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THE WORLD'S [illegible]TION FOR THE RADIO CONTROL ENTHUSIAST

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R/C MODELER

This Month's Cover features a 1/4 Scale Lockheed Little Dipper designed and built by Dick Tichenor. Powered by a Saito FA-90T four stroke twin, the Lil' Dipper utilizes a Hobby Shack Cirrus 7 channel radio. A construction article for the unique aircraft appears in this issue beginning on page 32. The lovely model is Annette Steward of Diamond Bar, California. Kodachrome transparency by Dick Tichenor.

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From the Shop

RCM STAFF

One of the joys of publishing RCM is being exposed to some tremendously clever people. An example is the following note that we received from Art Watson, Highland, Texas, and would like to share with our readers.

Warning!

A modeler in Texas who couldn't make himself sit down and subscribe to "R/C Modeler," sent his little son to borrow a copy from a fellow modeler. In his haste to do his father's bidding, the boy collided and fell on his father's 1/4 scale B-17S smashing the fuselage and wings. While trying to extricate himself from the wreckage he again fell on a large bottle of "Hot Stuff," gluing himself instantly to the floor.

Hearing his cries for help, the father who was now conducting flotation tests of his new PBY in the backyard pool, rushed back to the house, not realizing that his wife had closed the patio door he ran right through it, breaking the glass, ripping his brand new Levis and cutting himself in an embarrassing part of his anatomy.

Hearing a racket of some volume, the wife dashed in and upset a new gallon of butyrate dope all over the brand new indoor/outdoor carpet that had been installed the week before. As she screamed in frustration, her new set of $300.00 false teeth popped out and was grabbed up and buried by the family dog who thought they were some kind of new fangled bones.

During the excitement the oldest daughter ran off with an ultra-lite pilot from Houston and now spends her weekends buzzing local R/C flying sites.

All of this just to save a few bucks on the subscription. And in this case the poor father never did get to see a copy of that issue of R/C Modeler.

Don't let this happen to you!

★

We became aware of some obscure aviation history presented by Mack Patterson in the SACRAT, newsletter of Southern Alameda County Radio Controllers, Nancy Mitchell, Editor.

Unsung Heros of R/C

The chronicles of history continue to remind us of the heros and achievers in life. Every school child is carefully taught about the pioneers in aviation history such as Leonardo Da Vinci, Orville and Wilbur Wright, and Charles Lindberg. But the names of those many individuals who spent countless hours doing the mundane, insignificant research to support all those great achievements . . . are hardly ever mentioned! It is out of respect that we should revere the birthdays of those who have contributed so much to aviation, yet receive so little recognition . . .

January 19th — Ben Franklin's cat. The cat was strapped to Ben's kite when electricity was first discovered. Puss cat should be remembered as the world's first rechargeable storage battery. (Further developments led to the ability to recharge more than 9 times.)

March 15th — Marquis De Sade . . . for inventing the fiberglass propeller.

April 1st — Carol Doda . . . for her contributions toward the development of see-thru fabrics, which later led to the development of see-thru canopies.

June 10th — Seth Thomas . . . for his work in developing the ignition engine timing device.

June 27th — Mrs. William F. Buckley . . . for her efforts in developing that popular noise reduction device known as the muffler.

September 12th — Cary Seen Breath . . . an alchemist who was responsible for the research and development of nitromethane and glow fuels. Cary would have achieved even further developments, however he was a smoker, and his latter efforts resulted in his being dubbed "the human flame thrower."

★

To follow the foregoing we will add the often omitted part of the familiar quote from the famous Will Rogers, "I never met a man that I didn't like, except maybe that Wiley Post." □

FLYIN' FOOLS by Jim Dalton

ENGINE CLINIC

Clarence Lee

Our first letter this month comes from Jim Gottschamer of Kansas City, Missouri. Jim was having problems with his O.S. Max .61 helicopter engine carburetor. Out of desperation he sent the carburetor along with his letter. I know this is a temptation that many of you have, but guys, please do not send engines or related parts such as carburetors to me unless you have previously written and I have requested you to do so. The exception here naturally being the Custom K & B/Veco engines purchased from me or sent to me when new for the initial Customizing/blueprint procedure. That is part of the service I provide with the engines I sell or have reworked. In the past I have had fellows send me their Enya, Super Tigre, etc., with a note to "let's see you make this turkey run." Needless to say, if every person out there who reads this column who has a problem sent their engine to me to fix I would need half a dozen people to handle the job. Quite frankly, engine repairs are generally a losing proposition in that you can seldom charge for the time actually spent --- especially diagnosing problems. It is very easy to put an hour or even two into an engine checking it out on the bench, etc., but if a realistic labor charge is made you really get the squawks. Most engine manufacturers consider themselves lucky if they can break even on engine repairs. However, repairs are an obligation that engine manufacturers and those involved in engine rework have to make. It is also the reason that manufacturers will only service the engines that they sell. Many fellows have found this out after purchasing a foreign made engine through friends living in foreign countries, friends who fly for the airlines, etc. Then when they expect the U.S. importer of the engine to service it and he will not do so, they are a bit upset. I get letters of complaint along this line from readers all the time.

With that out of the way, let's get back to Jim Gottschamer's letter.

Dear Mr. Lee:

I have enclosed my O.S. .61 helicopter carb for your inspection. I have also enclosed an SASE which you may use to return it. So far, neither World Engines, Helicenter East, Helicenter West, or my local dealer has owned up to any experience in the ***internals*** *of this carb and, thus, have not been able to help.*

My question: Is the notched brass tube which fits over the end of the spray bar (and thus meters the fuel flow as it is rotated) supposed to be as loose in its attachment (to the throttle barrel) as this one is?

The carb has had the snap ring removed which holds the throttle barrel into the body, so that you may readily remove the barrel. Just remove the black set screw and the idle stop screw. The spray bar may be removed by removing the stop screw, and backing out the mid-range screw.

The carb is off of my O.S. .61 FSR-H (ringed with heat-sinked head), mounted in my Competitor helicopter. The combination operated very well for about the first two gallons of fuel (Red Max 10%, Synthetic/Castor), but for the last gallon it has become increasingly erratic from idle, up to lift-off rpm.

It has quit cold (no warning) once in hover, and twice below lift-off rpm. I can't seem (now) to find a combination of idle, mid-range, and needle valve adjustments which will satisyfy it for more than a few minutes. Once I got it off the ground, it operated more reliably and I was putting up with the erratic low speed operation — then it quit in the air but no damage.

The person I spoke to at Helicenter West said he had been tinkering a lot with his also.

I initially ran it with muffler pressure, but all of a sudden it started running so rich (all ranges) I had to close all adjustments way down — very critical. I then took pressure off, went back to book settings and did fine for a while (about 1/2 gallon). The tank and fuel line are clean, and no leaks — standard Competitor tank.

Sincerely,
Jim Gottschamer
Kansas City, Missouri

As Jim had sent the carburetor along I went ahead and pulled it apart to see if I could detect anything wrong. I did find several things that I was certain were causing his problem. The brass tube that he referred to in his letter is supposed to be a floating fit in the carburetor barrel. This compensates for any misalignment between the carburetor barrel and the spray bar that is retained in the carburetor body. Any slight misalignment here would result in a binding of the carburetor. This brass metering tube has a small hole in the end and is held in the carburetor barrel by what is known as a "dog point" set screw. This is a screw that has a smooth unthreaded section on the end such as those used for idle speed adjustment, etc., on many carburetors. This unthreaded portion fits into the small hole in the metering tube keeping it from moving from side to side but still able to pivot around the retaining screw and align with the spray bar. In Jim's carburetor the hole had enlarged from vibration and the metering tube was free to move back and forth ten or twelve thousandths. This, in turn, varied the fuel mixture. The solution here was to cut about a 1/16" length of fuel line and place it in the hole behind the metering tube. By applying pressure to the tube and reinstalling the set screw, the tube was, in turn, held in tension by the small piece of fuel line.

The spray bar itself is free to move in and out of the carburetor body as a means of adjusting the mid range and idle mixtures. The spray bar is sealed against fuel and air leakage by three "O" rings. All three of these had shrunk and were no longer sealing. This is often a problem with neoprene type "O" rings. The nitromethane in our fuels will cause them to swell. Then after setting for a few days they will shrink down smaller than their original size. So on any carburetor using "O" rings for sealing, check them once in a while for shrinkage or wear. Quite a few of you may have been experiencing this same problem with this type of O.S. carburetor so in a way it is a good thing that Jim did send the carburetor to me so I could bring the problem and solution to your attention.

I passed the above information on to Jim. He had not included the needle valve with the carburetor so I told him to check the "O" rings on this for shrinkage also. Following is the reply I received from him.

continued on page 11

Dear Clarence,

Thank you for the fast turnaround on my O.S. helicopter carburetor. Your suggestions regarding the O-rings on the spray bar and the play in the brass tube were, apparently, right on the money. Bad weather has limited opportunities for testing, but I did get a chance to hover it for a few minutes and it seems to be running smooth and even again.

Regarding the O-ring on the needle valve, my present one seems to be fairly snug, so I didn't change it. ***But, I have*** *had some acute problems with it in the past. First, it shrunk up so small that it did not contact the inner surface of the housing. Then, the new one I put on swelled up so tight, I could hardly get the needle out (I had oiled this one with 3-In-1). Next, I turned the O-ring groove a little deeper and put a third one on, lubricated with silicone oil. It has been on several months, and seems stable. The problem may involve improperly sized O-rings as well as a possible sensitivity to oil or fuel. The O-rings I have been using are packaged under the World Engines label, and were obtained from the Kansas City World Engines dealer.*

I was only expecting advice or instructions, so was pleasantly surprised to find that you had corrected the play in the brass tube. Thanks again.

Sincerely,
Jim Gottschamer
Kansas City, Missouri

Dear Mr. Lee,

I have read your column regularly for five years and have gained much valuable information from it.

Here are a few of my notes on my experiences with a Perry micro-oscillating fuel pump. This pump was installed per instructions, i.e., beneath a Fox Eagle III rear exhaust engine equipped with an OPS 6065 muffled tuned pipe — all this installed on a Double Eagle 60 built from RCM plans. The problem is the double 8 oz. fuel tanks hooked up in series are located approximately 16" behind the engine. Medium size fuel tubing was used; stock carburetor.

In this application the micro-oscillating pump could supply all the fuel volume required by the engine as long as the plane was level or nose down, but when lifting the nose the engine leaned out and quit no matter how rich the needles were adjusted. It appears this pump lacks pressure for remote tank mounting. Only with exhaust pressure added could the pump supply enough fuel to the engine with the nose elevated. However, with the plane returned to a level position the engine would still have to be set so rich that it was difficult to get off the ground. I have since installed a Robart Super Pumper which works beautiful in this application.

Thank you,
Howard Carpenter Jr.
Kalamazoo, Michigan

Unfortunately, the new Perry micro-oscillating pump does not have the fuel draw ability that the old integral back plate mounted pump did. The old style pump could lift fuel 5' or 6' and some fellows were installing their fuel tanks on the Center of Gravity of the aircraft. The new pump still has good fuel draw capability but the fuel tank should be mounted as close to the engine and pump as possible. I really hated to see John Perry discontinue the old style pump as there are many applications where it would prove beneficial — especially when using remotely mounted fuel tanks such as with your Double Eagle.

Dear Mr. Lee,

In August of 1982, I purchased an H.B. .20 R/C engine from a mail order hobby company along with an Eaglet "50" by Goldberg, and other accessories. I consider myself a novice in R/C at present, although I have been flying control line for a number of years.

The comment I am writing you about is in reference to the H.B. .20 R/C engine.

After building and flying my Eaglet with this engine for about 15 hours, I started having problems. The engine would surge from full throttle to three fourths back to full throttle again. So after close inspection, back on the bench, I noticed fuel bubbling from the left side of the engine head between head and cylinder.

I called the distributer of H.B. Engines, Precision Movements Company in New Cannan, Connecticut, and was told by the service department that there is not a warranty on H.B. Engines, but if any factory defects were found the engine would be repaired or replaced at no expense to me.

So I sent the engine back to Precision Movements along with a letter of explanation as to what the problem was. At the end of my letter I stated that I request they contact me ***first*** *before returning my repaired engine. After about 2½ weeks I received a C.O.D. package from Precision Movements, via U.P.S., and inside the box was my repaired engine along with a scrap piece of paper saying, "replaced old head with new one, engine runs okay." Looks like they failed to contact me before shipment as I had requested. Language barrier, I guess.*

Anyway, I put my H.B. .20 back on the Eaglet, set the high speed needle a bit rich and flew my plane about 2 minutes when the engine started surging again. I landed the plane and checked out the engine. You guessed it, the head leaking in exactly the same place as before.

After remembering what I used to do about this kind of problem, I pulled the head off the engine and made a head gasket out of some paper thin aluminum foil I found in our club house at our flying field. I then reassembled the head back on my H.B. .20 and have been having great performance ever since, with no

noticeable loss of compression.

I know this is an old method and may not be the best, but it worked for me and I thought the information should be passed on to other modelers who might run across this kind of a problem.

By the way, I enjoy reading your magazine and I find it very informative on all subjects of modeling. Keep up the good work.

Sincerely,
Louis E. Gennuso, Jr.
Lake Charles, Louisiana

Evidently H.B.'s service department thought the head was warped where actually it was probably an uneven sealing surface on the top of the sleeve. The engine must have gotten pretty hot at some time. Dressing the top of the sleeve on a piece of #360 emory paper on a flat surface such as a piece of glass would probably have solved the problem also. 3-In-1 or similar oil should be used when surfacing a part such as this. You might consider this if the aluminum foil ever blows out. Actually, there is nothing wrong with using aluminum foil for a gasket. Some of your old time engines used to come from the manufacturer with aluminum foil gaskets. Another cure for a leaking head is to lap it to the sleeve with lapping compound. Bon Ami is good for this but do not use Bon Ami for lapping piston/sleeve fits. It is far too coarse for this.

Dear Clarence,

I have recently purchased a 1947 O & R 23 in very good condition. I would like to run it occasionally, but find it difficult and expensive to obtain SAE 70 oil, which the instructions recommend.

My question is, can any other oil, and/or mix ratio be used? How about a top quality 50 to 1, two cycle oil? I would think it would work better.

Also where can spark plugs be purchased?

Thank you,
F. Terry Carmine
Lewes, Delaware

Oil technology has improved considerably since the old days when manufacturers recommended SAE 70 weight motor oil for the model engine fuel. SAE 50 weight non detergent oil available at most of your motorcycle shops will work fine. I really do not recommend the 50-1 two cycle oils as they are pretty thin and do not have much of a cushioning effect. They are better when used in engines with needle bearing rods, etc. If you do want SAE 70 you can purchase it from Herb Wahl — Herb's Model Motors, Box 61, Forksville, Pennsylvania 18616. The price is $1.00 a quart but due to the weight of the oil, $2.00 additional is required for postage. Herb Wahl is the fellow who produced modern day versions of the old Brown Jr. engine and is presently producing modern day Ohlsson Goldseal engines. For fellows needing a 3/8"-24 spark plug, Herb has them available for $5.00. The Ohlsson .23 used a 1/4"-32 spark plug and Otto Bernhart who operates 77 Products has NGK spark plugs in this size available for $5.00 plus $1.50 postage. Otto's address — 17119 S. Harvard Blvd., Gardena, California 90247.

