practical low wing thermal glider), super flying and very easy to build silent craft. The Maximum had its beginning many years ago with my Seville, also a low wing glider; looks similar but different. Also, the Crosswind (.15 power) smacks of the Maximum, but again different. The different part comes from the fact that this is the first built-up wing I have done in the past thirty years. Prior to this it's been all foam. You will find the construction of this wing to be very interesting. First the wing is built in one sitting (no waiting for parts or sub-assemblies to dry). Much as a pyramid, from the bottom up. Once the panels are dry they can be sanded and joined using epoxy, the same as foam wings are joined.

The wing platform shown is not limited to the Maximum flat bottom

airfoil. The technique of building on the platform can be applied to all airfoil sections. Merely cut a foam cradle for the airfoil bottom and proceed to build over it. This procedure eliminates the need to block spars or leading and trailing edges when building a semi-symmetrical or symmetrical wing.

The reaction of most fliers when they first see the Maximum at the field is that it sure looks good but "everyone knows that all thermal gliders are high-wing, so it won't fly well." All bets are off when the Maximum comes off the hook. Turns are easy and it stays up with the best of them and outdoes most in light air. How about on the slope? In a word, **excellent!**

When touching down on the single wheel, the Maximum smacks of the Sweitzer 232. By the way, the position of the tow hook and the wheel creates no problem with release of the tow line. Just keep chute or flag well-forward of the nose of the ship.

Built per plan your Maximum will be rewarding and make you stand out at your flying field.

CONSTRUCTION

Let's start with the fuselage so that while it's drying the wing ribs can be cut.

Fuselage Top:

Draw a line down the center of a 3/16" x 3" x 36" balsa sheet; make marks 1" out from the centerline at the nose end and at each former location; connect these points. Mark 3/4" from centerline 9" aft of rear former and 1/2" at tail.

Cut off last 3¼" of fuselage top (stab saddle block).

Pin fuselage top down on work area.

Glue and pin 1/2" triangle stock to fuselage top (do not glue at aft end where stab will set).

Cut out fuselage sides from 3/16" x 3" x 36" balsa sheet.

Glue and pin left and right fuselage sides in place (again do not glue to stab saddle block). Push the pins in through the outside.

Cut formers and glue into place.

Cut 1/2" triangle to length, glue and pin (from outside) in place to bottom inside edge of fuselage, front and rear.

Glue and pin fuselage bottom 3/16" balsa sheeting in place.

Cut nose block to outline shape and glue in place.

Set aside assembly to dry.

Wing:

Cut ribs from 3/32" balsa sheet.

Cut washout platform templates from 1/8" ply.

Note: A simple foam cutter can be made by pushing a 3/16" x 6" piece of piano wire into either end of a 40" length of 1" x 4" pine (or, etc.); drill holes first. Stretch a length of .015 piano wire between ends of the 3/16" wire. Power for your cutter can be a 12 volt car battery or a 12 volt battery charger (6 to 20 amps). **Never use more than 12 volts. Do not use household current.**

Cut washout platform.

As shown, place plans over washout platform.

Pin 1/16" x 2" balsa lower trailing edge sheeting in place.

Draw a line on the trailing edge sheet 3/4" from the trailing edge.

Glue and pin trailing edge stock into place, use the line to keep the T.E. stock straight.

Pin 1/16" x 2" balsa bottom L.E. in place.

Glue and pin inboard 1/16" balsa sheeting and 1/16" x 1/4" balsa lower capstrips into place.

Set lower 1/4" sq. balsa spar in place.

Pin and glue all ribs in place, start with #1 and move out.

Set top 1/4" sq. balsa spar in place.

Glue and pin 1/4" x 1/2" balsa leading edge in place.

Glue and pin 1/16" sheet balsa shear webs in place.

Glue and pin 1/16" x 2" leading and trailing edge top sheeting in place.

Glue and pin 1/16" inboard sheeting in place. Same for top 1/16" x 1/4" capstrips.

When both wing panels are assembled and dry, carve L.E. and sand wings. **Note:** The leading edge is steep and the bottom radius is only slight.

Join wings using 5-minute epoxy.

Cover with your favorite material. The original was covered with a transparent red on top and blue opaque on the bottom. This contrast produced an interesting appearance.

Tail:

Merely pin and glue parts into place over plans and sand. We used X-Hinge to link stab to elevator, same for rudder to fin. Again, cover as you choose.

Carve and sand the fuselage to shape and install 1/8" balsa doublers which fit above wing saddle and between the formers.

Finish covering and install radio, wheel, and hook. Skids for the wing tips, nose and tail will be of value.

Balance per plan and take your Maximum out and show them that a low wing thermal craft can give the Maximum.

Note: For your convenience a washout platform can be ordered for $6.00 plus $2.00 packing, $2.00 shipping, from Soaring Research, 454 Wildrose Lane, Bishop, California 93514. Pre-cut ribs are also available for $10.50 plus packing and shipping, or a complete package of the washout platform and ribs packed and shipped to your door for $20.50. California residents please add 6.5% tax.

Good lift. □

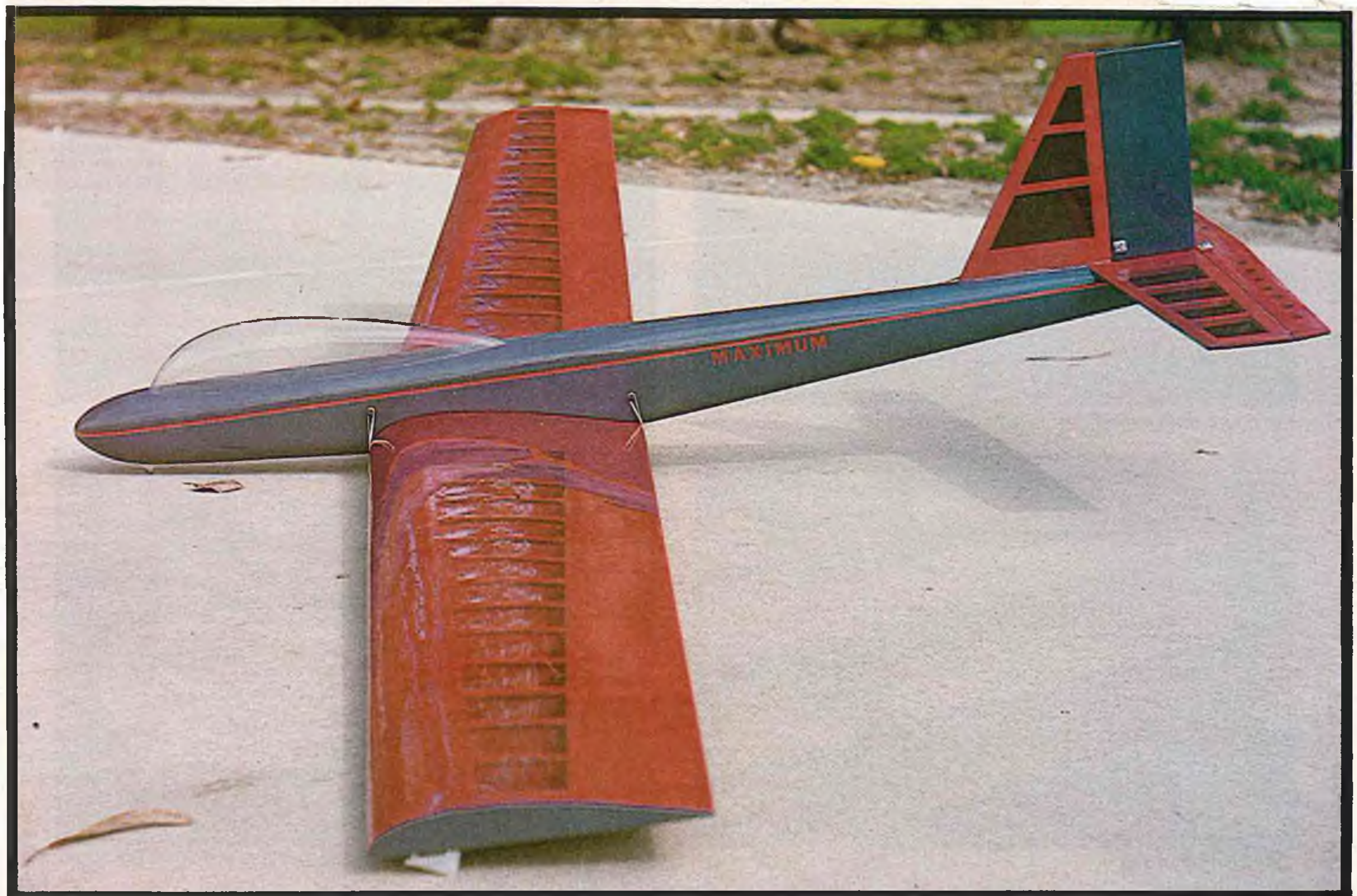
MAXIMUM

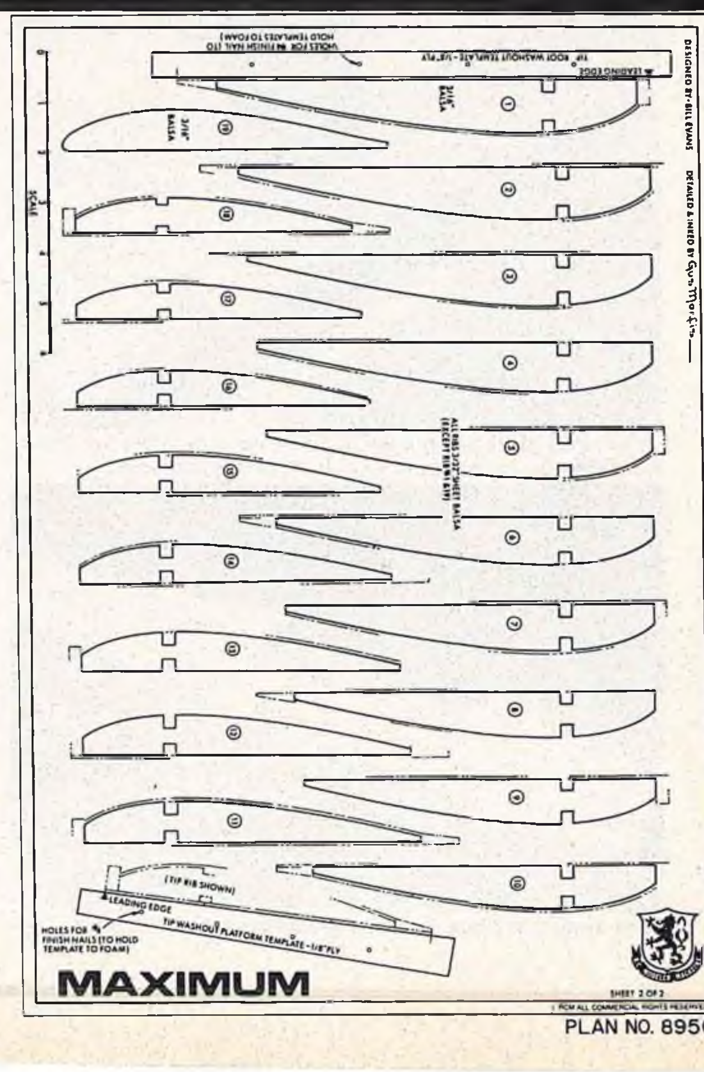
Designed By:
Bill Evans
TYPE AIRCRAFT
Low Wing Thermal Sailplane
WINGSPAN
71½ Inches
WING CHORD
8 In. (Avg.)
TOTAL WING AREA
570 Sq. In.
WING LOCATION
Low Wing
AIRFOIL
Flat Bottom
WING PLANFORM
Tapered L.E.
DIHEDRAL EACH TIP
4 Inch
O.A. FUSELAGE LENGTH
41"
RADIO COMPARTMENT SIZE
(L) 15" X (W) 2" X (H) 2"
STABILIZER SPAN
20 Inches
STABILIZER CHORD (incl. elev.)
4½" (Avg.)
STABILIZER AREA
89 Sq. In.
STAB. AIRFOIL SECTION
Flat
STABILIZER LOCATION
Top of Fuselage
VERTICAL FIN HEIGHT
7½ Inches
VERTICAL FIN WIDTH (incl. rud.)
6½" (Avg.)
REC. ENGINE SIZE
NA
FUEL TANK SIZE
NA
LANDING GEAR
Single Wheel
REC. NO. OF CHANNELS
2
CONTROL FUNCTIONS
Rud., Elev.
BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	Balsa & Ply
Wing	Balsa.
Empennage	Balsa
Wt. Ready To Fly	**42 Oz.**
Wing Loading	**10.3 Oz./Sq. Ft.**

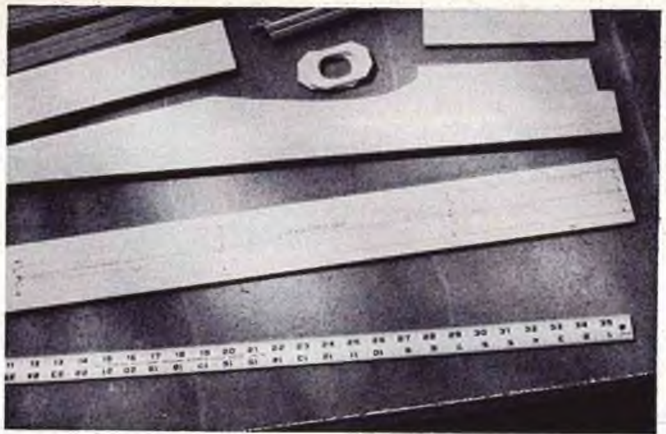
MATERIAL LIST

Balsa
4 — 3/16" x 3" x 36"
1 — 2½" x 2½" x 3"
4 — 1/16" x 4" x 36"
3 — 3/32" x 4" x 36"
5 — 1/4" x 1/4" x 36"
3 — 1/4" x 1/2" x 36"
1 — 1/4" x 3" x 36"
2 — T.E. Stock 3/16" x 3/4"
Ply
1/8" x 2" x 6"

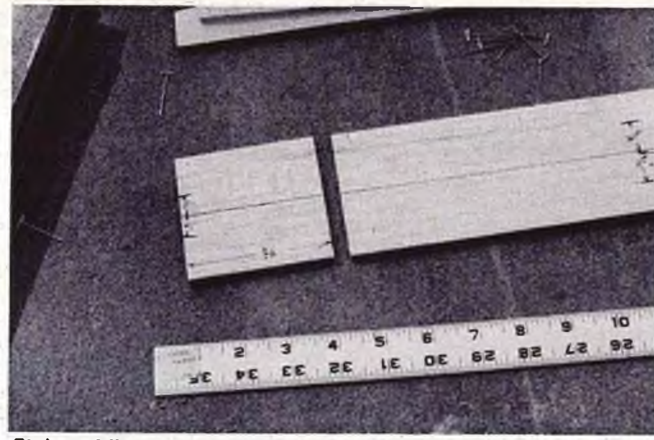




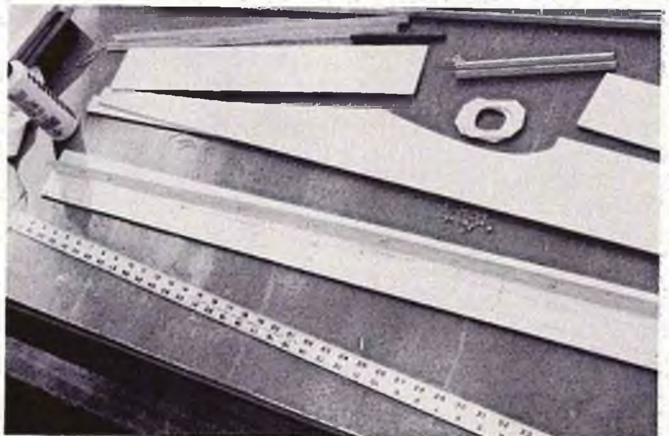
PLAN NO. 895②



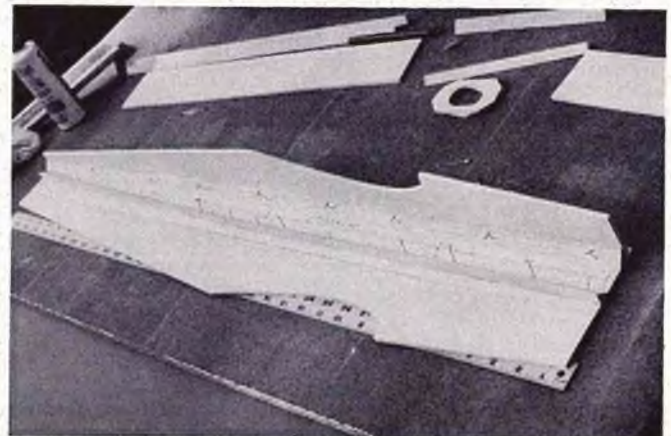
Fuse top, note centerline, 1" and 3/4" markings.



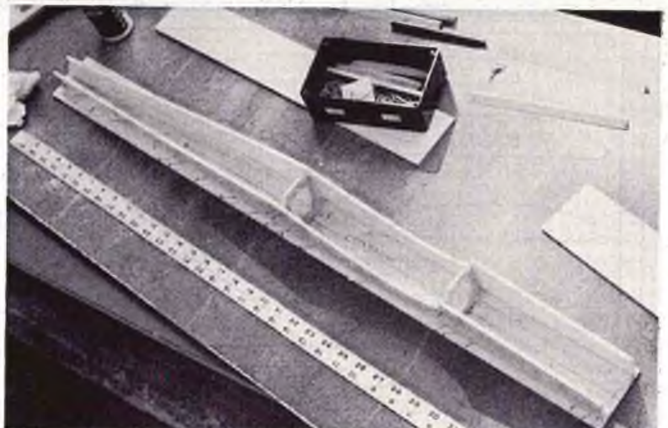
Stab saddle cut, note 1/2" marks.



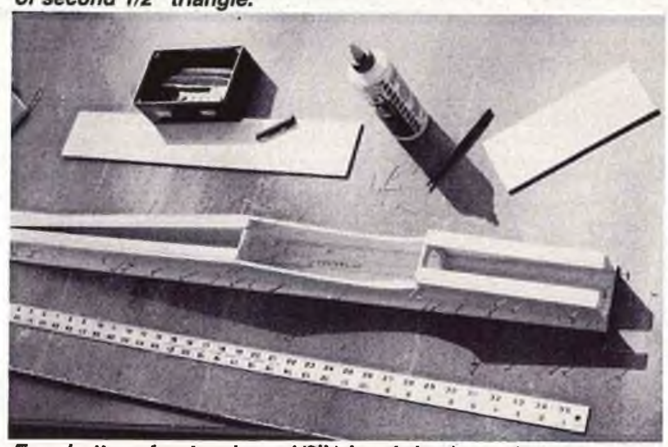
1/2" triangle in place.



Right 3/16" balsa fuse side in place, note line is an outside edge of second 1/2" triangle.

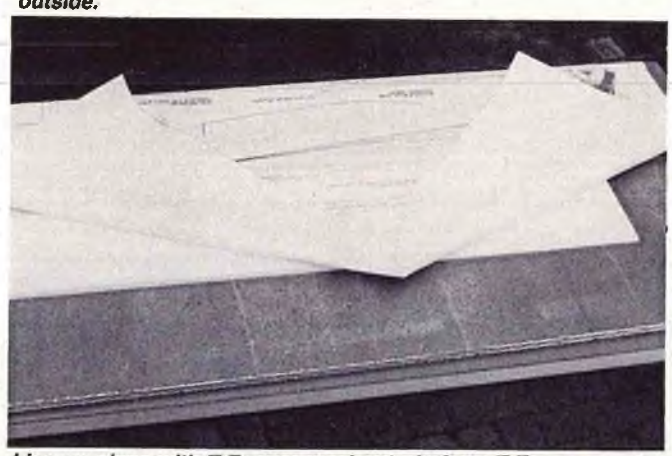


Fuse sides glued and pinned in place, be sure to pin the sides from the outside and remove pins from inside of fuse.



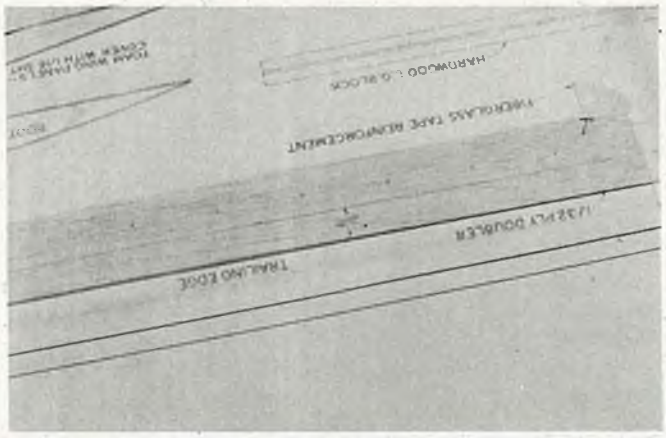
Fuse bottom, front and rear 1/2" triangle in place, pinned through outside.

Fuse bottom in place, finish by gluing nose block in place.

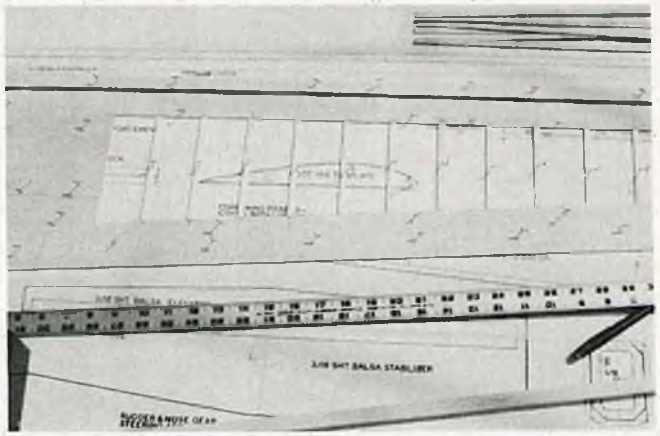


Line up plans with T.E. over washout platform T.E.

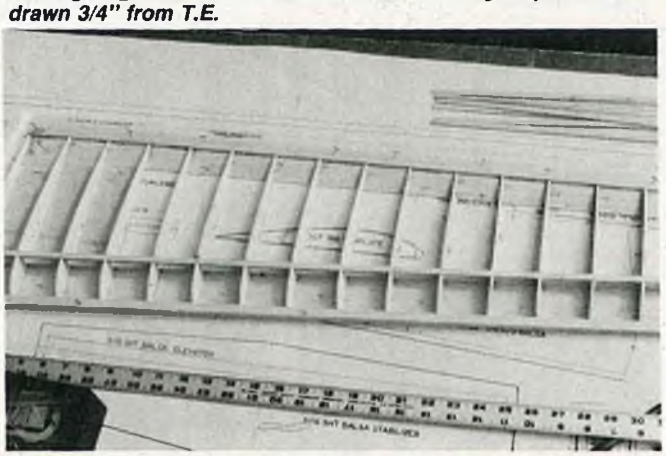

Trailing edge of platform is 1/4" higher at wing tip than at root.



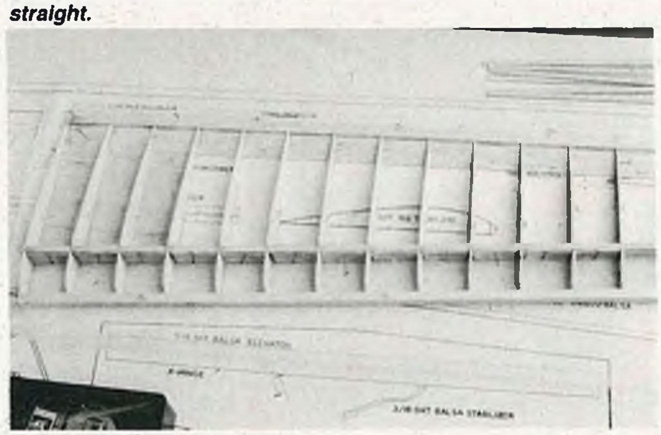
Trailing edge 1/16" x 2" balsa bottom sheeting in place. Line drawn 3/4" from T.E.



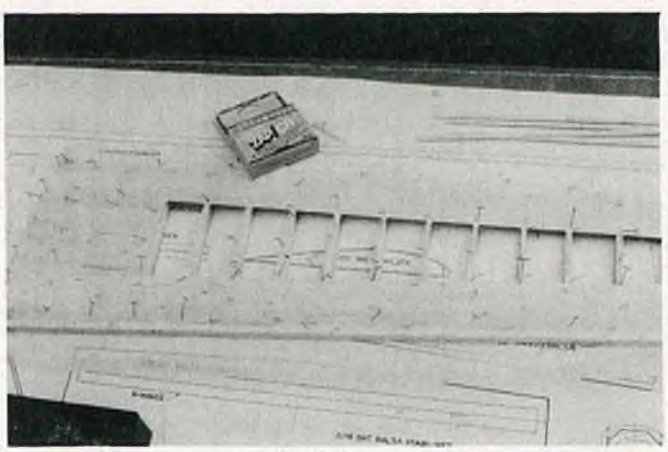
Bottom sheeting and cap strips in place. Note 3/16" x 3/4" T.E. stock is on marked line. This is to insure that the T.E. stock is straight.



Ribs, 1/4" sq. spars and 1/4" x 1/2" L.E. in place.



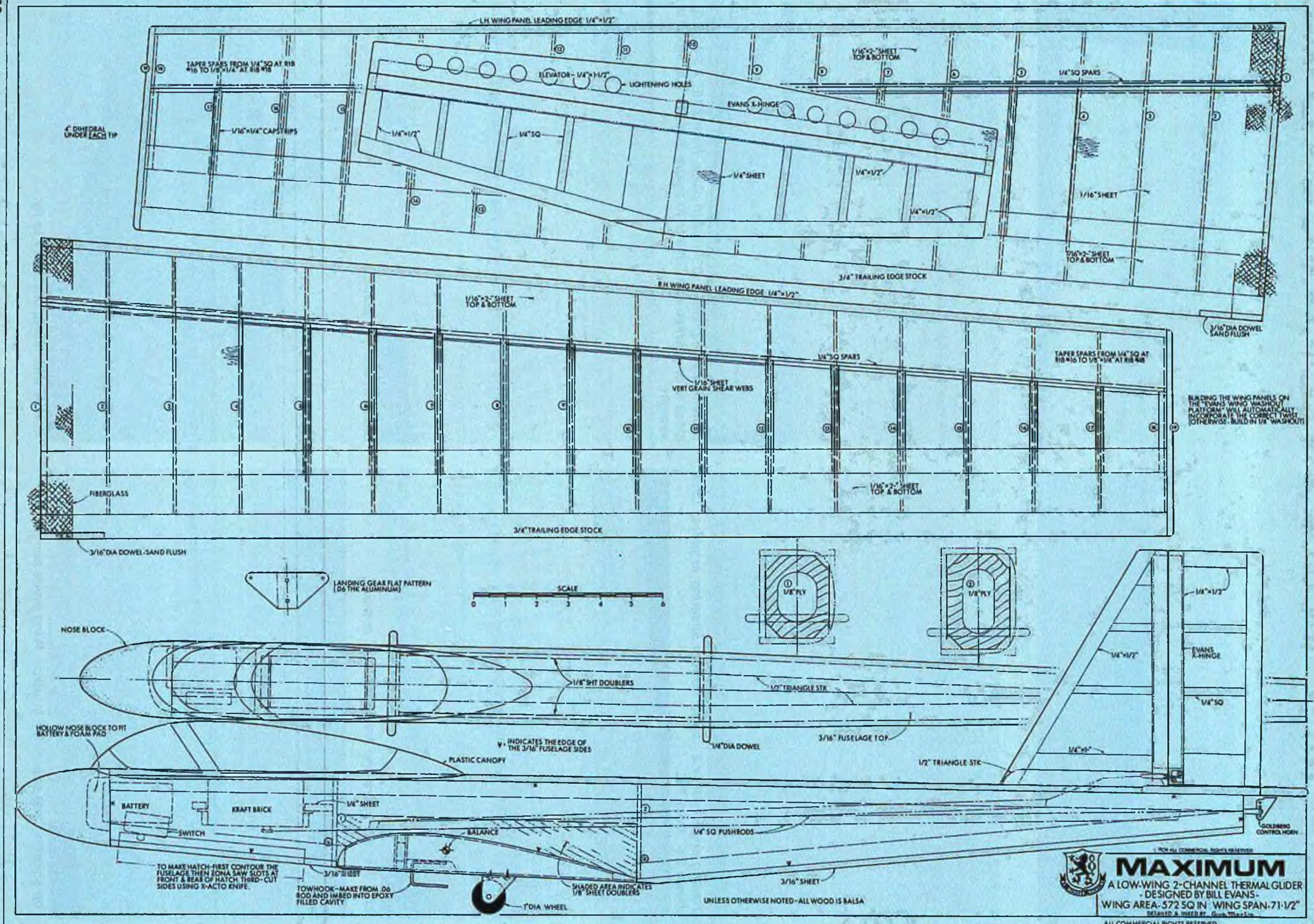
Shear webbing in place.



Top sheeting and cap strips in place. Wing panel complete.

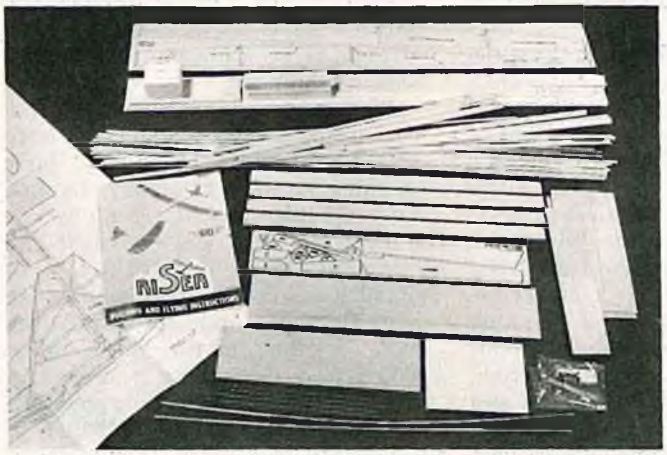
Author with Maximum ready to fly.

FULL SIZE PLANS AVAILABLE — SEE PAGE 194



RCM PRODUCT REVIEW

Sig Mfg. Co.
RISER



SPECIFICATIONS

Name	RISER
Aircraft Type	2-Meter Class Sailplane
Manufactured By	Sig Mfg. Co., Inc. Montezuma, Iowa 50171
Mfg. Suggested Retail Price	$24.95
Available From	Both Mfg. & Retail
Wingspan	78 Inches
Wing Chord	9 Inches
Total Wing Area	620 Sq. In.
Fuselage Length	41½ Inches
Stabilizer Span:	22 Inches
Total Stab Area:	110 Sq. In.
Recommended Engine Range	NA
Recommend Fuel Tank Size	NA
Recommended No. of Channels	2
Rec. Control Functions	Rudder & Elevator
Basic Materials Used In Construction:	
Fuselage	Balsa & Ply Doublers
Wing	Balsa
Tail Surfaces	Balsa
Building Instructions on Plan Sheets	Yes
Instruction Manual	Yes (24 pages)
Construction Photos	Yes

RCM PROTOTYPE

Radio Used	Cox 3 Channel
Engine Make & Displacement	NA
Tank Size Used	NA
Weight, Ready to Fly:	31 Oz.
Wing Loading:	7.2 Oz./Sq. Ft.

SUMMARY

WE LIKED THE:
Ease of construction, excellent plans and manual, good quality materials, Good for beginners, good enough for old timers.

WE DIDN'T LIKE THE:
Found no faults.

Riser is a Two-Meter sailplane designed by Bill Fleming, and kitted by Sig Manufacturing Company of Montezuma, Iowa. It arrived in a sturdy carton measuring 7" wide by 2¼" high by 38" long, and had a great, full color photo of Riser in action --- which did nothing except whet our appetite for some building, and some flying. We noted that the large print on the label stated that this glider was "specially recommended for beginners," and it is with that thought in mind that we review this kit. But enough of the appetizers, let's take a look inside. We would be amiss, though, if we didn't first comment on another bit of information carried on the label. In bold print it says that in addition to the kit, the following items will be necessary to complete it: adhesives, covering material, No. 64 rubber bands, two or more channel radio system, and basic modelers tools such as modeling knife, pins, single edge razor blade, sandpaper, etc. If you think that this little notice is unnecessary, put yourself in the shoes of the brand new modeler, and we think you'll agree that Sig is right on target with this helpful statement. But, we promised we'd open this thing up, so let's do it.

We found Riser's wood to be packaged neatly, with good quality balsa and plywood in fine condition. Besides the one plan sheet 38" x 50", and a 24 page instruction manual, we found a complete hardware package that included nylon control horns, Tuf-Steel R/C links, hinge material, rods, screws, and a set of semi-flexible nylon tubing pushrods.

Construction:

Following the advice (printed in large black letters) we read and studied the manual and the plan sheet until we felt comfortable with each building sequence. We must say that the instruction manual is one of the best that we have come across. In its 24 pages we found 146 construction photos, each illustrating a particular building step. These photos are not only clear and sharp, they are large enough to really show what they intend to with the average size at around 2½" x 3½". Each photo is numbered, and the number corresponds with a written section that describes the particular part of construction that is illustrated. Sig has put a lot of thought into this manual, and we feel you might be interested in just a bit more on it. And, remember, this is a kit aimed at the beginner. First, we are told, briefly, of the radio system requirements. Next are some rules to follow. These are miscellaneous bits of good stuff, like how to remove die-cut parts from sheets, the use of a building board and the kind of material it should be (Cello-Tex type wallboard), the use of waxpaper over the plans so the glue won't stick your model to them, etc., etc. There is a good section on how to build and use a sanding block, and another on glues. The next 22 pages are devoted to the illustrated construction information which, incidentally, has two illustrated pages on covering the model using iron-on plastic film. If that doesn't tell you something about how detailed this manual is, consider that

it ends up with good solid information regarding the first flight, slope flying, and thermal soaring. And, yes, radio flight system installation is detailed very well, too.

Construction started with the wing, a conventional polyhedral, flat bottom airfoil job. The wing is built in two halves and then joined permanently at the center through the use of ply dihedral braces and epoxy glue. A full 78" wing is not the handiest thing to haul back and forth to the flying field, but not all that bad either. Unless you go by bike, moped, or motorcycle, transportation of the wing shouldn't be a chore --- at least we didn't find it so. Fuselage design and construction, like the wing, is straightforward and offered no problems. Through the use of balsa, ply formers, and ply doublers, Riser's fuselage was kept light and strong.

The on-board radio system installation is well-explained and illustrated, and there was plenty of room for all components. Control hook-ups and pushrod installation was simple and effective. Tail construction was also easy, being given 20 photos of step by step instruction in the manual. Lest we are misunderstood, we hasten to assure you that, yes, we did use the plan sheet, and found that it, like the manual, was exceptionally well-done.

Super-Jet and Devcon 5-Minute Epoxy were the adhesives used throughout. All in all, we found that Riser went together easily, and ended up just the way Bill Fleming and Sig intended it to --- strong and light.

Covering:

We covered the wings with white EconoKote, and used yellow and checkerboard trim sheet by Top Flite to dress it up. All trim was edged with 1/4" black striping tape by D.J. The vertical fin and rudder were also covered with white EconoKote plus the same trim decor as the wing. For the fuselage we stuck with the EconoKote, but opted for the cub yellow color for better visibility on those hazy, lazy, smoggy days of summer. The stab was also covered with yellow EconoKote, and trimmed in white and checkerboard. Riser does not have a bubble type canopy --- just a semi-flat hatch for access to the radio gear. We installed a "fake" canopy by cutting a piece of blue trim sheet so that it went across the top of the fuselage, and extended down aways on the sides. Black 1/8" trim tape around the edges set it off nicely.

Radio:

As we have already mentioned, there was adequate space for our standard size radio gear which, for the record, was the Cox-Sanwa three channel model, Part No. 8003-12.

Flying:

Hand gliding found Riser a tad tail heavy, so a small amount of nose weight (approx. 1 oz.) was added, and she rewarded us with a long, flat, straight arrow glide, and we knew all was in readiness.

We used a very tired hi-start and, because of necessity, found we were trying to fly on a fairly cool, early morning no-lift sort of day. Launch was no problem, and the climb-up was done with very little use of the elevators. Off the line at the top, we found Riser flew pretty much as we had expected --- and hoped for. Glides were very flat, and the craft could be slowed way down with good control retention. A little down trim gave us a fair turn of speed, and we began to appreciate, once again, the virtues of the old tried and true flat bottom airfoil. We won't tell you that we caught a thermal and stayed up 'til the batteries ran down, but we can tell you that if one had been around, Riser would have lived up to her name.

Conclusion:

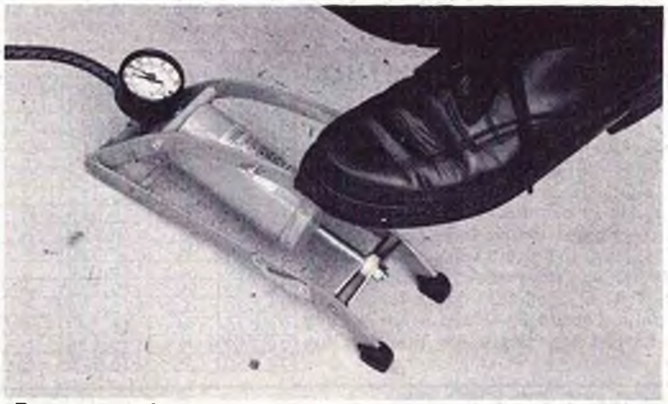
Because of Sig's aim at the novice builder and flier, we have tried to build and fly Riser with that idea in mind. How well has this kit fulfilled these goals? Well, we think that they have hit it right on. It's true that there are no radical design features, no innovative construction techniques --- just simple, basic design and building, and it's here that Riser fills the bill. Here is a good flying, easy to build sailplane that won't put a dent in the family budget. It can be taken on by the novice builder-flier with confidence --- and would be a delight to any "oldtimer" we know. □

HERE'S HOW

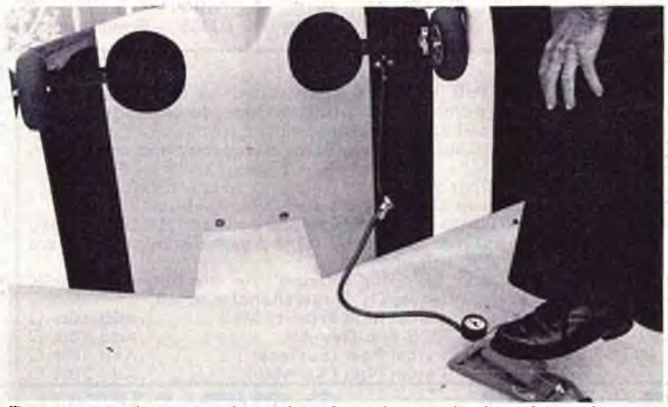
By Jerry Smith

Compact, heavy duty, high pressure foot operated air pump inflates up to 100 psi. Excellent for filling retractable gear air tank. Inexpensive too.

Handy gauge provided with pump monitors tank pressure. Outer ring of gauge rotates providing reference arrow for desired pressure.

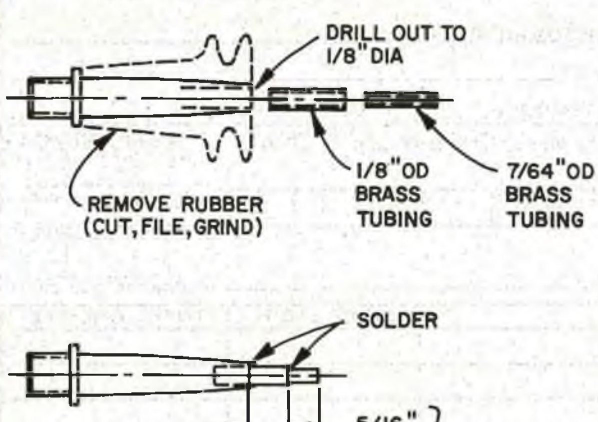


Easy to use. Just step on it. 6 or 7 quick pumps and the tank is full.

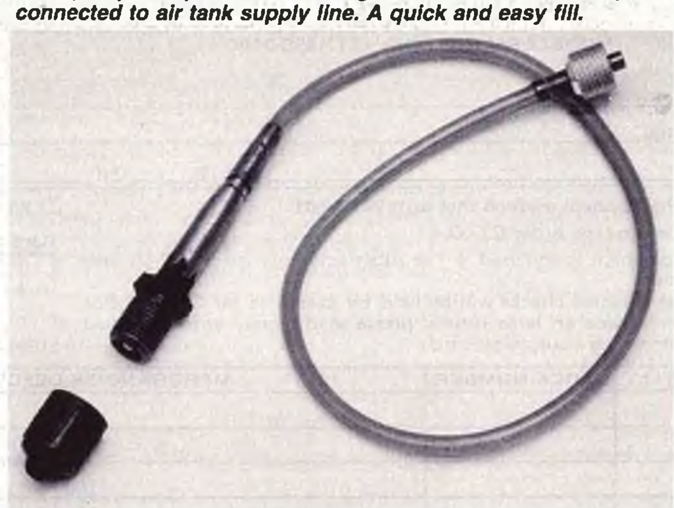


Foot pump in operation showing thumb lock valve adaptor connected to air tank supply line. A quick and easy fill.

MODIFY AS SHOWN



FITTING READY FOR HOOK UP



Modified automotive tubeless tire valve stem mounted on air tank supply line.

AUTOMOTIVE TUBELESS TIRE VALVE STEM

Every once in a while we, as modelers, run across a non-modeling related product that does the job better than anything the hobby market has to offer. In this case I think it is worth tauting. The idea was sent to me by Dick Barbosa of Littleton, Colorado. Dick is one of those innovative, avid RC'ers with a very active mind who is always questioning and saying to himself, there must be a better way. In this case I believe he has found it.

Basically, the idea relates to filling a retractable landing gear air tank with a high pressure foot operated pump. So what, you say! What's so great about this pump? Is it any better than a can of freon, a hand pump or my

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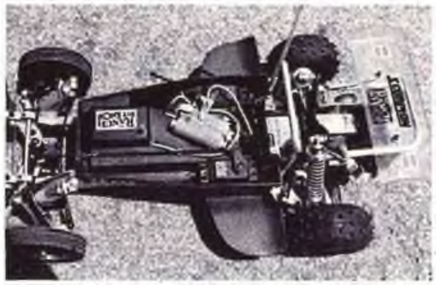
OFF-ROAD RACING

Gene Husting

There's a saying among mechanics that the race is won in the garage, meaning that the very best driver still needs a good car to win. Mechanics feel car preparation is as important as a good driver, and winning drivers know how true this is. So Gil Losi Jr. spends painstaking hours setting up his cars to handle good and be very reliable. When his car is put on the track, it's ready to race.



Gil is currently racing a Cox Scorpion car. The immaculately prepared car features Associated racing shocks on the front end, Kraft radio, Parma twin barrel resistor, Kyosho rear shocks and Checkpoint motor.

The hottest driver of off-road cars in Southern California, would have to be Gil Losi Jr. Gil just won both the Modified and Open classes at the big Score Off-Road Show, which is the biggest off-road race in Southern California. Gil didn't just happen to be lucky enough to win, he totally earned both wins with meticulous car preparation and an uncanny driving ability developed through countless other race wins leading to this race.

Twenty year old Gil Losi Jr. starter racing about four years ago, quite by accident. His dad, Gil Losi Sr. bought a Tamiya off-road car at the Mini Baja track in San Fernando Valley, which was run by Lou Peralta. Pops Gil thought it would be a lot of fun for him and his two sons, Gil Jr. and Alan, to play with. Well, it turned out to be so much fun, that it wasn't long before the Losi's were opening up their own off-road track in Colton. This lasted for a couple years when Gil Sr. heard that the Thorp track was going on sale in Pomona.

The Losi's bought the raceway and changed the name to the Ranch Pit Shop. An off-road track was immediately put in behind the 1/8 gas asphalt track. This is a fantastic off-road track with a very large covered driver's stand and a super lighting system for weekly night races, which has become very popular, in addition to the weekend racing. The whole family literally built the track by hand while Mom, Janet Losi, ran the well-stocked R/C car sales room. I think she actually runs the whole business, because every time I've been to the track all the guys are out racing their cars. I can just hear my wife, Midge, saying, "Well, who do you think runs your business?"

Gil started with the Tamiya off-road car, then last year switched to the Cox car, then an RCH prototype car and then back to the Cox car. He says the Tamiya car is more reliable and easier to drive, but that the Cox car is a faster car.

When Gil was asked what kind of advice he would give to new drivers he said they should learn to drive before driving too fast, and you must learn to pass before you can start to win. Having watched Gil in a number of races now, in off-road, as well as 1/8 gas and 1/12 electric, I would have to say that he is a very smart racer, who has learned patience in racing. Nine out of ten racers seem obsessed with the notion that they just have to beat the guy they're racing to the next corner at all costs. They can't wait for the 2nd or 3rd corner, it has to be the next corner. Watching Gil race with off-road, gas, or electric, he never overshoots a corner, he always seems to shut off at just the right point for the next corner, he uses just enough power to take the inside line around a corner and the car never looks squirrely. In other words, he never **looks** fast on the track. Some people think you can't be going fast if you're not out of shape halfway around the track. Gil sure proves this theory wrong.

Another thing that most of the truly great drivers are good at, Gil included, is passing. Gil mentioned that beginners should learn to pass before they can learn to win. Actually, there's the finesse type passing with no car contact, and then there's the banzai charge pass at the next corner, which generally entails running into the back of, the side of, straight through, or under the car in front of you. This obviously seems to be the most popular method and is, of course, the reason we have a black flag rule.

I've heard people say Gil is the luckiest racer they've seen. If you call apexing the corners correctly, using the correct amount of power and brakes, passing safely and winning races — luck — well, you're entitled to your opinion, but I call Gil's winning performances pure skill, which takes many hours of preparation and practice to achieve. It's true, he does have more track time than the average racer, but you'll also find that all winners have more track time than the average racer. It takes a lot of work to look lucky.

The first time I actually noticed the Losi's was at a 3 hour enduro race at

The Tamiya is still the most popular car. This one features Kyosho shocks, custom polished aluminum nerf bars, polished wheels, special knobby rear tires.

Some racers have it made in the shade. This racer uses a canvas covered flat bed truck for his super clean pit area.

Do you recognize that guy on the left? That's Arturo Carbonell. He was here for 1/8 gas practicing, but this day was off-road racing, so he thought he'd give it a try too. Next to Art is Cory Barana, publisher of Competition Plus magazine.

One of the reasons off-road racing is so popular with the spectators is that there's always a lot of action happening. Right from the start it's impossible to tell where that other guy is going.

Down the straightaway and into the sweeper the cars dirt track it through the corner. There's six cars there, can you see them?

Out of the sweeper, through turns 2 and 3 getting set up for the jump.

Thorp Raceway a couple of years ago. I was fortunate enough to be a member of the winning team along with Rich Lee and Chuck Phelps, but I remembered this Thorp car that was running along in 3rd place without missing a beat. These guys were doing a super job and I didn't even know who they were! After the race I told Gil Sr. how impressed I was with their performance. Little did I know at the time how much driving talent there was in this family! Gil Jr. said he thinks his brother, Alan, has more pure driving talent than he does. However, Alan's interest has been more into skateboarding where he has been a National Champion and even had a production skateboard named after him. I've seen some of the things

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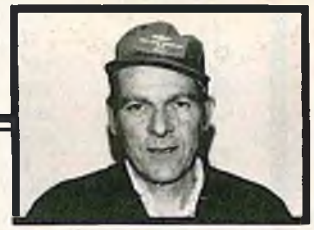
In a close race you take the jump flat out and hope the car lands on all four wheels because you've got an immediate right hand turn to make yet.

BIG IS BEAUTIFUL

Dick Phillips



Eric Miller, three year old grandson of builder Dick Miller, pretends to prop Grandad's half scale Pitts. Good looking machine weighs 48 pounds.

A three year old's paradise. Eric Miller fantasizes about being a Pitts pilot. He neither flies nor rides in model, of course. More details on the model in text.

Nobody knows everything. Unfortunate, perhaps, but true. I'm no exception of course and it bothers me from time to time. Why, well, I know there are all kinds of neat materials, methods and ideas out there that would work great in some area of modeling and part of a columnist's obligation is to discover, invent, contrive or develop some of these "hidden" things for the benefit of all of us.

That preamble leads me into telling you about a material someone found and passed along to me. I usually make notes on this sort of thing, but, in the crush of the exhibit hall at Las Vegas last October, I didn't and, therefore, can't credit whoever it was who passed me a small sample of a material called Gatorboard. My apologies to whoever it was!

Regular readers know I have long advocated the use of a material called Fome-Cor® which is a styrofoam center, faced on both edges with either kraft paper or artists board. It's sold in art stores and by people specializing in display advertising and Gatorfoam should also be available from these same sources.

Gatorfoam is a product of International Paper Co., and is a similar material to Fome-Cor® with an important difference. Gatorfoam, as its name implies, is faced with a tough skin made from resin impregnated wood fibres and it is tough! The paper faced board will dimple under pressure and the dimples stay there. Gator foam, on the other hand, will dimple, slightly, and the dimples all but disappear when the pressure is removed. The surface is not absolutely smooth having a slight texture to it but this is a very minor problem from our point of view. The board itself is a good deal stiffer than Fome-Core® and comes in a variety of thicknesses. The two sizes we are most interested in are 3/16" and 1/2" as they would fill the bulk of our requirements for a tough but light material from which to make wing ribs, formers and so on. The material may be painted with a variety of paints. (The foam will dissolve in oil based solvents and gasoline, so protect it from them.)

Adhesives which may be used include several we already use, plus polyvinyl Acetate, Dextron and contact cements. (As always, read the directions on any chemical product and exercise whatever care is indicated.)

Thicknesses available are: 3/16", 1/2", 3/4", 1", and 1½". Cost of a 4 x 8 foot sheet here in Canada is quoted at about $50.00, likely a good deal less in the USA. Even at $50.00 for a full sheet, compared to a similar quantity of balsa, it's got to be a bargain.

If you suspect Gatorfoam may be the answer to some of the higher costs of building large models, check around your area, you may be able to locate a supply of the material close to home. If, however, your local artists supply or display advertising firms can't supply you, drop a line to Cheryl

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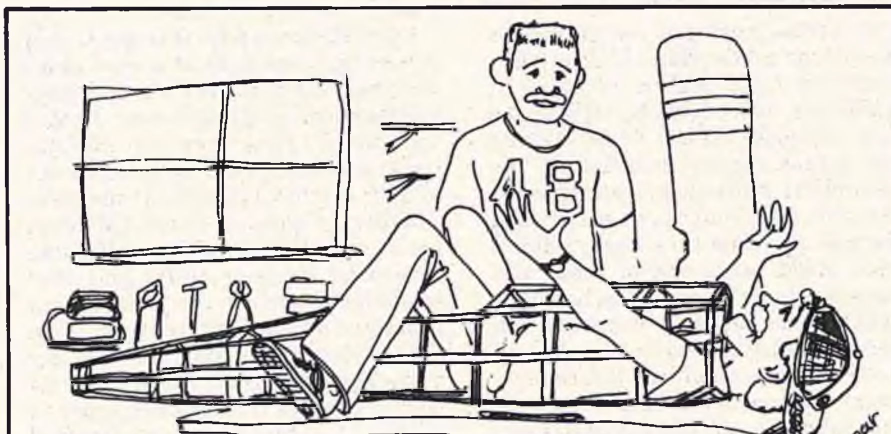

"I just got carried away, I guess!"

RAModels Redundant Battery System mentioned in text. Item should be on the market as you read this. A bit more expensive than others of the type, the Battery Backer needs only four cell packs rather than the five cell packs required by others.

3/16" Gatorfoam from International Paper. Material has tough plastic skin over styrofoam core. Excellent building material with greater strength than Fome-Cor® and other similar materials. More in text.

New release from Roush Manufacturing. Cobra 2.3 engine on the left and their new Cobra Jr (1.3 c.i.) on the right. Cobra Jr is similar to the Kioritz but produces 1.5 hp and weighs only 2.5 pounds. Initial testing indicates very fine performance. Cobra is $149.95 and the Jr $159.95 from Roush.

Jones, International Paper Co., Uniwood Division, P.O. Box 5380, Statesville N.C. 28677, and ask her to send you a sample of the material and a list of dealers in the U.S. and overseas. Only fair you should send the nice lady an SASE to facilitate the return. Put a little extra postage on the envelope as the list is fairly large — tell her Dick sent you! I'm quite impressed with it as there is a dealer close to home, I'm going to have a sheet of it on hand. Unfortunately, my dealer doesn't stock the 3/16" material which is what I would rather have but I'll settle for the 1/2" and try it out. They list 75 dealers in the U.S., so you shouldn't be too far from one of them.

As added proof that nobody knows everything all the time, I had a letter recently from Ralph Warner of RAModels, Inc. (4736 N. Milwaukee Ave., Chicago, Illinois 60630) taking me to task for not mentioning his redundant battery system when I sounded off about how great such systems are some time back. I didn't know RAM made one of these and suggested to Ralph that if he had been right on the ball he'd have told me about it sooner. However, they do, and I have ordered one which I'll detail in a future column, after I have seen it. They call theirs the Big Model Battery Backer and it sells for $49.95 which is a bit stiffer than other similar products on the market.

One difference with this one is that it uses only one pack at a time and I assume switches over to the other un-used pack when necessary. Most of the others I have seen run off both packs simultaneously and cut one out of the circuit should either fail. Another difference is that RAM's does not require the use of five cell packs according to their claim and that would mean you can use your present packs just adding an extra pack when the system is in use. It was my understanding that these systems needed the five cell packs in order to provide an output voltage as required by the RX as they drop the voltage in

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their own (redundant battery system) circuitry. With the other differences, the RAM system apparently does not require the fifth cell. I have asked Ralph to clarify this for me and will pass it along to you.

Ralph tells me their decision to produce this item was prompted by their concern that other systems could not deliver a stable and adequate voltage to systems using the larger (and therefore higher drain) servos. The RAM Big Model Battery Backer is claimed to be able to do this reliably.

RAM has quite a stable of products in addition to the one mentioned. Several lighting systems for both conventional sized and large models and rotating strobe beacons are among the offerings detailed in their catalogue sheets. These items are very light and would not even show up in the operation of a small model, let alone a large one. Drop them a line and an SASE for more information. Tell Ralph that Dick told you!

What with all the many products coming on line continually, it's no wonder you can't keep up with it all. I go to Toledo every spring and even that, as complete as it is, doesn't give you the whole story, not to mention that the mind has a hard time absorbing all that good stuff in such a short time.

I have been riding a little flack lately about my use of Knox gelatine as a sealer for the Dacron material I use in covering large models. Not that there is anything wrong with the material or the way I use it, the flack has been about using food-stuffs in model building. One smart aleck friend (possibly ex-friend) has suggested I try using cake icing as a filler and if it doesn't work, the failure could always be eaten as a picnic lunch at the field. There were a number of other suggestions all about as silly, so I won't bother repeating them here!

There is always the temptation to use more of an item than recommended. I guess it's the old theory that, if an ounce is good, then two ounces gotta be twice as good. It may work in some things, but it doesn't in others and the use of the Knox gelatin as a sealer is one where two coats is not twice as good as one coat. When the Knox is brushed onto the surface, one coat is all you want to use, two coats makes too thick a surface (although it isn't all that thick, really) but it will pull the paint right off the material when you mask it. Only use one coat, that's all that's needed.

Those of you whose experience goes back to the so called "good old days" of free flight who used Knox gelatin under dope will remember that too much of a good thing will cause the

dope to flake off the surface. Don't do it, it isn't needed and will only create problems for you.

Those of you who have been following along for a while have likely detected that I am not too keen on the monster models being built and flown around the country. I suspect that one of the reasons some of these are built is to attract attention and to get space in magazines. That's one of the reasons I haven't mentioned some of the really **big** models being built and flown. I'm still not convinced that our radio gear (even with two servos per elevator) is adequate to the job of flying these big brutes.

I also doubt that much work or research has been done as to the adequacy of most of our servos to the sort of job some of us are using them for. One writer recently published a lengthy list of servos "recommended" for use in our big models and I was a bit amazed at his temerity. I would bet that he had not personally tested half of them and to make such a recommendation based on manufacturer's specifications can be dangerous and, if based on hearsay, could be suicidal. Even in our hobby, not all of the suppliers of all that good stuff we use are totally honest when they advertise their wares and even those who are may select that information for publication which makes them look good and not publish that which raises doubts.

I have always been a bit reluctant to accept the manufacturer's published torque figures and often wonder how they manage to obtain them. I wonder a bit if they are derived from his street address, multiplied by his age, divided by the age his wife will admit to and then converted, loosely, to ounce/inches?

What I am suggesting here is that you do your own checks on the servos you are using, keeping in mind the type of model being flown. It's pretty obvious that the Sig Quarter Scale J-3 won't put the load on a servo that a Cap 20L with a real screamer of a power plant will. A simple test that I find quite useful is to take hold of the trailing edge of the elevator, with the model sitting on the shop floor, feed in full down and see if the servo(s) will easily lift the tail off the floor. This will also show you how much movement will be imparted to the elevator under some significant load. That is, if your control linkage has a lot of "slop," the tail won't lift very far as the servo travels. It will also let you know, from the sound of the servo operating, whether or not that servo is too heavily loaded and in danger of stalling. Sure it's a tough test, but so is flying.

I have not used all that many servos,

but the ones I do use satisfy me that they are capable of doing the job required and I fly with confidence that there are no surprises in store for me.

I used to use the EWH servo which is no longer available. This was sold through EWH in Texas and was actually the Jomac servo from the people who made the R/C cars. It is still around, but not all that readily available. It had a good deal of power and I still use the ones I did manage to get my hands on. Its electronics was on an external board and that was a bit of a nuisance as you had to make provision for the receiver, the electronics for the servo, and the servo itself in the model. It has an advantage as well. The servo was connected to the electronic package with a "one way" plug-in connector. The "one way" part of it could be forced together (minimal force required) the wrong way around and that reversed the servo. Very convenient for those times when you were working upside down and your brain was still right side up!

Royal Electronics now have what they tell me is basically the same servo but now with the electronics inside the case which is a bit more convenient, but now without the convenient reversing. (Make sure both brain and model are the same side up!) I have four of these which I have not yet flown, but they do seem to have the necessary jam to do the job and I feel they are among the right ones for the job we want done.

Royal is still making good progress with the radio they are designing specifically for our large models and I am looking forward to being able to tell you more about it in a future column.

One of the problems they encountered when approching this area of radio manufacture was the significantly greater load placed on the electronics by the higher current draw of our "normal" radios. Design practice had not provided for the greater current flow and it just could be that some of us flying more or less standard radios could have been on the thin edge of failure. They tell me they are designing to accommodate such problems and I look forward to seeing the first radio specifically designed to our needs. (At least as far as I have heard, I don't know of any other manufacturer who has taken this approach and that surprises me. We, the **big** builders are a growing segment of the market and one that has been neglected until Royal Electronics started the ball rolling.)

I should hedge that statement a bit as I now have on hand one of Airtronics Championship series radios with their new 94510 servos. The radio comes complete with a 1200 mah battery pack, and, what is really nice, a charger that is rated to charge that pack at a rate that provides full charge in the same length of time it takes to charge the TX pack.

The 94510 servo puts out a hefty 100 ounce/inches according to their spec sheet, and this is one I do not doubt. Several of my contemporaries here have tried to stop the servos from turning with their fingers, and, it can't be done. One local modeler who wasn't going to be beaten by a mere servo lost some skin off his fingers in the effort to stop the servo from moving. Oh, it groaned a bit, but it went where the stick was telling it to go and it took a small sample of epidermis with it when it went!

I have also used a couple of Royal Electronics' Maxi-Titans as well and, while they seem to do the job required, in a choice situation, I'd use Royal's RS150 servo. I have four of these and they perform well with the EK radios I use. (I have some reservations about doing this in light of Royal's findings about using heavy duty servos with standard radios, however, I have yet to experience any problem from that source.)

Servo selection is one place where the old saw about an ounce being good and two ounces twice as good does apply. I would rather have a servo doing the job for me that had a little too much power than one with a little too little!

One man who seems to be doing the right things with an extra large model is Dick Miller of Jonesboro, Georgia. Dick has a half scale Pitts he built from the same plans he used to build the full scale airplane. The model weighs 48 pounds, spans 104", engine is a 6.1 c.i. McCulloch turning a Grish 26/8 prop. Take-off roll is 75 to 100 feet. Servos are; 2 EMS Eagles on elevator, 2 Ace Atlas on aileron, 1 Ace Atlas on throttle and an Airtronics servo on a kill switch. Wing loading is 32 oz./sq. ft. which compares to 7 lbs./sq. ft. of the original. Construction materials used were spruce, redwood, white pine and lots of plywood. Judging by the construction details supplied by Dick, he followed original construction pretty closely and so has produced a model with a lot of strength and engineering of the original. Like me, Dick is no spring chicken and the age and experience combine to produce something properly engineered to be a safe flying model.

Dick sent along some photos of the model with his three year old grandson Eric sitting in the model. Eric does not fly in it of course and his grandad says he is a bit of a ham and as nice a boy as he looks. I'd bet that Eric spends a good deal of time with his grandad who admits to spoiling him a bit.

The point in all of this is that when a very large model is properly built out of the right materials, it can be as safe as anything flown. Dick Miller certainly seems to have the cart and the horse in the right places. Dick's AMA number is 740, so you know he's been around for a while. The Pitts is still in the testing stages and Dick has not attempted any severe aerobatics as yet. He says the big Pitts takes off as straight as an arrow "and about as fast" so, with the power provided and the wing loading as light as it is, it could be a very spritely bird in the air. Not to mention about as impressive as you are going to see anywhere. While the Pitts has been all but done to death in kit and plan form, at one half full size it should be a most impressive performer. No plan available other than the original right from Pitts, themselves.

Some new items from International R/C Specialties

Super Cable and Clevis — the long awaited product for the Quarter and Third scaler from International R/C Specialties. The Super Clevises are 1/3 larger than the standard clevis used today. What makes them unusual is that they are matched with their

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BALSAHOLIC

By Dave Thornburg or
By William Stewart Buckingham Smythe

"Well Champ, looks like you just bought the most incomplete kit ever!"

My name is William Stewart Buckingham Smythe. You can call me Bill. I am a balsaholic. This is the first thing I tell people about myself, see: I tell them, "I am a balsaholic." Because I am. And then I tell them something else: I tell them **I am not alone**. I have friends. I belong to Balsaholics Anonymous.

True, not many people know about Balsaholics Anonymous. So what? Isn't that what **anonymous** means, that not many people know about it right?

We meet at night, me and my friends, me and my fellow balsaholics. We meet in basements, in garages, in workshops. Everybody wears dust masks. This helps keep us anonymous.

We talk a lot when we meet, but we do not talk about ourselves. Oh no. We talk . . . about Balsa. We talk a lot, and drink a lot of coffee, but mostly we meet to hack at Balsa. Hack, sand, gouge, strip --- we give that old balsa billy-hell, see?

Balsa. It gets in our eyes, it gets in our hair, it makes little soft bulges in the corners of our pockets. Balsa. We love it. It has us hooked. You know why? Because balsa is **real**, see? We can get our hands on it. Balsa is something we can control, something we can carve, shape, bend. It gives us a sense of power. We can handle balsa. Everything else gets out of hand, runs amuck like Jake Tinback's bulldog. Not balsa. Balsa is our Friend.

Anything this good, you'd think everybody would want in on it, right? Ha. Tell that to my wife. She hates balsa. **Hates** it. Pure jealousy, you can't reason with it.

Look, I tell her from my workbench (carving, shaping, bending). Look, there's room for all three of us: you, me, balsa.

What about the kids, she says, voice rising. You always forget the kids.

What kids, I say (hacking, sanding, gouging).

Gretchen and little Bladder, she screeches. **Our** kids.

Oh, them. They're okay. Just keep 'em outa my balsa.

Blip your blipping balsa, she shouts. I wish to blip you had a whole blipping balsa tree right blip your blipping blipblip.

Articulate, my wife. Vocal. Majored in communications.

* * *

About balsa, my boss agrees with my wife. I don't know why. Maybe it's the sealed notes they send back and forth, in my lunchbox. My boss tells me my work is slow. Good, he says, but slow. He thinks maybe I daydream too much. Doodle. Sketch things to build out of balsa. Slow, he repeats, shaking his head. Good, but slow.

Speed, I inform him, is not everything. This I learned in school, tossing paper airplanes. More speed is not always better. Too much speed and everything goes haywire, runs amuck like Jake Tinback's bulldog. I explain to him slowly, carefully. Speed isn't everything. Balsa is.

* * *

If I could have anything I wished for, and only one wish, I would not waste my one wish on any of the usual things. No. I would not ask for eternal youth, or great wealth, or a three-digit AMA number. What I would ask for is this: I would ask for my house to be suddenly surrounded by a dense forest of balsa trees. Think of it! A yard filled with tall, slender trunks of Living Balsa! I could sell it and make a killing. Or I could keep it and make a kiln. I think I will keep it. Just imagine! Front yard, back yard, driveway, vegetable garden; all balsa.

Then "yard work" would take on a new and much brighter meaning.

"Yard work" would mean: harvesting a balsa tree. Sharpening the axe at dawn, honing it to

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razor-edge amid the cries of waking birds, the scurry of small animals in the underbrush. Strutting manfully, axe on shoulder, out to the edge of my forest to select a tree. The edge of my forest, of course, would be my neighbor Francis' property line. No matter. Francis sleeps soundly. He will not be disturbed by my "yard work."

I select a tree, and fell it with swift, clean strokes. It is a sixty-footer, and it falls slowly, majestically, arcing like a sick windshield wiper across the damp gray morning sky. It falls right in Francis' driveway. In fact, it falls directly across the hood of Francis' Ford Coppola.

Too bad, Francis.

That's what you get for all those remarks about "toy airplanes."

You shouldn't own a gas guzzler like that, anyway. Think of the poor people of the Orient. Think of the starving family of ten, who could live for days on the gasoline in your tank.

I could go on.

But duty calls. Before sun-up I must slash my initials into this noble, fallen giant and roll it into the thundering current of the river, there to float swiftly downstream to the waiting Mill. Where is my machete? Damn, still hanging in the family room. No matter, the river's dry anyway, till some of the neighbors up the street get up and start their sprinklers. Maybe I should just skip the river bit, and haul her around to the garage in the kid's wagon . . . These muthas are sure heavy before they're kiln-dried, ain't they? . . . You know, I always hated yard work anyway.

* * *

Escapists. That's what they call us balsaholics. Escapists. Avoiders. They think we're hiding from something, down here in the basement. They think we're hiding from our problems. They think we're hiding from Life.

They just haven't got the big picture.

Item: **There is no problem so large you cannot run away from it.**

They are not amused.

They fret about The Crunch. When The Crunch comes, what will you do, they ask. As balsaholics, we smile. We have faced The Crunch before. Usually after downwind turns. Yes, we know The Crunch well. We do not fret about it. If it comes, we will face it squarely, Hot Stuff in hand. If it comes.

Meanwhile, we hack, sand, gouge, strip. Meanwhile, we carve, shape, bend. Balsa. It gets in our eyes, our hair. It makes little soft bulges in the corners of our pockets. Balsa.

You're welcome to join us. No need to read the directions. Here's an X-Acto. Here's a spare dust mask.

Pull up a chair. □

POWER BOATING

Howard Power

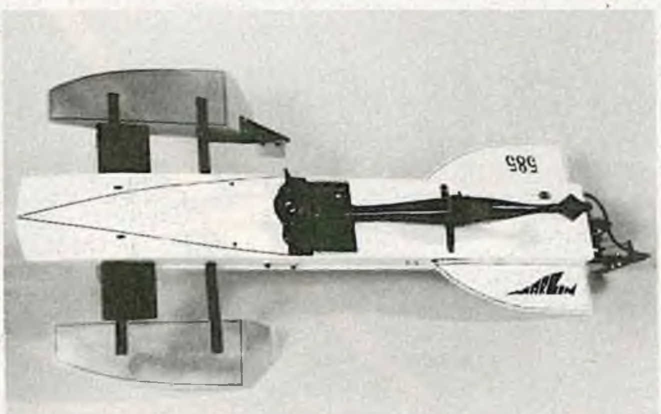

Photo 1: .60 powered Marlin Outrigger Hydro.

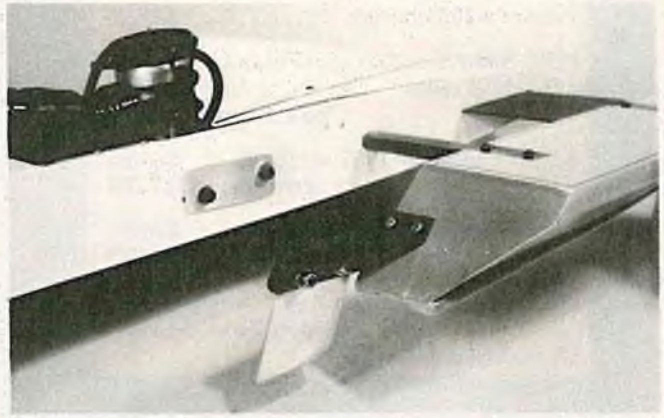

Photo 2: Marlin turn fin and sponson configuration.

This month we are going to discuss what most people consider the most exciting class of closed course model racing boats: the hydros. These boats are the fastest designs in racing. Their power is evident even right after launch when they are "grunting out" that big propeller hung on the back of the boat. As they attain a plane, the sound changes dramatically and these boats literally jump out of the water and accelerate to racing speed with tremendous acceleration. That twenty foot high rooster tail that arches beautifully many lengths behind the boat as it travels down the straight-away is enough to impress any spectator. The sight of a really fast hydro traveling down the front straight, followed by the sound of its rooster tail water drops showering the water in front of you as the boat rounds the turn, is part of what really turns me on in boat racing. Seeing four to six of these machines put up several walls of water as they go around the first turn together in a heat race has to be a crowd pleaser, to say the least. I guess that's why the hydro classes have been historically the most popular in racing and are the classes that I enjoy driving the most.