Dear Mr. Lee,

Being a novice, I diligently obey advice given me. Example — when balancing a prop — I'm told to trim bits off the tip of the prop until the prop is balanced, using a balancer of course. Again, we're trimming off the heavy side to achieve balance. Right? Well, I did this to a Top Flite 10/6. Net result, I have a perfectly balanced prop that measures 4¾" from center on one side and 5" from center on the other. But it's balanced, even if it does look like hell it's so obvious.

I haven't tried it on the engine. It may be balanced — but how about pitch — airflow — torque or any crazy question I'm thinking of? What happens to

airflow during flight in a situation of this type? I could just ditch the prop, but that won't tell me anything. Most people I ask don't seem to know proper answers — and sound almost like guesses to me. None of the other props I've balanced have required as severe trimming and this one may have been an exception to the rule — but how much can one alter the radius of a prop one to the other? I don't know if I'm describing that correctly — but to you this must be old hat, so I think you understand.

Peter Jacobits
E. Boston, Massachusetts

I am afraid somebody gave you some wrong information. You do not want to balance a propeller by cutting the end off the heavy blade. It could naturally be done but is not the recommended method. What you do want to do is sand material off the front side of the heavy blade at the tip. Do not remove material from the back of the blade as this alters the pitch of the prop. The only time you would remove material from the back side of the blade would be if you are intentionally changing the pitch. When removing material from the front of the blade be sure and maintain an airfoil shape.

Along this line of prop balancing — many times an engine that is a pretty good vibrator can be smoothed out with an unbalanced propeller. You place the heavy blade in line with, and on, the same side as the crankshaft counter balance. That is, with the crankshaft counter balance at dead bottom, the heavy blade of the prop should point straight down. The piston will be at top dead center which you can tell by removing the glow plug on most engines. This will only work on engines that have insufficient counter balance to begin with. The disadvantage is the position in which it places the prop for hand starting. If an electric starter is used there is no problem. This is an old speed trick I used to use back in the mid 40's when flying U-control speed. The old Bantam .19's, Torp .29's, Ohlsson .23's, etc., would really smooth out with the unbalanced prop trick. The same thing would pertain today for you fellows into the R/C assist old time free flight events.

Dear Mr. Lee,

Which of the ABC parts will fit the K & B 8011? Can it be converted to ABC by using the 8011 housings?

I have a K & B 7.5cc ducted #9100 that I am not using for ducted fan use. Will the muffler and backplate that comes on the 6.5cc #9130 fit on the 7.5cc? What mufflers can be used other than pipes? I want to remove the pump. I also want the 7.5 to run on 15% nitro. What has to be done?

I would certainly appreciate it if you could drop me a line and answer my questions. What I am trying to do with the 7.5 is get the most power output without the weight of tuned pipes. I am one of the top fun-fly contestants on the East Coast but I can't seem to get my planes below 4 pounds. The large motor mount, header pipe, tuned pipe, clamps and brackets seem to be the problem.

Thank you,
James Barr,
Simpsonville, South Carolina

There are no ABC parts that will fit the old K & B 8011 engine (now replaced by the #4011). Whereas the old #8011 was of cross flow ported design, the later K & B 6.5 engines are Schnuerle ported. So even if the piston/sleeve might fit in the case it still would not work due to different positioning of the port passages and number involved. I do not really understand your question regarding coverting to ABC by using the 8011 housings. Unless what you are asking is if the K & B 8011 front and back plates will fit the ABC 6.5 (.40) crankcase, piston, and sleeve assembly, to which the answer is no.

The K & B 7.5 ducted fan engine was designed to be run with a full

length tuned pipe. The muffler and backplate from the 6.5 front rotor engine will fit. Mac's Products makes a muffler that is less restrictive than the K & B. However, if you remove the Perry Pump that comes on the ducted fan engine and replace it with a regular backplate, you are also going to have to replace the carburetor. The Perry Pump carburetor has far too large an intake to be used without the pump. What's wrong with leaving the pump on and using the large bore carburetor as long as it is speed you are after? If you want to eliminate using a full length tuned pipe you will have to replace the pipe timed piston/sleeve that comes in the ducted fan 7.5 with an unpipe timed unit that comes in the K & B 7.5 outboard marine engine., Part #8734. This will allow you to use a conventional muffler.

That does it for another month, gang. Keep the letters and ideas coming in. If you want a personal reply do not forget the self-addressed stamped envelope. The gentleman in the previous letter requested a reply but did not include an S.A.S.E. And if you do want a reply, keep the questions to one or two and short. I have been getting a lot of seven and eight page letters lately which I enjoy reading but do not have the time to answer all the questions involved. □

CUNNINGHAM ON R/C

Chuck Cunningham

You and I are both nuts about anything that flies through the air — right? I've been that way since I was a small boy, and quite probably you have too. When something flies past, be it an airplane, helicopter, or a bird, I generally stop to watch what's going on.

The other day I had a unique experience. I got to watch a bird flying from a position above the bird. Jan and I were going up the chair lift at the ski area at Breckenridge, Colorado. The

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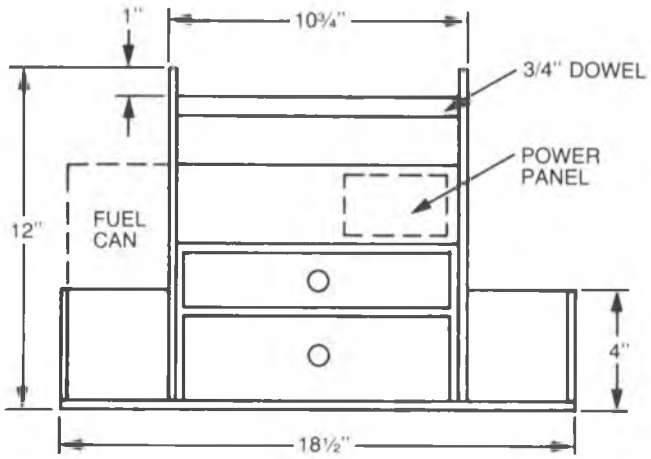

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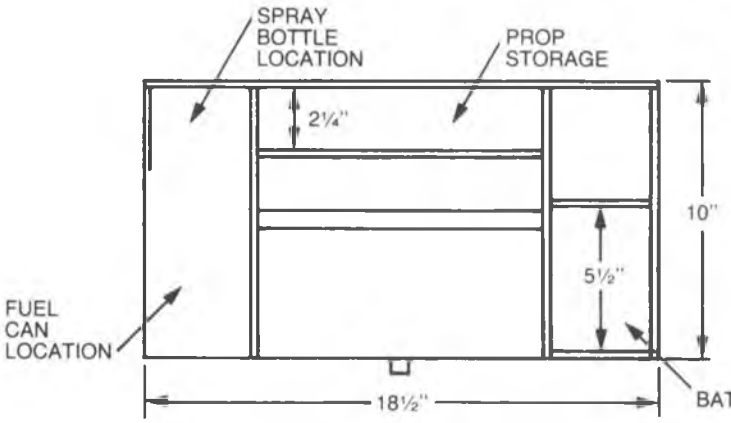

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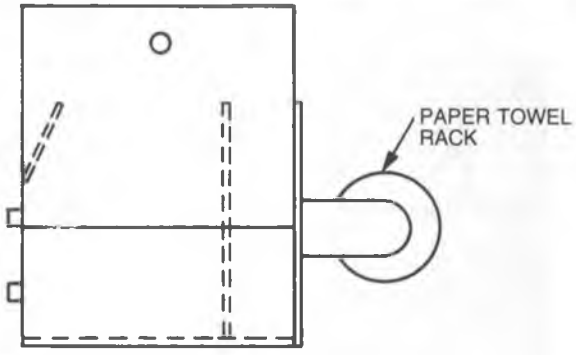

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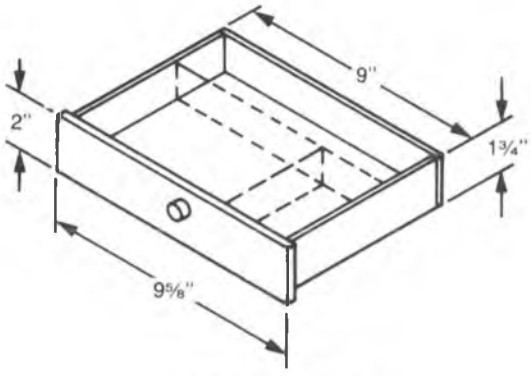

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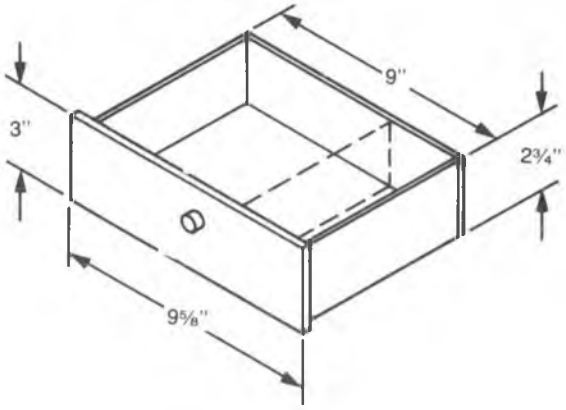
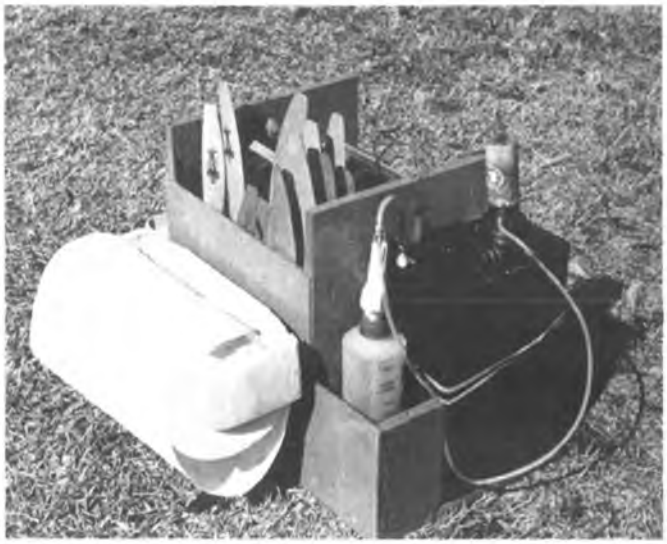


BOTTOM DRAWER

CHUCK'S FLITE BOX



day was clear and sunny, and the snow was nice, but not many skiers were out that day. About halfway up the mountain I spotted a largish bird pecking about on the snow. I really don't know what kind of bird that it was, but living at 11,000' altitude, and in zero degree weather, I know that it's a pretty tough bird. The chair lift passed above the bird. He took off and flew just under our chair seat, at the same speed that we were moving up the mountain, about 5' in front of us, and 5' or 6' below. He flew this way for a few seconds, and it was fascinating. We could watch him move his wing feathers to control his flight, watch the muscles of his back move his wings, and watch his head move from side to side looking for the next snack. Fantastic. Now, if I could just get a flight in a Fokker D-VII, or an SE-5 . . .

In many areas of the country, flying is done year round. With that in mind, let's talk a bit about going flying.

What you're going to be flying has a lot to do about how you go about it. For example, powered aircraft, soaring aircraft, and electric powered models all need different kinds of flight boxes with different equipment.

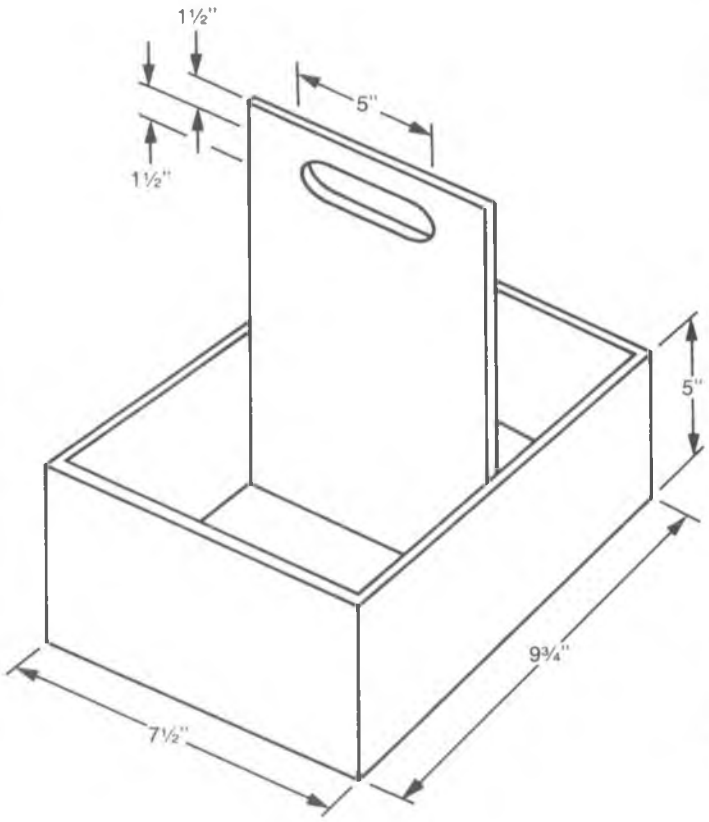
A lot of beginning RC'ers really don't understand the real value of a good flight box, while old hands often tend to drag too much stuff to the flying field. If you're an old hand at this hobby/sport and you like to fly several different kinds of models, then perhaps it would be a good idea to build multiple flight boxes so that you can lug along just what you need for that day's flying. For example, several years ago I built a flight box that just suits me for a normal day's flying of powered models. It has two drawers for stuff and goodies, a top hatch for holding things that you just toss back in the box, a place for a can of fuel with electric fuel pump, and a place for a motorcycle battery and starter. It has a location for a power panel, a place for several dozen props, ranging in size from 7" diameter to 20" diameter, and a towel rack for paper towels, and a spray bottle of cleaner. I used the very fine Goldberg case for some years with the addition of another level of drawers below the base of the box. This allowed me to carry more stuff with me, but also created a somewhat top heavy box. Finally I designed and built my box, which has proven to be just about right for me.

When I decide to take one of my chain saw powered models with me for a day of flying I have another box that is simply built. It carries a gallon can for gasoline fuel, a tire pump that I use to pressurize the fuel can as a method of filling the aircraft fuel tank, room for a small fire extinguisher, and a place to carry several props. I take both boxes with me.

Are you beginning to get the idea? A basic box for normal every day flying, and a more specialized box for special interests. If you're going out for a day of soaring, you need very little in the way of support systems; you don't need fuel, starters, big batteries, tachometers, a bunch of props, paper towels, etc. You can provide a very simple flight box, one that carries a few tools, and then a simple set-up to carry your high start, stake and hammer. When you have everything boxed as you need it, then you won't forget to take it with you. If you use a power pod, then you're going to need a starting battery and a can of fuel. You can use a small can of 1/2A fuel with finger operated pump attached, and a nicad battery with glow plug head clip attached, and you really haven't added much to a small carrying case.

How about the carrying case for electric power? You don't need much in the way of a flight box --- a fast charger that works off of your car battery, an extra prop or two, and a few small tools. But, if you design a small box around the items that you need, then when you get ready to fly that type of model, all you have to do is grab the model and that flight box and get with it.

You really don't need to spend an arm and leg to get the materials together to build any of these boxes. Look around a few construction sites and you can scrounge up enough scrap plywood to build any box that you might design. If you don't want to be a scrounger, then most of the newer type



TOTE BOX FOR GASOLINE, PUMP, ETC.