In this discussion I am going to limit myself to hydros used in competition around a closed course. The straight-away scene is another world that we may talk about at a later date. A good circle racing hydro, in my opinion, should have the following characteristics in their order of importance: Excellent turning performance, stability, acceleration, and speed. It's my observation that the ability to stay on the inside lane of the course while cornering is the most important aspect of winning races. It takes about a five to ten mile per hour speed advantage to pass someone on the outside. The only way to get by a good racer is to wait until he slides wide so that you can take the inside lane away from him. Let's face it, races are won and lost in the corners. The optimum circle racing hydro should have, therefore, excellent controllability in the turns, it has to be able to hold a line around the corner, and it should not lose a lot of speed when turning. Stability is important because, in racing situations, the hydro has to be able to cut across the wakes of other boats and it has to run in rough water conditions that always wait until race day to occur. Acceleration is very important coming out of a corner for obvious reasons. It is also very important to be able to "out drag" your competitors on the start so that you are the first boat into the first turn. It's a lot easier to win a heat when you are ahead instead of behind. In most racing, speed is synonymous with success, but in circle racing there are few that can achieve enough speed advantage to overcome a bad turning, unstable, or poor accelerating boat.

The most popular circle racing hydro boats are what are commonly called four point outrigger hydros. They characteristically have front and rear sponsons. The front sponsons are supported outboard of the fuselage or hull of the boat, hence the outrigger designation. The purpose of this configuration is to reduce hull lift and provide for a wide footprint for stability. Rear sponsons are usually mounted on the hull. These rear sponsons should only touch the water when the boat is launched and when it is slowedexcessivelyduring cornering. The purpose of the rear sponsons is to create lift to hold the rear of the boat up so that the surfacing propeller does not run too deep in the water at slow speeds. If that big wheel gets submerged it becomes very hard to spin and acceleration will be very poor. The rear sponsons also supply lift to keep the hull running attitude more level than if the rear sponsons were not used. Down the straights the rear sponsons do not touch the water and the boat has a less draggy three point suspension (the two front sponson riding surfaces and the propeller).

There are several designs suitable for racing in this class. Each part of the country seems to have its favorite. I have built and raced most of these commercially available designs. They all are good and have their own handling personalities. It became apparent, however, that my own driving skill (or lack of it) and personality did not fit any of the commercially available designs. Besides, everybody, sometime or another, decides that they can build a better mousetrap. I'm no exception. The result is the topic of this month's column: my attempt at the design of the ultimate circle racing machine. Before I could get started, however, I needed a really trick name. I finally chose the name "Marlin" because (you

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guessed it) the sailfish family are the world's fastest fish. My hopes are that the boat will spend most of its time on top of the water, not under it like its namesake! Now that the tough part was settled, I got down to the designing. A wise man once said that as soon as you come up with something new, somebody will recognize it as something that someone else has already done. The Marlin fits that description perfectly. The boat is not a radically new design but is an evolution and a refinement of some features found on the other designs available today. Photo 1 shows the top view of the Marlin and its outrigger configuration.

The heart of any hydro design is the sponson configuration. The Marlin uses an air cushion ride concept that was used first (to my knowledge) by Charlie Purdue on his "Boss" hydros. The sponson is designed to trap a cushion of air between twin wedge-shaped running surfaces on each sponson bottom. This reduces wetted area and spray production which results in a planing drag reduction. To maintain an air cushion, the sponson must ride at a lower than usual angle of attack and the sponson bottom surfaces must be parallel to the water surface when viewed from the rear. No sponson dihedral is used and the planing surfaces do not round off toward the front of the sponson as they do in the more conventional sponson designs. The air trap tunnels can also provide side area against which water can work when turning. To reduce speed loss in the turns the air cushion must be maintained. It is important that the running surface angle of attack be constant and the sponson mounting system cannot allow flexing such that the ride surfaces are not flat with respect to the water surface. The sponson must be rigid but light. For these reasons the sponsons are constructed using foam cores over which thin plywood sheeting is epoxy glued. The sponsons are supported by rectangular aluminum extrusions that Ed Hughey has used for many years on his very popular designs. The sponsons have a very simple internal plywood mounting structure in which blind mounting nuts are imbedded. Each sponson is fastened to the support extrusion by two 6-32 bolts and the extrusion is held to the fuselage by two more 6-32 bolts. This mounting system is very rigid and is simple to replace if damaged. It provides for easy adjustment of the sponson angle of attack and dihedral by simply placing thin shims between support extrusion and the sponson mounting surfaces. A large turn fin is mounted behind the right sponson inside

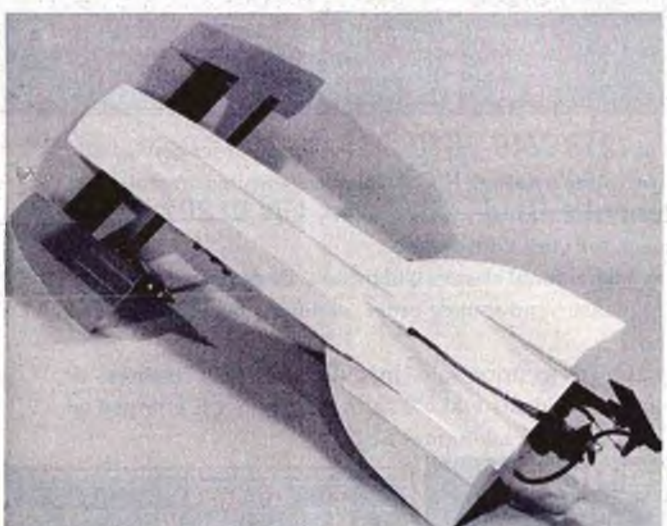

Photo 3: Bottom view showing fuselage tunnel and sponson air cushion tunnels.

Photo 4: The Marlin running clean and fast.

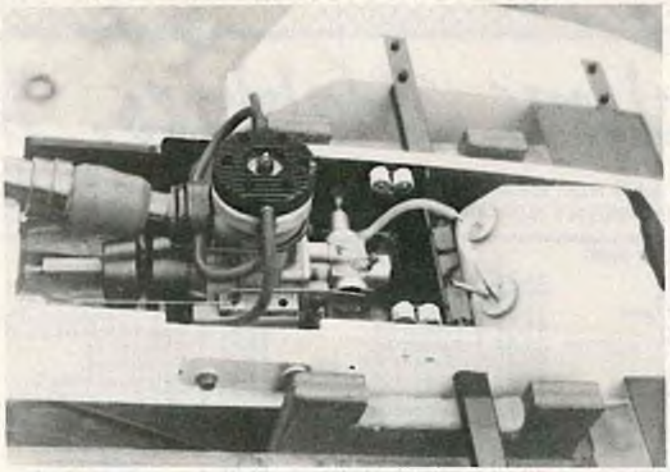

Photo 5: Engine and fuel tank compartment.

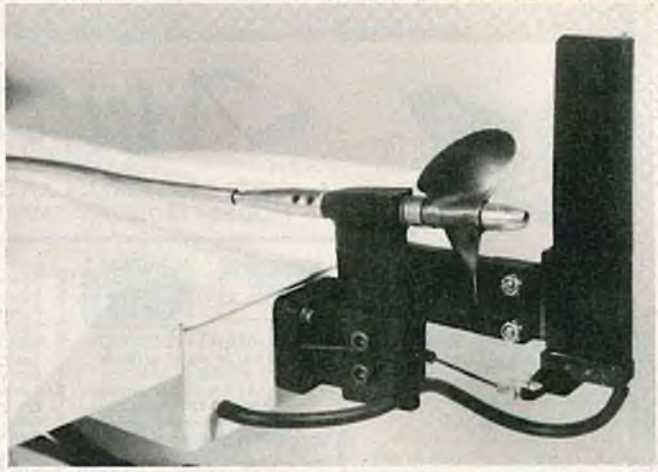

Photo 6: Rear view showing flex drive hydro hardware.

surface. This turn fin location is close to the boat Center of Gravity and has proved to be a most efficient method to keep the boat from sliding in the turns. The combination of the air cushion ride and turn fin location is very important in the turns. Photo 2 shows the sponson and turn fin configuration. The boat, when set up properly, corners smoothly and tightly with almost no apparent speed loss as if it were on a tether around the bouys.

Between the sponsons and the fuselage an inverted airfoil is mounted on the front aluminum sponson support extrusion. This airfoil streamlines the extrusion to reduce drag and it also provides downforce that increases with boat speed. In general, conventional outriggers have a tendency to blow off the water at high speeds because of increasing sponson lift with increasing speed. In the past, the standard fix was to mount bent-up sheet aluminum pieces on the sponson mounting brackets or on the sponson tops to push the nose down. These sheet metal pieces work but they are very draggy. The inverted airfoil and sponson combination (if properly sized) of the Marlin creates a system which is more aerodynamically neutral in lift and is very low in drag. These features prevent high speed blowoffs with little drag penalty. The results, in my experience, have been a faster, more stable boat.

To achieve excellency in turning, a hydro must be light in weight to minimize the centrifugal force developed when the boat is in the turn. The turn fin and rudder have to develop forces that exactly balance this centrifugal force. High forces result in high drag, hence the weight of the hydro is very important. The Marlin's construction is very strong but the structural design has lightness as a very important design constraint. When powered by a 7.5cc engine the boat will weigh just under seven pounds. An 11cc powered Marlin weighs in right at eight pounds. Although the boat is generous in size, its weight helps insure that turning performance and acceleration are excellent.

Another important factor is the vertical Center of Gravity location. As the boat turns a corner, a high Center of Gravity location will produce a tendency for the boat to lift the inside sponson. For this reason the vertical Center of Gravity should be as low as possible to reduce this tendency. The Marlin's fuselage is, therefore, suspended close to the water surface in the planing attitude. The fuselage bottom has an air trapping tunnel that runs the length of the fuselage. The fuselage bottom is not flat but has a nontrip surface on each side of the central tunnel. This fuselage bottom design was first used by Tom Prezenka's Wing Ding hydro. The Marlin's nontrip bottom surfaces overlap the vertical fuselage sides 1/8" to insure that any water that comes off of the nontrips is ejected away from

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the fuselage sides. This reduces drag in conditions when the bottom is wet. The central air tunnel decreases the suction caused when the bottom is wet so the boat can easily free itself from the water surface if it should contact it. Photo 3 shows a good view of these features.

The fuselage profile is symmetrical except for the area in front of the engine compartment. In this area a streamlined cowl is used to help increase downforce production as speed increases. This cowling design decreases drag and reduces the normal nose-up pitching tendency of an uncowled boat at high speeds. It also keeps water from being ingested when you run through another boat's rooster tail. The boat is designed so that the fuselage runs with its line of symmetry parallel to the water surface. In this attitude the fuselage contributes very little lift.

Rear sponsons are mounted solidly on the fuselage. They are constructed using the same styrofoam core and plywood sheeting method used to construct the front sponsons. These sponsons are designed to produce increasing lift as speed increases. Since they are mounted aft of the Center of Gravity the sponson forces are stabilizing factors when the boat tries to change its attitude. The Marlin's rear sponsons have been reduced to size that reduces drag caused by front sponson spray impingement.

Photo 4 shows the Marlin in its natural habitat. This shot gives a good view of the fuselage profile and cowl design. The sponson shapes are also very evident. The boat, when trimmed properly, rides cleanly with little spray production, the sign of a fast design. The rear sponsons are well out of the water and the boat is riding on its prop and front sponsons.

The entire section aft of the engine compartment is used to house the radio gear. Any hydro that is capable of speeds greater than about 50 mph should have dual rudder servos. We used two Futaba FPS-7 servos that have a total of 84 inch/ounces of torque available. In addition, I always use a five cell battery pack in my hydros to further increase available torque and servo speed. When the boat hits the corner at full speed, you need all the servo power you can get to turn the rudder reliably. The rudder linkage should always be arranged so that the servo pulls to turn right. In this way the linkage does not have a compression load which tends to buckle the linkage.

The receiver and battery pack are placed in a waterproof bag and are wrapped with foam rubber for vibration protection. These components are positioned as far forward as possible in the radio compartment to keep the weight on the prop light and to reduce the moment of inertia about the vertical axis.

The radio compartment has a large rectangular lid which mates to a ledge built into the top sheeting. The lid is held on by 3M clear plastic tape. Messy seals and thousands of screws are not needed to keep the water out of the radio when you use this method.

Photo 5 shows the boat's engine and fuel tank compartment. The boat has adequate space for any .45 to .80 sized rear rotor racing engine. Even the more lengthy rear drum valve engines will fit with ease. The engine is mounted upon any of several commercially available metal motor mounts that are 5" wide. Steve Muck, Octura, or Marine Specialties mounts will work. I, personally, like using an Octura Swift Switch or Steve Muck mount because the basic frame can remain mounted and several engines can be used by simply changing the mounting inserts. In this way one hull can easily be powered by several engines so that you can race in at least three classes. The cowl is held down by a single pin mounted at the front bulkhead and by two kitchen cabinet door clamps seen mounted between the motor and the fuel tanks. Twin eight ounce Pylon plastic fuel tanks are used to provide plenty of fuel even if you should have to run extra penalty laps. The tanks are set up so that the tank on the outside of the turn will remain full and the inside tank will empty first. This reduces any chance of fuel foaming and provides for a constant fuel pressure seen by the carburetor. In this way motor runs are very consistent.

Photo 6 shows a rear view of the boat and its flex drive hardware. This hydro uses a flexible 3/16" drive cable housed in a 1/4" O.D. brass tube. The cable is clamped at the engine end by a hex engine nut and set screws. The other end of the cable ends with a cable ferrule that is Sta-Bright silver soldered to the cable. A 3/16 stub shaft passes through the strut and into this ferrule. The other end of the stub shaft has the normal drive dog, propeller and streamlined prop nut mounted upon it. Using this system the expensive prop remains with the boat even if you break the flex shaft.

The rudder is mounted as far as possible on the left side of the hull. The rudder blade is mounted behind the propeller to minimize cavitation due to rudder interference. The rudder blade is mounted on a block so that its fore and aft angle can be adjusted. This forward or aft rudder rake angle is used to help adjust the riding attitude of the boat in the corners.

Photo 3 clearly shows that the strut is mounted an an angle of five degrees to the left with respect to transom when looking from the top. This strut offset corrects the right turning tendency of the boat caused by the surfacing propeller. As the surfacing blade of the propeller enters the water it pulls the rear of the boat to the left. As a result, the boat's path would be an arc to the right if the rudder was in the neutral position. It is less efficient to trim out this turning tendency with rudder deflection than to offset the thrust.

You will notice that the brass flex shaft housing tube is bent in an "S" shape so that the ferrule end of the cable approaches the stub shaft in a straight line. This insures long cable life and it actually reduces the drag between the cable and its housing. The strut is adjustable in depth and in angle just by loosening two bolts. All these adjustments enable the boater to adjust the trim of the boat at the lake without having to change the hull configuration. If the boat tends to ride tail down and tries to fly off the water, the boater can easily deepen the strut depth or increase the strut angle downward to raise the stern. If the hull "bucks" down the straights, the strut depth or angle can be reduced until the boat glides level without blowing off. This adjustability lets you trim the boat for just about any propeller your motor can turn. Hydros with straight solid drive shafts do not have this ease of trim characteristic.

I hope that you have enjoyed reading about the Marlin's design features and maybe you can use some of these features to make your own ultimate racing machine. For those of you who would like to duplicate this design I have made a limited number of kits available for ninety dollars. The kit has all pre-cut plywood parts, sponson brackets, foam parts, fiberglass cowl, full size plans, complete assembly and running instructions, but is less hardware. A universal hydro hardware kit will be available soon as some minor tooling problems can be cleared up and a cost determination can be made.

★

I received the following letter which outlines a procedure, if it works, that every scale boater can use to decorate their boat. It's great to receive these ideas and techniques from you readers. I encourage you all to write to me and let me know any tricks you use when building or running your own boats. We all can learn from your experiences.

Dear Howard:

I am writing in what I hope to be an answer to Daryl Tulberg's problem (RCM, May 1983). He is searching for Anheuser-Busch Eagles. I do not know if decals are available but I do have a

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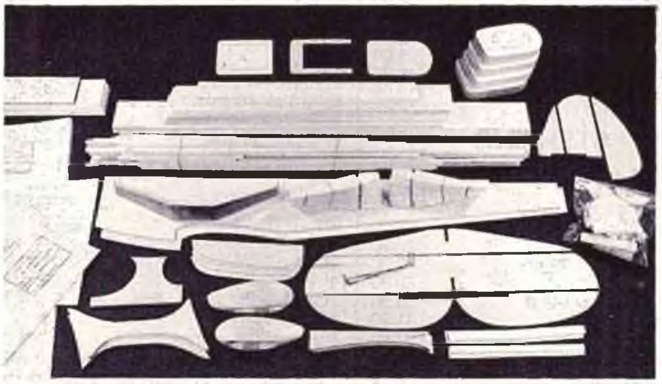
RCM PRODUCT REVIEW

Indy R.C. Sales, Inc.
INDY BIPE



SPECIFICATIONS

Name	INDY BIPE
Aircraft Type	Sport
Manufactured By	Indy R/C Sales,Inc. 10620 N. College Indianapolis, Indiana 46280
Mfg. Suggested Retail Price	$98.50
Available From	Both Mfg. & Retail
Wingspan	51 Inches
Wing Chord	8.5 Inches
Total Wing Area	865 Square Inches
Fuselage Length	41 Inches
Stabilizer Span	22 Inches
Total Stab Area	137 Sq. In.
Mfg. Rec. Engine Range	.45-.60
Recommended Fuel Tank Size	16 Oz.
Recommended No. of Channels	4
Rec. Control Functions	Rud., Elev., Throt. Ail.
Basic Materials Used In Construction:	
Fuselage	Balsa & Ply
Wing	Balsa & Ply
Tail Surfaces	Balsa
Building Instructions on Plan Sheets	Yes
Instruction Manual	Yes (6 Pages)
Construction Photos	No

RCM PROTOTYPE

Radio Used	Futaba FP7FG
Engine Make & Displacement	Como .51
Tank Size Used	Sullivan 12 Oz.
Weight, Ready to Fly:	108 Oz.
Wing Loading:	18 Oz./Sq. Ft.

SUMMARY

WE LIKED THE:
Overall quality, plans, flight performance, appearance.
WE DIDN'T LIKE THE:
Limited hardware (very minor).

Indy R/C's new bipe kit was designed by the Foxworthy brothers to offer outstanding flight performance and ease of alignment during construction. Indy R/C will use the Indy Bipe as a flagship to introduce their new line of quality kits.

In a very well-packed box measuring 42½ x 11¼ x 4¼, you will find a totally machine-cut and sanded kit. The kit that we reviewed was a hand-cut prototype, with some parts requiring a light sanding to get a good match to the plans. Overall, the wood quality and packaging was excellent.

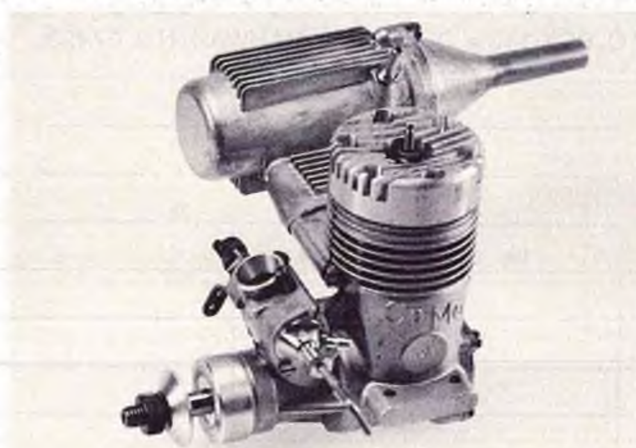
The hardware included consists of aluminum gear with bolts for the axles, tail wheel assembly, aileron torque rod set, and wheel pants. A complete parts list of required hardware is included in the instructions.

Construction:

Two well-drawn plan sheets measuring 53" x 30½" and 58½" x 30" are all included, as well as an excellent set of instructions. These plans were drawn and used originally to scratch-build and have all surfaces, bulkheads, and both wings completely drawn. A good set of plans is a great aid to navigation.

Both wings build directly over the plans using 3/32" balsa ribs, 1/4" square balsa spars with 3/32" balsa sheeting and capstrips. The top wing pylon mounts are indicated on the plan as 1/4" ply, but 1/8" ply is provided in the kit. The 1/8" ply is more than strong enough the way it mounts, the 1/4" would be bullet proof.

The bottom wing includes built-up ailerons and 5/8" dihedral per tip. The top wing is built flat with some



differences in the locations of mounting points, but otherwise identical construction. The top wing could easily accept a modification to include ailerons for those of you who like an airplane that rolls fast enough to become a blur. We used Goldberg Super Jet to speed up the assembly time.

The fuselage is constructed using 3/16" balsa fuselage sides, 3/16" balsa bulkheads, and 1/4" ply for the firewall

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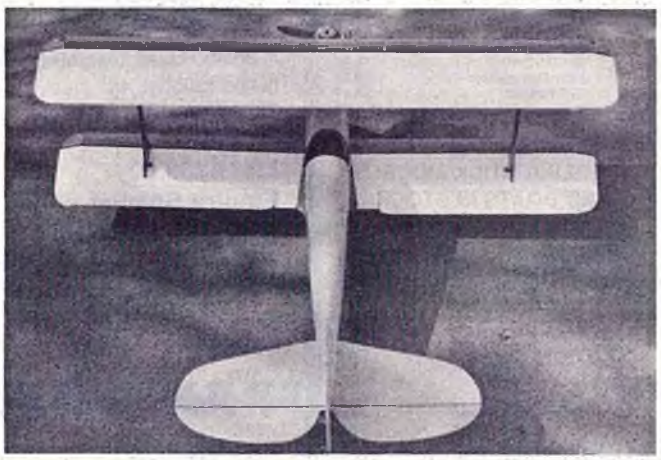
and landing gear mount. The fuselage is basically a box with the upper deck added later. The center pylon is well-braced and easy to align before the upper deck is sheeted using 1/8" balsa. The cowl is built using four 1" balsa rings and cut and shaped to fit your engine and muffler combination. The method of attachment is left to the builder. We cut the cowl in half fore to aft, glued the bottom half to the fuselage, and attached the top half using screws into ply plates. Goldberg Super Jet was used for everything except the firewall, here we used Gas Model Products' epoxy.

The horizontal and vertical stabs are built using 1/4" balsa that is already cut to shape. It took us about 5 minutes to glue both stabs together and join the elevator halves using Goldberg Jet and Super Jet. The horizontal stab has pre-cut notches to accept the vertical fin, which



ensures the basic alignment. At this point, each sub assembly was sanded to shape, all flight control hinge slots cut, and all basic alignments checked and set, to prepare for covering and the final assembly.

Covering:

We used K & B polyester resin to fuelproof the cowl and fuel tank area, and then gave the complete fuselage a coat followed by sanding with 220 grit paper. We sprayed two coats of acrylic lacquer primer, sanded with 400 grit, and then sprayed the color coats of acrylic lacquer. Dave Brown's Flexall was added to eliminate cracking. The wings and interplane struts were final sanded and given a coat of Balsarite before covering with Top Flite Super MonoKote. We used automotive striping tape to finish the design. After completing the covering and painting, we installed the flight controls using Du-Bro hinges and Gas Model Products' epoxy.

Engine:

We installed a new Como .51 with the stock muffler on a Kraft 40 long mount. The long mount is required to move the engine forward for clearance between the cowl and prop. The Como .51 is a super running engine that has a very good idle and great top end power. We run ours using 5% Sheldon's fuel and an 11/5 Top Flite or Zinger prop. There is enough room in the tank compartment to install almost any fuel tank up to 16 ounce. We used a 12 ounce Sullivan tank and Aero Trend fuel line to complete installation.

Radio:

During the installation of our Futaba FP7FG, we found the radio compartment to be large enough to install any radio, however, you should place your components as far forward as possible to keep from adding any more nose weight than necessary. We placed the battery under the tank and located three servos side by side just aft of the F-2 bulkhead. Sullivan pushrods and a combination of Goldberg and Du-Bro hardware completed the hook-up. We wrapped the receiver in foam and placed it just aft of the servos. The switch and charge jack are mounted in the cockpit area. We mounted the charge jack using one of the new remote charge jack adapters from Ernst Mfg. This has been the best $2.00 investment we've ever made.

Flying:

To set the C.G., required the addition of 8 ounces of weight epoxied in the cowl area. We feel that the required nose weight would have been much less if the fuselage had been covered with MonoKote, but the paint sure looks good. The plans and instructions do not indicate the amount of flight control travel recommended. We set ours based on experience, wisdom, and blind luck. Blind luck prevailed, with the ailerons at 1/4" up and down, elevator 3/4" up and down, and the rudder set at 3/4" left and right.

The model proved to be a very smooth flier. The take-offs are a breeze with the bipe needing only a slight application of rudder during roll. The Indy Bipe quickly lifts its tail, and a small amount of elevator will start it flying. In flight, the Como .51 provides enough power for loops and rolls at slightly more than half throttle, while full throttle permits very spirited performance that will be enjoyed by many dedicated Sunday fliers. Landing speeds are very slow due to the low wing loading.

Conclusion:

This is a well-designed kit with excellent plans, wood, and flight performance, but minimal hardware. Any builders with a few kits behind them could build this great looking bipe. The flight performance can be mild to wild depending on the size of the engine and amount of throttle you use. The Indy Bipe would be an excellent choice for your first bipe or for anyone who would enjoy building and flying a biplane with class. The bottom line is, outstanding flight performance, a quality kit, super looks as well as the mystique and magic of a biplane. □

TBF AVENGER

From 1942 to 1945 the Grumman TBF Avenger ruled the skies over the Pacific and Atlantic oceans. Designed to replace the TBD "Devastator," the TBF was soon to make its mark in the annals of military aviation. The avenger was a rugged, pure fighting machine. Originally designed to be a torpedo bomber, it soon was adapted to suit a multitude of combat tasks, including horizontal bombing, close air support of ground operations, anti-submarine warfare, and radar picket operations.

The Avenger's weaponry consisted of two 50 calibre machine guns in the wings, one 50 calibre machine gun in

the ball turret, one 30 calibre machine gun mounted in the lower tunnel. The payloads range from one MK-13 aerial torpedo, or two 1000 pound bombs, or four 500 pound bombs, or anti-submarine depth charges (bombs). The wings were equipped to carry eight air-to-surface rockets.

The size of the TBF was enormous for a carrier aircraft. A length of 40 feet and a wingspan of 54 feet made the plane one big turkey! Its speed was 263 mph and rather slow in pulling out of a slight dive. Despite the sluggish flight characteristics, no other torpedo bomber could match it. The TBF was designed by Grumman Aviation and built by Grumman and Eastern Motors Division.

The Model:

My TBF-1C started out as a "Bob Dively" Stand-Off Scale plane. The kit is well-engineered and fairly straightforward in its building plan. As a modeling purist, I decided to go a few steps farther than Bob Dively and turn his design into a Precision Scale model with great personal appeal.

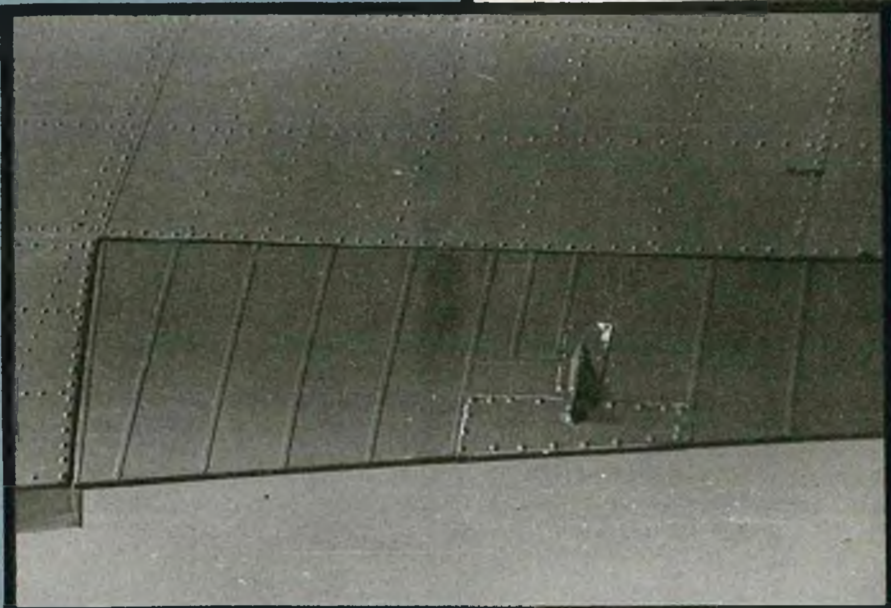
My scale resource material is courtesy of Grumman Aviation Corporation, "Avenger at War," by Tillman KOKO Fan Publications, and "TBF Avenger" by Aero Publications, plus many photos I had taken at the E.A.A. Fly-In at Oshkosh, Wisconsin.

Building the Avenger was fun! Before I started the kit, I got my hands on the actual blueprints for the TBF and compared them to the plans in the kit. At that point, I made a list of what changes were necessary to make this model Precision Scale. The canopy and ball turret had to be totally reworked, molds were made and plexiglass pulled down over the molds. The distance from the canopy sill to the wing was changed to meet scale standards. My building techniques were quite orthodox, and the local hardware store was getting rich on my purchases of supplies of sandpaper.

In building Bob's kit, simplicity is paramount.

The fuselage went together nicely and the plank-on frame went on without any problems. Alignment of the stabilizer was done with a fuselage jig and a carpenter square. Before

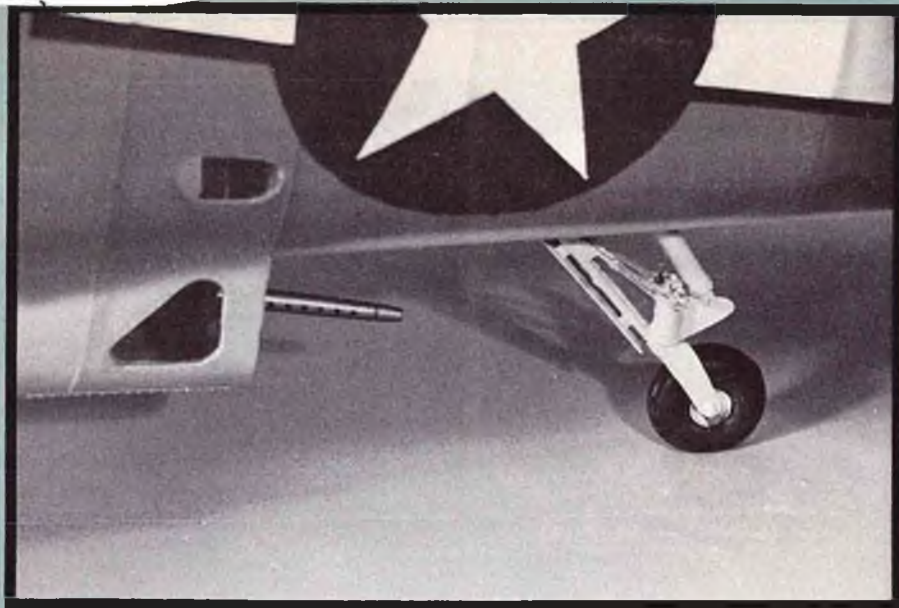
Composit view showing entire cockpit area.



Close-up of aileron detail.

Port quarter view showing turret, panel lines, rivet detail and stencil lettering.

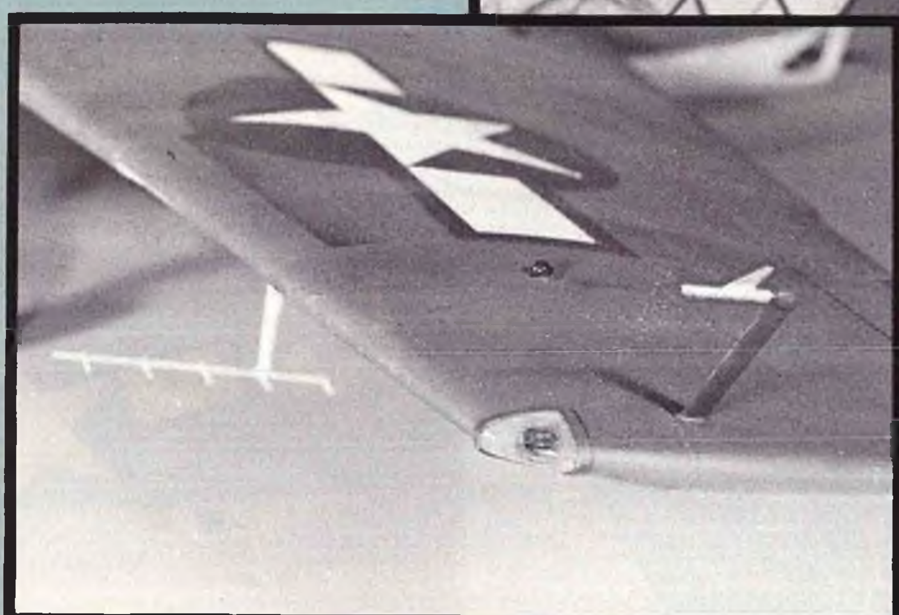
By Malcolm F. Gatford



Scratch-built retractable tail wheel made from welding rod, sheet metal, and silver solder.

gluing the tail block in place, the rudder post and horn are installed and the tail block is hollowed out to hide the horn. Now comes the sanding --- and sanding --- and sanding! Filling was done with spackling compound and then more sanding. When the fuselage was done to a tee, it was time to build the wing. Bob's kit comes with some beautifully molded foam core wings. The first thing to do in building the wings is to set up the retractable landing gear. I used the Robart heavy duty mechanical gear mounted on 1/4" aircraft plywood set into the foam wing at the proper angle forward and backward. The struts were then bent to the proper dihedral. The shrouds around the piano wire struts are two sets of Robart's landing gear. The tail wheel is a modified Robart actuating system with a scratch built tail wheel assembly made from a welding rod and silver solder. The wheels are Robart's diamond tread wheels. The wing are now sheeted with 3/64" plywood sheeting instead of using the sheeting in the kit. This adds the proper thickness to the wing and a terrific amount of strength. After sheeting, installing tip blocks, wiring for navigation lights and formation lights, and machine gun lights, the sanding and filling begins again. After the sanding and filling is completed, the split flaps are cut out and the flap wells are beefed up at this time. The wheel wells are also cut out and installed.

Close-up shot of scratch-built cockpit interior.



Wing tip detail showing navigation and formation lights, and pitot tube.

Now that the fuselage and wing are built, filled, and sanded, it is time to glass the plane. I used 3/4 oz. glass cloth with Hobbypoxy II cut 50:50 with acetone instead of polyester resin. (The resin tends to smell up your house and gets your wife all over your case!)

After glassing, it was time to build the rudder, elevator, and ailerons. I covered them with Super Coverite to give a fabric effect. The rib tape is chart tape attached with super glue, and hinged with Robart's heavy duty dowel hinges.

The plane is now sprayed with white Hobbypoxy undercoat which is used to fill and prime it. The panel lines were

then installed using chart tape and white undercoat built up to the tape and then sanded and feathered in. The tape is removed and you have a perfect overlapping panel joint. The rivets were put on using white glue in a hyperdermic syringe. The TBF had mostly raised rivets which gave it added structural strength. The horizontal flush rivets on the fuselage were made by using a sewing tracing wheel and placing a drop of white glue on each hole. The DZUS fasteners were made with a 1/8" piece of sharpened hollow brass tubing in the Dremel tool, with the slot cut in each with a sharp X-Acto blade. Access panels are lithographic aluminum.

The TBF is now ready for painting. To start, I painted the entire plane, less the rudder, elevator, and ailerons, with Floquil aluminum silver paint. After the silver had completely dried and cured for three days, I painted the whole plane with Polly "S" chromate green, which is a perfect match for interior green. After the chromate had set, it was time to install the scale interior. The interior was totally scratch built using structural hobby styrene plastic. The gauges are from Tatone Products. The roll and bank indicator and artificial horizon actually work! The bomb bay indicator lights work when the bay is open, and the bomb salvo lights also function.

The turret interior is also scratch built with a modified GI Joe machine gun, redesigned to simulate a M-2 50 calibre machine gun. The ammo belt is from Williams Bros. The turret and working canopy are now glued in place with R/C 56 glue. With the canopy glued in position, it is now time to paint, weather, and seal the replica. I used Jim Miester's technique, using Polly "S" paint because of the perfect color match, and the ease of application. I used the standard 3-color camouflage system used by the U.S. Navy from 1943 to late 1944. After the paint had set for one week, I started applying the insignias using stencils and my air brush. The lettering is rub-off decal letters. It is now time to accent the vertical panel

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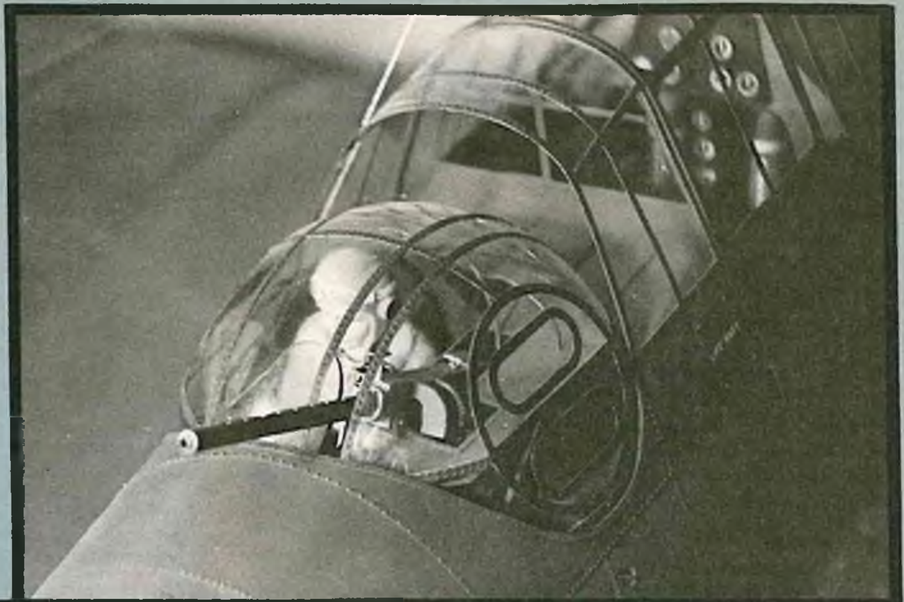
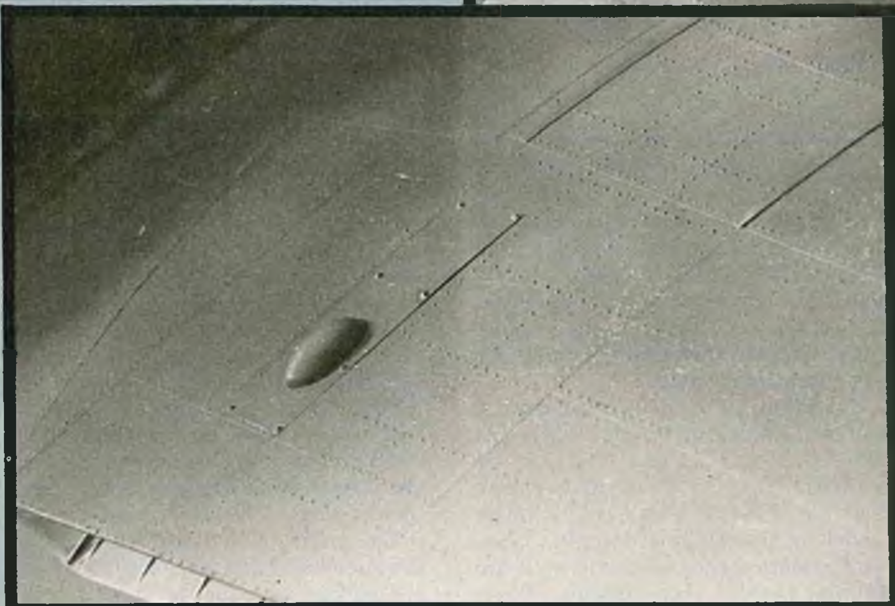


View of detailed ball turret with gunner.

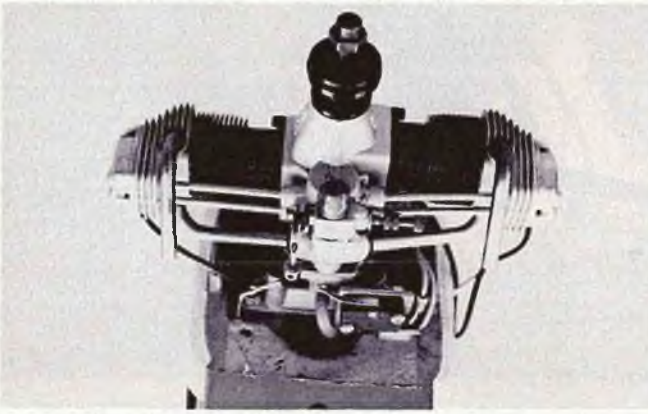


Close-up view of wing detail.

View of pilot and instrument panel.

CUNNINGHAM ON R/C

Chuck Cunningham



Trainor Mihaila's O.S. Gemini twin powered Lazy Ace. Note glo plug heater on low throttle.

You know, I never really realized just how weak wood really is until the past several years. Up until the advent of the super glues when something in a model broke, it was the glue joint. Years ago I switched from the traditional model cements. First to the white glues, then to the tan glues, a very brief fling with the hot melt glues, a long time affair with contact cements of several kinds, an ongoing romance with epoxy, both short and long reaction time, and a total involvement with the super glues. The other evening I was reworking the aileron servo and torque tube set-up in one of my larger Turbulent models. I didn't like the way that I had hurriedly installed the aileron servos, so I moved the servo rails. Getting them loose really wasn't as large a problem as I had thought. The wood that the servo rails were attached to broke, not the glue joint. On reinstalling them, I used several wood braces around the joint so that the wood could not shear along the grain. This type of glue is so darn good that not only does it make building easy, but, sometimes, just too easy. If you're in doubt about the strength of the wood, beef it up with a bit of plywood, or use the regular type super glue, such as regular Hot Stuff, to soak the wood around the joint.

Speaking of aileron linkage, it seems to me that on larger models it is more difficult to get really good aileron control than any other function. I don't mean really large models of the chain saw engine type, but the more standard models with the .90 and Gemini type engines. These aircraft present more of a problem than the normal sized model, yet not nearly as much as their larger sisters. I had tried a number of ways of hooking up ailerons for this type of aircraft. The method that I like the best was first brought to my attention by Jerry Smith when he used a direct drive system on his first Lazy Ace about six years ago. This method works great when you can put the servo near the aileron surface. You simply mount an aileron servo in each wing in such a manner that the control arm of the servo extends below the bottom surface of the wing, and a Kwik Link type connnection ties the control horn on the aileron directly to the control arm on the servo. This method also works well if you have servos mounted farther out in the wing, thus requiring longer leads to bring the power to the servo.

Some radios have a difficult time accepting these long leads without going into convulsions, and glitching all over the place. Several cures for this disease have been presented in electronic articles in RCM in the past. You need to experiment with your radio to see if the longer cords cause any trouble. If you don't like to mount the servos way out in the wing, but like them closer to home with short leads, then the torque tube method of aileron control is the best. We are all familiar with torque tube aileron control. This has been the standard method of hooking up strip ailerons on smaller models since day one, just that the torque tubes are only about three inches long.

The method of making longer tubes is somewhat the same, except that you cannot use wire for the tube. On my latest .90 Turbulent I decided to remove the bellcrank aileron hook-up and go to a torque tube set-up for more aileron deflection. The torque tubes are made of aluminum tube from the tubes available at the hobby shop. The length was more than 12" so I spliced a 6" piece of 1/4" ID tube to a 12" piece, using a smaller size tube inside for a splice. This splice was made with Hot Stuff, after the tube was roughened up with sandpaper. The control horns, both for the servo hook-up and the Kwik Link to the aileron control horn were made by using the outer section of a Goldberg nosegear tiller with the metal insert removed and the nylon reamed out to just fit over the aluminum tube. Insert a piece of 1/4" pine dowel into each end of the torque tube and Hot Stuff in place to give added strength where the control horns hook on. Line the control horns up. One up and one down. Drill a hole through the nylon control horn and the tube with a 1/16" drill and then screw it all together with a #4 x 1/2"

sheet metal screw.

Now, here comes the part that will either make or break your aileron installation. You must provide good bearings for these torque tubes. The ones on my Turbulent were added after the aircraft was finished and flown. I cut into the bottom of the wing and diked off the hook-up for the bellcranks. Then I located the position of the torque tube on the bottom of the wing and removed the covering in a 1" wide strip all along the bottom of the wing. (Okay, if you guys have silked and doped your beauty, stick with the old method of aileron control, or make the changes while you're building.) I always use plastic films, and patches, especially on the bottom; they really don't show up very much.

Next, I drew a line on each rib where the tube was going, then used my razor saw to cut a slot in each rib down to the depth necessary to accept the tube. The bearings were made of 1/8" plywood with a nylon bearing surface with a 9/32" hole drilled in it, then slightly enlarged it with fine sandpaper wrapped around a 1/4" dowel. The nylon bearing surfaces were cut from the main part of Goldberg nylon control horns. These were then Hot Stuffed and screwed with two small screws to the plywood surface. The hole in the plywood should be at least 5/16" to keep anything from binding. These were slipped onto the torque tubes prior to final attachment of the control horns. All of this was then slipped into the slots in the wing ribs, everything lined up, then the plywood supports were Hot Stuffed to the ribs in each end of the torque tube line. It should have

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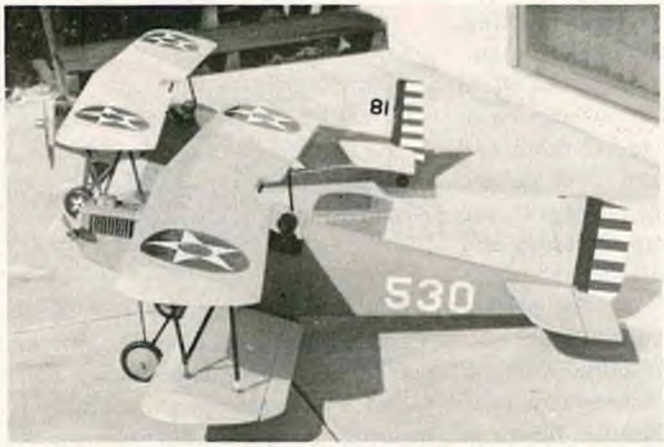
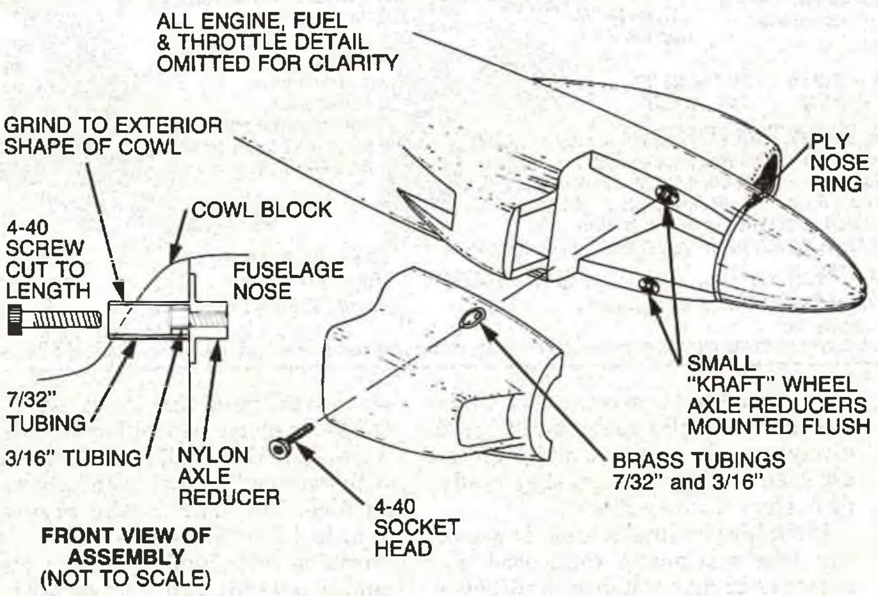


Harold Davidson and Ralph Henrich modified Balsa USA Phaeton Bipes. Powered by 4 strokers.

Dennis Martin modified Andrews Minimaster and used twin O.S. .20's.

FOR WHAT IT'S WORTH



FRONT VIEW OF ASSEMBLY
(NOT TO SCALE)

Bob Coffee of Port Hueneme, California, submitted his method of attaching cheek cowl to fuselage.

For those who have had a difficult time trying to find a suitable way to attach full or partial engine covers to the fuselage nose, use a pair of small, flanged, black nylon, "Kraft" wheel axle reducers that come with the wheels and are usually thrown away. Countersink them flush and epoxy them in the fuselage noseblock on the same geometric plane as the mating surface of the engine cover block. These axle reducers are just the right size to allow a 4-40 socket head screw to be threaded in snugly.

After this is done, drill corresponding holes in the engine cover block with a 7/32" drill. Using brass tubing of the same diameter, cut two pieces as long as the maximum depth of the holes. (This tubing allows a 4-40 screw head to slip right through.) Cut two more pieces of 3/16" tubing 1/8" long and sweat solder these inside the 7/32" tubing flush with one end. (This smaller tubing stops the 4-40 head from slipping through.)

Epoxy these tube assemblies into the engine cover block with the soldered end flush on the mating surface. After the epoxy dries, take your moto tool and grind off the excess tubing flush with the exterior surface of the nose block. Insert the screws and tighten. You now have a strong, good-looking engine cowl installation that puts no strain on the cowl block whatsoever and will not vibrate loose. See drawing.

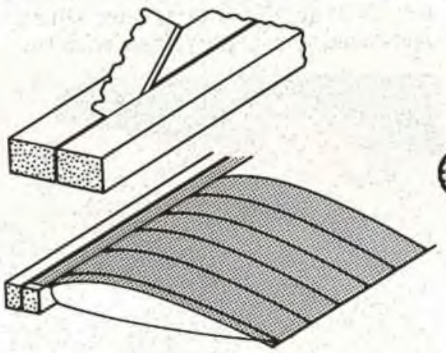
Ed Turner, Cheyenne, Wyoming, tells of his aggravation and solution.

If there is anything in the world more frustrating than attempting to get fiberglass tape to lay down and take its epoxying like a . . . er, person, it has to be diddling about with the various plastic wrap, balloons and other unmanageable paraphanalia recommended as being the perfect solution to the difficulity. Byuk!

The above is preliminary to the announcement that Ed has found the perfect solution, of course. There is now a product --- likely discovered twenty years ago and kept secret from Ed by a giant conspiracy --- called Perma-Tite tape, which is a self-adhering glass tape made by Perma Glas-Mesh Corp., Dover, Ohio.

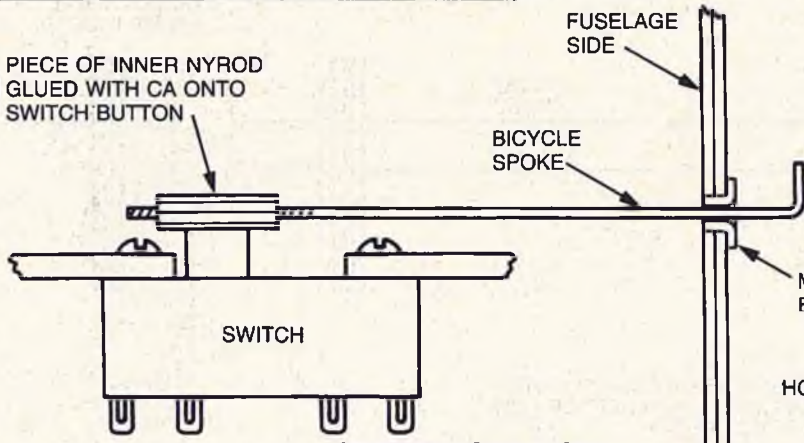
The roll Ed has, was purchased at Ernst Hardware, and is 2" wide by 150' long with about a 3/32" mesh. You simply cut it to length, stick it in place (no cyanoacrylic to make you sleep with a wing or fuselage while your divorce is in progress) and then, when everything is perfect, only then, you gently epoxy it and your done. No M%$ plastic wrap, no M%$ balloons! Try it.

Jonathan Young, Denver, Colorado, came up with a nice bit of cockpit decor. He personalized his Little Super Lucky Fly (Johnny Casburn kit) with what he thinks is a unique touch and which has tickled some of his flying field friends. The "touch" comes in the form of a tiny picture of Jonathan's wife mounted on the instrument panel of the cockpit! He sorted through a stack of photos and selected one taken of his wife, Sandy, at a distance such that when he cut the picture down to postage stamp size, he had a nice facial (shoulders and up) "portrait" of her. Use a razor to square the portrait up, and mount the portrait on a white rectangle of paper just 1/16" wider all around the portrait. This yields a nicely bordered photo which is easily glued anywhere one desires inside of the cockpit area.



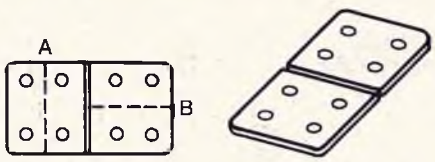
Bob Beers of Poughkeepsie, New York, dreamed up a useful tool to make the covering chore easier and neater. Frequently, you want to trim covering material so it has a constant width for overlap, such as on the leading edge of a wing or along the sides of a box fuselage. A simple jig can be fabricated from a couple of equal lengths of scrap balsa the width of the desired overlap. Simply place the two pieces of balsa side by side and carefully apply a little Hot Stuff to the ends. Half of a double edge razor blade inserted into the center of the joint will give a clean cut of the desired width when the assembly is guided along the edge of the structure. When not being used, the blade can be removed and the assembly safely stored until the next project. See sketch.

FOR WHAT IT'S WORTH



SWITCH ACTUATOR

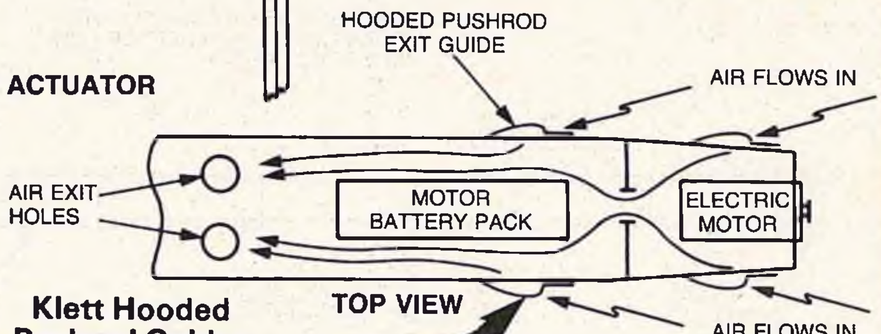
John Collin, Farramere, South Africa, devised an internal mounting method for his radio switch. See sketch for details.



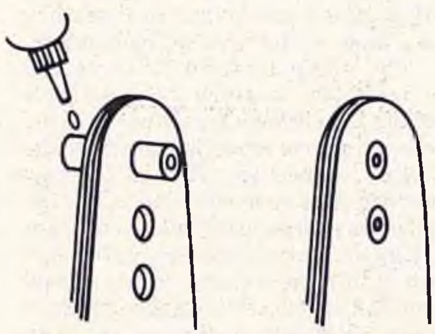
The following idea comes from Harold Davidson of San Jose, California. When looking for landing gear hold-down straps he couldn't find any in his kit's accessory bag so he looked for an alternative. The alternative turned out to be a nylon hinge. If one cuts the hinge along dotted line "A" with an X-Acto knife, the holes are farther apart than if the cut is made from the center of the hinge line outward, "B." So, there are two sizes for the price of one. Harold says that these hold-down straps have held up under many and varied landings.

Keith Klingebiel, Colesville, Maryland, has an effective, yet simple approach to providing cooling inlets on your electric powered models.

He installs hooded pushrod guides (such as Goldberg) in the motor and battery compartment. Install them backwards to allow the air to flow in. Cyanoacrylate adhesive works well for the installation of the guide after locating and drilling the appropriate holes. It is important to remember that the air exit holes should have an area approximately 4 times that of the entrance area so that proper flow can be maintained. The air exit holes can be placed in the bottom of the fuselage and won't even be noticed. Keith has used this arrangement on both gliders and Old Timer electrics (such as the Leisure Playboy). The hooded pushrod exits look good and keep your motor and batteries cool!



Klett Hooded Pushrod Guides



Peter Butler, Arkport, New York, sent in this handy hint pertaining to control horns.

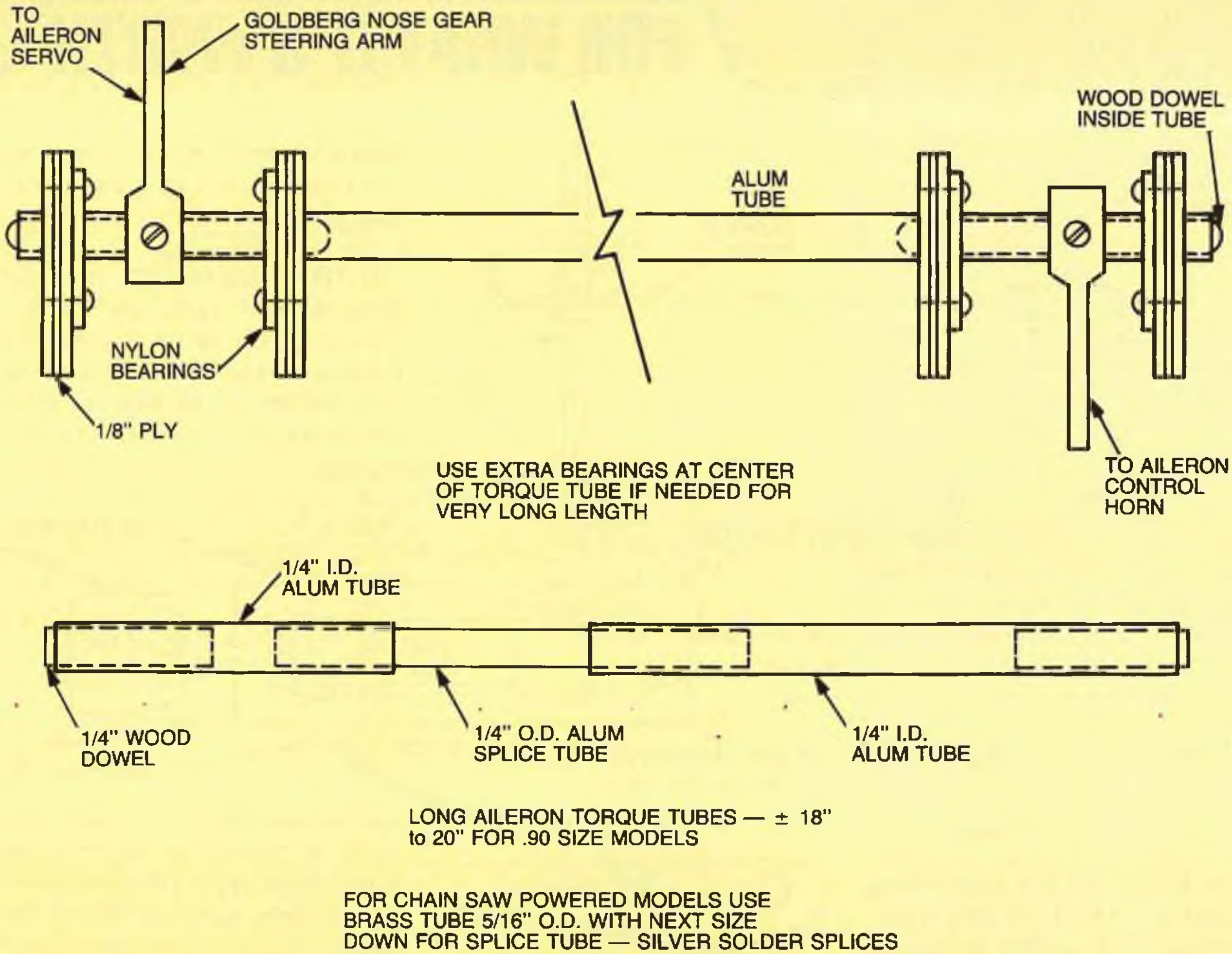
When plans call for a plywood control horn, he installs bushings made from short sections of NyRod secured with CA. The NyRod is then trimmed and sanded flush. The bushings prevent wear in the clevis holes and maintain a slop-free control hook-up. See sketch.

Dallas Wilhelm, Jr., Hasting, Nebraska, sent in this helpful hint.

Isopropyl alcohol is great for removing those blobs of wet epoxy from fingers, workbench and other places it's not intended to be. For several years Dallas has used a pint bottle of rubbing alcohol from the supermarket, applied to paper towels, to clean these "mistakes." He believes that he has discovered a better way. Pharmacies carry small, disposable alcohol pads for cleansing the skin prior to injections. These are sold in boxes of 100 pads, each individually wrapped in a foil package, for less than $1.50. A box of these on the workbench will keep you and your creations free of unwanted epoxy for an entire building season. They are also handy in the field box to remove oil and grime from your hands, planes, transmitter, etc.

Thomas Burkett of Revelstoke, B.C., Canada, discovered another filler material. Tom found that when faced with making fillets or filling in nicks and dings in balsa framework, something which works well is "Poly Fix." This is a ready mixed fine surface filler and comes in 284 ml (about 8 oz.) cans. It is fast drying and spreads and sands easily.

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.



TORQUE TUBES FOR LARGER MODELS

worked perfectly, right? But, it didn't. The distance between the last rib (containing the bearing) and the control horn was too great. This distance allowed the torque tube to flex, and the control system to be sloppy. The answer: install another bearing at each end of the torque tube just past the control horn. This then gives you four bearing points and makes for a good, tight assembly. It is possible that if you're using a larger type of tube, this extra support might not be necessary, but what the heck, just a little more work will make everything really perfect. You don't have to worry about long aileron extension cords, you have a great range of control throw adjustment, and all of the parts are readily available at the nearest hobby shop.

The same method is certainly feasible for pattern type aircraft where the ailerons are outboard in the wing, and one servo is operating the longer torque rods. This isn't a new method by any means, lots of torque tubes have been used, but if you've got a long connection problem, and need to get from here to there, this is a good solution, and doesn't weigh very much either. Remember, though, to make sure that everything is lined up and that there is no binding in any bearing point.

★

The guys at RCM have been sending me quite a collection of club newsletters for the past several months. It's very interesting reading through these newsletters to find a common thought, or really several common thoughts, running through many of these letter.

Common thoughts number 1. How to get more members to the meetings, how to make the meetings more interesting, and how to get a lot of last year's members to pay this year's dues.

Common thoughts number 2. How are we going to find a new flying field, how are we going to keep from losing the old flying field, and how are we going to keep the guys from flying over that house way over there. (You know, the one where the little old lady lives who keeps calling the police.)

Common thought number 3. "Come on you guys, this is your newsletter, and if you don't send me something to print in it, I'm gonna run out of words and just stop writing the whole darn thing!"

Common thought number 4. "We need to get these engines more quiet, or we're going to lose our field for sure."

Recognize your newsletter here? I'll bet you do. Not only do these thoughts

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run through the newsletters from the U.S., but also from all over the world. I bet that the Japanese newsletters are saying the same thing, but I can't read them.

Many newsletter contain information sections much like this magazine. Several that I read recently were telling their members about the problems of overweight. No, not the problem of the pilot being overweight (in my case that goes without saying), but rather with overweight aircraft. This is a subject that I haven't touched upon for several months or more, so let's talk about wing loading for a while. Actually, wing loading isn't the entire story, wing loading and power loading in combination makes the difference between a really good flying aircraft and a real dog.

First, how do you go about figuring wing loading? Okay, weigh the aircraft, ready to fly, no fuel. Suppose that you're flying a .25 powered aircraft with a total wing area of 380 square inches. All-up weight is 5 lbs. What kind of wing loading do you have on this bird? (Read that "this lead sled.") Okay, divide the wing area of 380 square inches by 144 square inches (one square foot) to find out how many square feet are in this wing. Punching the buttons on your magic $9.95 shirt pocket calculator gives you a wing area of 2.64 square feet. Now, convert the weight of 5 lbs. to ounces by multiplying the weight by 16 (16 ounces to the pound). This gives you a weight of 80 ounces. Wing loading is stated as ounces per square foot, so divide the weight of 80 ounces by the number of square feet (2.64) and you get a wing loading of 30.3 ounces per square foot. This loading is okay for a pattern bird with a tuned pipe and an engine that can burn up the sky because the power loading is way up there, but for your gentle (ha!) trainer, 'taint worth a flip. Marginal on take-off, glides like a rock, and squashes down to a landing, bending the landing gear and breaking the prop almost every time.

How about the same aircraft with a weight of 3½ lbs.? 3.5 x 16 equals a weight of 56 ounces giving a wing loading of 21 ounces per square foot, an altogether very acceptable level, and one that will result in a good flying aircraft. That is unless you built this combination with an engine that is too small, or lacks enough power to haul it off the ground. The mistake that many beginners make is to purchase an engine that is either too much on the small side for the model, or an engine that doesn't have the guts to pull the aircraft. That really good bargain that you got at the last auction might be less than super when it comes to running and pulling your aircraft.

Too heavy a wing loading is a plague that can infect any size aircraft from a .049 powered model to the large thirty pound and up models. Weight has to be balanced with power and wing area to have a successful flying aircraft.

You can save weight in building by several methods — first and foremost is to resist the urge to slaver twenty coats of hand rubbed paint on your model. If you're looking for a best finish award, then go ahead, but if you're looking for a model that will fly well, and give you lots of fun, then save the hand rubbed finish for the piece of furniture in the den that your wife wants you to rework someday.

Many times a radio that is too large for the aircraft will prevent a good flying model. If you're using a standard size radio, and building a very small aircraft, you've really got a problem.

Too much heavy glue, and too much beefing up can also add to the overweight condition. Each part adds up to the whole, and you must check yourself along the way to make sure that you don't wind up with a lead sled.

If you're building a kit, make sure that it has adequate wing area for its engine and size. Take the time to run the figures on your pocket calculator based upon the sizes stated on the kit, or in the instructions. Sometimes an aircraft is simply designed too heavy for the wing area that it has, to carry the weight. You can calculate this before you start building. You just might be surprised.

★

Dennis Martin sent in some pictures of his modified Andrews Mini-Master. Dennis added a couple of engine pods supporting O.S. .20 engines that operate from a central tank in the fuselage. As yet he hasn't flown it but it is a beautiful looking little bird.

Another interesting letter was received from Harold Davidson modifying existing kits:

Dear Chuck:

Ralph Henrich and I share RCM and both enjoy your column. One of your ideas has given us a lot of pleasure so we would like to share it with you.

A year or so ago you wrote an article about modifying fun-fly kits into "quasi stand-off scale." Well, Joe Albanese had a Balsa USA Phaeton Bipe with a K & B .40 that both Ralph and I flew. We fly taildraggers mostly and found the Phaeton the easiest plane to take off, corkscrew around the sky, and land that we have seen. Subsequently, Ralph picked up on your idea of modifying the Phaeton into pre-WW II trainers and using our O.S. Max 4-cycles.

The sound of these two planes is realistic and attention getting. Ralph's is in the Navy trainer blue, and mine the Army khaki. They are covered with Solertex with Sig stars, MonoKote stripes/numbers, and Aerogloss painted fuselages. We both modified the vertical stabilizers, front ends, tailwheels, landing gears, and wing struts, and installed Williams Brothers wheels and swivel headed pilots. The yellow and blue plane has an O.S. .40 4-cycle and the other has an O.S. .60 4-cycle engine.

At $26.95 per kit, the Phaeton has been the year's best buy. Good flying.

Harold

And yet another letter from a bipe lover, Trainor Mihaila:

Chuck,

I finally finished the installation of the "Gemini" in my Lazy Ace. I've enclosed some pictures for your rogues file. The engine close-up shows how I mechanically and electrically hooked up the micro switch for "onboard" glow plug heat at idle. It works just fine. The cowl is balsa with Hobbypoxy paint.

I've also incorporated adjustable cowl flaps. The Gemini turns an 18/6 prop with some authority in the air and there is no sound to match it when the Ace turns final and heads for home with the characteristic whistle of a bipe and the plop-e-t-plop of the engine idling. It's sheer magic. The only changes I made in the ship were one cockpit in lieu of two, and I made "I" struts in place of the "N" struts. No biggies.

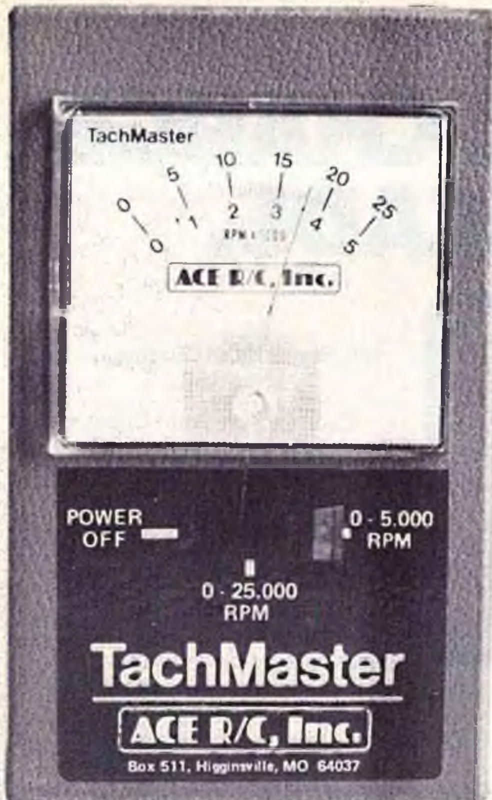
In conclusion, Chuck, it's a great kit and you can bet there will always be one in my hangar.

See you at the Jumbo Fly-In.