"carry anything" lumberyards carry plywood in smaller pieces. Gone are the days when you had to buy a 4' x 8' sheet of plywood for anything that you wanted to build. Generally, you can purchase a piece as small as 2' x 4' for just a couple of bucks. For the larger boxes that carry so much stuff in them, the basic frame should be from at least 3/8" plywood, while all of the smaller boxes can be fabricated from 1/4" or even 3/16" paneling type plywood. Takes a real pro to nail one piece of 3/16" plywood to the edge of another piece of 3/16" ply. But, why do much nailing, get out that ever popular bottle of Hot Stuff and stick 'em together just like your favorite model. Use small nails in high load places and Hot Stuff all other places. If you want to paint the finished product, purchase a can of spray-on Rust Oleum paint. It is fuelproof for any of the normal nitro content fuels.

Now that you have a flight box project underway, what do you need to go into it. This is where you may have some slight duplication of equipment, as you may need similar types of tools for glider flying as power flying. Some modelers of vast experience take almost a complete workshop to the flying field each time that they fly, while others take almost nothing and expect to borrow what they need from some other modeler. Know both types, don't you? Generally, you need a couple of screwdrivers, a moderately large one, and a small one, perhaps even a small Phillips head driver. A pair of small pliers, a four way (or similar) prop wrench, a razor blade or two, a collection of new glow plugs, an assortment of small bolts, nuts, and screws, a few stick-on weights for balancing after test flying, rubber bands (if the wings on your model are held on in this manner), a small bottle of Hot Stuff for field repairs, a small box of pins, a spare servo, and assorted other junk that will find a permanent home in your flight box. The best way to keep the small parts is in small plastic boxes, the kind that are flat and easy to store. You may want to put several different screwdrivers in each of your specialized flight boxes, and also boxes of screws and nuts in each. Show me a guy who doesn't have a jillion small screwdrivers and a jillion nuts and bolts and I'll show you a guy who isn't a model builder.

★

Let's talk about another subject --- that is take-off and landing. I've received a couple of letters in the past month or so with the same question, "Why do you use toe-in for the wheels on a tail dragger rather than toe-out?" First, let's talk a bit about landing gears on aircraft that perch on main wheels and a tail wheel. It is most important that you set up all three wheels exactly square with the aircraft, and with each other. Way too many pilots complain that a tail dragger is squirrely and hard to handle on take-off run, and as a result give the tail draggers a bad name. Nuts. Look at most of today's models — the new generation brought on by the big engine revolution. Ninety percent or better are tail draggers, most of which do a great job of rolling down the runway and taking to the air. The reason that the fliers of these models have been successful is that they have paid attention to assure that the landing gears on their aircraft are square with everything. Then they make sure that the tail wheel is not cocked off at an angle.

Now, to toe-out versus toe-in. Personally, I believe that wheels that are set up straight ahead, or just very slightly toe-in are much better than wheels that are toe-out. This set-up will give you better straight ahead tracking on both take-off and landing. If you land with one wheel first on a toe-in setting, it tends to pull the aircraft toward the centerline of the aircraft, keeping the aircraft moving in the correct direction down the runway. A toe-out wheel will pull the aircraft off of the straight line into a ground loop. Of course, if you land correctly, both wheels should touch down at the same time.

One thing that a tail dragger will always do is to take-off and land right

Chuck's 84" span Turbulent for 90, 2-cycle and 1.2 4-stroke engines.

Dan Yarchin's Lazy Ace pulled by Gemini Twin.

into the wind. You can compensate for this but if you're landing cross wind, you can bet that the aircraft will turn into the wind just as soon as it touches down. The same is true for a take-off run. You must make it into the wind to be good, otherwise when the aircraft breaks ground it's going to swing itself pretty much into the wind. If you're flying a model with ten times more power than it needs to fly, then the shear power of the engine will help it to bore ahead disregarding the wind direction. However, if it is a scale aircraft with similar scale-like power, then, by all means, make sure that the take-off run is exactly into the prevailing wind.

★

It's time to extend another invitation to you to attend the Seventh Annual Southwestern Jumbo Fly-In to be held at Thunderbird Field, on the west shore of Benbrook Lake, just west of Forth Worth, Texas. The dates for the world's second oldest Fly-In for large models are July 21 and 22, 1984. If you want additional information on this fly-in, write to me at 2440 Colonial Parkway, Fort Worth, Texas 76109, for a map and a motel list. We are expecting another banner year for big model flying and sure hope that you come along to join in the fun. Be sure to bring your suntan lotion and big hat because, naturally, it's going to be the hottest weekend of the year.

□

LITTLE DIPPER

A unique competitive sport scale model of a little known aircraft with a distinctive personality.

By Dick Tichenor

The Little Dipper was without doubt one of the most interesting and inspired light airplanes ever built. It was also Lockheed's smallest and least publicized product and it never got beyond the prototype stage. The design concept was unparalleled in its simplicity, performance was remarkable and, above all, it was thoroughly safe and easy to fly.

John W. Thorp was the Assistant Chief of Preliminary Design at Lockheed's Vega Division in 1944 and had been conducting some design studies on a small two place aircraft on his own time. His boss, Mac Short, was impressed with John's design and presented it to Lockheed's President, the late Robert Gross.

Gross gave Short his blessing and the Dipper project was formed in the Vega Division in June 1944, with Thorp in charge. The group, which included five designer-draftsmen and five experimental mechanics, immediately set up shop and began constructing the prototype Little Dipper Model 33 (Vega V-304) and a four place pusher companion model called the Big Dipper. Progress moved at a rapid pace and in about three months' time the first machine, NX18935, was ready to fly.

An ideal engine was not available for the Little Dipper but engineers worked out a deal with Air-Cooled Motors whereby two cylinders from a Franklin engine would be mounted on a special crankcase. The resulting two cylinder, 50 hp Franklin turned out to be almost ideal.

Vega's chief test pilot, Bud Martin, flew the Little Dipper for the first time during the last week of September 1944. The event took place without incident at the old CAA emergency field near Newhall, California. A few days later the Little Dipper took to the air again, this time in the hands of the famous Milo Burcham, former Lockheed chief of flight testing. The tiny plane was a complete success, giving all that was expected of it and more.

LOCKHEED LITTLE DIPPER

Designed By:
Dick Tichenor
TYPE AIRCRAFT
Sport Scale
WINGSPAN
75 Inches
WING CHORD
13 Inches
TOTAL WING AREA
970 Sq. In.
WING LOCATION
Mid-Wing
AIRFOIL
Flat Bottom
WING PLANFORM
Constant Chord
DIHEDRAL EACH TIP
3⅜ Inches
O.A. FUSELAGE LENGTH
48¾ Inches
RADIO COMPARTMENT SIZE
(L) 13" x (W) 5¼" x (H) 2½"
STABILIZER SPAN
28 Inches
STABILIZER CHORD (incl. elev.)
8 Inches
STABILIZER AREA
220 Sq. In.
STAB. AIRFOIL SECTION
Symmetrical
STABILIZER LOCATION
Top of Fuselage
VERTICAL FIN HEIGHT
11½ Inches
VERTICAL FIN WIDTH (incl. rud.)
9½" (Avg.)
REC. ENGINE SIZE
.90 (4 stroke), .60 (2 stroke)
FUEL TANK SIZE
8 Oz.
LANDING GEAR
Tricycle
REC. NO. OF CHANNELS
5
CONTROL FUNCTIONS
Rud., Elev., Throt., Ail., Flap
BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	Balsa & Ply
Wing	Balsa & Ply
Empennage	Balsa
Wt. Ready To Fly	**168 Oz.**
Wing Loading	**24.9 Oz./Sq. Ft.**

In spite of the fact that he was not an official test pilot, John Thorp did much of the initial flying. The Little Dipper, which was a direct development of his original two-place design, was his baby and he was anxious to prove the airplane's worth and versatility. Thorp never missed an opportunity to demonstrate its amazing maneuverability and short-field performance. He could and often did take off, fly around for fifteen minutes, or until he got dizzy, and land the airplane — all within a 300 ft. circle! Its turning radius was so short that it could almost pivot on a wing tip.

Following the crash of the prototype Big Dipper in the spring of 1946, the entire project was written off the books. The Little Dipper was then placed in dead storage along with a second partially completed example. In spite of several sincere efforts to save the airplanes, the Little Dippers were subsequently broken up for tax purposes a few months later.

This writer has been fascinated by the Little Dipper for more years than he will admit but has been deterred from building a model because of the huge canopy requirement which is a vital part of the Dipper's personality. The introduction of the Saito FA-90T four stroke two cylinder engine brought an end to the procrastination. The dimensions of the Saito FA-90T are very close to one quarter size of the two cylinder Franklin engine used in the Dipper. Since the original Little Dipper had a wingspan of only 25 feet, a Quarter Scale version has proven to be an excellent combination.

Our enthusiasm for this project during construction was exceeded only by the flight performance. We know that everyone raves about how well his latest pride and joy bores holes in the sky to a point of causing disbelief. Hang on, here it comes again. This bird flies like the original, the combination of ample power and light wing loading with wing flaps provide a remarkable speed range with safety. Horizontal flight at full throttle results in a quite respectable speed; a landing approach with full flaps, nose a bit high, engine with a touch of throttle gives a walk-along touchdown speed. Loops from horizontal at 3/4 throttle are no sweat, inverted flight with full flaps looks dumb but the airplane doesn't mind.

Horizontal Figure 8's while rolling to the outside only require some smart thumbs on the transmitter as the Dipper does what ever you tell it to do. This maneuver will amaze your friends who will remark, "I don't believe it, do it again!"

We prefer to barnstorm but the Little Dipper does fairly well in competition. Within 30 days from the first test flight it had brought home a first place and two second place trophies. It picked up a static judging score of 92 points at the 1983 Western Scale Championships. Somehow it makes this construction article a bit easier to put together and we have stopped calling it Tichenor's Little Toad.

This might be an appropriate place for a confession along the lines of "don't do as I do, do as I say." When we reached the point to quit tinkering and see if this project is going to fly we simply packed our gear and headed for Mile Square. Of course, this was a brand new unflown airplane. Also, the Saito FA-90T engine had never been fired up. Further, the Hobby Shack Cirrus 900 XLC 7 channel radio had never been flown, like out of the box and installed in the Dipper. You might refer to this approach as going for broke.

After the aircraft was assembled we went through a satisfactory range check and all the controls worked in the proper directions. After pumping fuel into the tank came the moment of truth with the engine. Guess at a needle setting, choke a couple of turns, hook up battery, and flip the prop. That Saito came to life! A bit of tweeking on the needles, no sag in rpm with the nose held straight up, and an agreed "let's do it." Sometimes you just plain luck out, everything worked beautifully from the very beginning and has been the most trouble-free airplane that we've ever had. What can you say about a Cirrus radio that has performed flawlessly hour after hour? No complaints whatsoever, it is great and at the Hobby Shack price you can't find a better value.

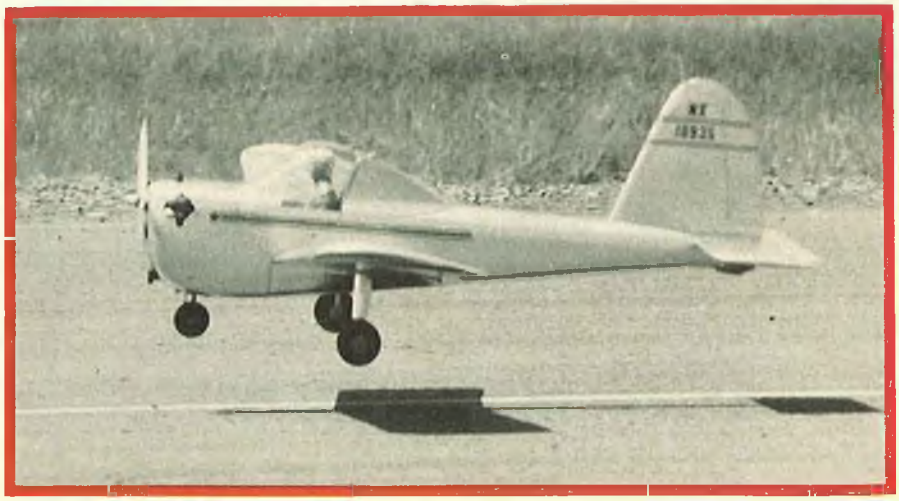
We can't say enough good words about the Saito FA-90T four stroke engine. Powerful, excellent idle, reliable, quiet, easy to start, and a beautiful piece of machinery. It has one characteristic that you learn real fast, it doesn't like to be choked very much. Over-choke it and it will bite

Little Dipper Partial Kit
available from
P & W Model Service,
1114-B E. Edna Place,
Covina, California 91724.

Partial Kit contains: *fiberglass cowl, fiberglass headrest, butyrate canopy, 3/16" dia. formed main landing gear, fuselage formers (ply & balsa), and machine cut ribs for wing, stab and fin.*

Complete Package $56.00 p.p. in Continental USA.

Foreign countries write for prices. Allow 4-6 weeks for delivery. California residents add 6% sales tax.



you and that smarts so don't do it. Even our conservative Clarence Lee has heaped enthusiastic praise on the Saito FA-90T twin.

As for the airplane, not only has it performed exceptionally well but it has a personality all of its own. It is refreshingly different from the rest of the models and we really enjoy the compliments from those who examine it on the ground and watch it in the air.

Since we are not recommending this project as the first R/C airplane for a beginner we will not go into the glue part A to part B routine. The drawings and photos are pretty much self-explanatory and there really isn't anything unusual or difficult. Also, there are a couple of discrepancies betwen the photos and the plans, in such cases we have found a better way after building the model so give the plans precedence over the photos. Further, if you have your own favorite construction methods, have at it, we just did the things that were the easiest for us.

CONSTRUCTION

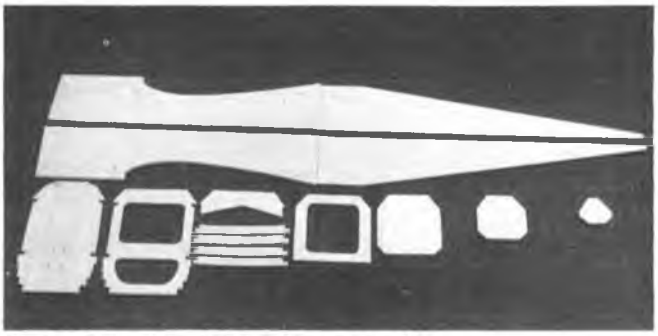
This was our first exercise in building an entire model using only cyanoacrylate adhesives. There is one exception that we will explain a little later. For this project we selected the Pacer line of products, primarily the Zap/CA, CA + Zap-A-Gap, Kicker, and a bit of Slo Zap CA –. Our reference will simply be Zap or CA. To be straightforward about this subject, we haven't really felt comfortable in using CA in some applications; it is difficult to break some old habits. The Little Dipper has lead a rigorous life, is still as good as new and we are now totally oriented toward CA. Not really as good as new, big Joe Zdankiewicz has just about worn out the tires with his spectacular landings while using the wheel brakes.

Fuselage:

As usual we cut out the basic fuselage parts and in this case the first assembly is the 1/4" ply parts F-1, F-2,

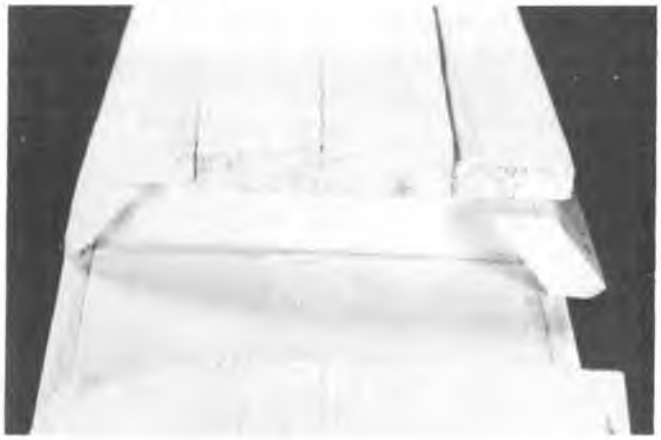
continued on page 39

The original Lockheed Little Dipper in its final configuration. Only one example was built and it was destroyed for tax write-off benefits.

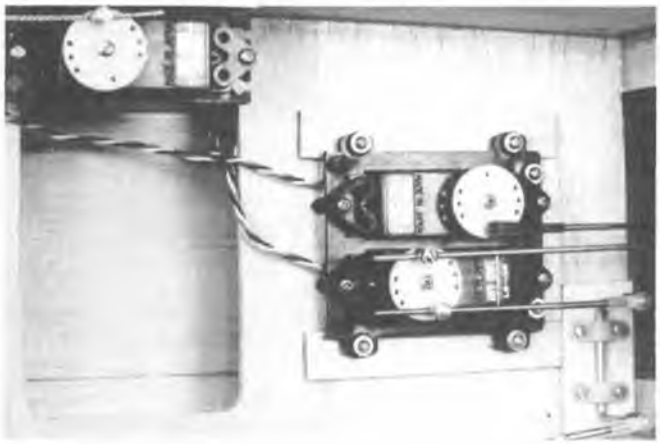


Parts required to start fuselage assembly.

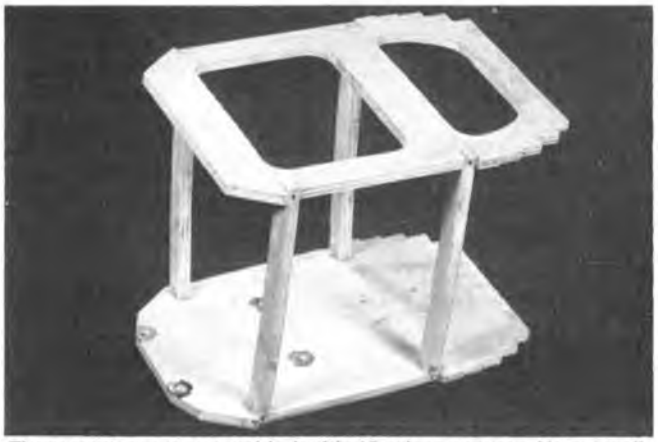
Compound curves in nose section is obtained by shaping strips and sheets as shown.



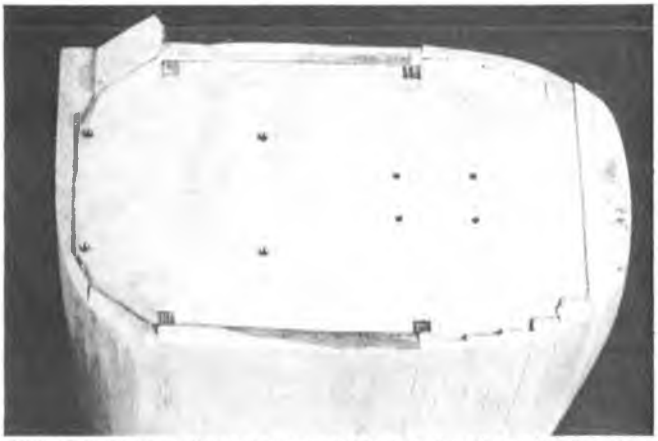
Top aft sheeting at cockpit area.



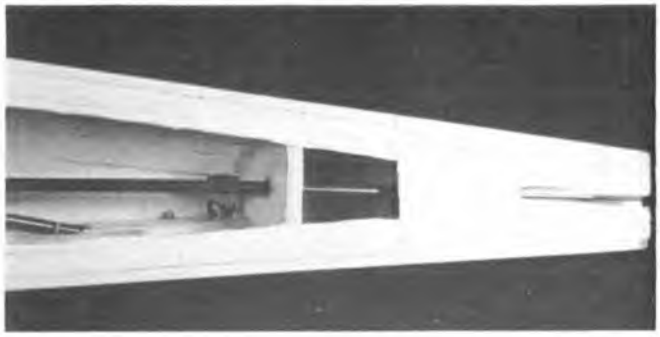
Rudder and elevator servo installation. Nose steering rocker is shown in lower right corner of photo.



These parts were assembled with 45 minute epoxy. Note small nails to hold while epoxy sets. Proper alignment is critical.

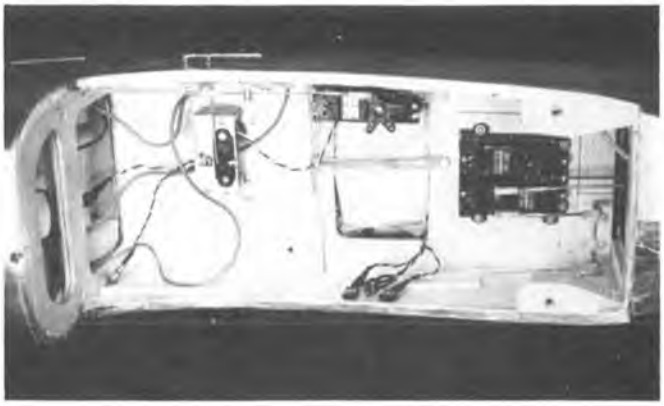


This is how the shape came together at the firewall. Note top sheet is recessed to clear engine mount nut plates.

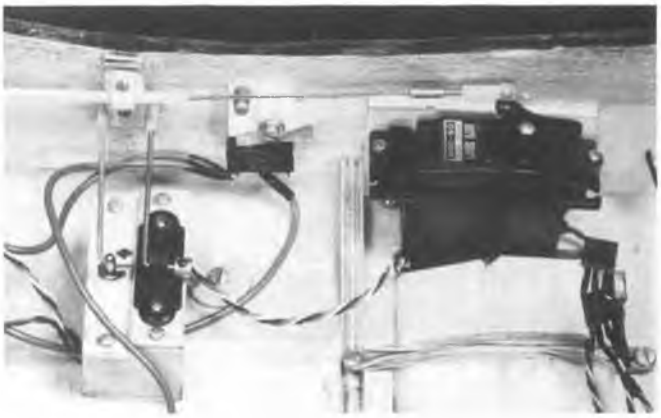


Rigid Gold 'N-Rod pushrods were installed in fuselage prior to attaching bottom aft sheeting.

A Great Planes' Switch-N-Glow twin harness on-board ignition system was used with the Saito FA-90T 2 cylinder 4-stroke engine. The micro switch is shown installed, other components shown for info only.



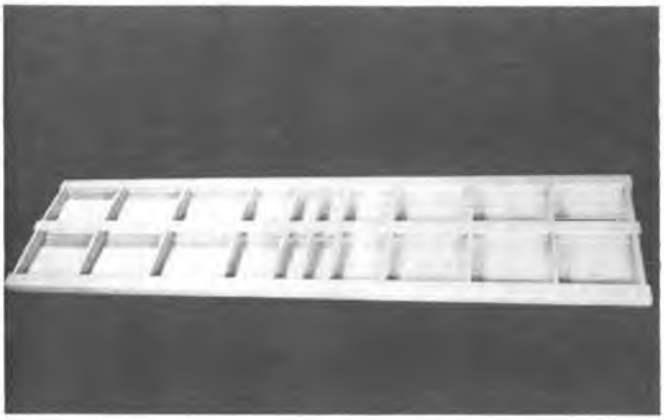
General view of fuselage radio installation. Foam wrapped receiver is located in center opening. A Hobby Shack Cirrus 900-XLC 7 channel radio was used.



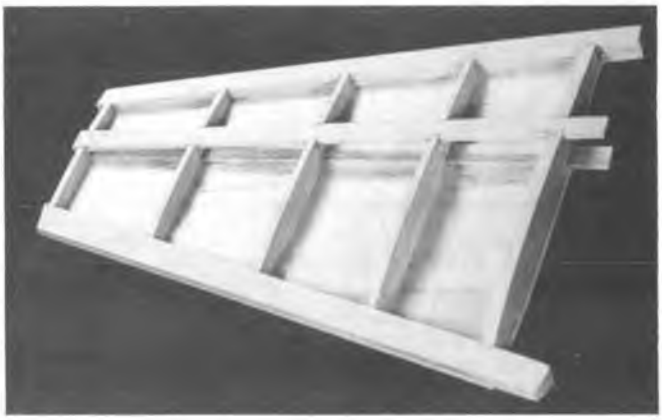
Details of ignition switch (on left) and receiver switch installation. Throttle servo uses an aileron type mount.

A fiberglass headrest was made after encountering difficulties in fitting a carved balsa part.

The original belly pan is shown here for structural details. An improved version is shown on the plans.



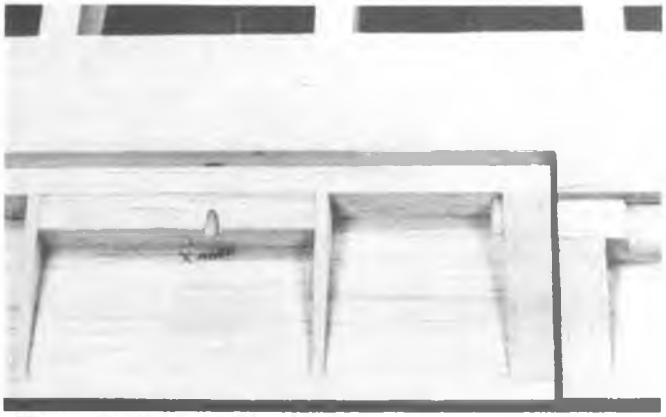
Horizontal stab structure prior to installing top skin.



Vertical stab prior to attaching left skin.

Inboard wing panel in early assembly stage. Note dihedral gauge for center rib.

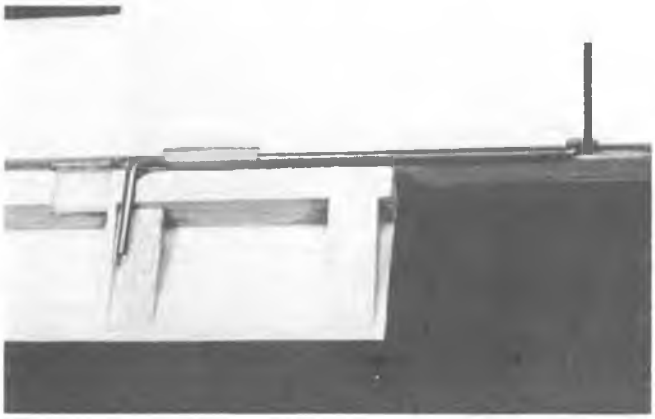
A larger view of wing assembly.



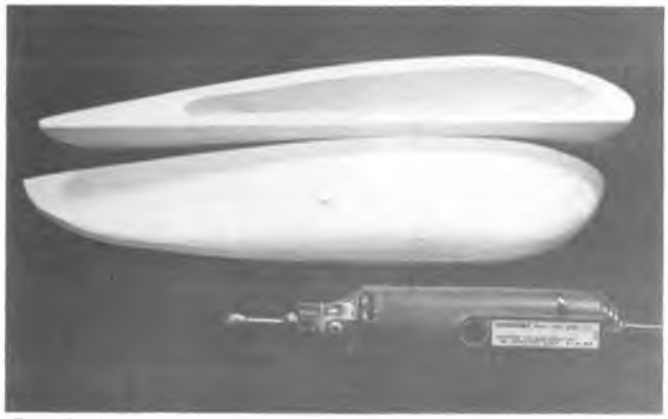
Aileron structure at inboard end.

Aileron control installation.

Flap control details.



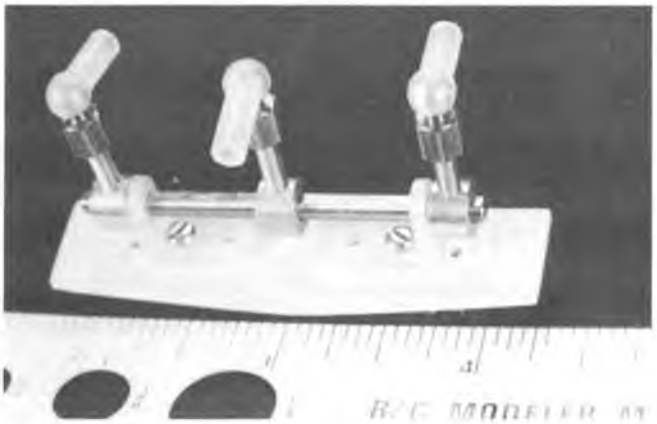
Flap control installation at inboard end of unfinished flap.



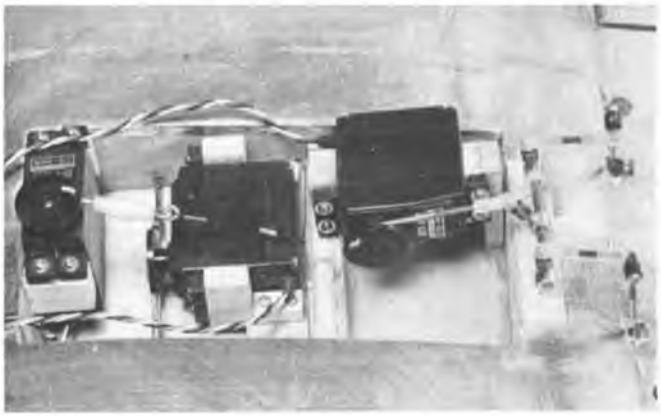
Rough shaped and hollowed wing tips.

License numbers were cut from red MonoKote. Masking tape was used for location and alignment of numbers.

Robart scale struts were installed over the wire struts and streamline fairings were later added to the main gear struts.



Details of the wing flap control rocker assembly.



Servo arrangement in wing center section. Servo on left actuates wheel brakes.

A Du-Bro 1/4 scale pilot was cut off as shown and decorated. It gives a realistic scale effect.

The pitot tubes help the static scoring.

A Goldberg aileron horn set was modified for use as a rudder control horn.

A simple stand bolted into wing mounting blocks is useful for safely transporting Little Dipper.

The Little Dipper is competitive as evidenced by the three trophies won within 30 days from first test flight.

FB-1 and FB-2. This is a rather critical assembly and here is where we used 45 minute epoxy to allow enough working time to check and double check the alignment. Very small holes were drilled in the assembly for small nails used to secure the parts during the alignment checks.

The rest of the fuselage assembly is a fairly normal glue and trim approach. We used a good bit of large size balsa and trimmed it down to the proper size and shape. Soft, light balsa will make the job a lot quicker.

We suggest making provisions for the radio and pushrod installations before applying the bottom sheeting to the aft fuselage. This will provide easier access. You will note that the radio installation shown in the photos has a couple of features not normally seen. One is a rocker arm for nose wheel steering. Its purpose is to allow the stranded pushrod cable to run along the fuselage side forward to the nose wheel steering arm.