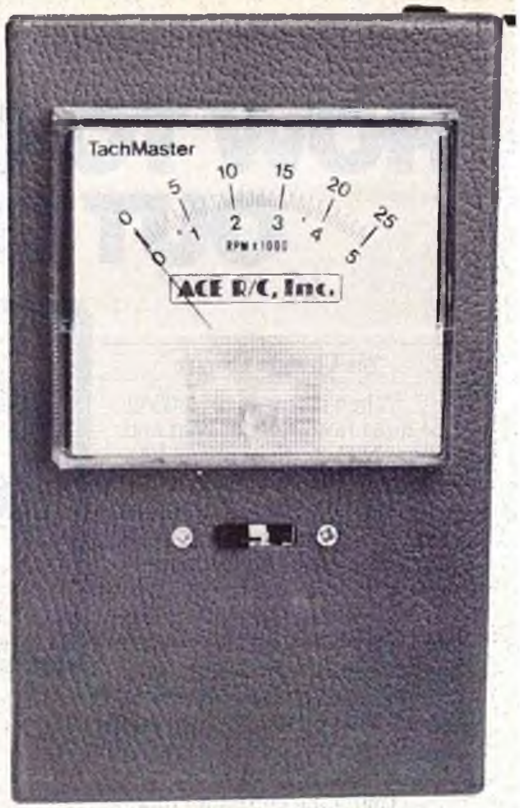
Trainor Mihaila

★

R/C building and flying is just about the most fun in the world. Do yourself a favor, go out and help someone else get started in this best of all hobbies. Now, let's pack up our stuff and head to the flying field. See you there. ☐



TACHMASTER



If you've been putting off buying a good tach because you thought you couldn't afford one, look no further. The author shows you how to build a darn good one that won't overheat your wallet.

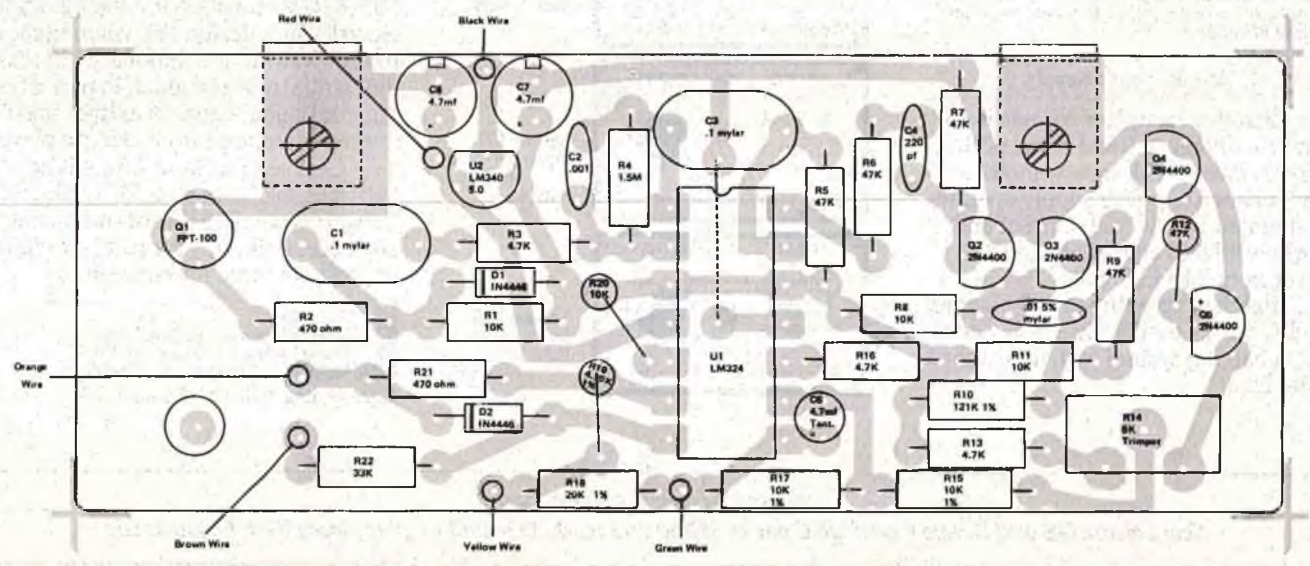
By Mike Dorffler

Most fliers today, whether they prefer Sunday sport flying, or feel impelled to go for the Gold, will tell you that there is no substitute for having a good tach when you need one.

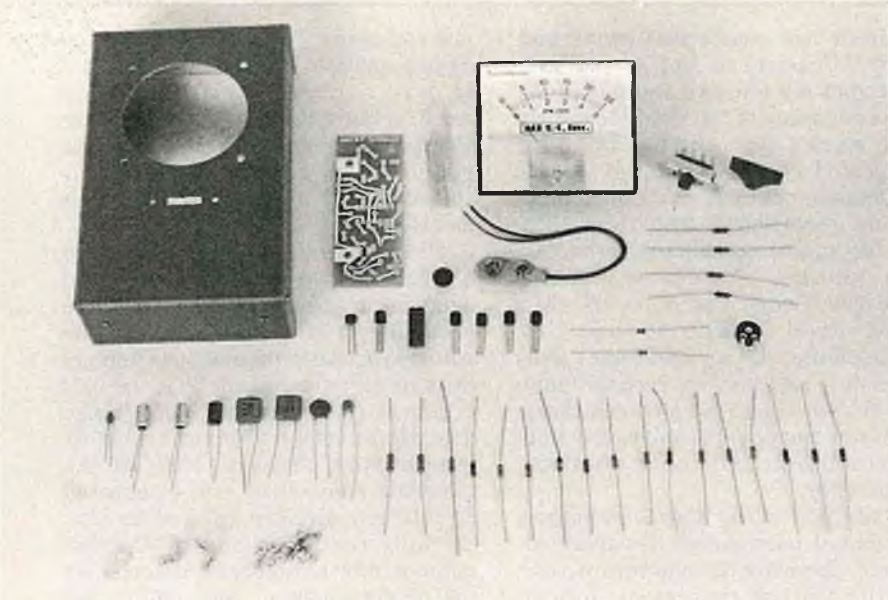
Tachomoters can't make our engines run any better or any faster but they can tell us immediately what our so-called fine sense of hearing can't. And that is that our hearing usually provides us with a very optimistic rpm reading whereas a tach tells it like it is.

Eventually, most fliers come to this same conclusion and decide it's time to invest in a tachometer. Choosing a tach from the many available is not an easy task. Final selection is usually done in the time-proven modeler's ritual of pulling out the catalogs and magazines, closing one's eyes and pointing. This isn't too far from the truth because there really hasn't been any "cast in stone" rules to follow in this selection. Most tachs are okay, right? All tachs work the same way, right? Why isn't this one as good as that one? Trouble is these questions aren't answered until the unit is purchased, if then.

But aside from these judgments, the actual final selection is made more on the price than anything else. Generally speaking, you would expect that the higher the price, the better the tach. At the same time, if you don't feel you can invest a lot of money in a tach you will simply have to accept the quality and the accuracy of the unit you purchase. In many cases this is probably true. I have personally experienced the same dilemma more times than I care to admit and, because of this, I got mad enough to try to do something about it.

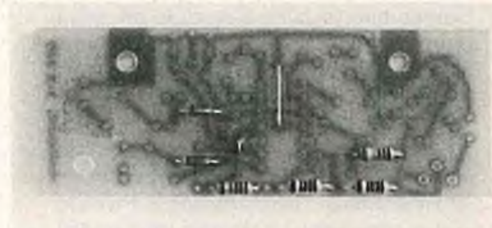


2 X SIZE



Complete package of components to build the tach.

First step in PC board construction: installing the jumper and two diodes.



Second step: install the 1% precision resistors.

Third step: install the remainder of the resistors.

Fourth step: install all capacitors and the trim resistor.

In an effort to change what I considered a tachometer price versus performance barrier, I set out to create a tach that would:

(1) Offer superb performance while at the same time be in a price range usually associated with low cost "imports."

(2) Be very simple to construct and calibrate.

(3) Be extremely easy to use and operate over the most adverse lighting conditions.

I believe I have accomplished all of these and possibly a bit more in the TachMaster.

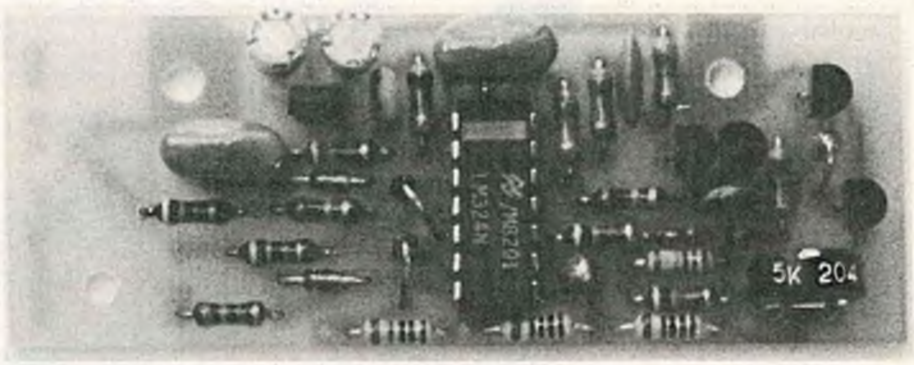
Thus far I have used the term "good" as my only means to distinguish what qualities a tach should have to be considered worth buying. So what determines "good?" Simply, a tach that doesn't lie to you. A tach that doesn't require body English or a well-placed tongue at the right place inside the mouth to get steady readings. A tach whose meter needle doesn't bounce all over the place. And a tach that will also work on overcast days. Some of you may have other requirements which you use to grade the quality of tachometers and I will leave these to your discretion. But I am sure the TachMaster will live up to whatever these may be.

In order to meet the design goals of the TachMaster, some compromises did have to be made. However, I feel quite strongly that these are insignificant when compared to the overall performance.

First, for most fliers, two rpm ranges are more than adequate. I chose to incorporate 0-5,000 rpm for checking engine idle and 0-25,000 rpm for the remainder of the engine's performance.

As long as the tach's meter has a large enough face, the distinction of an rpm reading is an easy task. You will note that the graduations on the meter in the 0-25,000 rpm range are in 500 rpm increments. Even if you only have average eyesight you can discern better than a 200 rpm accuracy in reading the meter. For normal use, this boils down to a simple eyeball interpretation of what the meter is telling you. The fact will always remain that the circuitry of the TachMaster is delivering a very accurate rpm reading. On the 0-5,000 rpm range, the meter graduations are in 100 rpm increments. Again, you should be able to easily see better than a 50 rpm accuracy.

If you, as an individual, feel that you must have better accuracy than this then you are walking on a razor's edge. But even so I would have to tell you to look elsewhere for another tach, and the only suggestion I can offer is the Royal Electronics ProTach designed by Sid Kauffman. The ProTach offers a total of seven expanded scale rpm ranges while, again, the TachMaster only has two.



Fifth step: install the I.C., transistors, and voltage regulator.

One other compromise I made in the TachMaster is that it does not contain or offer a switch setting allowing the user to check the condition of the battery which may be found on other tachs. One reason for this is that the TachMaster only requires a single 9 volt transistor radio battery. If you choose to use just about the lowest price battery you can find, you will

probably still get a whole season of flying before it goes. The current consumption of the TachMaster is extremely low and will still give accurate rpm readings even after the battery voltage has dropped to about 7.5 volts.

There simply is no need to check the condition of the battery when it will last this long. All you have to do is to remember to turn the unit off after you're through with it. However, when the tach starts giving you some screwy rpm readings, it's time to change the battery.

The TachMaster is a comfortable size and is intended to be used and operated with the right hand. I would have considered forming the metal case so that it could be placed on the ground in front of the plane but I have witnessed a very scary incident when a tach was used in this manner. Since then I would never recommend to anyone to set their tach on the ground in front of the plane while tinkering with the carb. Always hold your tach in one hand. That way you can always account for the location of at least one of your hands when working in the vicinity of propeller driven meat grinders.

It should be cautioned that the apparent low component count and small P.C. board do not in any way contradict my effusive statements as to the accuracy of the TachMaster. It just works out that way. The integrated circuit employed in the TachMaster circuitry contains a total of four operational amplifiers each with countless transistors locked in their interior. The majority of the circuitry "work" is done by this integrated circuit but is complemented by an additional four transistors and various resistors and capacitors. Some of the resistors employed have a 1% tolerance and these contribute to the accuracy of the TachMaster.

In addition to the above, two other components used should be explained further. These are the phototransistor and the voltage regulator. Optical tachometers have been around for some time and their designers have had several methods to choose from in the actual detection of a revolving mechanism. Of these methods only three are in actual use today. These are the photoresistor, more commonly known as the Photocell, the Phototransistor and the Photodiode. The TachMaster employs a Phototransistor which is located on one end of the P.C. board and appears as just another transistor except that it has a clear dome. During construction this device is installed in the rubber grommet in the end of the case and is the point where the reflected light off the propeller is detected.

The voltage regulator also appears as just another transistor but is of extreme importance in the extreme accuracy of the TachMaster. The voltage regulator maintains a voltage on the circuit board that for all practical purposes does not change due to battery fluctuations or temperature changes. Most of the elements controlling the integrated circuit are directly related to this carefully controlled voltage. In this manner information being detected by the phototransistor and sent to the integrated circuit is always on an "apples to apples" basis.

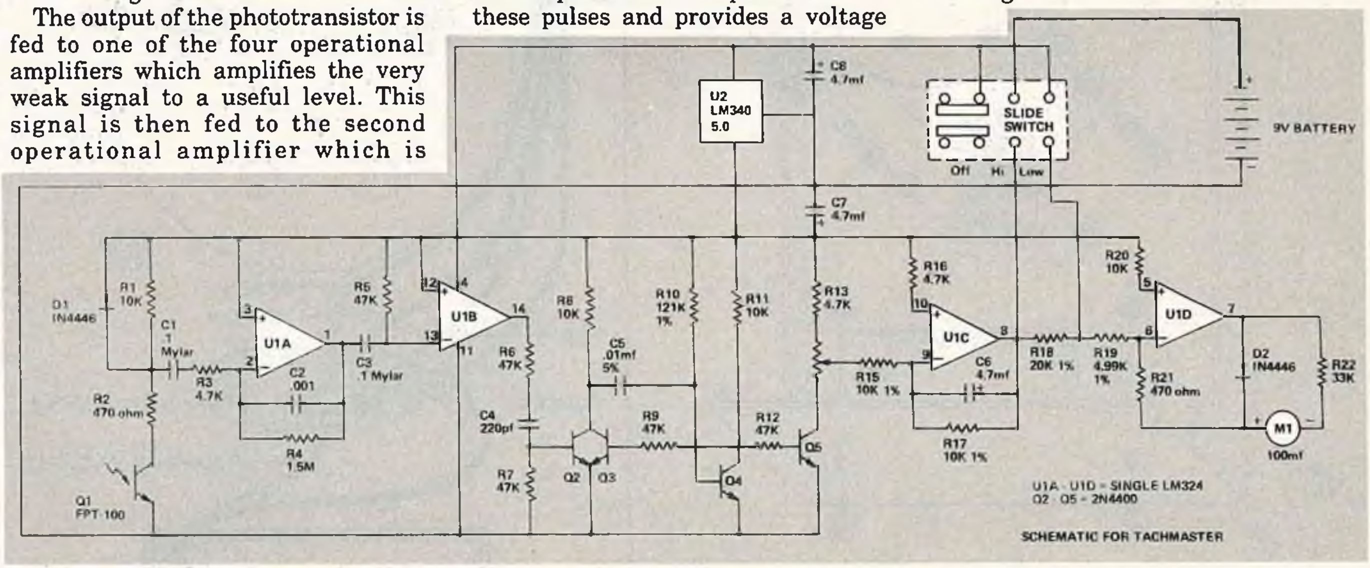
I understand very well that many modelers are not electronically oriented and this is certainly nothing to be ashamed of. This just happens to be my forte. Flying is another matter, but I'm not ashamed of the fact if that helps in the point I'm trying to make. So, if you are interested, I will briefly explain how the TachMaster works

with as much fat removed as I can.

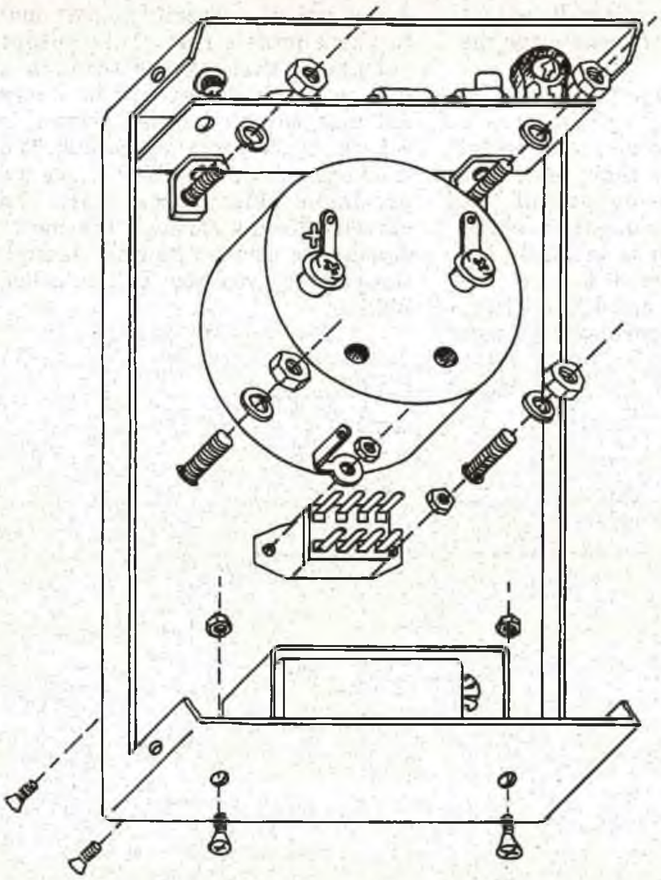
A rotating propeller on the front of a model engine reflects sunlight, as does everything else. The difference is that a stationary item reflects light at a constant rate. The propeller being long and thin and rotating, reflects light at an ever changing rate. The phototransistor detects this rate of change and produces an output current which is proportional to this reflected light.

The output of the phototransistor is fed to one of the four operational amplifiers which amplifies the very weak signal to a useful level. This signal is then fed to the second operational amplifier which is connected as a comparator. Its output is either high or low depending on the state of its inputs.

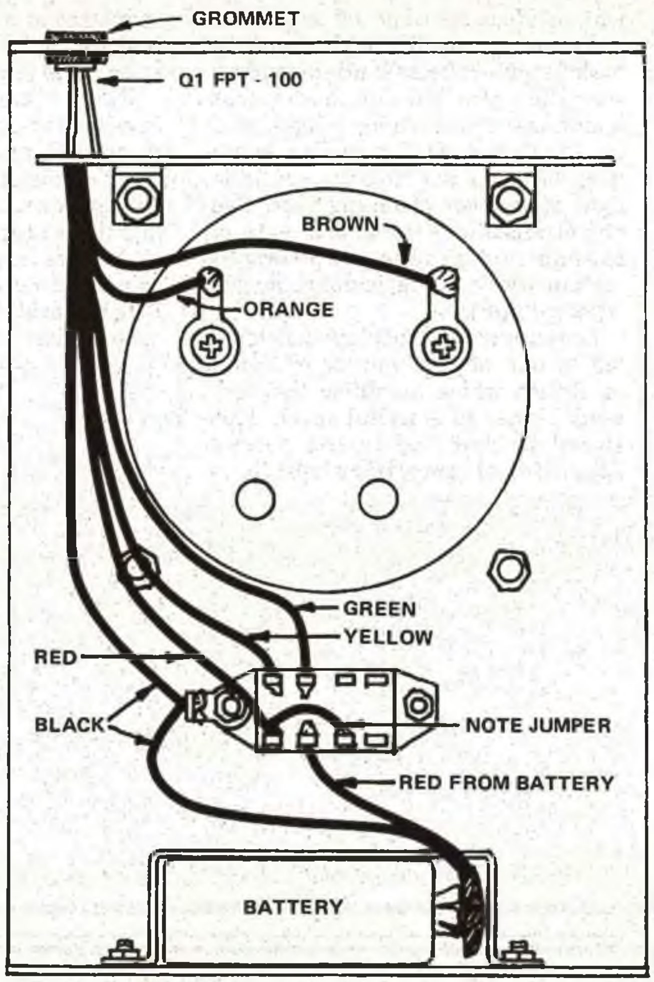
Each time the output of the comparator goes high it fires a monostable multivibrator composed of four transistors and their associated components. The output of the multivibrator is a negative going square wave which is precisely the same width each time it is fired. The third operational amplifier filters these pulses and provides a voltage output which is directly proportional to the engine's rpm. This output voltage is then passed through a precision resistor resulting in a very definite current. This resistor is selected by the rpm range switch. The final operational amplifier drives the precision 100μA meter until the current flowing through the meter equals the current flowing through the precision resistor. This is called nulling.



SCHEMATIC FOR TACHMASTER



MECHANICAL ASSEMBLY ILLUSTRATION



FINAL WIRING ILLUSTRATION

Therefore, the current flowing through the meter is directly proportional to the engine rpm. We scale the meter in rpm instead of current because that is what we are interested in. Owing to component tolerances, we add a trimpot for final calibration of the tach and this is covered later.

Ace R/C, Inc., has been kind enough to offer the TachMaster in full kit form for $29.95 or in completely assembled form for $39.95 but, if you wish to scratch-build the unit, all the pertinent information is contained here in this article. There is also a parts list showing Ace's part numbers and prices in case you have difficulty in locating some of them. You will find, however, that the only source for the meter is from Ace. Sorry 'bout that.

Whichever course you decide to take, either scratch-built or from the kit, be sure you have all the parts rounded up before you start. In this manner you can assemble the entire unit in one sitting without having to wait for a part or two still hung up in the mail somewhere or on the local parts supplier who is out of stock. It's simply less trying on the nerves.

Tachmaster Construction

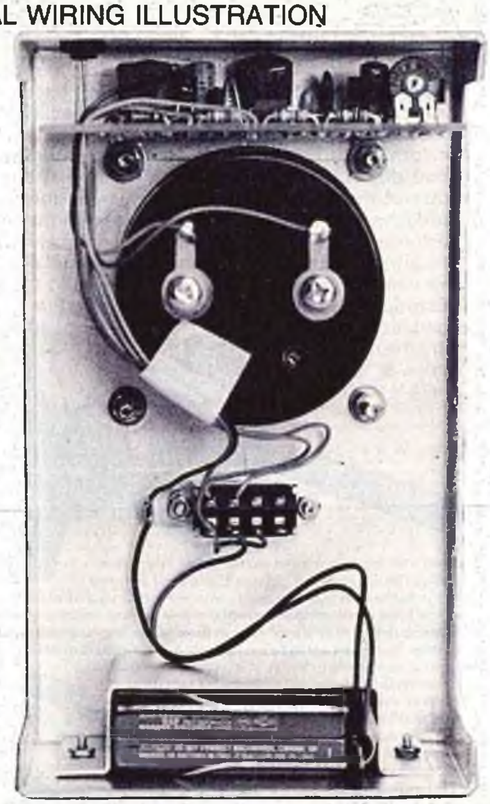
The first thing to do is be sure you have all the components as stated above and that they are the correct value. Organize the components in groups such as resistors, capacitors, transistors, etc. Examine the printed circuit board for any undrilled holes, and use a 1/32" drill bit if this occurs. If you have etched your own board, clean it thoroughly with steel wool. Please do not use the kitchen variety which has soap in it. Yuk!

Soldering the components to the P.C. board should be accomplished with a soldering iron with a heating element rated at no more than 37½ watts and use a small chisel tip which is no wider than 1/8". Use only rosin core solder of the smallest diameter you can find. Avoid the big bulky stuff. Keep the soldering tip clean while you proceed by wiping it on a damp sponge.

Circuit Board Construction

( ) Install and solder the two 1N4446 diodes being sure the banded end of the diodes are in the right direction.

( ) Bend the jumper lead from one of the snipped diode wires. Make the jumper bends as exactly as you can so that it will lay flat against the board.



Looking inside of the tach as final assembly takes place. Phototransistor pushed into grommet in upper left hand corner and easy access to the trimpot for final calibration.

Refer to the component overlay at all times if in doubt which holes are used for each component.

( ) Install and solder the LM324N integrated circuit. Be sure you orient it correctly with the number 1 pin in the right place. Check the angle of the pins on the I.C. if you have difficulty getting it in the board. If the pins are spread slightly (which is usually the way they come from the manufacturer) hold the I.C. by its ends and gently apply downward pressure on a flat surface on each set of 8 pins at a time. At the same time apply a gentle rocking motion. This will bend each set of pins inward just enough that the I.C. can then be inserted in the board quite easily. Be sure to snip all 14 lead ends after they have been soldered.

( ) Install and solder four 10K 5% resistors (brn., blk., org., gld.). Note: resistors can be installed in either direction, it doesn't matter.

( ) Install and solder two 10K 1% resistors (blue body-brn., blk., blk., rd., brn.).

( ) Install and solder one 121K 1% resistor (blue body-brn., rd., brn., org., brn.).

( ) Install and solder one 1.5M 5% resistor (brn., grn., grn., gld.).

( ) Install and solder one 20K 1% resistor (blue body-rd., blk., blk., rd., brn,).

( ) Install and solder one 33K 5% resistor (org., org., org., gld.).

( ) Install and solder two 470 ohm 5% resistors (yel., violet, brn., gld.).

( ) Install and solder three 4.7K 5% resistors (yel., violet, rd., gld.).

( ) Install and solder five 47K 5% resistors (yel., violet, org., gld.).

( ) Install and solder one 4.99K 1% resistor (blue body-yel., wht., wht., brn., brn.).

( ) Install and solder the LM340-5.0 voltage regulator. This part looks identical to the other transistors so be sure to check it before installing. Be sure the flat side is oriented as shown on the component overlay. Mount the LM340-5.0 so that the bottom of the body is about 1/8" to 3/16" from the board. This insures that you don't damage the part by trying to mount it too close to the board.

( ) Install and solder the four 2N4400 transistors paying careful attention as to which direction the flats of the bodies are pointing. Position the transistors about the same height above the board as the LM340-5.0.

( ) Install and solder one 220pf disc capacitor marked 221K. Disc capacitors should be mounted all the way down on the board and standing vertical.

( ) Install and solder one .001µf disc capacitor marked .001P.

( ) Install and solder one .01µf 5% Mylar capacitor. This part is green in color.

( ) Install and solder two .1µf Mylar capacitors. These are orange in color and marked 104K.

( ) Install and solder one 4.7µf Tantalum dipped capacitor. This part is blue in color and must be installed properly with the small positive (+) marks oriented correctly. Refer to the circuit overlay.

( ) Install and solder the two 4.7µf electrolytic capacitors. These must also be oriented correctly on the board with the arrowed negative (−) sides towards the outside edge of the board.

( ) Install and solder the 5K vertical trim resistor. Make an effort to install this part as vertical as you can and as close to the board as possible.

( ) Prepare the following lead wires by cutting to length, stripping 3/16" insulation from each end, twisting the fine strands together and then tinning.

( ) Black wire, 6" long.
( ) Red wire 5" long.
( ) Red wire 1" long.
( ) Orange wire 2" long.
( ) Brown wire 3" long.
( ) Two yellow wires, each 6" long.

( ) Install and solder each of the above wires in the appropriate P.C. board holes shown on the component overlay with the exception of the 1" long red wire.

( ) Pass all of the wires through the hole shown in the P.C. board so that they exit out the bottom.

( ) Now clean the soldering residue from the bottom of the circuit board using any good solvent and a small stiff brush. Examine all soldering joints. They should be nice and bright indicating a good job of soldering. Also look for solder bridges and remove them at this time. Solder bridges are when solder has flowed from one circuit land to another. If not removed, the circuitry will be inoperative and components can be damaged if not corrected before power is applied.

( ) Re-examine your component placement on the circuit board compared to the component overlay. **Be sure all the parts are in the right place.** Double and triple check this before proceeding.

( ) Mount the two "L" brackets to the circuit board using the two 4-40 x 1/8" long pan head screws. The brackets should be mounted on the circuit or soldered side of the board. Now set the board with the brackets sitting on a flat surface and eyeball that the brackets are properly bent to 90 degree angles. If they are not and you will be able to see this, then remove them from the circuit board and carefully tweak them with a pair of pliers until they meet your satisfaction. Now re-install them to the board and snug up the screws. Also pay attention to the fact that both brackets should be aligned with their flat sides parallel to the edge of the circuit board.

TachMaster Mechanical Assembly

( ) Locate the #1 sized grommet and install it in the opening in the end of the vinyl-clad aluminum case. A little saliva on the grommet may make installation easier.

( ) Mount the battery bracket in the inside bottom end of the case using two 2-56 x 1/4" flat head Phillips screws and nuts.

( ) Find the #4 solder lug and make a 90 degree bend 1/4" from the small tapered end.

( ) Install the switch from the inside of the case using the two remaining 2-56 x 1/4" flat head Phillips screws

PARTS LIST

Quan., Ace #, Description & Price

Resistors: (5% unless specified)	
4 — R4-103 10K — Brn, Blk, Or, Gld	.20
2 — R4-103B 10K 1% — Brn, Blk, Blk, Rd, Brn	.20
1 — R4-124B 121K 1% — Brn, Rd, Brn, Or, Brn	.20
1 — R4-155 1.5 Meg — Brn, Grn, Grn, Gld	.20
1 — R4-203B 20K 1% — Rd, Blk, Blk, Rd, Brn	.20
1 — R4-333 33K — Or, Or, Or, Gld	.20
2 — R4-471 470 ohm — Yel, Vio, Brn, Gld	.20
3 — R4-472 4.7K — Yel, Vio, Rd, Gld	.20
5 — R4-473 47K — Yel, Vio, Or, Gld	.20
1 — R4-492B 4.99K 1% — Yel, Wht, Wht, Brn, Brn	.20
1 — RV078 — 5K Vertical Trim Pot	.60
Capacitors:	
1 — CD102 — .001 mf Disc	.25
1 — CD221 — 220 pf Disc	.25
2 — CE475PI — 4.7 mf Electrolytic, P.I.	.50
1 — CT475A — 4.7 mf Dipped Tantalum	.90
1 — CY103 — .01 mf Mylar 5%	.40
2 — CY104 — .1 mf Mylar	.64
Semiconductors:	
2 — SS121 — 1N4446 Diode	.30
4 — SS029 — 2N4400 Transistor	.50
1 — SS041 — LM340 IC	1.40
1 — SS087 — LM324 IC	1.20
1 — SS150 — FPT100 Photo Transistor	2.00
Hardware:	
4 — HW042 — 2-56 X 1/4 Flat Head Screw	.04
4 — HW001 — 2-56 Nut	.04
2 — HW111 — #2 x 3/16 Self Tap	.06
2 — HW080 — 4-40 x 1/8 Screw	.04
2 — HW192 — L-Bracket	.30
1 — HW171 — #4 Solder Lug	.10
Miscellaneous:	
1 — PC153 — TachMaster PC Board	3.50
1 — MT010 — TachMaster Meter	12.50
1 — SW018 — DP3T Slide Switch	1.00
1 — PLA381 — Slide Switch Topper	.25
1 — SM192 — TachMaster Metal Case	8.00
1 — LB092 — TachMaster Case Label	.30
1 — CC042 — 9v Battery Connector, sm.	.30
1 — SM191 — Battery Bracket	1.00
1 — RP015 — #1 Grommet	.10
6" Ea. Red, Black, Green Hookup wire	
5" Yellow, 3" Brown, 2" Orange Hookup wire	
36" Solder	

The above parts plus complete kits and assembled units are available from Ace R/C, Inc., Box 511, Higginsville, Missouri 64037. Add $1.00 handling on all direct orders and please include the part number.

26K25 Ace TachMaster, Complete Kit	$29.95
26K25C Ace TachMaster, Assembled	$39.95

and nuts while capturing the #4 solder lug under the left side of the switch. The left side is referenced when looking inside the back of the case with the meter opening above the switch.

( ) Install the meter through the opening in the case from the front. Secure it with only the two posts nearest the switch. The meter comes with a small mounting hardware bag and each post should be secured with one washer, one lock washer and one nut. Remove all hardware mounted to the binding posts of the meter and re-install only the solder lugs and screws. Position the solder lugs on the back of the meter so that they point away from the switch. Snug up the screws but don't strip them.

( ) Again referring to the component overlay, insert the phototransistor into the appropriate holes in the circuit board from the top but do not solder it in place.

( ) Now mount the circuit board in the case by sliding the "L" brackets down over the top two meter posts. The electronic components will be facing the inside of the case. Secure the circuit board by installing the remaining meter post hardware.

( ) Wet the body of the phototransistor and push it into the grommet so that the back surface of the phototransistor is even with the inside edge of the grommet. Solder all three leads of the phototransistor to the circuit board and snip the excess leads.

Final Assembly

( ) Referring to the switch wiring diagram, solder the short red wire to the appropriate two lugs. Note that the long red wire coming from the circuit board also solders to one of these lugs so you may find it better to solder both wires simultaneously.

( ) Solder the red wire from the circuit board to the switch in the manner described in the preceding step.

( ) Strip an additional 1/8" of insulation from the black wire coming from the circuit board and pass it through the hole in the solder lug adding a small bend in the end of the wire, so that it stays in place.

( ) Solder the two yellow wires from the circuit board to the appropriate switch lugs.

( ) Solder the brown wire to the negative (−) meter terminal.

( ) Solder the orange wire to the positive (+) meter terminal.

( ) Locate the 9 volt battery snap connector and carefully strip 1/4" insulation from the black wire. In the same manner, strip 1/8" insulation from the red wire. Twist the fine wires of each lead and tin.

( ) Solder the black wire of the battery snap and the black wire already present at the solder lug at the same time.

( ) Solder the red battery snap wire to the appropriate switch lug.

( ) Now go back and double check that you have wired all connections properly. Do not proceed until you are satisfied that everything up until this point has been done correctly.

TachMaster Calibration

Calibrating the TachMaster is a very simple procedure. All that is required is a small bladed screwdriver and room light. It is not necessary that you be any closer than about 6 feet from the closest lamp or overhead lighting in your shop.

( ) Set the completed TachMaster, meter up, on your workbench. Gently tap on the meter face with your finger to check that the meter needle is resting precisely on "0." If not, carefully rotate the zeroing screw in the face of the meter until the needle is indeed on "0."

( ) Now check the position of the small arrow in the center of the trim pot mounted on the circuit board. It should be adjusted at this time so that the arrow is pointed straight up or in the centered position.

( ) Check that the switch is in the off position. Off is to the far left when the tach is viewed from the front.

( ) Attach a fresh 9 volt battery to the battery snap and place the battery in the metal battery bracket.

( ) Turn the switch on to the far right position and point the unit at a nearby lamp (this is the 0-5,000 rpm range) and observe the meter reading. If the meter doesn't move, you have a problem. If so, now is the time to go back and find your mistake. If everything is normal as it should be then the meter will be reading somewhere in the upper half of scale.

( ) While keeping the switch in this position, rotate the trimpot with the small screwdriver until the needle is positioned directly over the small calibration arrow on the meter face on the right-hand side. Also note this corresponds to a reading of 3,600 rpm on the 0-5,000 rpm scale.

( ) Now move the switch to the center position and note the meter reading. It should now be directly over the left-hand calibration arrow corresponding to a 3,600 rpm reading on the 0-25,000 rpm scale. If you find a very small discrepancy in the reading from one scale to the other, then you may consider touching up the calibration by using the arrow on the 0-25,000 rpm range instead. What this does is create better accuracy in the 0-25,000 rpm range than the 0-5,000 rpm range. However, it must be said that for a TachMaster to have this discrepancy will be very rare.