The other is the installation of the bellcrank micro-switch actuator for the Great Planes on-board ignition system. This ignition system has proven to be one of the most worthwhile features of the Little Dipper project by not only allowing an unbelievably reliable low idle for the Saito FA-90T twin but we also use it for starting the engine. It is a nice show-off gimmick to go to the flight line with only the airplane and transmitter. The micro-switch is adjusted to operate on the bottom 1/4 of the pushrod travel.

You will also notice both the on-board ignition and radio switches were mounted on a plywood stand-off with wire pushrods extending through the fuselage side.

We have used a multitude of the nice little accessory items manufactured by Carl Goldberg Models and Du-Bro Products, all of which are available through hobby dealers. The Goldberg 5/32 steerable nose gear set was used for practical (availability) reasons even though it compromised the true scale aspect. If you desire to go for the scale swept forward strut you can bend the lower strut to slant forward at the spring coil and insert a spacer between the nylon bearing block and the firewall for strut clearance. In either case a clearance hole must be cut in the bottom of the fuselge to allow strut installation.

Tail Surfaces:

Both the horizontal and vertical stabilizers were assembled using conventional leading and trailing edges and spars glued to the ribs. The balsa sheeting was applied and then the tip blocks were installed. The elevator and rudder were made of soft 1/2" sheet balsa. A Goldberg aileron horn set was modified for the rudder control to make adjustments convenient and close to the fuselage. Du-Bro large hinges were used with the rudder and elevator installation.

Wing:

The wing design and construction is the simple old standard type that is assembled over the plans on a flat building board. Beyond emphasizing the flatness of the building board, our only other suggestion is to make good snug fits between all the parts. Then you can set the parts in position and Zap the structure together quicker than you can tell about it.

My favorite method of obtaining equal movement on the flap control is with an idler rocker and it is detailed on the plans. Care should be taken on final assembly to adjust for equal and precise flap deployment. The plans also show how I like to rig aileron differential at the servo output wheel. Differential is necessary on this type airfoil to prevent adverse yaw while banking.

The third servo, shown in the wing center section, operates brakes on the main gear. I was able to scrounge up a pair of the old Du-Bro drum brakes which have given us a lot of pleasure. The current Du-Bro coil spring brakes work just as well but aren't quite as realistic in appearance. A piece of 1/8" O.D. nylon tubing was built in each wing panel above the landing gear blocks to contain the nylon thread that runs up, across, and down between the wheels. Wheel brakes are a bit of a bother to install and adjust but the enjoyment is well-worth the effort and there are points given for proto taxi in scale competition.

Covering:

Since the prototype skins were of 2024-T3 Alclad aluminum and the parts having compound curves were made of 2 SO aluminum and were not painted, we decided to cover the model with chrome MonoKote. This proved to be a unique and frustrating experience and is the most difficult iron-on material to apply that this aged modeler has ever used.

Good buddy Joe Zdankiewicz came to my rescue and worked wonders. The secret is to work with higher temperatures and don't expect very much flexibility around compound curves. The chrome finish is like a mirror and the distortions in the reflections will drive you up the wall. To break up the surface reflections we used a 50¢ Singer tracing wheel intended for a seamstress to transfer pattern marks to fabrics. By rolling the wheel along a straightedge you can simulate rows of rivets which, while not quite to scale, are very effective in breaking up the surface into smaller areas.

The next step is to surround those areas (one at a time) with a low tack masking tape. Then scour that enclosed area lightly back and forth in the same direction with a 3M green Scotch-Brite® scouring pad. Do not use steel wool, Brillo Pads or any other pads as Scotch-Brite® is the one that gets the effect. Mask and scour each area in a slightly different direction and you get the effect of aluminum panels. We smile a lot because we've been asked dozens of times, "Where did you get that aluminum covering?"

Coverite had not introduced aluminum Micafilm when we were building the Little Dipper. Since then I have been most favorably impressed with it. It is easy to apply, is excellent on compound curves, has good shrinkage and has a very realistic aluminum appearance. You might well-consider Micafilm for your Dipper.

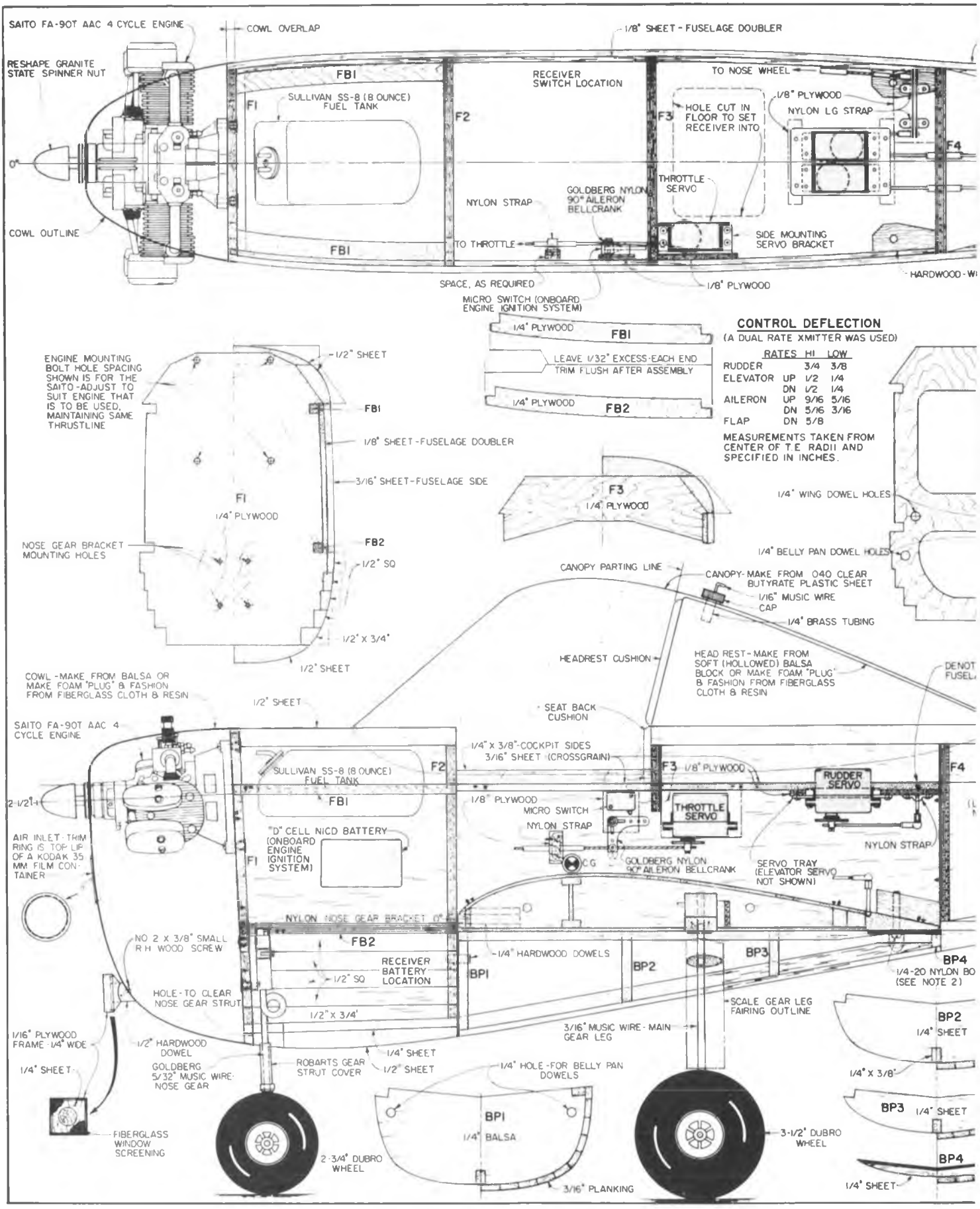
We had access to the original Lockheed markings drawing for the Dipper. Only the license numbers were described and the color was specified as simply "RED." The red 1" Coverite graphics numbers were used on the tail and numbers cut from red MonoKote went on the wings. We cut the wing numbers around patterns made from cardboard. Don't forget the old gimmick of wetting the wing panels with water containing a few drops of liquid dishwashing detergent to aid in positioning the numbers and eliminating bubbles. Also a baby sock pulled over your sealing iron is a big help when sticking the numbers to the wing covering.

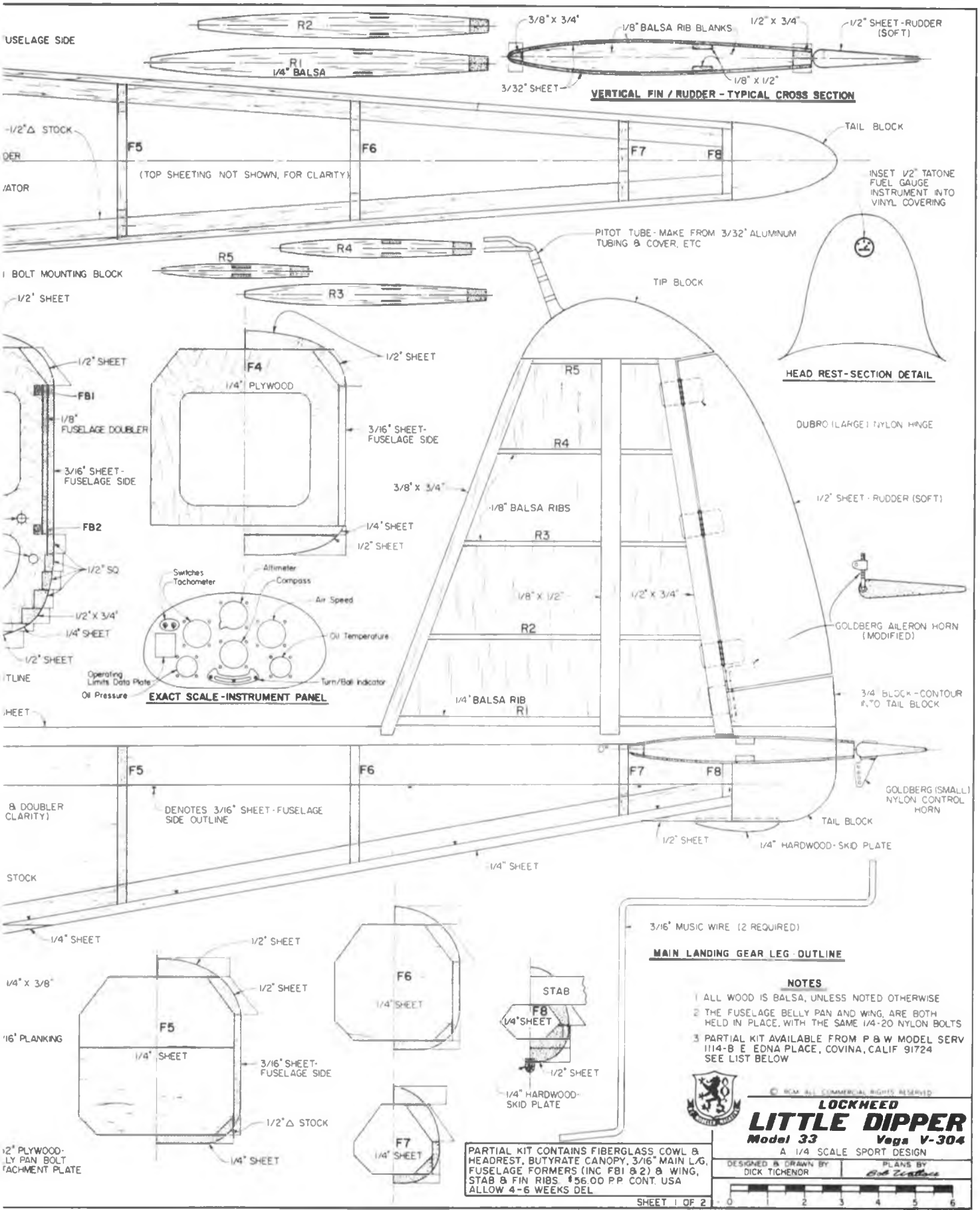
There seems to be no documentation on the trim striping other than in photos of the final configuration. Our location for the trim was established by scaling the photos.

Flying:

Usually a construction article includes comments on the flight pecularities of the model. In the case of the Little Dipper we don't know of any. All we can say is to make the normal preflight checks and have a go at it. This bird has given us nothing but sheer enjoyment.

In conclusion, I want to thank several people who graciously provided information to authenticate my Little Dipper project. Former Lockheed employees such as Tony LeVier, Bill Krecek, and Bob Wiehle loaned me an unbelieveable number of obscure photos and original drawings. Little Dipper designer, Johnny Thorp, kindly reviewed and endorsed my documentation package. Gene Wallock and Don Dombroski helped me find sources for material. Joe Zdankiewicz not only rescued me with his know-how with chrome MonoKote but, as usual, his superb flying talent makes my flying machines look fantastic. Thanks again gentlemen.


SAITO FA-90T AAC 4 CYCLE ENGINE
COWL OVERLAP
1/8" SHEET - FUSELAGE DOUBLER
RESHAPE GRANITE STATE SPINNER NUT
FB1
F1
SULLIVAN SS-8 (8 OUNCE) FUEL TANK
F2
RECEIVER SWITCH LOCATION
TO NOSE WHEEL
HOLE CUT IN FLOOR TO SET RECEIVER INTO
F3
1/8" PLYWOOD
NYLON LG STRAP
F4
THROTTLE SERVO
NYLON STRAP
GOLDBERG NYLON 90° AILERON BELLCRANK
COWL OUTLINE
TO THROTTLE
SIDE MOUNTING SERVO BRACKET
SPACE, AS REQUIRED
MICRO SWITCH (ONBOARD ENGINE IGNITION SYSTEM)
1/8" PLYWOOD
HARDWOOD - W
1/4" PLYWOOD
FB1
LEAVE 1/32" EXCESS EACH END TRIM FLUSH AFTER ASSEMBLY
1/4" PLYWOOD
FB2
CONTROL DEFLECTION
(A DUAL RATE XMITTER WAS USED)
RATES HI LOW
RUDDER 3/4 3/8
ELEVATOR UP 1/2 1/4
DN 1/2 1/4
AILERON UP 9/16 5/16
DN 5/16 3/16
FLAP DN 5/8
MEASUREMENTS TAKEN FROM CENTER OF T.E. RADII AND SPECIFIED IN INCHES.
ENGINE MOUNTING BOLT HOLE SPACING SHOWN IS FOR THE SAITO - ADJUST TO SUIT ENGINE THAT IS TO BE USED, MAINTAINING SAME THRUSTLINE
1/2" SHEET
FB1
1/8" SHEET - FUSELAGE DOUBLER
3/16" SHEET - FUSELAGE SIDE
F1
1/4" PLYWOOD
NOSE GEAR BRACKET MOUNTING HOLES
FB2
1/2" SQ
1/2" X 3/4"
1/2" SHEET
F3
1/4" PLYWOOD
1/4" WING DOWEL HOLES
1/4" BELLY PAN DOWEL HOLES
CANOPY PARTING LINE
CANOPY - MAKE FROM .040 CLEAR BUTYRATE PLASTIC SHEET
1/16" MUSIC WIRE CAP
1/4" BRASS TUBING
HEADREST CUSHION
HEAD REST - MAKE FROM SOFT (HOLLOWED) BALSA BLOCK OR MAKE FOAM "PLUG" & FASHION FROM FIBERGLASS CLOTH & RESIN
COWL - MAKE FROM BALSA OR MAKE FOAM "PLUG" & FASHION FROM FIBERGLASS CLOTH & RESIN
1/2" SHEET
SEAT BACK CUSHION
SAITO FA-90T AAC 4 CYCLE ENGINE
1/4" X 3/8" - COCKPIT SIDES
3/16" SHEET (CROSSGRAIN)
SULLIVAN SS-8 (8 OUNCE) FUEL TANK
F2
F3
1/8" PLYWOOD
F4
RUDDER SERVO
FB1
1/8" PLYWOOD
MICRO SWITCH
NYLON STRAP
THROTTLE SERVO
2 1/2"
AIR INLET - TRIM RING IS TOP LIP OF A KODAK 35 MM FILM CONTAINER
"D" CELL NICD BATTERY (ONBOARD ENGINE IGNITION SYSTEM)
F1
C.G.
GOLDBERG NYLON 90° AILERON BELLCRANK
SERVO TRAY (ELEVATOR SERVO NOT SHOWN)
NYLON STRAP
NYLON NOSE GEAR BRACKET
FB2
NO 2 X 3/8" SMALL R.H. WOOD SCREW
RECEIVER BATTERY LOCATION
1/4" HARDWOOD DOWELS
BP1
BP2
BP3
BP4
1/4-20 NYLON BO
(SEE NOTE 2)
1/2" SQ
HOLE - TO CLEAR NOSE GEAR STRUT
1/2" X 3/4"
SCALE GEAR LEG FAIRING OUTLINE
3/16" MUSIC WIRE - MAIN GEAR LEG
BP2
1/4" SHEET
1/16" PLYWOOD FRAME - 1/4" WIDE
1/2" HARDWOOD DOWEL
1/4" SHEET
GOLDBERG 5/32" MUSIC WIRE NOSE GEAR
ROBARTS GEAR STRUT COVER
1/4" SHEET
1/2" SHEET
1/4" HOLE - FOR BELLY PAN DOWELS
1/4" X 3/8"
BP3
1/4" SHEET
BP1
1/4" BALSA
3-1/2" DUBRO WHEEL
BP4
FIBERGLASS WINDOW SCREENING
2-3/4" DUBRO WHEEL
3/16" PLANKING
1/4" SHEET



NOTES

1. ALL WOOD IS BALSA, UNLESS NOTED OTHERWISE
2. THE FUSELAGE BELLY PAN AND WING, ARE BOTH HELD IN PLACE, WITH THE SAME 1/4-20 NYLON BOLTS
3. PARTIAL KIT AVAILABLE FROM P & W MODEL SERV 1114-B E. EDNA PLACE, COVINA, CALIF 91724 SEE LIST BELOW

LOCKHEED

LITTLE DIPPER

Model 33 **Vega V-304**

A 1/4 SCALE SPORT DESIGN

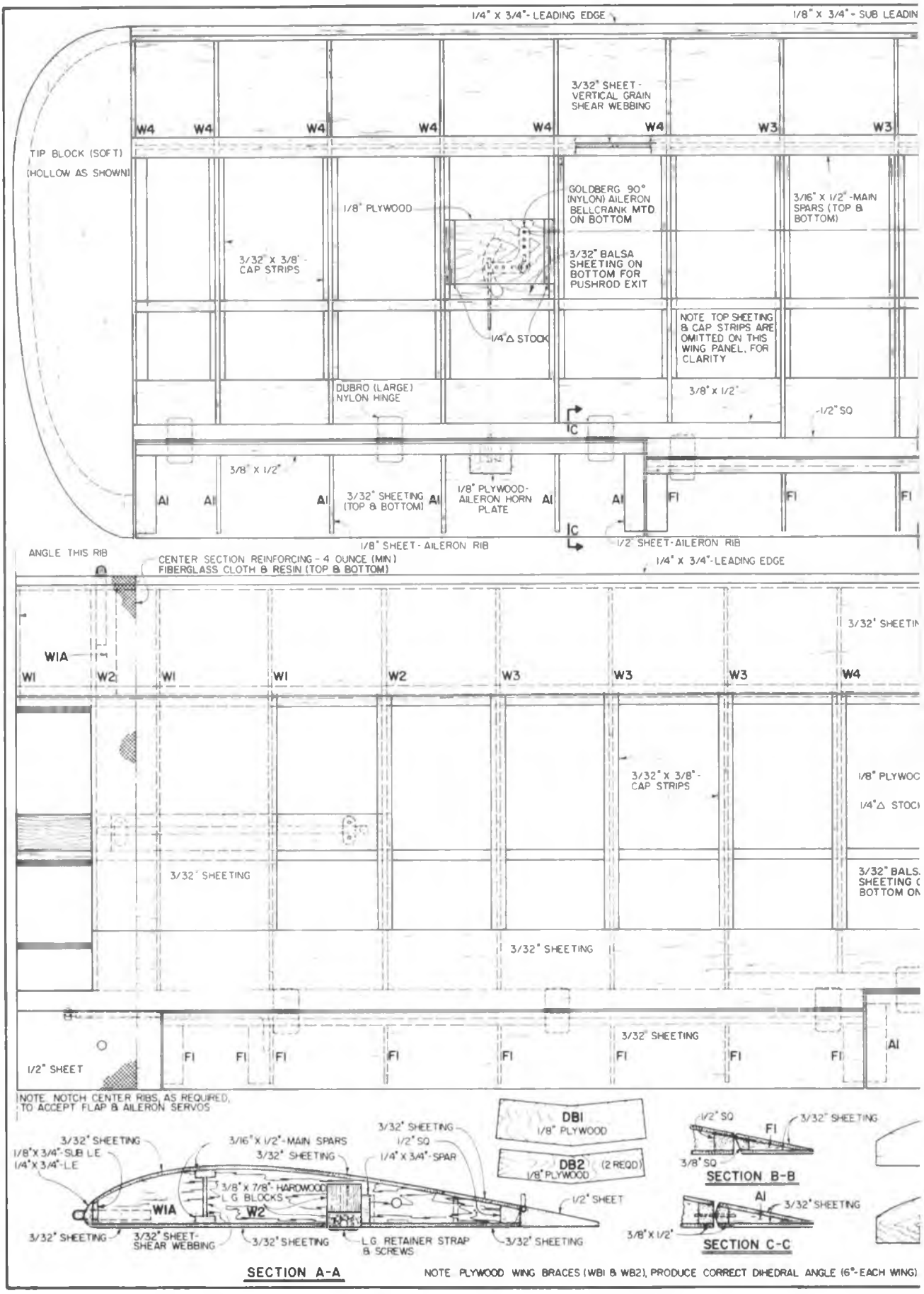
DESIGNED & DRAWN BY DICK TICHENOR

PLANS BY Bob Zeltner

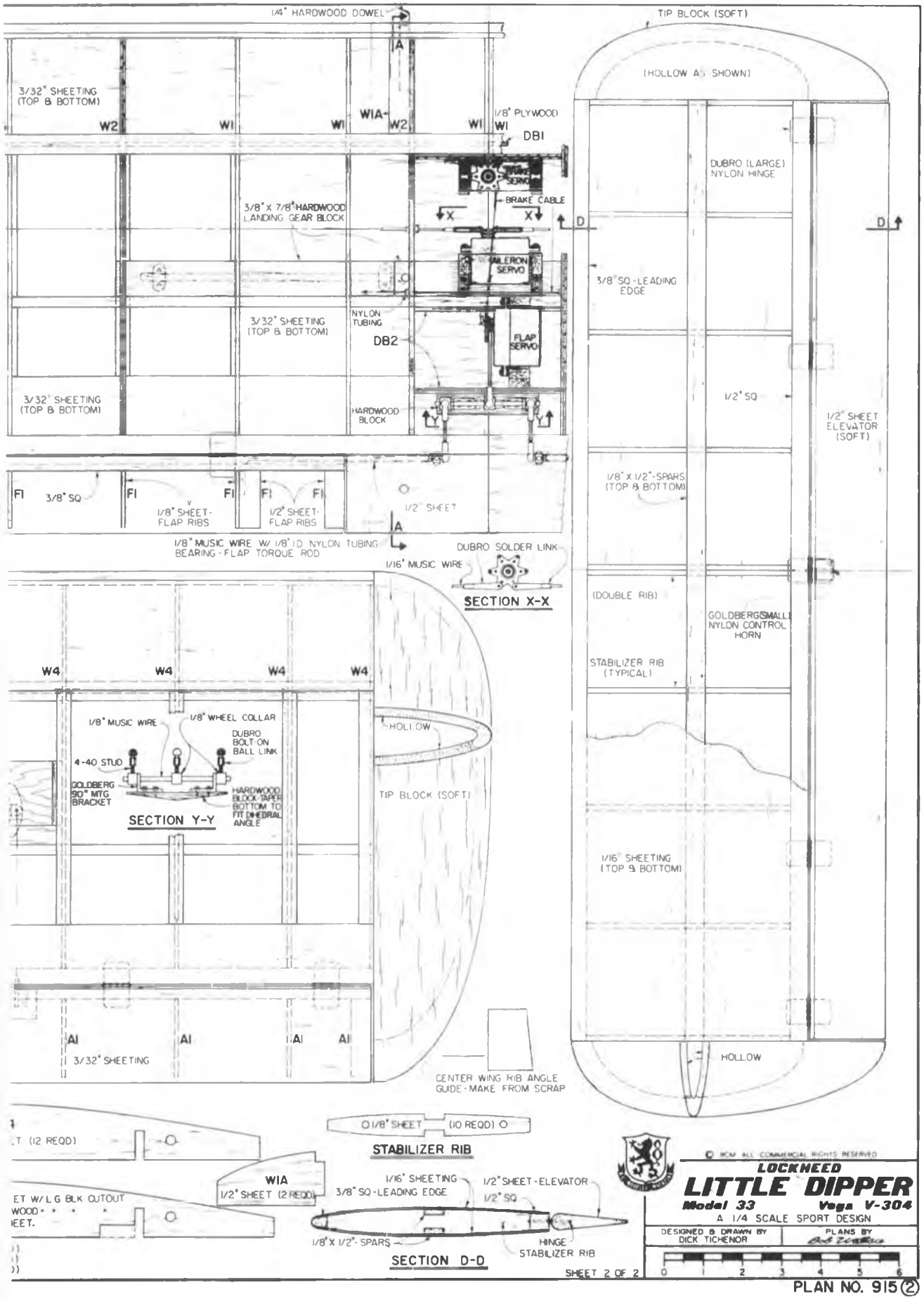
PARTIAL KIT CONTAINS FIBERGLASS COWL & HEADREST, BUTYRATE CANOPY, 3/16" MAIN L/G, FUSELAGE FORMERS (INC FB1 & 2) & WING, STAB & FIN RIBS. $56.00 P.P. CONT. USA ALLOW 4-6 WEEKS DEL

SHEET 1 OF 2

PLAN NO. 915(2)


1/4" X 3/4"- LEADING EDGE
1/8" X 3/4" - SUB LEADIN
3/32" SHEET - VERTICAL GRAIN SHEAR WEBBING
W4 W4 W4 W4 W4 W4 W3 W3
TIP BLOCK (SOFT) (HOLLOW AS SHOWN)
1/8" PLYWOOD
GOLDBERG 90° (NYLON) AILERON BELLCRANK MTD ON BOTTOM
3/16" X 1/2" -MAIN SPARS (TOP & BOTTOM)
3/32" X 3/8" - CAP STRIPS
3/32" BALSA SHEETING ON BOTTOM FOR PUSHROD EXIT
1/4"Δ STOCK
NOTE TOP SHEETING & CAP STRIPS ARE OMITTED ON THIS WING PANEL, FOR CLARITY
DUBRO (LARGE) NYLON HINGE
3/8" X 1/2"
1/2" SQ
C
3/8" X 1/2"
A1 A1 A1 3/32" SHEETING (TOP & BOTTOM) A1 1/8" PLYWOOD- AILERON HORN PLATE A1 A1 F1 F1 F1
1/8" SHEET - AILERON RIB
1/2" SHEET - AILERON RIB
ANGLE THIS RIB
CENTER SECTION REINFORCING - 4 OUNCE (MIN) FIBERGLASS CLOTH & RESIN (TOP & BOTTOM)
1/4" X 3/4"-LEADING EDGE
3/32" SHEETIN
W1A
W1 W2 W1 W1 W2 W3 W3 W3 W4
3/32" X 3/8" - CAP STRIPS
1/8" PLYWOC
1/4"Δ STOCI
3/32" SHEETING
3/32" BALS. SHEETING (BOTTOM ON
3/32" SHEETING
3/32" SHEETING
1/2" SHEET
F1 F1 F1 F1 F1 F1 F1 F1 F1 A1
NOTE NOTCH CENTER RIBS, AS REQUIRED, TO ACCEPT FLAP & AILERON SERVOS
3/32" SHEETING
1/8"X 3/4"-SUB LE
1/4"X 3/4"-LE
3/16"X 1/2"-MAIN SPARS
3/32" SHEETING
3/32" SHEETING
1/2" SQ
1/4" X 3/4"-SPAR
3/8" X 7/8"- HARDWOOD L.G. BLOCKS
W1A
W2
1/2" SHEET
3/32" SHEETING
3/32" SHEET- SHEAR WEBBING
3/32" SHEETING
L.G. RETAINER STRAP & SCREWS
3/32" SHEETING
SECTION A-A
DB1 1/8" PLYWOOD
DB2 1/8" PLYWOOD (2 REQD)
1/2" SQ
F1
3/32" SHEETING
3/8" SQ
SECTION B-B
A1
3/32" SHEETING
3/8" X 1/2"
SECTION C-C
NOTE PLYWOOD WING BRACES (WB1 & WB2), PRODUCE CORRECT DIHEDRAL ANGLE (6°- EACH WING)

FULL SIZE PLANS AVAILABLE — SEE PAGE 212



LOCKHEED

LITTLE DIPPER

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A 1/4 SCALE SPORT DESIGN

DESIGNED & DRAWN BY DICK TICHENOR

PLANS BY

0 1 2 3 4 5 6

SHEET 2 OF 2

PLAN NO. 915 (2)

FLYING LOWE

Don Lowe

Tangerine Internats

The Sixteenth Annual "Tangerine Internats" was held in Orlando, Florida, in December and early January this year. In spite of record cold weather that all but destroyed the orange crops in this area, many brave souls bundled up and did their usual thing. Would you believe 19°F in Orlando — or a day in which it did not once reach above freezing? Many were the tales of terrible traveling conditions to reach Florida — only to get there and it's still cold. In spite of this, a full schedule of IMAC, pattern, racing, helicopter, scale and night flying was held — and we had a ball, thanks in a large part to the very welcome use of the beautiful facilities of R/C World. For those who have not seen this facility — you owe it to yourself if you are ever down our way. It now boasts probably the best model flying facility in the world; and development of the first phase — condo units — begins this spring — in fact, the first phase is all sold out.

Attendance was down somewhat in most categories with some exceptions. IMAC boasted a threefold increase

Dedication of the R/C World facility to the memory of Warren Hitchcock, Glen Sigafoose and Sid Axelrod, was made by Shirley Hitchcock, Hazel Hester and Louise Izzo. Lee Painter, Pres. R/C W, in center.

R/C World's huge flying field has a lengthy runway and spacious shelter.