( ) Turn the switch to the off position.

( ) This completes the calibration of the TachMaster.

Final assembly is simply a matter of attaching the case back with four #2 x 3/16" self-tapping screws, attaching the front label over the switch opening and installing the switch "topper" on the switch button.

Using The TachMaster

In use you will find that the best place on the prop "disc" to take a reading is in the outer half. You will not get any useful results by trying to take a reading from the spinner so don't waste your time. Normally, good readings will always be found while holding the tach about 4 to 6 inches from the prop and you should **always** keep an eye on yourself when using any tach. **Never** turn to talk to someone when using a tach or you may find yourself with bodily injury let alone a pulverized tach, prop and possibly damage your engine. If you want to take constant rpm readings while tuning a carb, then use the buddy system. You can detect visually where the prop disc is, but working in these close distances from it should never be taken lightly. Just remember that a good .60 on 10% is pumping out 1½ horse at 12,500 rpm or about the same as some smaller lawn mowers. Would you consider sticking your hand into the mower blade?

Keep 'em flying. □

COMING NEXT MONTH

The Golden Oldie designed by Fred Reese for a .40-.45 four stroke engine. In the following month, floats for the Golden Oldie.

SUNDAY FLIER

Ken Willard

Photo #1

Photo # 2

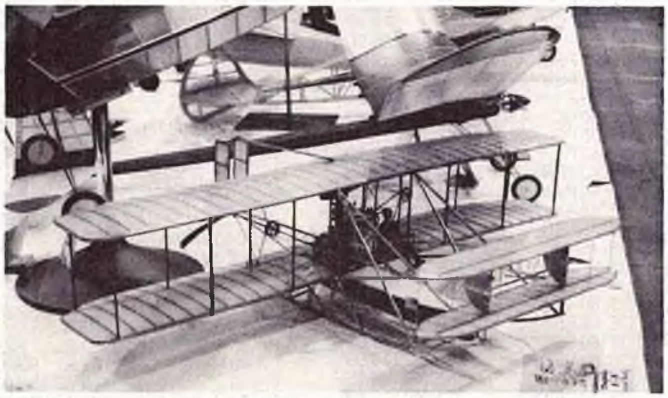


Photo #3

Photo #4

Last month I told you all about the Stits Skybaby quarter scale model going-to Toledo. This month, the Skybaby took to the air --- and bit the dust. Here's what happened.

Before attempting to fly the Skybaby, I made a one-half scale model of it out of foam, balanced it, and chucked it into the air. After many attempts, and adjustments of the center of balance, I reached a set-up which allowed the model to climb straight ahead under the impulse of the hand launch, then settle into a glide, which was quite steep, but steady. So, I knew the configuration would fly. After all, the full size job did, and so did the one eighth scale glider. (See Photo 1.)

The only thing I did not know was how much surface travel would be required for ailerons, elevators, and rudder. I set the throws at what I thought might be about right, and went out to the field. Yes, I was a bit nervous.

The engine started up and ran perfectly --- good top rpms and good idle. Dave Bridges carried the model out to the center line of the runway and headed it into the wind --- about five miles an hour right down the line. I gave it full throttle, and Dave let go. It ran down the runway, and when I thought it had flying speed, I lifted it off --- too soon. It stalled and dropped back down, nosing over and breaking the prop. No other damage. I did note that when it lifted off, it wanted to climb too fast, so we replaced the prop, restarted the engine, and made ready for another try. I also gave the elevators a bit of down trim.

Again, full throttle and let go. The Skybaby went about four feet and nosed up. Too much down trim --- and, in retrospect, that should have told me something, specifically that the

Photo #5

Photo #6

elevator was a bit too responsive. But I was too intense, and just figured I forgot to hold a good neutral.

Replaced another prop, and ready for another try.

Full throttle, let go, and down the runway went the Skybaby. This time I let it get more speed before lifting off, and the liftoff was a bit ragged, but good enough to stay airborne. The model gained altitude, and I thought "Hot dog! It's gonna fly great!"

After about five seconds of climb-out, the model started to turn slowly to the left. As the turn and bank increased, I gave it a bit of right aileron. Nothing. More right aileron. Nothing. Full right; the turn diminished, but continued to the left, right towards the parked cars. Gotta **do** something, so I fed in some right rudder. **Snap!** The Skybaby rolled viciously to the right into a vertical right bank before I could even neutralize. Quickly I gave it left aileron, and, knowing that the ailerons were ineffective, fed in a bit of left rudder. **Snap!** Back to almost vertical bank to the left. Now I knew I had a tiger by the tail. Carefully I tried to give just a small bit of right rudder and aileron, and finally got it flying with the wings level, but climbing too much. A bit of down elevator. **Zoom!** Right into a high speed dive, and again with that blasted left turn showing up.

Well, the end was near. When I pulled up elevator to get out of the dive, the nose came up, but the left turn increased. Another try to the right resulted in another snap, and finally the PIO (Pilot Induced Oscillation) got ahead of me, and the Skybaby snapped into the ground at high speed.

Rats! Six months' design and building down the drain. (See Photo 2.) Dave went over and picked up the pieces. We put them in the back of my car, and when I got home, left the wreckage and took a stiff martini, and another.

About an hour later, somewhat mellowed, I took the wreckage out of the car. Hm-m. No damage aft of the cabin, but pretty messy forward. Only minor damage to the wings. The decision was made; like the Phoenix, the Skybaby will rise to fly again. Surface control travel will be adjusted for less elevator and rudder, and more aileron, and the C.G. will be moved a tad forward, and we'll try again. Stay tuned.

★

By the time you read this, the results of the judging at Toledo will have been published and the winners named. Judging models at the Toledo show is something like judging some perfectly cloned models of Bo Derek. Which one really deserves the 10? With one exception, and that was the ship model that received the Best in Show award.

Since I had the Skybaby entered in Stand-Off Scale, I was interested personally in that category. No, the Skybaby didn't even rate the time of day with the judges --- and properly so,

Photo #7

Photo #8

under the circumstances. But I was surprised at the final results. Don't get me wrong --- Henry Haffke's Gee Bee is truly beautiful, and big. But, as I viewed the models, and did some informal judging of my own, I came up with some different results. So here are the Sunday Flier Awards for Most Unusual Stand-Off Scale models:

First Place — Frank Gordon, Avon, New York. (Photo 3.) Wright Standard Type "A" Canard Biplane.

Second Place — Gary Abrigo, Toledo, Ohio. (Photo 4.) Space Shuttle on 747 Transport.

Third Place — L. Mikulasko, Hamilton, Canada. (Photo 5.) Fairey Rotodyne.

Take a look at the photos, and you'll see what I mean. None of them were really **big** models, and didn't overshadow other aircraft in the display. As I've said before, big is almost synonymous with beautiful these days in the model world. But these three models were exquisite, in my view. The fact that each of them was also unique enhanced their attraction. To me, anyway; I like "different" models.

Speaking of different models, here's a letter I received from Sten Persson, Halmstad, Sweden:

Dear Ken,

I always read with great interest your "Sunday Flier" feature in RCM and, with particular interest, your coverage of unusual models in the November 1982 issue. I have always been interested in what the English call "unorthodox" models and, as an F/F modeler for some 20 years, I built and flew many weird shapes, such as canards, deltas, tail-less models, "flying discs," autogyros a.s.o. After I purchased my first Futaba radio some 8 years ago I first flew R/C assisted Old Timers for some years but then the old urge to try something different (at least when compared with what most of my club friends flew at the time) could not be resisted and I successfully built and flew Skip Ruff's FA-61 twin rotor autogyro from Model Builder plans.

Having been a delta fan ever since I first saw a SAAB 35 Draken (back in 1958) with its slender "double delta" wing, I then proceeded to build the delta model. I'd like to say that I designed it myself but a similar wing planform had been tried successfully on a German model several years ago and so I hesitate to claim that my "Black Delta" is entirely of my own design. It surely isn't a scale model but my sole goal was to create an impressive, even aggressive, picture in the air and, according to many spectators at model air shows where the delta has been flown, I succeeded to design a model that seems to be moving fast even when at rest on the ground!

Although a very simple model, its fuselage being a 1/8" balsa box and its wing a symmetrical section, silk-covered affair, it is quite impressive. It is true it is not much of a pattern machine but it rolls faster than I can follow it and loops are big and truly jet-like. However, its menacing, arrow-like shape against a blue sky or a low level beat-up of the field with its pusher S.T. G.15 screaming at close to 20,000 rpm on a 7/4 prop always make it a show-stopper. Yes, probably due to its clean design, pusher prop and low weight (36 oz.) it is very fast and has a tremendous acceleration. Its wingspan is 34", length is 38", and an electronic mixer operates the elevons. A mechanical mixer used initially was found to be less suitable on a high speed ship like this, probably because I never managed to make the link-up completely slop-free.

Although I had taken some precautions (lightweight elevons, elevon section thicker than the T.E. of the wing and minimal gap between the surfaces), elevon flutter developed on two occasions during shallow high speed dives and, on the the second time, the model was landed with part of the right elevon ripped loose. It has never occurred since. A Robart pump handles the fuel flow from the tank which is situated at the C.G.

My "Black Delta" has been around for some 4 years now (yes, I built it before Hobby Lobby's "Delta 40" appeared). Then, in quick succession, I built two ducted fan models (one R/C and one F/F) but then I planned to go back to my "Black Delta" design again. Although a simple sport model, it is by far my most successful R/C model yet and I want to try an even hotter .15 size engine (Rossi or Nelson) in a slightly modified version of it. I may still try that Rossi in my old trusty delta, but I won't build that second version mentioned above. The chief reason is that the SAAB factory recently has released a 3-view of their next fighter project, the "futuristic looking" canard SAAB JAS-39 that will start replacing the "Viggen" in the late eighties or early nineties. I have started drawing a simple model of it, based upon my experiences with the "Black Delta." Preferring the smaller size models it will be roughly the same size as my delta and similarly powered by a .15 size pusher engine. If it turns out as successful as my delta I will send you some black and white photos of it. I only have color shots of my "Black Delta" and, being made from

transparencies, they are not perfectly clear. However, for reasons mentioned above, I want you to have a look at them.

I know that most delta models more or less resemble the Greek letter that gives them their name and I have also built and flown (F/F) several such more or less equilateral triangles myself. However, I have seen no other delta planform that matches the looks of my "Black Delta" in the air and that's why I wanted to try it. Hope you like it, too!

Yours sincerely,
Sten Persson

Sten's a modest guy, apparently, since he had the model held by a friend for the photo (Photo 6). I agree with Sten --- the model looks like it's going supersonic even when it's being held!

Unusual models are always interesting. Another thing that is equally interesting is unusual flying technique. Here's a letter from Marty Vagts, Granada Hills, California:

Dear Ken:

As a subscriber to RCM I've enjoyed your column for many years. It has often been somewhat frustrating, though, to read about those sensational seaplane designs and not have a suitable water-flying site nearby. There are several of our Canyon Crosswind (Saugus, California) fliers who just love the look of a scale or semi-scale aircraft with floats. But where to fly? A pair of enterprising and enthusiastic club members decided to do something about it.

Jim and Ann Cross modified their two year old scratch built Cruisaire to accept a set of 32" Sure Flite floats. When they arrived at the field one recent Sunday and proceeded to unload their amphib they were greeted with ooh's and ah's from the local cloud burners. Jim fired up the HB PDP .40 with an adjustable three blade prop and began to **taxi** *over the wet grass of our infield! The craft gained speed rapidly and executed a beautiful take-off. The plane flew very well in spite of the added weight of the floats. When Jim landed on the grass and taxied back to the edge of the pits he was given a hearty round of applause. Now we can fly float planes anytime right from our landlocked field. Oh, by the way, we do have a timer operated pop-up sprinkler system which we installed to keep the grass green --- and very wet!*

Marty Vagts
Granada Hills, California

How about that! Seaplane floats and grass skis! Hose down your grass runways, fellows, and fly your seaplanes. Like Jim and Ann Cross (see Photos 7 and 8).

Or should I say "grassplanes?" □

GIVE IT A WHIRL

John Gorham

Last month we discussed some of the advanced flying that can be done with the newer, technically advanced helicopters and we talked of two maneuvers, autorotation and inverted flight. I plan to discuss the setting up of a helicopter for inverted flight in a later column. As we said last month, however, autorotation is not only easier to do but can be a much more useful (in case of engine failure) and, hence, a more widely used maneuver, so I thought we would discuss autorotation this month.

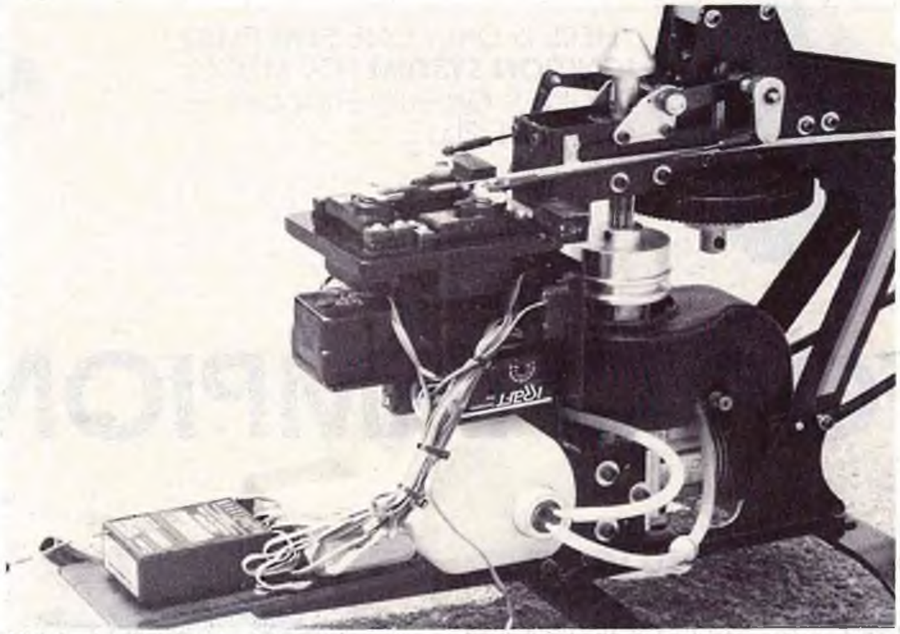
Understanding the autorotation process is not easy. To many of us, there is a conflict in believing that a rotor system which is normally **driven** by an engine can, after an engine failure, be itself **driven** by the same air which it was **driving.** It appears like lifting yourself up by your own bootstraps! Despite this credibility problem it is important for us to understand it if we are to do it so I'll try to describe autorotation in the very simplest terms I can. Bear in mind I may have to take some technical liberties here and there.

Full size helicopters have had autorotation capability incorporated since the very early days. The reason is obvious: human life is involved and engines do fail. So, especially if we only have a single engine, we must have a system available to ensure that our helicopter is capable of a reasonably safe emergency landing, **without** the use of the engine. Full size helicopters not only have the autorotation capability incorporated and available at all times but helicopter pilots are required by the FAA to practice and regularly demonstrate that they can handle an engine failure on the particular type of helicopter in which they are rated.

Theory Of Autorotation

Now how does it work in theory? Well, in a few words, it's a matter of using energy wisely. When a helicopter flys at an altitude above the ground, it possesses "potential energy." Potential energy, as the name suggests, is energy which a body possesses because of its position above the ground. The higher the helicopter is above the ground, the more potential energy is available. (Figure 1.) Gravity will always insist upon the helicopter coming back to earth if the power to keep it up fails to do its job. You can visualize potential energy by a heavy weight situated just a few inches above you. If you hold your hands up and the weight falls you'll probably be able to handle the situation, depending upon the heaviness of the weight. But if the weight is a good distance above you when it falls, then you're unlikely to be able to stop it when it reaches you. If the weight is heavier it need not be as high and if it is lighter if could be a lot higher. What has happened is that the weight has converted its potential energy into kinetic (or moving) energy. The further it falls, the greater the kinetic energy it possesses. (Figure 2.)

So the actual **energy** potential of an object is a function of its height above the earth's surface and its mass or weight. A helicopter will possess potential energy due to its position



Not received in time for last month's column, this shows a typical gyro installation in a helicopter.

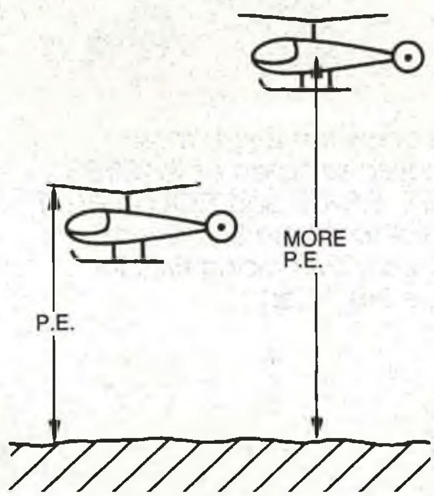


FIGURE 1
POTENTIAL ENERGY INCREASES WITH HEIGHT

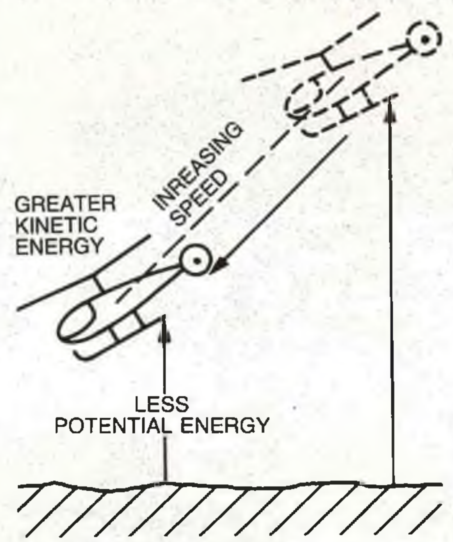


FIGURE 2
KINETIC ENERGY INCREASES AS POTENTIAL ENERGY DECREASES

above the ground. However, what we need to provide to the rotors so that our helicopter can land safely after an engine failure, is not potential energy, but kinetic energy. That is to say, a moving or working energy, not a positional energy. Kinetic energy is the energy which a body possesses because of its motion. In order to flare and settle a helicopter to a soft landing, energy has to be fed into the rotor blade system to overcome drag. This energy must come from somewhere and is the basic need of autorotation. If our helicopter has a high potential energy level (that is to say, it is a reasonable distance above the ground), if our helicopter has a good blade speed (and therefore a good stored energy in the rotor blade system), then by the proper use of these two elements in our piloting we should be able to arrive close to the ground with enough energy available in our rotor blade system to flare and land the helicopter gently, even though we don't have an engine to provide the power to do this. Basically, to conduct an autorotation safely we need:

(a) Stored energy in the blade system. This can exist already because of the rotor blade speed just prior to engine failure and/or we can derive it from:

(b) The potential energy due to our height above the ground. Autorotation is a properly controlled interchange of (b) into (a) so as to arrive at the ground with enough stored energy in the main rotor to flare and land.

Obviously if an engine of a helicopter fails at only 10 feet above the ground there will be enough energy stored in the rotor blade system to enable the pilot to land the helicopter safely. This is simply because the rotor system has enough stored energy to last long enough for the pilot to increase collective blade pitch enough and, hence, lift to produce a soft landing.

But what if the helicopter is at about 1,000 feet and the engine fails? Now, although we have the same energy in the blade system, this energy can expend itself before we get to the ground simply because the power needed to feed it has ceased to exist. That is, the engine has failed. So we must now find a way of transforming our potential energy into sufficient kinetic energy for the main rotor blade system to continue rotating until we have landed safely.

Operational Limitations

As we have discussed, there will be a height below which it is readily possible to autorotate and there will be a height at which we should have

to page 140

enough potential and kinetic energy (if managed properly) to conduct a safe landing. However, there are situations when we will be in a position where we **cannot** interchange the energies properly in the time we have available and, under these conditions, it will be impossible to make a safe autorotation landing. Figure 3 shows what is known as the "dead man's" area in which it is normally impossible to make a safe autorotation.

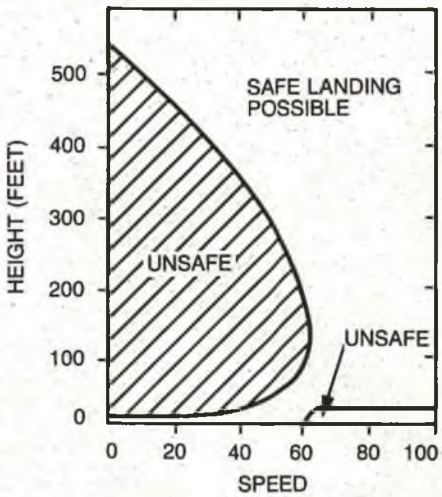


FIGURE 3
"DEAD MAN'S" ZONE FOR AUTOROTATION

Design Limitations

So far as the helicopter design is concerned, we must have enough mass (and speed) in the main rotor blade system so that the energy we need to safely conduct the flare and landing is available at, and for, the time needed.

We must have a low value of frictional drag in our system. That is to say, all of the parts making up the main rotor drive system must move freely.

We must have a collective pitch range which includes the capability of setting the required negative pitch blade angles.

How To Do It

Now, how do we go about swapping our potential energy in order to feed in and, hence, maintain the kinetic energy in the rotor blade system? Normally our rotor blade system is being rotated by the engine and the rotor blades are "pulling" air down and over the surface of the blade airfoils, thus creating lift (Figure 4). In order to maintain the rotational speed of our rotor blades we provide power from the engine to overcome the aerodynamic drag created as the airfoil passes through the air to create the lift which we need. If our power source fails then, depending upon the rotor system speed and drag, the blade system will slow up, and eventually

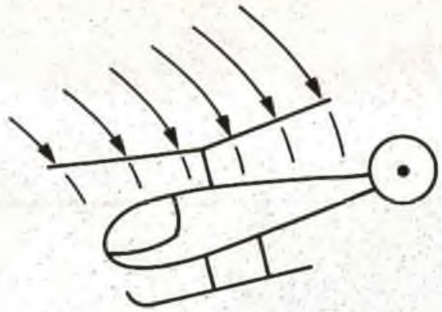


FIGURE 4
AIRFLOW OVER ROTOR BLADES IN FORWARD FLIGHT

stop, simply because there is no force available to overcome the drag. Lift then stops also.

So we must keep the rotor blade speed up in some way. But wait! As our helicopter falls (as it must after an engine failure), air will be flowing up from below causing forces which will slow up and quickly stop the rotor blades (Figure 5). In fact, the airflow would then commence "windmilling" the blades in the wrong direction!

Suppose we reduce the pitch of the blades, even to a negative angle. Then, under these conditions, the air flow coming up from below the helicopter caused by its fall through the air will now drive our rotor blades in the proper direction. Except, of course, we now basically have negative pitch and so, in theory, negative lift. If the amount of negative angle is too great the helicopter will fall extremely fast, thus creating the need for much more energy in order to break its fall. If the negative angle is too small, then the upward flowing air will not provide sufficient driving power to the rotor blades. They'll slow down and eventually stop. In practice, what happens is that, after an engine failure, the pilot will immediately adjust his rotor blade angles (collective pitch setting) to such a negative angle that there will be a rotational driving force on his main rotor system. This driving force will take place over the center part of the rotor blade system where the forward blade speed is less. **Lift** will exist in the outer part of the blade system where the forward blade speed is greater. (Figure 6.) So now we have a rotational driving force, **plus** some lift. This is kind of hard to understand but if you look at the diagram you will see that the outboard part of the rotor blades are going through the air at a faster speed than the inner portion. So the actual lift vector is positive at the "outer" ring and negative at the "inner" ring of the rotor blade system. The **combined** result will be a slightly positive lift force which can be

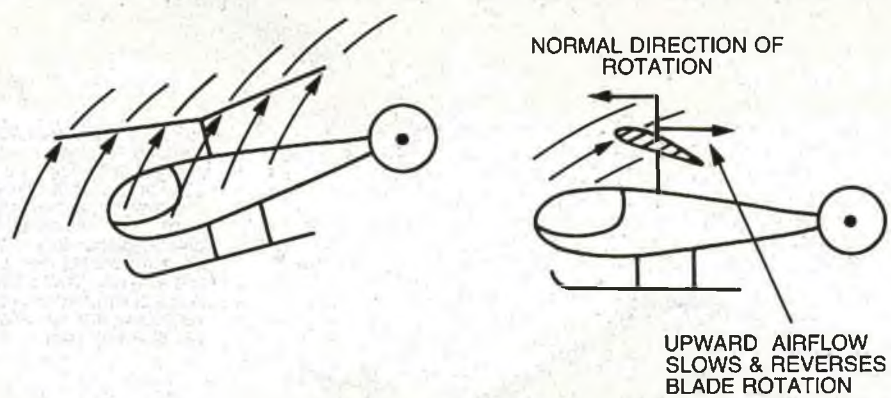


FIGURE 5
HELICOPTER FALLS — ROTOR BLADES SLOW, STOP AND REVERSE DIRECTION

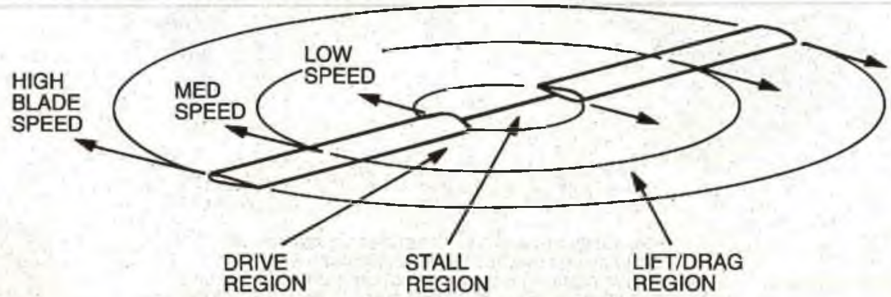


FIGURE 6
AUTOROTATIVE LIFT/DRIVE REGIONS OF ROTOR BLADE SYSTEM

varied by either changing the pitch angle of the blades, or by changing the descent rate/flight path angle of the helicopter. It is not really necessary to fully understand the theory of this, but it is necessary to appreciate that adjustment of the pitch angle of the rotor blades will make a difference to the falling speed of the helicopter and, hence, the amount of energy needed at the last part of the landing. You can create a very strong driving force by having a high negative pitch angle but then you will need a lot of energy to break the fall, flare and land. (Figure 7.) If you have less negative pitch angle, then this may result in there not being enough energy contained in the blade system when you finally get to the flare and landing. It's a matter of adjustment in the flight path, as well as the negative pitch setting of the rotor blades. Fortunately, it's not as hard to do as it is to understand.

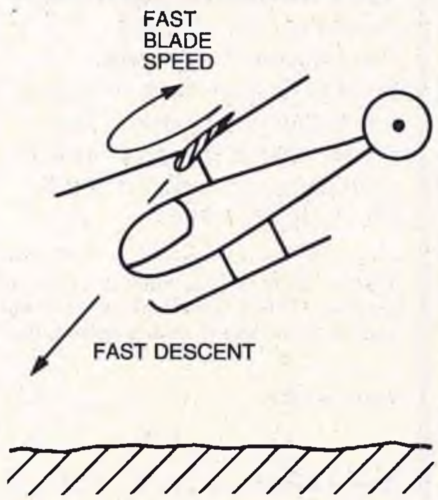


FIGURE 7
TOO MUCH NEGATIVE PITCH

Mechanical Arrangement

Now how do we arrange the mechanics of our helicopters in order to permit this autorotation? Well, in a full size helicopter, the engine is driven through a clutch which can be disengaged rapidly. (Figure 8.) When this clutch is disengaged the whole drive machinery is now free to move

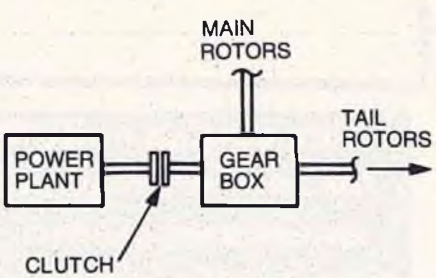


FIGURE 8
MANUALLY OPERATED RAPID DISENGAGE CLUTCH

only against the friction of its bearings and shafts and the aerodynamic drag of the rotor blades. The tail rotor system is still connected to the main rotor system and the pilot has the ability to lower the pitch of his main rotor blades to a negative angle by the use of his collective pitch lever.

In the case of our model helicopters it is our current practice to have a **centrifugal** clutch mounted on or close to the engine. (Figure 9.) The engagement (and disengagement) of this type of clutch depends upon the **speed** of our engine and it is there so that we can have an automatic means of engaging our engine while standing safely away from the rotor blades. If you'll think about this for a moment, even though the clutch will eventually disengage as the speed of the rotor blades fall, the engine speed must, of necessity, be very low when this happens. Hence, the main rotor speed will be low before the drag produced by the "dead" engine can be released.

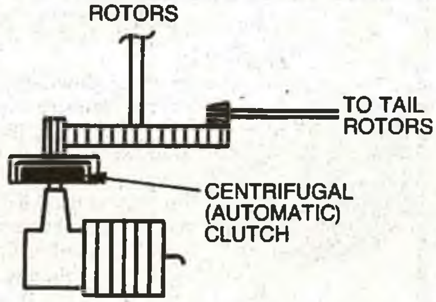


FIGURE 9
MODEL R/C HELICOPTER CENTRIFUGAL CLUTCH

Now you have lost some, in fact most, of the stored energy which you needed so badly. The solution to this, adopted on nearly all modern R/C model helicopters, is to place an additional clutch in the hub of the main drive gear of the rotor shaft. This clutch is designed to engage and disengage simply as a function of the **direction** of rotational drive. It is a directionally sensitive, not a speed sensitive,

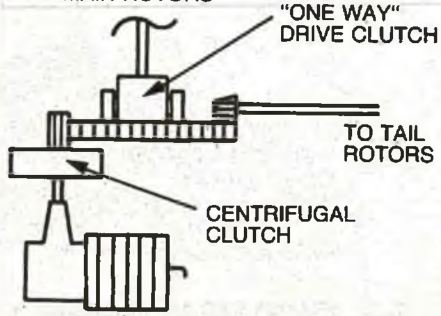


FIGURE 10
"ONE WAY" DRIVE CLUTCH

CONTEST ANNOUNCEMENTS

MIDDLE TENN. RADIO CONTROL SOCIETY & KROGER CO. VOLUNTEER STATE SCALE MEET (R/C Scale)
September 10-11, 1983.
Mid-Tenn. Aviation, Dickson, Tennessee.
For further info, contact: Stan Alexander, 320 Welch Rd. G-4, Nashville, Tennessee 37211. Ph. (615) 331-7903.

CAPITAL AREA SOARING ASSOC. 1983 SOARING CONTEST
September 10-11, 1983.
The National Geographic Society, Gaithersburg, Maryland.
For further info, contact: Tom Dickey, 20408 Meadow Pond Pl., Gaithersburg, Maryland 20879. Ph. (301) 977-9424.

If your club is planning a show or contest, fill out this form and we will publicize the event, space permitting.

Name of Club: ____________________

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Type of Event: ____________________

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Date of Event: ____________________

AMA Sanction #: ____________________

Location: ____________________

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For further information, contact: (name, address, phone no.): ____________________

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

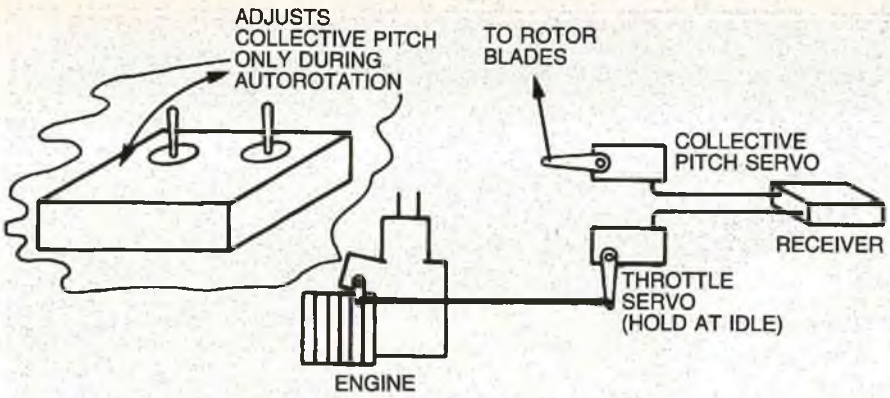


FIGURE 11
THROTTLE "HOLD" MODE FOR PRACTICE AUTOROTATIONS

device. Clutches of this type are known as "Torrington," "Spragg" or "No-back" and when the main shaft or engine is **driving** the rotor blades, the clutch provides a positive drive. When the drive torque stops (as in the case of an engine failure), then the rotor

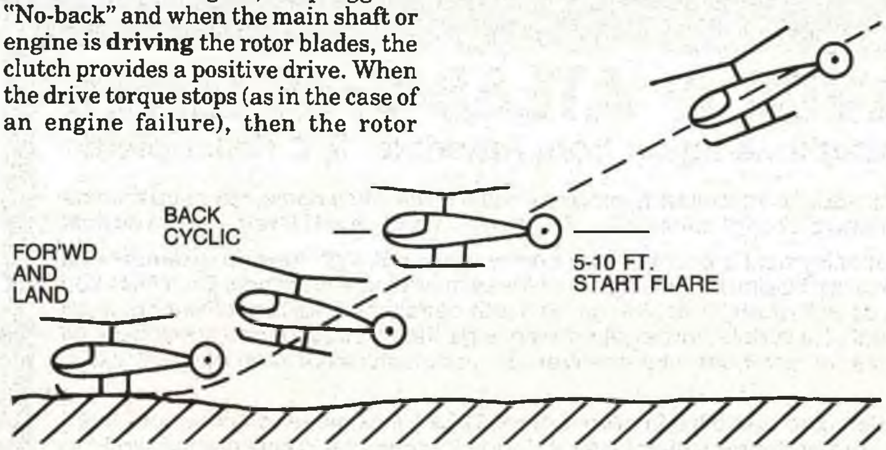


FIGURE 12
CYCLIC FLARE AUTOROTATION

system is able to, and will, continue spinning since the clutch is virtually friction free in this opposite direction. (Figure 10.)

Ah! But now we don't have any tail control since the tail rotor gearbox is no longer connected to the main rotor system because our R/C model helicopter clutch is fitted on the main rotor shaft **after** the tail drive shaft takes it power. As it happens, we "luck out" because if we are not **driving** the main rotor system from the helicopter then we don't have any **torque reaction** on the fuselage. So we don't need compensation of this torque by our tail rotor system. The driving force on the main rotors is provided from the air outside and, hence, the torque reaction on the helicopter fuselage is virtually zero. (There is a "leetle" due to the friction of the main shaft bearing but is too small to worry about.)

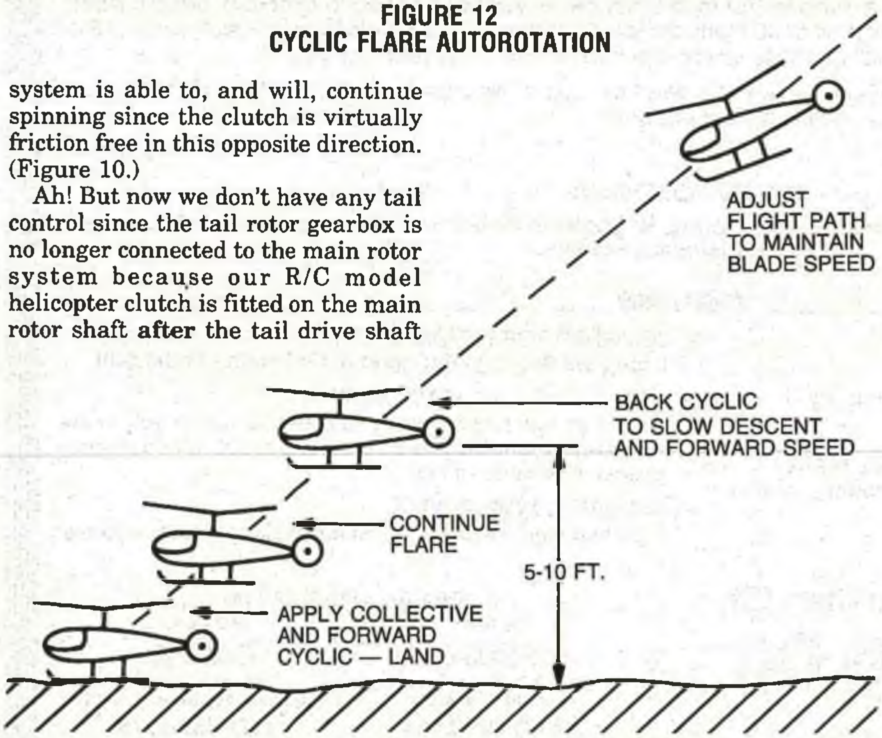


FIGURE 13
COMBINED CYCLIC AND COLLECTIVE AUTOROTATION LANDING

There is one problem of not having tail rotor control, however. We cannot **rotate** the helicopter when we are near to landing and this is sometimes required with the full size helicopter, especially when autorotating in tight places. But if we are concerned solely with making a safe, even an accurate, landing without the need for any rotational yaw motions, then our model system is perfectly adequate. The system used on the R/C model also has the advantage that we have relieved the whole main rotor system from all friction except its own bearings.

Piloting Techniques

How about the piloting technique needed to do an autorotation. First of all your helicopter must have collective pitch so that you may change the pitch angles of both blades simultaneously, as required. Secondly, your radio system must provide you with the ability to change these rotor blade angles (collectively) independent of the throttle position from the control on the transmitter, of course, if you want to **practice** autorotations. Practicing autorotations is done by freezing the engine throttle setting in a low idle position, but keeping your throttle/collective servo still controllable by the throttle (collective) lever. Naturally you must have five channels to do this, one each for engine throttle control and one for collective pitch control. Most helicopter radios today have this capability and they also have a transmitter located switch called "throttle hold." When you flip this switch your engine speed is held at idle while you can still vary collective pitch as desired by adjusting your "throttle" lever. (Figure 11.)

Now, as you can see, you can fly your helicopter to the desired height (high!) and speed (fast!), flip the switch as you drop the throttle lever and you will come whistling through the air toward the ground at a "great rate of knots" to practice your autorotation. If your courage fails or you have doubts about the wisdom of what you are doing, you can flip the switch again which reconnects you and your throttle lever

to the engine power and "go around" again for another try. This feature has enabled some fliers "demonstrating" autorotations down to about ten feet. These "demos" are not true autorotations at all. That last few feet is a very important (and scary!) part of the autorotation and is also the most difficult part. However, the ability to practice autorotations in the early stages of learning is useful, especially if you really mean to do one, or two, or . . . If your radio doesn't possess the required switching feature, there is a gadget which you can buy to fit on board the helicopter. This device can be switched by one of the additional channels and it stops the engine servo in a certain position (low idle), thus providing the same feature as the transmitter based switch.

Now for the actual technique for doing an autorotation. As we said earlier, you should experiment with the negative pitch angle which your helicopter requires in order to maintain rotor blade speed while preserving a reasonable descent rate. You (or, rather your helicopter) will be descending at between 3 to 5 times the normal descent rate of a fast approach. This can be quite scary until you become confident that you can **stop** this descent reasonably easy. The negative pitch angle at which your blades should be set varies with different helicopters but is usually between 1 and 2½ degrees. This angle should be adjusted until, while you are descending, you can hear that the blade speed is being maintained without the need for an unreasonably steep flight path angle descent. Some fliers even drill small holes in the tips of their rotor blades so that they can better judge rotor blade speed by the audible sound that the holes produce.

Now comes a part which is not difficult to do but which is kind of like diving into the swimming pool off the 30 foot board for the first time! When you actually commit to an autorotation you are approaching the ground at a rate of maybe between 25-50 feet per second. Now here's the joy of your life about to smash itself into little pieces and you're the one that's making it do it. Don't panic; it's amazing how much a little back cyclic will do to slow the descent and, in fact, that's precisely what you do in an autorotation. At an altitude of somewhere between 5 and 10 feet above the ground, pull back on cyclic pitch. This creates a backward and upward lift vector from the rotor blade system which slows the descent rate of the helicopter and also reduces its forward speed. In fact, it's possible to perform a safe autorotation without using any positive collective pitch at all. One of the types of autorotation

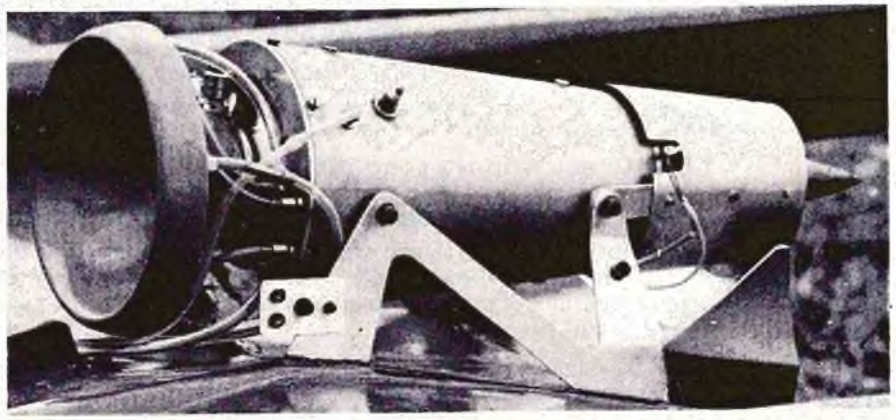
practiced by the full size helicopter pilots is simply that. The "flare only" autorotation is done by inputting back cyclic at the proper moment. The helicopter then slows up and settles to the ground at a fast reducing rate of descent. A little forward stick at the last moment will let it slide on to a relatively soft landing. (Figure 12.) Of course, the surface of the ground must be reasonably smooth for this to be a safe procedure and this type of autorotation is more elegant when done in a relatively strong headwind.

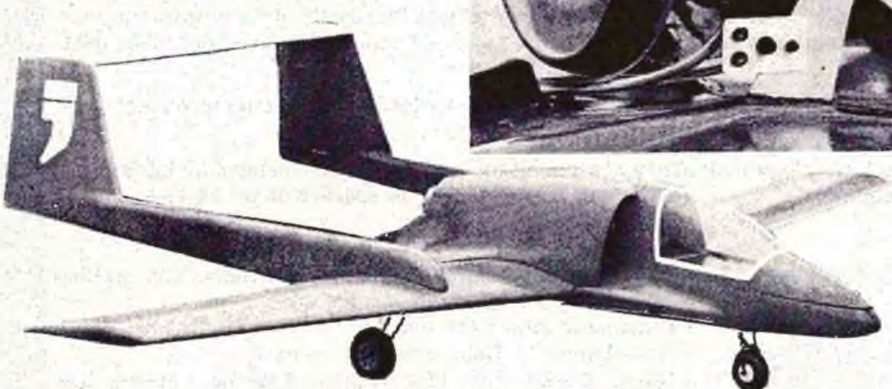
The other and more normal type of autorotation is to use a combination of cyclic flare and collective pitch. Cyclic pitch control is applied just as described at between 5 and 10 feet and, as the helicopter settles down to the ground, collective pitch is added and the nose is then tilted forward so as to land the helicopter almost in the normal manner. (Figure 13.) Some fliers are becoming so good at autorotations that they can land on a 3 foot diameter landing pad quite frequently; certainly the helicopter is almost never damaged, even after dozens of autorotations.

So, if you want to try autorotations you must ask yourself several questions. Do I want to do it? I guess I believe that if I'd had an adequate autorotation capability available and had the skill to use it I could have saved myself quite a number of major crashes over the years. Is my helicopter capable of doing it? If it has a relatively stiff drive system and light blades then it may be very difficult to do autorotations. With poorly designed mechanics and clutch, the conservation of energy process becomes critical because the stored energy in the blades is being constantly used up against the high frictional forces of the helicopter drive train and its clutch. If your helicopter has reasonably heavy blades, a very low friction drive system, and a well-designed autorotation clutch then autorotations can be really easy. Many of the newer helicopters available today can do autorotations readily and regularly. Some of the older ones will do them, too, but the pilot needs to be much more skillful. In any event there is no doubt that our modern R/C helicopters, from now on, will not only have to possess "autorotation" but it must be a true autorotation capability which is readily usable in the hands of an average flier.

□

JET FLIGHT TRIUMPH!





The gas turbine engine is above in place on the *Barjay*. On the left is the completed aircraft ready to roll.

ON MARCH 20, 1983, a small red aircraft rolled down one of the runways at RAF Greenham Common and lifted into the wintery sky with the unmistakable whistle of a jet engine. A common enough occurrence at many airfields, but what made this particular event so important was that it marked the first ever flight of a radio controlled *model* aircraft powered by a gas turbine. Few of the people who wanted to see this momentous occasion were actually present, for in fact the purpose of that day's excursion was to be ground testing and taxi trials to check on the aircraft's fuel system, but the machine (which has been christened *Barjay*) showed such potential even with the throttle mechanically restricted to limit the engine to 60000rpm that the aircraft was allowed to accelerate to take off speed and gently lifted off into a smooth and historic three minute long first flight.

It has been Jerry Jackman's personal determination that has kept this project going through eight years of development. Jerry himself stresses, however, that the final achievement was very much the result of a team effort, the team comprising of Barry Belcher, Ray Carter, David Sitch and Chris White, each having a specialised talent essential to the project.

All team members are active aircraft modellers. Jerry, who started the project alone, recruited the individual members of his team from the flying field, each member feeling able to contribute some of his specialist knowledge to Jerry's particular problems which appeared to increase as the project developed and the technology evolved.

At one stage, eight years ago, Jerry had evolved a prototype which would self sustain but not accelerate. Chris White (machinery engineer for a petrochemical contractor) 'climbed aboard' and redesigned the compressor and power turbine blades. The improvements resulted in the requirement for a man to redesign the rotor mechanics. Consequently, David Sitch was recruited and further improvements resulted. Ray Carter joined five years ago and made dramatic improvements to the mechanical design. The last member, Barry Belcher, who's finest contribution was to conceive and design a superb test bed with eye appeal, also refined the turbine blade shape to achieve even better performance. Many setbacks and disappointments had been overcome to arrive at the main runway at Greenham on the 20th March and some problems have still to be solved to improve the reliability of the powerplant.

Basic principles

Mechanially, the jet engine is one of the simplest engines for there are so few moving parts. It is necessary, however, to understand a few of the basics of the jet before going into details of the construction and performance.

Air, like all gases, expands when it is heated. In an internal combustion engine, the air is mixed with fuel before it is injected into the cylinder and ignited. The expanding gases push the piston down the cylinder and the con-rod and crankshaft translate the linear motion into a rotary one, which has to be used to create thrust through some other medium; propeller, ducted fan, wheels, etc.

A jet engine is simpler in concept for the expanding gases are directed out of the open ended tube within which the fuel is burnt to create pure thrust on Newton's principle of action and reaction. For thrust to be continually generated it is essential that the expanding gases only come out of the rear end, while fresh air has to be fed into the front to maintain combustion. The ram jet gets around this problem by the simplest means possible, for it relies upon the ram effect of the air entering the intake preventing the exhaust going the wrong way. Unfortunately, this engine has to be moving through the air at considerable speed before it can be started, which is why it is infrequently seen.

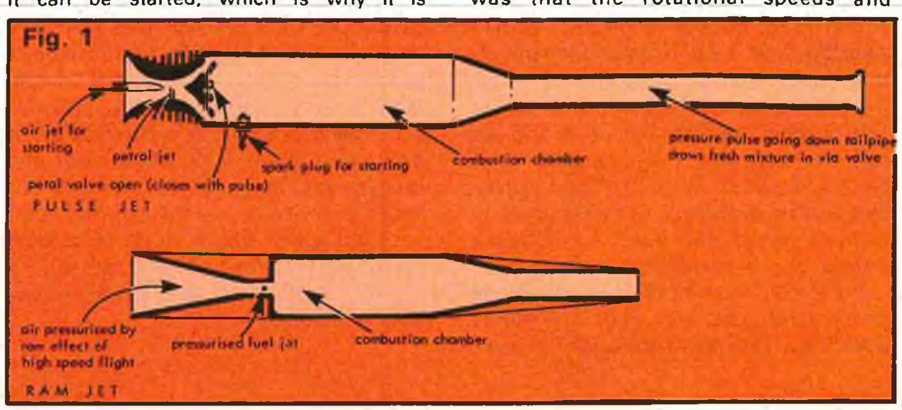
A spring loaded shutter or valve fitted into the air intake turns a ram jet into a pulse jet. Air and fuel passes through the valve until the charge in the combustion chamber ignites. Back pressure then closes the valve as thrust is generated, this remains closed until the charge is exhausted when spring pressure opens the valve to allow more fuel and air to enter the engine, restarting the cycle. The drawback to this jet is lack of effective control both of the thrust pulses or the ensuing noise. Thrust increases as the pulse jet accelerates to create a ram effect at the intake. (See Fig. 1).

In order to generate thrust air must be accelerated through the engine in a continuous stream. As with a piston engine efficiency increases with operating pressure which in the case of a gas turbine is provided by a compressor. Jerry's compressor absorbs about 25 bhp. To drive this compressor at 85,000rpm a highly efficient turbine is required. This item has proved to be the most difficult single component to develop and manufacture. Energy that is left in the hot exhaust is converted to thrust by accelerating the gas down the tailpipe.

Jackman's Jet

It would seem from the theory that a gas turbine would be an incredibly easy device to build, but the theory ignores the practical considerations of metallurgy, thermodynamics and aerodynamics.

One of the first facts that had to be realised was that the rotational speeds and



This superb article on Jerry Jackman's gas turbine engine was written by Gordon Batt and is reprinted from Radio Modeler Magazine through the kind consideration of Ron Moulton, Managing Director, Model & Allied Publications, Ltd., Herts, England. The successful flight of a radio controlled model aircraft powered by a gas turbine engine is indeed a historical milestone for model aviation. RCM congratulates Jerry Jackman and his dedicated team for an outstanding accomplishment. Please Note: There are no other plans, technical data, or any type of information available from RCM, Model & Allied Publications, or the Jackman Team. At this time, the Jackman Team does not intend to enter into commercial production, in any quantity, of the jet engine. If there is any change, the world will be advised by the model press. Meanwhile, none of the above mentioned organizations are staffed to enter into correspondence regarding the Jackman jet engine.

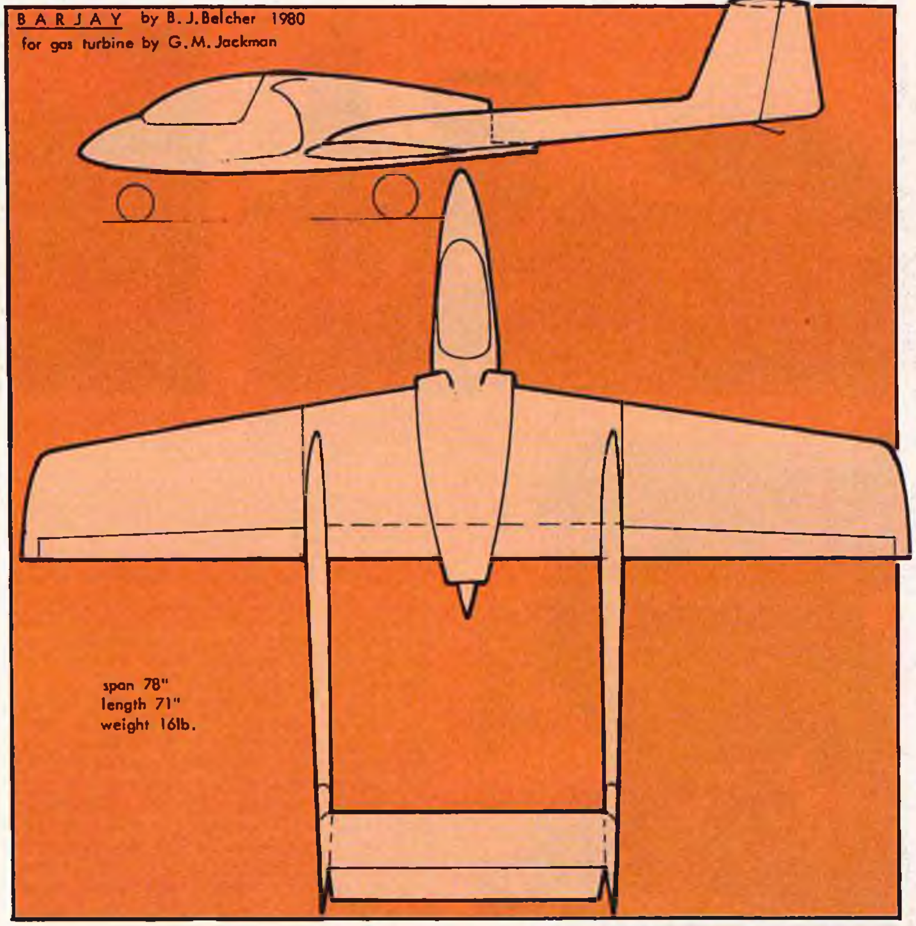
Diameter: 4.75in.
Length: 13.5in.
Weight: 3¾lb.
Fuel: Propane.
Centrifugal compressor: 3in. dia., tip speed 1,100ft./sec. Pressure ratio 2 to 1.
Combustion chamber: Annular.
Turbine: Axial flow.
Exhaust temperature: 650°C.
Starter: 24 volts, 1.5hp at over 30,000rpm.
Thrust: in excess of 9lb. at 85,000rpm.
Top rpm limit: 97,000rpm.

temperatures were going to be far in excess of normal aeromodelling experience. For example, many modellers are reluctant to rev their two-stroke glow motors faster than 24,000rpm, but the model gas turbine cannot even be started until the shaft has been spun up above this figure. At about 37,000rpm the engine is self-sustaining but has to be run up to 45,000rpm to create thrust and obtain a rapid throttle response.

Externally, the jet is just a featureless cylinder with a large rear exhaust nozzle and a strangely tiny intake in the blunt forward face. The large diameter of the front is due to the use of a centrifugal compressor, a type that has contoured blades that spin a cylinder of air, centrifugal force throwing the air outward in a ring to create a low pressure at the centre which draws more air into the compressor. When the engine is turning over at 85,000rpm the compressor draws in five cubic feet of air per second into the engine through the approximately 2in. diameter intake.

After leaving the compressor the air has to be turned sharply back towards the annular combustion chamber and drastically slowed to increase the pressure. The air then passes back along the outside of a perforated shroud, between the combustion chamber and the outer casing. Considerable effort went into the design of the shroud, for holes have to be correctly positioned and absolutely the right size to allow the right amount of air through at the proper speed. For example, the front of the combustion chamber primary (or combustion) air has to be fed in at a very slow rate to feed the gas jets without extinguishing the flame. At the rear of the shroud the secondary air has to be fed in at the correct position for it to be heated by the gas flames.

The size of the flames are critical to the running of the engine. Too small and the engine will lack power, too large and they will hit the turbine and tailpipe causing a frightening rise in temperature. Obviously the flames cannot be seen when the engine is running so considerable theory and calculation had to be gone into to design the fuel jets and combustion chamber to produce the necessary flame. In the early days engines were built that glowed white hot and the team were highly delighted when the tailpipe



temperatures were reduced to a mere 600°C.

It is the turbine wheel that takes the full force of these frightening temperatures and also has to resist the stresses imposed by the terrifically high rpm.

Nickel alloy is used for this particular part of the engine, which has to be cut from a solid disc as trials have proven that separate blades cannot be fixed securely into a solid hub. Alloys of such tensile strength cannot be worked on the kitchen table with a vice and file, and the team had to employ a spark erosion machine to form the turbine blades.

Spark erosion is a controlled use of the phenomenon that causes a car's contact breaker points to erode. The workpiece takes the place of the cathode and the anode is formed in the shape of the hole that has to be cut. An electric current caused sparks to jump from cathode to anode and each spark carries with it a particle of the workpiece.

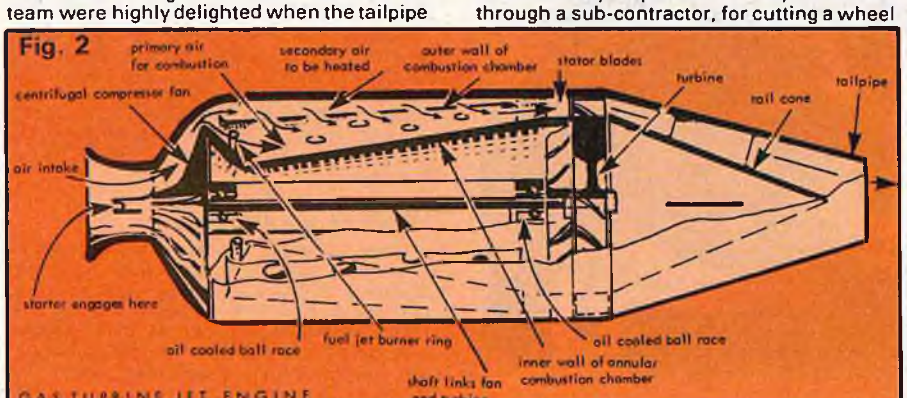
Commercial spark erosion machines are tremendously expensive to buy or to use through a sub-contractor, for cutting a wheel takes a few hundred hours. Jerry therefore developed his own miniature spark erosion machine, which was no mean technical achievement in its own right.

The turbine and compressor are linked bv a 1in. diameter shaft, the size of which is an indication of the amount of power that is taken from the potentially available thrust in order to compress more air. Special high speed bearings support the shaft and these are both cooled and lubricated by a pressurised oil supply.

Oil is carried in a small pressure tight cylinder similar to a gas lighter refill, which is pressurised by an air bleed from the compressor. In the course of a ten minute run the engine will consume some 35ml of Castrol Turbine oil, the used oil being thrown out of the bearings into the gas flow through the engine.

Fuel consumption is also quite staggering, for in the course of a seven minute run at 85,000rpm (about 90 per cent available thrust) the jet will guzzle 1¼lb of liquid Propane. In the aircraft, the fluid is carried in a lightweight pressure bottle in the fuselage below the engine. During the initial taxi trials problems with the fuel supply were encountered, which the team believes have now been solved. From the tank, liquid propane is taken via silicone fuel tubing up to the throttle valve, which is a servo driven needle valve, a barrel or butterfly valve being far too insensitive. From the throttle valve the fuel is taken, via copper tubing around the tailpipe of the engine to vapourise the fuel and then to the ring of fuel injectors at the front of the combustion chamber. There are a number of jets in the fuel manifold, their size, position and number being precisely calculated so that the quantity of fuel would be correct for the amount of air and the size of the flame required.

Fig. 2



TURBINE

Left: Ray Carter tops up the bearing oil before another flight.
Above: the *Barjay* is assembled.

Above: the packed fuselage. The fuel-tank can be seen between the wing root leading edges behind the oil tank.

Airframe details

The engine is supported by an alloy sheet frame on the back of the fuselage in the manner of the Heinkel He 162, although the twin boom layout of the whole aircraft reminds most people of the *Venom* or *Vampire*. Even though the aircraft has been designed expressly as a flying test bed for the engine, the finish is absolutely superb, the canopy in particular being crisp and flawlessly moulded.

The three parts of the fuselage (underside, engine cover and front top) were moulded from red pigmented glass fibre while the wing panels, tail booms and tail surfaces have a balsa construction. Dope, tissue and paint were used to finish the airframe. A tricycle undercarriage is employed, each leg being individually sprung and the nosewheel is equipped with a brake to allow the engine to be run up before take off.

Control linkages are kept as short as possible by locating servos adjacent to each control surface, for example the elevator's is mounted within the tailplane and each of the twin rudders has its own servo within each boom. The receiver Ni-Cad, nosewheel, brake and throttle servos are concentrated in the nose of the fuselage. For transportation the tailbooms and tailplane are removed in one piece and each outer wing panel detached from the fuselage and centre section.

Pilot's notes

The engine is started with a geared up electric motor which engages with a cone on the compressor. Access to the installed engine for starting is obtained by removing the front top of the fuselage, which also allows the necessary metering devices to be temporarily attached. These include a tachometer which works from a light source and photo cell within the air intake cone, pressure sensors to check on the effectiveness of the compressor and a tailpipe temperature sensor.

To start the engine, the starter is engaged and the rotor spun up to about 24,000rpm, at which point the fuel mixture is ignited by a miniature spark plug set in the combustion chamber wall. After this first ignition the burners work continually like a gas cooker ring. The engine is then carefully monitored as it is accelerated to its normal running speed and the starter removed.

From the spectator's point of view this is the most exciting period of the flight demonstration. The engine, running at well below peak efficiency, bursts into life with a hoarse roar and then growls unevenly as the throttle is slowly opened. As the engine accelerates to its designed running speed it actually cools off and at peak efficiency it is possible to lay your hand on the outside casing of the engine.

When the designed running speed is achieved the engine note changes to the clean steady howl of the true jet engine and the metering instruments and starter are all cleared away. The aircraft is then reassembled ready for take off.

Several attempts were made at a first flight but problems can still occur even though the engine is perfected. Some of these will be familiar to all modellers, like those concerning fuel feed and contamination, and others associated with full size jets, such as FOD, (Foreign Object Damage), i.e., damage caused by stones, etc. being drawn through the engine.

The first flight was made almost upon an impulse on one of the days originally set aside for taxying trials. A mechanical stop was set up on the throttle to restrict the engine to 60000rpm, less than half the theoretical maximum available, and the aircraft taxied around to check upon the performance of the engine with the aircraft's fuel system. Even with such a restricted amount of thrust (which gave a power to weight ratio somewhat better than *Concorde* at full bore), the jet showed such willingness to go that Jerry allowed the machine to accelerate to flying speed and lifted off into a three minute flight of steady circuits. At the time of writing a flight with the engine producing 100 per cent thrust has yet to be attempted.

What of the future?

What indeed. It is unlikely that versions of this motor are going to be seen powering models at many clubs flying fields over the coming months, for although the idea of producing the engine commercially has been considered it would be extremely expensive, the price possibly exceeding even the fabulous Techno radials. □

Jerry starts up the turbine for a test run. Fire precautions are in evidence, very important considering the volatile and explosive qualities of the Propane gas fuel.

TAKE A LOOK AT F3E ELECTRIC SAILPLANES

R/C Electroflight or F3E, as it is identified by the FAI, covers quite a few aspects of model flight. Electro powered models have been flown in pattern, pylon, scale, and glider events in Europe for quite some time now with outstanding success.

"So howcum we don't have all that good stuff here in the good 'ol U.S. of A.?" you ask. Good question! From my point of view there is no reason why we in the U.S. cannot enjoy the benefits that electric flight has to offer, and we will, just as soon as we can dispel some of the myths that surround this form of power for models.

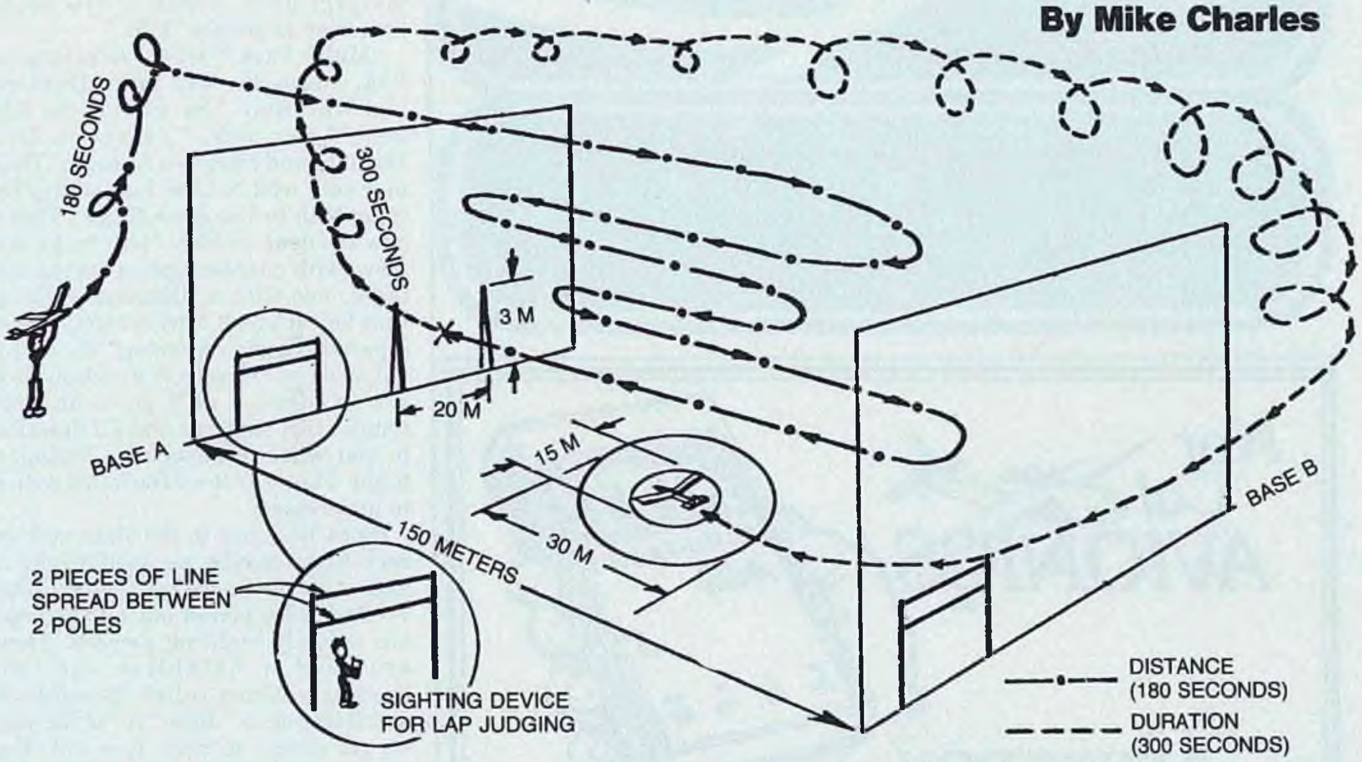
How to do this is probably the hardest question that we who know electro-power works are faced with. I can't think of a better way than to examine one of the most popular E-Flight events being flown today throughout the world. I'm speaking of course of the F3E sailplane event as put forth on page 117 of the AMA Rule Book, and defined as "A Multi Task Event for Electropowered Motorgliders."

Sounds interesting, right? Well let me tell you it is, especially when you consider the magic words in the title. What do you mean you don't know

Roger Roth prepares to launch "Olympian 05." Astro Flight motor w/3:1 gear drive unit. 7 cell motor battery. Span 85", area 750 in. sq., wt. 44 oz.

Dan Fink & "Electricus." Leisure 05 motor, direct drive 7/4 prop, 6 cell motor battery. Span 74", area 600 in. sq., wt. 38 oz.

By Mike Charles



which "Magic Words" --- why the words "Multi Task" that's what. They are the key to a more exciting future in soaring for all of us. If you haven't heard them before then you've probably been hanging around the wrong people. You know the ones I mean. They told you the only way to get **real** performance from your "Schlepper Mk 9" sailplane was to modify it by adding a **third** set of turbulator spars. These are the same guys who told you that if your sailplane had a wing loading over 5 oz. per square foot that it would fall off the end of the world as soon as you released from tow. **Bunk!** High performance doesn't exist at wing loadings under 10 oz. per sq. ft. But enough of this "heavy" soapbox talk. Now that I've got your attention I want to tell you about F3E Motorgliders, which I will refer hereafter as simply "F3E."

"Multi Task," when referring to F3E, means the two tasks Distance and Duration. "So what's the big deal?" you ask, "everyone flys Distance and Duration already." That may very well be true, but do they fly them both in the same flight? That's how it's done in F3E. Both tasks are flown with no interruption during the flight, but with a different working time for each task. Sort of together but separate. Sound confusing? It's really not, once you've seen it in action. I've got an **idea** --- we'll go to an F3E competition together and I'll describe to you what is happening during a flight. That way it will be much easier to understand.

Since Distance is the first task of each flight maybe we should take a look at the Distance course now. The vertical poles placed out on the field are actually sighting devices. They are used to establish the two imaginary planes called "Baseline A and Baseline B." Base "A" is the one we are closest to here. It is also the place from which the contestants must launch their aircraft. We better move out of the way, here comes the first contestant of the day. It looks like --- yes it is, Harry Megawatt, one of the premier electric fliers in the U.S. He's going to be flying his own design aircraft today, the "High Voltage." There's Harry's helper Amp. He's the one holding the plane up for identification. That's so the flagman at Base "B" will know what the aircraft looks like, and to alert him that a flight is imminent.

They'll be going up soon now and, as I said, for the first part of the flight they'll be flying the Distance task. For this, Harry has 180 seconds (3 min.) from the moment the model leaves the launchers hands to climb to altitude, and complete as many laps between

Unnamed original design twin pusher by John Krug. Twin Leisure 05 power, 12 cell motor battery. Note Tornado props modified for folding. Mfgrs. take heed.

PB-26 by IBA/BAU models. Pre-built German import especially designed for F3E. Span 104", area 860 in. sq., fiberglass reinf. fully sheeted wing.

Olympian F3E by Larry Jolly. Geist 40/14 motor and 3.5:1 gear drive, Geist prop, 14 cell motor battery. Model: Span 100 in., area 900 in. sq., wt. 85 oz.

What goes in an unlimited class F3E model? L/R shows servos in rear of fuse, electronic speed control, 22-26 nicads of 1.2 ah. capacity, Keller 50/24 motor, Zinger wood prop modified to fold.

Ultra 7 designed by Mike Charles, built by Bob Gerbin. Powered by Leisure 05, 7 cell motor battery, direct drive 8/4 prop. Model: Span 75", area 630 in. sq., wt. 37 oz.

Another view of PB-26 model. RTF weight is 117 oz. This makes wing loading over 20 oz. per sq. ft. Flys super! Climb rate of 1500 ft. per min. is norm for unlimited class electrics.

Base A and Base B as he can. By the way, a lap in F3E may be different than you think since one trip from Base A to Base B (or vice-versa) is counted as one lap. A lap can be any distance up to 150 meters (492 ft.). The lap is scored at a value of 1 point for every 10 meters flown of a **complete** lap (10 pts. for 100 m laps, 15 pts. for 150 m laps). No score is given for partial laps.