Flown in IMAC by E.O. Mitchel was this 10 lb. Dalotel with 1.20 4-stroke power. The author has flown this ship and is favorably impressed with its excellent flight capabilities.

A scale view at the Tangerine. Good crowds in spite of cold temperatures.

over last year and scale was a real beaut with almost forty entries. We saw several multiple event entries with the same aircraft such as IMAC and scale. For those of you who have not tried IMAC — you're missing something; it's a real ball! This year we had the services of IAC judges (International Aerobatic Club) and they did a fine job — in spite of sub-freezing weather. Next year we promise 80° balmy weather for the Tangerine — so y'all come! (No guarantees you understand.)

Pattern Ship Set-Up:

I have been in this game seemingly forever — and it's easy to overlook the fact that most modern modelers are new to the game and need fundamental answers to things. Over the past many years I have touched on about every aspect of model design and set-up — but I forget everyone doesn't always read my stuff. Robert D'Entremont wrote concerning questions that he, as a beginning pattern flier, has and I'm sure many others have had at one time or another. His list of five questions may help all of us so here goes:

First of all he asks, "What are the benefits of a swept wing?" As briefly as possible here it is. Sweeping the wing on a model is pleasing aesthetically (to some). It also provides a dihedral effect when the model pulls angle of attack — either positive or negative — and, thus, helps stabilize in roll. It also moves the center of lift inboard and helps in rough air — something like a low aspect ratio wing. It also makes the ship snap easier since, as you pull angle of attack, you get some roll coupled with application of rudder. Too much sweep is not good since excessive roll-yaw couple can screw up rudder corrections in maneuvers. Over the years I've tried it all from 5° to 25°, 10°-12° is really all you should go for.

Robert's second question deals with anhedral in the stab. He wants to know its benefits and whether it can be added to existing designs. This is a very involved subject and deals with investigations of yaw-roll and pitch couples that I and others have worked with for years. Briefly here it is: We have found that the location of this stab vertically on the fuselage has a powerful influence on whether the ship will pitch up or down with application of rudder. Now, we don't want it to pitch since this makes a lot of maneuvers more difficult where rudder application is involved. Generally, moving the stab up causes the ship to pitch down with application of rudder and, conversely, when it is moved down using dihedral in the stab has the effect of moving the stab position. You should **not**, in

A flight line view from the R/C World control tower.

Hazel is calling for Maxey who doesn't seem to mind the obvious cold.

Bill Williamson, Right, took Best Jet award of $500.00 with a beautiful A-4D and superb flying.

Dean Pappas and his modified Tipo which he calls Turnare or Tiporound. Designed for the new FAI event it is very light with two wheel retracts. Did well in both IMAC and AMA Pattern.

Seen at the Tangerine. Almost perfect symmetry in a pattern design. Flew great.

Don Kowalleck fires up his pattern entry at Tangerine.

general, add anhedral to an existing design — assuming that design does not have the unwanted pitching. Do **not** use it on a Phoenix 8 since this design should not have couple if properly set up. Properly applied, varying amounts of anhedral can fix a problem on an existing airplane — but, then, this is hard to do with a fixed tail installation. That's why I recommend "plug-in tails" which will allow small trimming adjustments.

Robert's next question deals with differential aileron throw — also a subject of much depth — but here goes: Differential aileron throw is used to modify the rolling character of a model. If the ship corkscrews or does anything but "roll on a string" — play with different amounts of differential to straighten this out. Usually more up than down is required — but not always. Sometimes simply making one aileron move farther than the other one works. Generally, if the ship had dihedral and excessive lateral stability, differential is required. Of course, in a pattern design, the ship should have neutral lateral stability. Test for it by putting the ship in knife edge flight. If it rolls proversely (i.e., couples into a roll into the direction of applied rudder) then dihedral must be reduced and, conversely if it rolls the opposite direction. I usually don't use differential aileron — or a very small amount — 1° or 2° at the most — but I **always** start by getting the dihedral

right — even if I have to cut the wing to do it.

Robert next asks an easy one. He wants to know if lateral balance involves the wing or the whole model. Naturally, it involves the whole model. Unbalance laterally is often caused by a sidewinder engine installation. Simply add weight to a wing tip until it balances — assembled!

I usually use lead weights buried in the tip block — it's best to wait until the model is finished. Then cut a small hole in the tip (underneath) and sink in appropriate lead weight. Lateral balance primarily helps in pitching maneuvers and is a **must** prior to trimming the model. Let me add one more suggestion while we're at it. Do not attempt to trim the model until the aileron hinge gap is **sealed air tight!** You probably won't be able to achieve good pitch trim without it. The model also may not roll well or too slowly. The easiest way to seal a finished model is to use a mylar tape on the bottom creased to the hinge line to permit free motion. If you have a model that can't be trimmed in pitch (insides and outsides) seal your gaps — or look for wing warp.

Robert next asks about wing loading — can it be too high or too low? A good wing loading for a 700 in.^{2} pattern ship is about 26 oz./ft.^{2}. That translates into about 8 pounds. If that same ship were to be used for the new FAI F3A (turnaround) pattern I would shoot for about 23 oz./ft.^{2} or 7 pounds. Generally, lower wing loadings are needed for tight maneuvers and it also allows slowing the airplane down. Too high of a wing loading requires the ship to fly very fast in order to maneuver clearly. Too low of a wing loading makes the ship bounce more in windy and gusty conditions — so we seek a compromise. We can use aerodynamic tricks such as lower aspect ratio and sweep to give a smoother ride at lower wing loadings. Always shoot for a light model; do not layer on paint — especially primer. If you add weight to a model, make it pay its freight by adding structural strength. You can always add weight, but it's very difficult to take it out.

I hope that the preceding discussion helps some. Admittedly, it's very sketchy — but, then, each question could require a complete column to answer in depth. □

SUNDAY FLIER

Ken Willard

In the November 1983 issue of RCM, I told you about a phone call I got from Scott Christensen of Top Flite, inquiring as to whether I had any theories about their Contender design making a left turn and nosing down when the command sent to the model was for right rudder. It was, and still is, an intriguing question, so I asked you readers if you had any theories. The response has been very gratifying. Many of the letters came up with the same answer, and some of them had some pretty exotic thoughts. I have picked out some typical examples to share with you. Some of you who wrote in will recognize the similarity to your own letters. Unfortunately, space does not permit printing all of them. Don't be discouraged; I'm gonna give you another couple of gems to ponder later on in the column.

Bob Hayford, Mansfield, Texas, covered the situation quite succintly, and his diagrams helped to make the point.

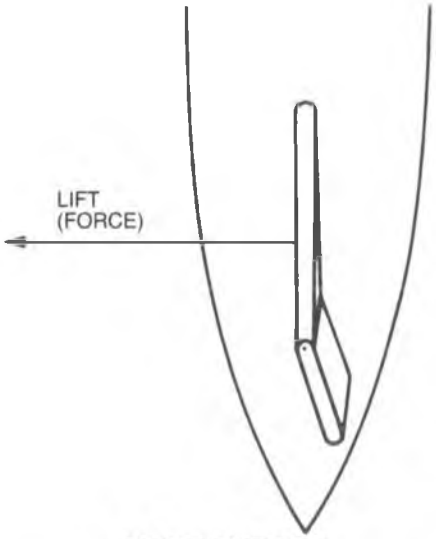
Dear Mr. Willard,

Reference your November 1983 column in R/C Modeler. The following thoughts are offered to explain the Contender behavior you describe.

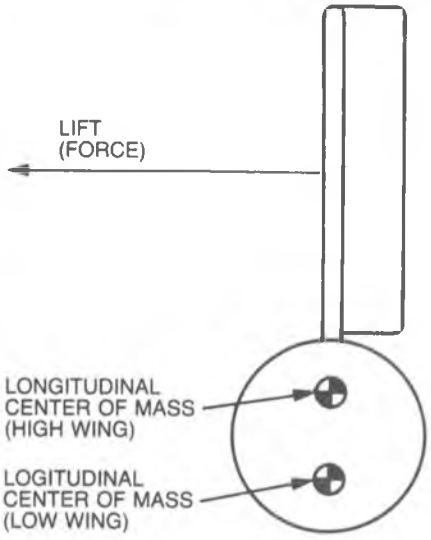
First, any balanced aircraft will drop its nose in a turn — assuming it stays balanced. This is because in a turn, vertical lift is lost. Carried to the ultimate 90° bank, whatever (vertical) lift is provided comes from the fuselage/rudder. This is why we always "give it a little up elevator in turns."

Second, referring to the enclosed figures, just as with an aileron or elevator, the rudder generates a (lift) force as shown. With low wing aircraft such as the Contender, this force is well-above the longitudinal center of mass — that is if you balance the model by holding nose and tail, it will balance lower than for a similar high wing type. For the types that you describe, that force is sufficient (i.e., greater than the others at work) to twist the model about its comparatively low longitudinal center of mass. That is, you have a greater moment arm.

As speed builds up the force-moment arm effect increases. As you slow down, toward stall, the off axis force, hence the phenomenon, disappears. To totally eliminate these effects, one could place an equal amount of rudder above ***and below*** *the longitudinal center of mass.*



RIGHT RUDDER (VIEWED FROM ALMOST DIRECTLY ABOVE)



RIGHT RUDDER (VIEWED FROM BEHIND)

I enjoy your column very much. I'm comtemplating building a Boeing 314 "Yankee Clipper" R/C model. Any ideas or relevent comments you cast in your column would be appreciated — especially regarding sponsons.

Best Regards,
Bob Hayford

Your thoughts on the rudder action are shared by most of the readers who replied, Bob. And as for your plan to build a Boeing 314 Clipper, go to it. It's a fine flying boat. There are some excellent photos of the full scale job in my book "Mission to Gibraltar," one of the RCM Anthology series. I flew from New York to Foynes, Ireland, via Bermuda, the Azores, Lisbon, and on up to the U.K. in a 314.

The only suggestion I would make for your model, if you don't mind sacrificing true scale, would be to make the sponsons slightly larger — especially in span. The full scale job, in cross winds, frequently dipped the wing tip fully under water, and the crew had a devil of a time righting the boat. The model would have the same characteristic.

Back to the "right rudder, left turn syndrome." Here's a letter from Dr.

area, as well as the planes' weight, is mostly above the roll axis (which I presume runs close through the center of the wing). As such, the force created by rudder surface generates a torque to the roll axis. Right rudder would contribute to a left roll and left rudder, a right roll.

In addition to the roll effect, the rudder would also contribute to the expected yaw (i.e., left rudder, left yaw). But I speculate that perhaps, under some conditions, the roll effect is greater than the yaw. For example, if the plane is flying parallel to the horizon, the weight of the plane (being above the roll axis) would enhance the effect of the roll. If the roll effect is greater than the yaw, then left rudder would give a predominately right roll instead of a left yaw. In a vertical climb, on the other hand, the weight of the plane no longer lies above the roll axis, so the roll effect is no longer enhanced. One would then expect the yaw effect and this would explain the correct stall turns that you observe.

As we all know, wing dihedral tends to counteract the roll instability produced when the Center of Gravity is higher than the roll axis. This might explain why planes with dihedrals do not exhibit the paradoxical turns.

My hypothesis, however, leaves one important effect unexplained — why does the nose drop? Nevertheless, it may be important to evaluate whether or not my hypothesis has any merit. Unfortunately, I only have my 8 year old Ugly Stik and Strikemaster. If I had a Contender, I would extend the rudder substantially below the fuselage. My prediction would be that if there were equal rudder area above and below the roll axis, left rudder would cause left yaw and right rudder, right yaw. In other words, the rudder would no longer behave like aileron.

Although my answer may contribute little intuition to your paradox, I do want you to know that didactic questions as the one you raise are thought provoking. I learned a lot by attempting to find a reasonable explanation. Thanks.

Sincerely,
Rocky Young

Well, Rocky, Bob Hayford's letter partially answers your question as to why the nose drops in a turn --- unless you ease in a bit of up elevator. As you can see from his diagrams, the rudder action creates "horizontal lift" at the start, and when the airplane banks, the lift vector assumes both horizontal and vertical components, and the vertical component lifts the tail and lowers the nose. Just goes to show that when you have a machine operating in six degrees of freedom (two in roll, two in pitch, and two in yaw) then as soon as the control surfaces are moved out of their "normal" attitude, they cause interactions in the other directions; when an airplane is in a vertical bank, and you want to raise the nose (with reference to the earth) you do it with rudder, not elevator. Witness the "knife-edge" maneuver, for example.

Here's a letter that's sure to arouse some controversy. Owen Pratz, Ellensburg, Washington, has some interesting comments:

Dear Mr. Willard,

I am writing in response to your request for ideas on why the "rudder turn" on a low wing model with no

continued on page 58

dihedral leads to a turn in the opposite direction and a dropping of the nose (RCM, November 1983).

First, I should explain that I don't yet fly. I am building a large biplane trainer. When I get it going I intend to begin building your Regent biplane. I hope someday to obtain a private pilot's license. At the moment, though, my information about flying and theory of flight all comes from numerous readings of "Stick and Rudder" by Wolfgang Langeweische.

My guess, essentially, is that the peculiar counter turn you describe arises from the model losing lift, nosing down in a yawed attitude, catching the forward wing, and banking into a counter turn.

Let me explain my reasoning in more detail. The first element is yaw induced by the rudder. The rudder does not turn an airplane; it causes it to yaw. Banking turns the airplane. Yaw coupled with dihedral produces banking and, eventually, a turn. Without dihedral, especially on a low wing aircraft, left rudder produces yaw to the left, but the motion of the airplane is continued in the original direction. The result of this yaw without a change of direction is a loss of lift because of diagonal airflow over the wings. With loss of lift, the nose drops while the airplane is still yawed to the left. The airplane is now pointed slightly nose down and is moving yawed to the left with the right wing projecting slightly forward. The right wing then catches the wind on its upper surface and drops even more. The result is a bank to the right and the ship, therefore, turns right. The sequence of events is probably yaw to the left, loss of lift and dropping of the nose, a bank to the right and a downward turn to the right, all in such quick succession that it appears to be simultaneous.

You mention the loss of the effect with any dihedral or sweepback in the wings. I think that either of these coupled with yaw would produce differential lift favoring the wing swung forward by the yaw (in a left turn, the right wing) which would induce a bank and a turn in the intended direction.

There is an even deeper problem centering around "rudder turns," however. Those of us who hope to eventually pilot full-scale airplanes run a grave risk learning to fly three channel R/C models and using the rudder alone to turn the airplane. As I mentioned before, the rudder doesn't turn the airplane; it produces yaw. However, the idea of the rudder as the turning control is deeply embedded in our common sense ideas about flying, and continued practice turning models with rudder alone embeds it even

deeper. The tragedy is that for those who fly full-scale airplanes this misconception is one of the key elements in the all too familiar sequence: stall-spin-crash. The mis-use of the rudder in turns has been repeatedly demonstrated to be a major factor in such crashes. For the modeler the consequences are slight: if you drop it, repair it or build another. For the full-scale pilot the consequences are all too often simply fatal. I think the model airplane industry has an implicit responsibility to teach proper theory of flight and use of controls. We may very well be setting up false understandings that are keys to disaster for erstwhile full-scale pilots. We should abandon "rudder turns" and instead teach proper use of ailerons for turns with the rudder in its proper role, simply canceling adverse yaw.