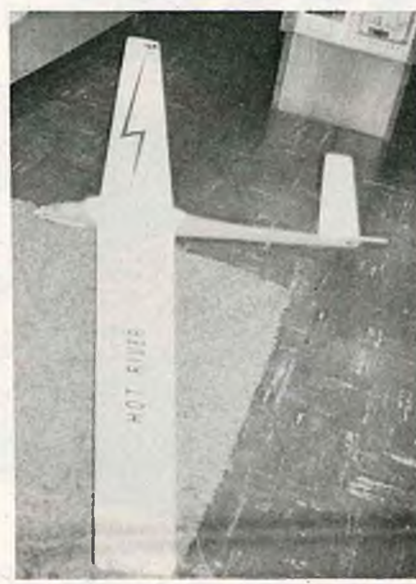
There goes Harry now. I'll time him so you can get an idea of the flying style involved. Check out Harry's plane, it's climbing almost straight up. Not bad for an electric model, eh? He really has a good combination of "motor, prop, battery." I'm sure it took a little experimenting to get just the right combo, but it looks like it's worth it to me.

I just heard the near flagman tell Harry that the model is behind Base "A." That means that he is clear to enter the course whenever he wants, but it looks to me like he is still under power. Oh yes, that's another thing. You must fly the Distance task in **gliding** flight. That means no power once you enter the Distance course, which is done by crossing Base "A" in the direction of Base "B."

It's time to pay attention; Harry is turning back in the direction of Base "A" now which means he's going to enter the course. He's actually diving with the power on to build up speed. Now he's leveling out. I just heard him yell "off" to the official timer --- and there's the buzzer to tell him that he is officially "on the course." Boy, he timed that just perfect, turning off his motor almost simultaneously as he entered the course. Let's see what his time for the motor run was. My watch says 39 seconds. Not bad, considering his altitude, which I'd estimate as between 1000 and 1200 feet. It's pretty hard to tell the exact altitude when the model is that hard to see.

I briefly mentioned the buzzer before when Harry started his Distance run, and I'd like to take a few seconds now to tell you a little more about it. They are using the "buzzer" system during Distance today to notify the pilot when he has completed each lap, instead of the more traditional "flag" method. The buzzer, though not essential to the ultimate success of the contest, is a much superior method of calling the turns for several reasons. First, using the buzzer virtually eliminates the problem of a missed or mistaken flag signal by substituting an audible tone for both pilot **and** helper to hear. Second, using the buzzer means that the pilot can fly his own turns without having to rely on his helper to call a flag for him. This eliminates one set of reactions, which makes for faster laps. Third, since the timer is now free from calling the turns he can easily perform some much more important jobs. These are: Counting laps — letting the pilot know his "per lap" times so he will know if he needs to speed up the model to make the number of laps he needs, or slow down if he is losing too much altitude by flying too fast. And, of course, keeping track of the all important "Working Time," because it won't do you any good to fly 27 laps if your working time ran out on the 15th lap. All of this is very important when you take into account the fact that in F3E the rules allow only **one** helper on the field with you besides the official timers supplied by the contest organizers. This "one helper" rule is really a blessing in disguise for those people who think they might like the FAI sailplane event, but can't put together the ground crew necessary to do the job. F3E could be for you!

Hey! Take a look at Harry. While we've been talking he's been clicking off laps. It looks like he's almost finished now, judging by his altitude. If we move a little closer maybe we can hear what's going on. There's the buzzer, and I just heard Amp count "17." Harry's on his way back to Baseline "A" now but I don't think there's time enough for him to complete another lap. He's too low now so he can't dive to build up speed and, if he turns on his motor again, counting of the laps is automatically stopped. What a tough decision to have to make --- oops! There's the horn that signals the end of the working time in Distance. Harry got 17 laps. Now he's got 60 seconds (during which time he may do whatever he chooses) to fly through the "gate." Did I forget to mention the gate? Let's talk about it



Hot River electric sailplane by Geist Modellbau. Geist 40/14 motor, gear drive, 12 cell motor battery. Model: Span 100", area 850 in. sq., wt. 90 oz.

now since we'll be seeing it in use very shortly.

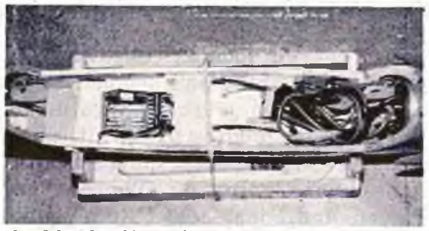
The "Gate" (which is positioned at, and on, the same vertical plane as Baseline "A") is 3 meters (10 ft.) high and 20 meters (65 ft.) wide. You must fly through this gate, in the direction from Base "B" to Base "A," to start the time for the Duration portion of the flight. If you do not fly through the gate within the allotted 60 second time period, your flight is stopped and you get a zero for your Duration score.

Here comes Harry now. He's through the gate with his motor on and now he's climbing away like a rocket. Listen to Amp, he's counting down from 15. That must mean they're going to try and max with only a 15 second motor run — unbelievable.

What's Max? Glad you asked. It looks like --- yes, Harry has turned his motor off, now it appears that he's found himself a small thermal to work. That gives us a little time to discuss the Duration task.

For this part of the flight you are given 300 seconds (5 min.) of working time, which starts the moment the model passes through the gate. You accumulate points at a value of one point per second of flight time, up to the end of the working time, or when the model comes to rest (which means when it stops moving, not when it first touches the ground as in "AMA" style competition), whichever comes first. From this you would then deduct the **total** motor run time, at a value of one point per second. Also, if you are still in the air, or even in motion, when the working time runs out, you lose flight points, again at the rate of one per second of overtime.

Hold it a minute! Take a look at Harry's plane. While we were talking he wore that little thermal out and is almost on the ground, and by my watch he's still short of the target time. Listen, I just heard him tell the official timer that he plans to start the motor. Yes, you guessed it. In the **Duration** portion of F3E you can re-start your motor, and not just once either. You can re-light as often and for as long as you want but just remember, every second of motor run time comes off your score. Kind of makes you wonder which route to take. Do you go for a short motor run, hoping to find lift and work it up knowing all the while that if you don't you will have to switch on again? Or do you go for a slightly longer motor run which you know will safely get your target time without a re-start? In my



Inside the Hot River. L/R, Rx, electronic speed control, mass of wiring, motor just visible. Servos? They're in rear of fuse, on removable tray. Motor batteries go on top of wing, covered by removable canopy.

Flier Frank Heacox gets his signals straight with helper before launch. This is very important in F3E competition.

Ampere by Eismann. German import designed specially for F3E. Geist 60/28 motor, direct drive, 22 cell motor battery. Model: Span 112", area 870 in. sq., wt. 120 oz.

opinion that's one of the most exciting things about F3E, the strategies involved. They must be flexible to change with varying weather conditions, and your competitors' scores.

Listen! **"On"** there is Harry's signal — "One, Two, Three, Four, Five, **Off.**" It appears to me that the extra five second run will give Harry the altitude he needs to make the target time, now all he has left to worry about is the landing. Yes, there's still a landing task and, speaking of that, let's take a quick look at the landing area. By my calculations we've got about a minute before the landing, that should be long enough.

See the two circles marked out over to the side of the Distance course? The outer circle is 30 meters (98 ft.) in diameter. Coming to rest in this circle gets you 15 more points. The smaller inner circle is 15 meters (49 ft.) in diameter, and if you end up inside it you are awarded a bonus of 30 points. Why aren't they smaller? Yes I know, anyone should be able to land a sailplane in an area that large, but these aren't your average Sunday sailplanes. We'll see that when we examine the models more closely.

to page 166

Besides, everyone is always complaining about the landing at sailplane contests anyway. The guys who can't land (and you know who you are) keep saying we should have "scale-like" landings. That's fine, for scale competition, but don't try and force a value judgment into one of the few remaining "clean" (no judged, only **real** scores) competitions. Or, better yet, spend your time practicing the task instead of cry-babying. Then you can put the blame where it really belongs, on your inability and not on the task. Or, **best** of all, de-emphasize the landing as the F3E organizers in their wisdom saw fit to do and put the importance back where it belongs, on the flying!

Whoops! Didn't mean to get so carried away, I better move the ol' soapbox out of the way 'cause here comes Harry for his landing.

Amp is counting down the working time, now Harry is on the ground sliding --- sliding --- right up to the center of the small circle. Perfect landing! My watch says 2 seconds over the target time, but the official timer's watch is the one they will score from. Let's take a quick look at it. The official's watch says just one second over. That was an excellent flight. Let's move back out of the way and I'll figure out what the score should be.

Distance score = (# laps × course length in meters / # of meters per one point).

Duration score = (flight time − total motor run time − any overtime).

Landing score = (inner circle 30 pts., outer circle 15 pts., other . . . 0).

Harry's score:

Distance = 17 × 150/10 . . . 255 pts.

Duration = 300 − 20 − 1 . . . 279 pts.

Landing = . . . 30 pts.

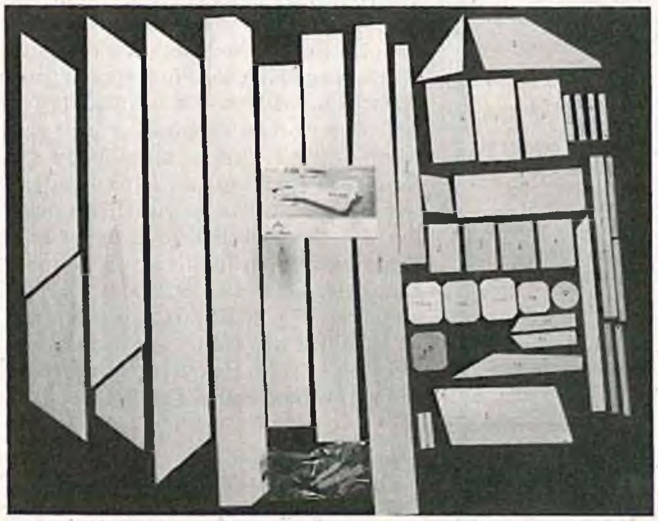
Total: 564 pts.

That's even better than I thought. I'm sure Harry will be pleased with that score; in fact, I'll wager that he will be the one to catch today. While they're getting ready for the next flight why don't you take a closer look at some of the models and equipment the fliers are using. I'm sure that will bring a few questions to mind. If you do come up with some questions (rules, where to get F3E aircraft and supplies, etc.), write them down so you won't forget them. Then, next time you see me I can answer them for you. Or, better yet, if you want an even faster answer just mail them off to me in care of this magazine. They will make sure I get them.

If you'll excuse me now I've got to run, I'm expecting a very important phone call from an old flying buddy. It seems he's discovered a special De-riboxyonucleonicly charged tack rag (imported of course) made especially for wiping the spent electrons off your wings. Rumor has it that by using it before each flight guarantees you do 19 Distance ef-fort-less-ly, and will max Duration with no motor run "regardless of the weather conditions." This could be a real breakthrough for us here in the U.S. He's supposed to test it on his plane today and call me, and I can hardly wait to hear how it went. See you around. □

RCM PRODUCT REVIEW

Zia Models
DELTA DART



Want to get out of the rut? Tired of the same old type airplane? Try a Zia (formally Airforms) Sport Delta Dart, available as an F-106 or KFIR. Both kits use a .40 with prop for power and are eye-catching out at the local field. We picked the F-106 for our test model.

Upon opening the box (36" x 3" x 7½") you'll find all of the parts numbered and bandsawed to shape. Dont try to find the wing ribs as the surface is 1/4" balsa. Yep that's right! A flat surface. In fact, just about all of the wood is 1/4" balsa. Makes for fast, easy building which takes a minimum amount of time.

Construction:

We used Hot Stuff for all of the construction and had the plane framed, ready for radio installation and finishing in four evenings. If one was in a hurry I am sure it could be completed, ready to fly within a week of easy night building.

Wood selection is average and the parts fit with a little sanding here and there. As there are only elevons — no rudder or elevator — this saves quite a bit of time. I found an old EK mixer in the junk box for the elevons. There are separate plans included for a mixer, however, and a Du-Bro will also work. Sullivan cable was used for throttle and nose wheel steering. An 8 oz. tank fits perfectly in the nose area. As the construction is conventional all you have to do is read the instructions, which are on the plans, and glue the parts together. The whole top of the fuselage, from aft of the canopy, is removable for easy radio access. The one item we did not care for was the 1/8" wire nose gear strut, it was just a little too flexible for the long moment arm. I thought it should have been 5/32".

Covering, Engine and Radio:

We finished our Delta Dart in arctic markings, red wing tips and fin top. All up weight with the K & B .40 and three Royal Products Mini Titan servos was 4½ lbs., as advertised. This was with glass cloth and resin covering the complete airplane. Top Flite decals added the remaining color. Control throws were set up as shown on the plans.

Flying:

Our reviewer being an old Delta driver, was very excited about the flying characteristics of the model. It does act and fly like the real one. It needs speed to get in the air; don't horse it off — keep the nose down to build up the airspeed. In high "G" turns it bleeds off airspeed quite fast so fly it around, don't yank and bank. Landings are fun; set up a nose high attitude and control rate of sink with the throttle. A word of caution: balance on the C.G. as shown on the plans.

Conclusion:

Overall we thought the Zia Delta Dart was a very different type sport model. It's easy to build and flies quite good. Just the ticket for a Sunday, go out and fly type model. Try one. □

SPECIFICATIONS

Name	DELTA DART
Aircraft Type	Sport
Manufactured By	Zia Models 1605 E. Grand Clovis, New Mexico 88101
Mfg. Suggested Retail Price	$54.95
Available From	Both Mfg. & Retail
Wingspan	36 Inches
Wing Chord	18½ Inches
Total Wing Area	432 Square Inches
Fuselage Length	43½ Inches
Stabilizer Span	NA
Total Stab Area	NA
Mfg. Rec. Engine Range	.35-.51
Recommended Fuel Tank Size	6-8 Oz.
Recommended No. of Channels	3
Rec. Control Functions	Throttle & Elevons
Basic Materials Used In Construction:	
Fuselage	Balsa
Wing	Balsa
Tail Surfaces	NA
Building Instructions on Plan Sheets	Yes
Instruction Manual	No
Construction Photos	No

RCM PROTOTYPE

Radio Used	Royal Classic
Engine Make & Displacement	K & B .40
Tank Size Used	Sullivan 8 Oz.
Weight, Ready to Fly:	72 Oz.
Wing Loading:	20 Oz./Sq. Ft.

SUMMARY

WE LIKED THE:
Fast construction, different looking.
WE DIDN'T LIKE THE:
1/8" wire nose gear strut.

SHOWCASE '83

from page 173/167

optional adapter kit for Rhom retracts is also available. It makes installing the Rhom belly mount system quick and easy.

All fuselages are now lighter and of superior quality. They also now include factory installed mounting bases that are pre-drilled and ready to accept the specially designed retract adapter kit for the Rhom Air retracts. A unique gravity feed fuel system that ensures a positive and uninterrupted fuel flow to the carburetor has also been added. As with all Byron Originals' kits, the new F-16 is indeed a complete kit. The factory direct price for the kit is $264.98 plus $10.50 shipping. The optional retract adapter kit sells for $65.95 plus $2.50 shipping. For additional information, or to place an order, contact Byron Originals, P.O. Box 279, Ida Grove, Iowa 51445 or call (712) 364-3165.

TBF AVENGER

from page 101/98

lines with a charcoal grey paint lightly dusted on. A light grey is then shot with merging formations over the wing and top of the fuselage. When this step has dried, wear points around access panels, wing walk areas, and general wear areas are hit with "0000" grade steel wool. It is now time to seal and fuelproof the water base Polly "S" paint. I used K & B clear with the flat hardener with a touch of light grey added. This seals, fuelproofs, and tones the paint down to simulate fading.

The plane is now virtually finished with the exception of installation of the radio gear, fuel tank, engine, and special effects. The plane is set up for a 7 or 8 channel system. The channels are set up for throttle, aileron, elevator, rudder, flaps, retracts, bomb bay, machine gun light, and sound effects, and navigation and formation lights.

The fuel tank is a Kraft 16 oz. Slim Line. The engine is a 1.40 Rhino which swings an 18/6 prop. The kit is designed for a .60 to a .90 size engine; with my changes I needed a larger, more powerful engine.

The special effects are an operating bomb bay that drops a scale MK-13 torpedo. The machine gun sound effect unit was built from plans given in RCM some time back. The machine

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TBF AVENGER
from page 182/98

gun blinking system is from Strobe-Flight, and has been modified to increase the blinking rate. The formation and navigation lights are 3 volt dollhouse lights, with "Lite Brite" caps.

The flight characteristics of the model are true to the plane it is modeled after. It is slow and sluggish --- just as the real aircraft was. Let's remember it not as a fighter plane, but as a torpedo bomber.

I feel Bob Dively deserves a lot of thanks for designing this historical aircraft. It has been a long time coming. □

POWER BOATING
from page 86/79

possible solution. I have solved this problem by making my own.

What is needed are the following: a gold color print of the eagles or whatever else is to be used. In this print, the eagle should be made to the proper scale. Having access to my father's dark room helps. You need one can of Krylon Crystal Clear spray paint, one can of flat white spray paint, some type of glue, and wet or dry sandpaper. The eagle (at the proper scale) is cut out with a sharp knife. Spray with ten to twelve coats of clear. Be sure and allow each coat to dry thoroughly. The picture is then soaked in water and the paper is rubbed off the back. This will leave the colored impression on the clear. Then spray flat white on the back of the image. This eagle is then glued onto its proper place on the model. Spray with additional coats of clear, wet sanding

in-between to smooth the surface and give the illusion of a painted picture. I hope this helps someone. It has worked for me.

Yours truly,
Charles Oliver
Shreveport, Louisiana

★

Under the headline of industry news, it has become official that K & B Manufacturing is again owned by John Brodbeck Sr. and John Brodbeck Jr. As a result we can be reassured that K & B will continue to produce engines for R/C boaters. The K & B .67 Marine will be delayed a bit but is still the next new engine to be produced. In a parallel development, K & B has transferred its Marine Specialties line of hardware back to Pat and Charlie Pottol who originally developed it. Charlie says that the old product line will be reviewed so that obsolete items will be eliminated and that several new products will be forthcoming. Marine Specialties (P.O. Box 588, Saratoga, California 95070) is back in business the old fashioned way. They will sell direct to dealers at normal discounts and if you don't have a dealer in your town they will sell retail to boaters through the mail. Charlie says that this old way helps remove some of the distance between boaters and the manufacturer which results in better feedback. In this way Marine Specialties' hardware line will maintain quality control on their fully guaranteed parts.

★

Well, that about does it for another month. Send your questions, comments, and great ideas, etc., to the address at the end of this column. If you desire an answer before magazine publication, enclose a self-addressed stamped envelope so I may answer your letter by return mail. Howard Power, Hobbies Unlimited, 766 Broadway, Seaside, California 93955, (408) 394-1200. □

Our apologies to Don Sobbe, of Vortac Mfg., Co for referring to his company as Vortex throughout Richard Edmunds Timebomb article in the July '83 issue of RCM.

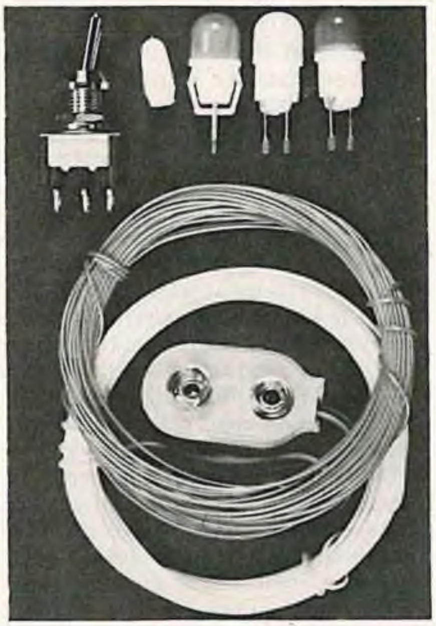
BIG IS BEAUTIFUL

from page 72/65

Super Cable that has a swage steel ball that allows you to pull the cable through a threaded ferrule, which will rotate inside of the clevis. This allows you to adjust control cables or flying wires without removing the clevis from the horn. When the final adjustments are made, a lock nut is provided for safety. The steel ball only comes on one end of the Super Cables. The other end is Hot Stuffed into an identical ferrule and clevis. You can Hot Stuff the cable into the ferrule because the Super Cable is coated with a special Teflon and a special high tolerance machine hole through the ferrule. They have made the extreme test of pulling over 80 lbs. of weight with a completed cable. They did not exceed any more than this, because they felt that in miniature aircraft this is beyond a normal test.

Super Clevis comes in two sizes; 48" and 82". Ed will also be packaging the standard size 36" length cable, with standard size clevises, 16 threaded ferrules and 16 lock nuts. These do **not** have a swage ball on the end, both ends are Hot Stuffed in place.

Navigation Lights — another new item from International R/C Specialties are navigation lights for Quarter and Third scale aircraft. The lights, themselves, are made up in three pieces — the base with molded terminals, the bulb (which is replaceable), and the cap cover. The Navigation Light package comes with 34 feet of special silver-coated, low resistance wire in two colors. Also a miniature toggle switch that is supplied can be mounted on your instrument panel and be functional, like the real plane. The system works off a 9 volt transistor battery. (The red,



green, and white lens caps are included in the kit.)

Instrument Panel — International R/C Specialties has a **new** upgraded instrument panel for **both** Quarter and Third scale planes. The previous Quarter Scale kit contained a sheet of 20 instruments. They have now added 10 more **new** instruments, making a total of 30 instruments.

The **all new** Third scale instrument panel also contains thirty instruments. The **new** photographing of the instruments is comparable in clarity to the real one. Each kit contains 34 special machine screws, 8 bezels, 30 instruments, 1 sheet 8mm plywood, celluloid and instructions. For information or for ordering any of the above products, write or call: International R/C Specialties, Ed Morgan, 2310 Cimarron Road, Las Vegas, Nevada 89117, (702) 878-1306.

Those of you who are not able to make our Big Model Bash at Bawlf, Alberta (drop me a line for more details, 9 Geneva Crescent, St. Albert, Alberta, T8N 0Z3 Canada, 403 459-3727) on the July 1-4 weekend, may wish to attend the first annual such event in Washington State, July 16 and 17. Al Alman, 605 East 168th Street, Space 95 Spanaway, Washington 98387, (206) 535-1549, is Fly-In Director, so give him a shout for more information. They will be using Mt. Ranier Radio Control Societies' field and facilities and will have a few plug-ins available for RV's. Food and drink will be available at the site and Al will send you an information package if you give him a shout at the above address. □

OFF-ROAD RACING

from page 64/62

he can do on a skateboard, and I still don't believe it.

Gil was asked what type of racing he considered most challenging and he said he thought the 1/8 gas was the toughest. He had been spending most of his time lately working on his RC500 car getting ready for the World's Championships in France this summer. Somebody else working hard on the upcoming World's Championship was the current World's Champion, Arturo Carbonell, who was at the Ranch Pit Shop for a week practicing. But this 1/8 gas club race belonged to Gil Jr. as he easily won with his RC500. He must be lucky.

Roar 1/10 Scale Electric Off-Road Rules

ROAR now has a set of Off-Road Rules, thanks to the greatly appreciated help of ORRCA officials Gil Losi Sr. and Mike Tobey, as well as ROAR Rules Committee members, Bob Rule and Gene Husting.

These new rules are very similar to the current ORRCA rules, with a few changes being consistent with the ROAR 1/12 electric rules.

Off-road racing is starting to grow very fast around the country, and now ROAR is in a position to offer a nationally accepted set of rules for everyone to race by. This will allow Regional as well as National races to be run, which will further the growth of off-road racing. The Ranch Pit Shop in Pomona, California, has put in their bid to hold the first ever ROAR Off-Road Nationals in 1984.

Any clubs that would like an advance set of ROAR's new Off-Road Rules please send me a request for a copy of the rules through R/C Modeler Magazine.

See you at the races. ☐

HERE'S HOW

from page 58

12 V air compressor? You bet it is! With just 6 or 7 strokes of the pump you have 100 psi in your air tank. Try that with your hand pump. The secret, of course, is the pump cylinder is much larger in volume than the air tank. It delivers a large volume of air with each stroke and can be monitored on the gauge which, by the way, comes with the pump. I was amazed at how quickly the air tank was filled. And, with no guesswork on my part.

The foot pump is easy to use with far less exercise than the hand pump. It is compact and heavy duty in design. A 24" hose with thumb lock and valve adaptor allow for easy hookup. Obviously this pump has many uses besides filling retract air tanks. Other things like tires for bicycles, motorcycles, automobiles, rubber rafts and air mattresses should give you some justification for owning one. The foot pump can be purchased at any Target store for less than $10.00. I have seen them on sale for less than $5.00 so it will pay you to shop around. Other discount stores may handle them, however, you can get them for sure at Target.

In order to use the foot pump to fill your retract air tank it is necessary to change the air supply fitting. Although the valve adaptor will hook up to this fitting, it will leak air considerably. What is needed is a check valve. This can best be fabricated from an automotive tubeless tire valve stem. Most of the places that sell and fix tires usually have valve stems available. Very little effort is required to modify the valve stem for your use. Remove the rubber and grind down the brass stem some to get rid of the bulk. Drill out the hole, opposite the valve, with a 1/8" drill. Insert a short piece of 1/8" O.D. and 7/64" O.D. brass tubing, as shown in sketch, and solder. This will provide the correct size tube with which to slip on the high pressure air line.

Once you try one of these inexpensive pumps I'm sure you will be pleased. It provides for a quick and easy way to fill your retract air tank. No guesswork, no drying out of seals or cold weather pressure loss because of freon. And, best of all, the whole system can be yours for less than $10.00. In this day and age of high prices **cheap** is the name of the game! ☐

ENGINE CLINIC

from page 39/33

unit?

Do I simply need a larger displacement engine such as the Evra? With the Evra, could some weight be saved by using an electronic ignition? Can you recommend a unit?

Could I reduce heating in the Tartan

and get more rpms by doing such things as taking out one ring to reduce friction or painting the head black? The engine has had two hours of break-in time, but maybe some rubbing compound to seat the rings is needed. These things were apparently used successfully in a Kioritz as reported in the Sept. '82 issue of MAN in the "Monster" article. Aside from my particular problem, the Tartan is an excellent engine.

Sorry my letter is so long and I realize you are a very busy man, but I do not know where else to go for answers. I would appreciate any comments, no matter how brief. Thanks.

David Cohn
San Pedro, California

Dave, you are trying to fly too much airplane without enough motor. As a result you are trying to get more power out of the engine than it is capable of supplying. Painting the head black is not going to help the overheating enough to make any noticeable difference. The same thing applies for removing a piston ring to reduce drag. Although a slight bit of power might be gained, it will not be enough to make that much difference. Be sure that you are adequately cooling the engine. Air exit area is just as important as air entrance. The hot air has to get out, otherwise a positive pressure is created in the cowling and the air just goes around rather than through the cowl.

Actually your best bet is a larger displacement engine. The geared Webra .90 would not provide much more power than your Tartan 1.3. As far as belt drives, they do have their limitations. The engine runs at a high rpm with the prop turning slower which makes for a very "unscale" sound. The belts wear and have to be replaced, etc. The larger displacement engine is just the best answer.

Electronic ignition systems work fine. Both Fabtronics and C.H.S. Electronics offer fine units.

Dear Mr. Lee:

Your column has been so informative for me over the years, so I'd like to pass on to your readers a very frustrating problem I had and how simply it was solved once the cause was identified.

I have an O.S. Max 40FSR that began to run badly although it was apparently in good condition. At full throttle it would surge — slow down for about 5-10 seconds, briefly speed up, slow down again, etc. I tried everything that my more experienced friends and I could think of. There was no air leak or fuel blockage. I tried new fuel and a new glow plug. Frustration.

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ENGINE CLINIC

from page 193/33

Finally, I discovered that it would run steadily without muffler pressure but not with it — even though I've used that muffler successfully for years. The light went on! I use a straight JCM muffler as shown.

In some previous mishap the pressure tap was knocked slightly out of vertical alignment. At full throttle, the rapid exhaust flow over the angled tube caused a vacuum in the fuel system — just enough to overcome engine suction and stop fuel flow. The problem was cured easily by drilling another hole and reinstalling the tap vertically. I'm sure you have seen this type of problem before, but it was beyond my experience level and might help some other readers.

Thanks again for your help to all of us.

Sincerely,
Art Ambrush
Manhattan Beach, California

Thanks for sending in the solution to your own problem, Art. This type of letter is always appreciated. I would like to add that this same problem is often caused by a slug of old congealed oil (especially castor) collecting in the muffler pressure line. The pressure take off fitting can also become plugged with cooked oil. So check these things out once in a while guys. □

GROUND CHECKING GUIDE

from page 23/22

plane. It's not just luck that will let your old faithful plane become a faithful old plane. If you follow those three rules I mentioned at the onset of this article, you have a good chance of keeping your planes flying like new for years to come: (1) Remember to groundcheck the entire plane at least prior to each flying session; (2) Range check your radio at the beginning of every flying session; and (3) Closely observe your plane while it's in flight to detect signs of fatigue or malfunction and to determine corrective maintenance necessary to keep it in top operating condition. These measures will not only help your plane last a long time, but will make you and your plane a safer team at the local flying field. □

SCALE VIEWS

from page 14/12

You could have reversed this process --- drilling the manifold first, inserting the pipes and **then** soldering them in place. This technique requires starting the exhaust pipe holes on the outer surface of the manifold --- and poses a drill locating problem. Drilling the manifold accurately might require a "V" block and a drill press. Then, too, a bit of each of the scale exhaust pipes will project into the manifold and have to be filed flush with its inner contour. It's about six of one and half a dozen of another --- which technique you use. In any event, clean up the inside and outside of the manifold and exhaust pipes with a wire brush, steel wool and/or sandpaper to remove the soldering scale. Then "attack" the silver solder fillets with a small circular file. The flux residue is glass-like and breaks off in pieces. A few more strokes with the file and the joint **shines!** Silvery and **strong!** Actually, silver soldering is no big deal. It's just like using soft (lead) solder --- only hotter. If you take the time to learn how to use silver solder, you'll find a new scale modeling world opening up. Tubular engine mounts are within your grasp --- and they have the advantages of scale appearance, great strength, good heat dissipation, light weight (when compared with the usual aluminum and glass filled engine mounts) and they provide a lot more room for scale exhaust systems! We've included a photo of the ultimate silver soldered (brazed) project --- a tubing landing gear built by Scale Master, George Fischer for his quarter sized Art Chester's "Goon." Using various diameters of steel tubing, George built an exact duplicate of the Goon's retractable gear. A note --- "brazing" is nothing more than silver soldering, but brass solder is used (which is also very strong).

A couple of things to consider before we're through. It's very important to hook up your newly silver soldered scale exhaust system and run your engine with it in place. It's best if you can do this on a test stand (to keep from getting exhaust "goop" all over your semi-finished model). The big idea is to see if the addition of the system has affected the operation of your glow-plugged "hummer." Run the engine with and without the system and check its temperature and rpm's. Don't want to wreck a good

engine by inducing too much back pressure or causing it to run hot! Constricted systems can do either/or --- while some home-grown scale exhaust systems can give an almost tuned pipe effect. Visualize **your** scale system to permit **flow** (no 90° bends) --- and the system should work admirably!

The second consideration, after making sure your system fits into the model, is to check **where** the exhaust structure comes close to wood or other flammable substances. Your R/C fighter, going down in real flames may appear to be realistic, but it'll spoil your whole weekend! Of course, the whole system will be hottest right at the engine exhaust pipe, but it's a good idea to give the system as much structural clearance as possible, throughout its length. If it's possible, the panel on the outside of the model through which the individual exhaust stacks protrude, should be made of metal (aluminum or brass) if scale clearances are to be maintained. If the pipes (stacks) exit through wood, give 'em enough clearance so that they don't char it. If air exits **around** each tube, so much the better because it'll tend to cool 'em. If your cowl is fiberglass, the exit holes should provide adequate clearance, as well. Although a lot of people get torqued out of joint at the mention of the word, "asbestos," thin sheets of the stuff (or heat reflecting or heat protective tape) will permit your home-grown scale exhaust system to run closer to flammable structures than without it. A few spots of stove cement can hold the heat proofing in place. Use a good face mask when you're handling asbestos (the same kind you use when you're painting your model) and wash your hands before touching your face. Kinda doctor-like, but there's no sense in inhaling **any** asbestos particles!

There's another scale plus from building and installing a scale exhaust system --- exhaust streaks! Most of us who "weather" our scale models usually airbrush or paint black, oily or silvery-gray streaks along the flanks of our model fuselages, aft of the scale pipes, to simulate exhaust streaking. With a "real" scale system, exhaust residue collects in a most scale-like fashion, **exactly** where it did on the prototype! Granted, there's more oil in a model engine's exhaust, than from an Allison, Merlin or Menasco --- but it sure looks neat to have a scale smear on your model. Don't forget to seal the ends of your manifold --- so that all of the goop gets funneled to its scale location. And, after flight, tilt your model so that anything that's collected in the manifold can drain out. Think

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SCALE VIEWS

from page 199/12

you'll be pleased with a silver soldered scale exhaust system in **your** scale model!

In response to many requests, Pettit Paint Co., Inc., makers of Hobbypoxy, is interrupting their presentation of external camouflage colors this month in order to give you the information needed to complete the painting of cockpits, wheel wells, and other interior surfaces. Specifically, our colors are the two shades of Zinc Chromate Primer widely used on American aircraft of the World War Two era.

Zinc Chromate Primers are anti-corrosion coatings applied to bare metal surfaces of an aircraft structure before final painting. On combat aircraft, the primer was usually left unpainted on interior surfaces in the interest of lighter weight and faster production. In its standard form, Zinc Chromate Primer is a greenish-yellow color, leaning more heavily toward the yellow side. For use in cockpits, it was decided that a more olive-green shade would be appropriate, and a specific color designated "Interior Green No. 611" was standardized for use in both U.S. Army, Air Force and Navy aircraft. This color was achieved by tinting the yellow Zinc Chromate to make it darker and greener. Quite often, however, the unmodified yellow shade was used on all surfaces except the cockpit, and would therefore be found inside wheel wells, cowlings, hatches, and so forth.

Here are the formulas for mixing these colors using standard Hobbypoxy Part A colors. After blending, add an equal amount of Part B Flat Hardener for the proper matte finish!

Interior Green No. 611: Five parts H49 Cub Yellow; three parts H47 Bright Yellow; two parts H33 Stinson Green; one part H81 Black.

Zinc Chromate Primer (Yellow): Three parts H47 Bright Yellow; three parts H49 Cub Yellow; two parts H70 Gray. □

FROM THE SHOP

from page 4

I whip open a kit; its all full of nice stuff.
I cut and I sand 'till my hands are quite rough.
I cut stuff and fit stuff, pile stuff upon stuff.
More glue and epoxy and even Hot Stuff.

There's wires and pushrods and gear trains and pots.
There's fuel tanks and craptraps and lots and lots
Of stuff for the engine and stuff for the fuel.
Stuff for the wing rods and stuff for the tools.

I've got stuff in my workshop and stuff in my car.
It fills up my house and spills into the yard.
Stuff stacked upon stuff and if that ain't enough,
My mailbox is stuffed with more stuff that say please buy more stuff.

So here's the sad moral, I just can't ignore it.
Each little doo-dad needs more-dads to support it.
It's really quite bad, there's no advice I can heed.
The more stuff I've got, the more stuff I need.

★

That does it for this month, see you at the field. □