Sincerely,
Owen Pratz

Your comments on models flown using only rudder, elevator, and engine control (REM) will probably bring some opposing views. Three control models --- rudder, elevator, and engine, or the other combo, aileron, elevator, and engine --- when properly designed for those controls, do an excellent job of flying. A model --- or for that matter, even a full scale job --- that has the proper amount of dihedral for interaction of the vertical tail surfaces (fin and rudder combined) can make turns that are so smooth you'd swear they were coordinated rudder and aileron turns. How about it, Sunday fliers? Agree or disagree?

Anyway, I think we've pretty much solved the problem of reverse turns and nose down actions on low wing models when only rudder action is used, so let's think about some other items of interest. Mark DeSchane, Park Rapids, Minnesota, has conducted some in-depth research which merits exposure not only to modelers, but their wives and families as well. Behold!

Dear Ken,

First, let me introduce myself. Although most anybodys never heard of me, I am the formost knowlagable person on model aeronautics in the greater Emmaville/Park Rapids area. I currantly hold, (there are some whom would take this away from me). A P.H.D. in Model Aeronautics and flying Insect Behavior from the University of Emmaville. (Sumus Quid Aviatus.)

I would like to state that the questions raised by yourself, and your readers are very good ones indeed! And, I am ready to score them at this time.

First of course, is the age old "Downwind turn" question. I'm very happy with the score on this one, as all answers were compleatly correct.

Next, is the very commen questions about "P-factor." I have to state that "P-factor" is almost non-existant in airlines. But, can become sever in small general aviation aircraft on long legs of cross country flights. And, relating to model aviation, it can become a problem for people without foresight.

Many more very good questions have been documented in detail in your column. And, an explanation for everyone of them would take reems of paper. So, rather than bore you and your readers with a bunch of "Gobbldy Gook" with graphs, and precise formulae, I will score them as a whole. The combined scores of thease answers did not stack up with the overwelming success of the "downwind turn" question. But, still point out that modelers as a whole are incredably intellagent.

Correct 76% — Incorrect 28%

Now, on to your currant question of low winged, slightly dihedral, rudder induced, anti bank syndrome.

I am sure yourself, and your readers will be most interested to know that this Phenomena was the basis for my final thesus entitled "Adverse Bank in Toy Airplanes, and the Commen House Fly."

This Phenomena in house flys, is the

reason for house flys constantly flying into windows, and the faces of small children. Dispite most people thinking that flys can't see windows, and that they are after the sticky residue constantly smeared on small childrens faces, the actual cause is fear induced, antihedral in the flys wings. Any number of fears, such as being in the way of speeding cars, confined places, and the fear of being stuck to sticky residue, can cause this action in flys.

Currently, due to my thesus, the F.A.A. is considering an "Air-worthness Directive" to correct this problem in house flys.

In toy airplanes, adverse bank is even easier to understand. Those interrested in understanding can send $100.00 to me, in care of myself, and I will send the reems of paper with graphs precise formulae and "Gobbldy Gook" that will leave no doubt in thier minds as to how expensive education is.

Although not compleated at this time, I am also working on another fine paper entitled "Spouses, and Other Uninterested Partys, Guide to Model Aviation Terms." The paper will deal with the most asked questions that spouses and other uninterested partys are concerned about.

Re:

1. Making a cake walk of Reynolds numbers.

2. 11 x 7s or 11 x 7½s?

3. Coverite — MonoKote, who's kidding who?

4. Curbing enthusiasm in modeling husbands.

Cost for this paper is unknown at this time, but I'll keep you posted Ken.

Back to work for me now. As you can see I am a busy man. And now, with the many orders I expect to see for papers, I probably won't be able to quite work untell 3:30 or 4:00 p.m.

Oh well, no rest for the wicked.

Yours Mark DeSchane,
Park Rapids, Minnesota

P.S. Cash only on orders.

Your fascinating theories undoubtedly will be perused with much concentration by the modeling fraternity, Mark. As for your treatise on the subjects, the price of the volume seems reasonable. As you say, education is expensive. We will forward all inquiries.

Meanwhile, we will await your explanation of whether a fly does a half loop or a half roll in order to land on the ceiling.

Aerodynamics are best explained to students by brilliant discussions of theory, but if that fails, then baffle them with bullbleep.

Few can tell the difference.

□

RCM PRODUCT REVIEW

Hobby Shack
DE HAVILLAND TIGER MOTH

SPECIFICATIONS

Name	DE HAVILLAND TIGER MOTH
Aircraft Type	Stand-Off Scale Bipe
Manufactured By	Pilot O.K. Models Ltd. Japan
Distributed By	Hobby Shack 18480 Bandilier Cir. Fountain Valley, California 92708
Mfg. Suggested Retail Price	List $89.95, Sale price $69.99
Available From	Both Mfg. & Retail
Wingspan	47 Inches
Wing Chord	7 Inches
Total Wing Area	620 Sq. In.
Fuselage Length	37 Inches
Stabilizer Span	15 Inches
Total Stab Area	82 Sq. In.
Mfg. Rec. Engine Range	.19-.35
Recommended Fuel Tank Size	6 Oz.
Recommended No. of Channels	3-4
Rec. Control Functions	Rud., Elev., Throt., Ail.
Basic Materials Used In Construction:	
Fuselage	Balsa, Ply
Wing	Balsa, Spruce, Ply
Tail Surfaces	Balsa
Building Instructions on Plan Sheets	Yes
Instruction Manual	Yes (1 page)
Construction Photos	Yes

RCM PROTOTYPE

Radio Used	Kraft
Engine Make & Displacement	O.S. .30 W/Muffler
Tank Size Used	6 Oz.
Weight, Ready to Fly:	56 Oz.
Wing Loading	13 Oz./Sq. Ft.

SUMMARY

WE LIKED THE:
Engineering of the kit, everything fits exactly as shown on the plans.
WE DIDN'T LIKE THE:
Lack of right wing drawings on the plans.

The Tiger Moth DH-82 was the aircraft in which Churchill's, "Few who did so much for so many," learned to fly before they progressed onward and upward to the Spitfire. In the United States, Cub was synonymous to small plane, in England that credit went to the Moth. It is probably the plane that is immediately recognized by more people than any other.

This is a new updated Tiger Moth kit which is one of three kits of this plane that have been offered by Pilot. As some of you will remember, the previous kit that was on the market for many years was somewhat larger and more built-up. This kit for engines from .19 to .35 has a new plastic cowl, lock tab construction and sheet balsa fin, rudder and elevator. The stab is built-up. There is also, at present, a Quarter Scale Tiger Moth available from Pilot.

As with all Pilot kits, the box of single weight cardboard is beautifully done in full color with many pictures of the plane in a variety of views. Not only are there pictures of the kit model but there is also a set of 3-views, in full color, of a military DH-82. All of this makes duplication of the camouflage very simple.

We really appreciated the manner in which small parts are packaged to keep things from being scattered all over the box. The soft balsa preformed parts are separated from the hardwood parts and hardware each in its own plastic bag.

Every sheet of balsa is clearly labeled in black as is each part on the sheet. The die-cutting is cut all the way through and pieces in both balsa and ply almost fall from the sheet.

This kit, like all other Pilot kits, contain an extra sheet that not only identifies each part or item by name and dimension, but many times shows exact size 3-view drawings of the piece. The reverse side of this sheet has many construction photographs along with instructions. The instructions are a little briefer than we expected, but if you have the experience to build and fly the Tiger Moth, they are sufficient.

It was necessary to substitute two 8-32 machine screws which hold the lower wing on. The kit screws are metric threaded and we did not have taps to match to cut the threads in the wing hold-down blocks. Please keep all kit hardware separate from your regular hardware due to the metric threads.

Construction:

The large 3' x 4' plans show not only the normal 3-views but also include many detailed cross sections. Every piece is labeled on the plans making it easy to find it in the box. If there was any complaint it would be here; the plans showed only the left half of each wing making it necessary to draw the other half before construction.

In your kit you will receive a small piece of paper entitled "Landing Gear Assembly." That's it, all the rest is in

Japanese except for an A and B. The A and B are positions for the wheels. Thanks to a good neighbor who speaks fluent Japanese we found out that Position B is for smooth landing surfaces such as asphalt and position A for rougher surfaces such as grass. The scale position is B. Both the front wires are included in the kit hardware.

The engineering of the kit is excellent, everything fitting exactly as shown on the plans. The wire cross braces in the wing struts and flying and landing wires were not shown on the plans. Fortunately, we had a copy of the April 1972 American Aircraft Modeler in which Don Berliner did a bang-up job on a two page drawing layout with photos of the DH-82 which make it so easy to do your own detailing. Other books such as the International Encyclopedia of Aviation, The Great Planes and Pictoral History of Aircraft, all contain photos of the DH-82's still in existence and still flying.

Covering:

The RCM prototype was covered with yellow Super Coverite. All bottom surfaces and landing gear were sprayed with Krylon yellow primer which was sanded with 600 wet sandpaper then given two coats of Pactra Formula U Aviation Yellow. All top surfaces, fin and rudder were given two coats of Formula U Flat Camouflage Tan, sanded between coats. Do not sand after second coat, any corners sanded will show a lighter tan. The camouflage pattern was made with shelf paper, the tan was masked off and the remainder was sprayed with Formula U Flat Olive Drab. The decals, some of the best we have seen, were applied after first dipping in water containing a few drops of dish washing detergent. This made the decals easier to position when they were rubbed dry with facial tissue. When completely dry, they were burnished down firmly.

Engine:

The beam mounted engine is an inverted O.S. .30 with a Du-Bro muffler. This muffler does the least damage to the beautiful four piece plastic cowl. It was this cowl, with the included oil tank cover, that really sold us on this kit. The four pieces are joined exactly where they were on the full size DH-82, and it is a joy to build. Do so carefully and avoid spoiling the finish by allowing the included MEK to seep through the joints to the outside. There is a 6 oz. fuel tank included in the kit and this is installed in the usual manner just aft of the firewall.

Radio:

The cut-out servo tray is part of the kit and is an integral part of the fuselage. All servos except the aileron servo are mounted inverted just under the front cockpit and are accessible by removing the bottom wing. The receiver is located under the back cockpit. There is room for everything, but care is needed in putting it there. We used a Kraft rig with four KPS 12 servos.

Flying:

The flying characteristics of the DH-82 are great. The C.G. location on the plans is fine, however, our C.G. was just ahead of the indicated position and we felt this gave a little bit more stability. We noticed no erratic flight tendencies.

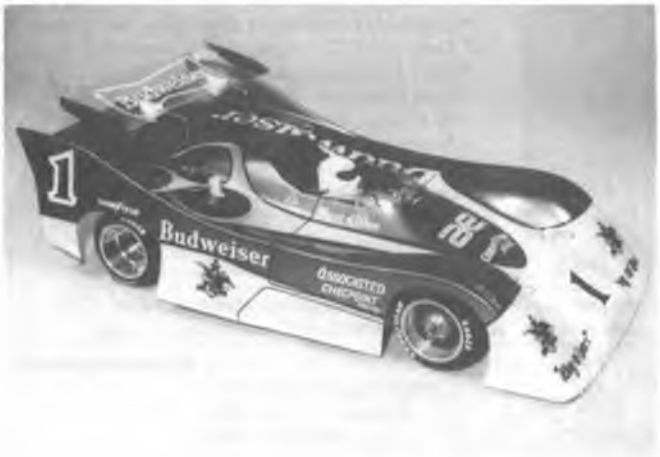
Conclusion:

This kit is for the person with a fair amount of building experience. There are no step-by-step instructions needed by a beginner. What instructions there are on the plans and supplemental sheet are more than adequate for the experienced builder. We were pleased with all phases of building and flying this model. □

When writing to RCM, please be sure to include your Zip Code.

PIT STOP

Gene Husting



Associated's TOJ body is the most popular body used on the RC12I electric cars.

Tuning Tips

Unless you can already go as fast as Mike Lavacot, Joel Johnson, Ralph Burch Jr. or Arturo Carbonell, I believe I can give you some tuning tips that will enable you to go a bit faster and thereby beat some of the drivers you haven't been able to beat before. It just depends on how close attention you want to pay to details, how much practicing and testing you want to do, and how bad you really want to beat that guy that's going just a little faster than you. It's not all that hard to do and I know you can do it, if you really try.

Let's start with electric cars, then we'll go into gas cars. Don't be turned off if you only race one or the other. You'll be surprised at how many basic items apply to both types of racing, and anything new that you can learn which you can apply to your form of racing, can only help you. I'm writing this for **you,** not for your friend, although you might think it might apply more to him than to you. This is only for you, so even if you think you know it all now, let's see if we can help you to go faster.

Some racing great, many years ago, made a statement that says so much, in such a simple way, that most people overlook it. Don't you make that mistake. "To be first, first you must finish!" In other words, no matter how fast you are, you cannot win if you do not finish your race. Every time you work on your car, you must ask yourself, how can I make the car more reliable? Obviously, you want your car as light as possible, **without sacrificing reliability!** I'll give you an example of the dumb award of the month. Racers who use nylon nuts on their ball differentials to save one millionth of a gram. Every race I've been to lately, I've seen differentials loosening up because someone was using nylon nuts on their diff. The stock answer is, "Oh, he didn't have it tight enough. But it works for me." Guess who's diff loosened up the next time? Please use an aluminum Ny-Loc nut. Eliminate problems. Do not make problems for yourself. Nylon nuts are too soft and are not capable enough to maintain a specific tension on the diff and they will automatically loosen up by themselves. It's very important for you to keep thinking reliability on every part of your car. Have you

Parma's Panther is a very successful 1/12 scale car and Parma has a full line of accessories for all R/C cars.

If you like round track racing you're in Bo-Link country. Bo-Link also has the impressive Digger off-road cars.

Delta's Eagle is a popular 1/8 gas car and their Phasar is equally popular on the 1/12 scale electric car scene.

Associated's Elfin body on the RC500 car is a winning combination.

noticed that most of the fast guys in the "A" Mains always finish their races, while most of the guys who do not finish their races are in the slower Mains? The fast guys have learned, "To be first, first you must finish!" The sooner you learn it, the faster you'll be.

Let's talk about bodies. There was one body that was used by eighteen out of twenty "A" Main drivers at the World's Championships, and at the recent Indoor Championships in Cleveland, with 333 entries, it was used by all twenty "A" Main drivers. This was Associated's TOJ Can Am 1/12 body. If you plan on beating Lavacot or Johnson, you may have to use this body. However, if there's another type body you like, don't be afraid to use it. Personally, I like the looks of a lot of the GTP and Group C bodies. They look really sharp on the track and they work almost as well as the best Can Am bodies. The differences can only be apparent when they're pushed to the limit, so if you're a beginner or novice class driver, you might as well start with a body that appeals to you. If you have doubts, try both and see if you can tell the difference.

Mount your body as low as possible, but not too low. Make sure the body cannot drag on the track. A body that touches the track, is like running with the brakes on. Make sure there's plenty of clearance for the front tires when they're turned lock to lock. Make sure the rear of the body cannot roll over onto the tires in a sharp turn. Is there enough clearance for the front end linkage and the resistor wiper? Don't put any more paint on the body than is necessary. That weight is up high, exactly where you don't want it. Is a wing necessary? Yes, yes, yes! 95% of the time. Most racers don't understand the importance of a wing, and the importance of the correct size, wing angle and placement of the wing for a given track. They generally run the same wing they've run forever. Big mistake. A little experimentation here can pay big dividends. A couple years ago at the Winternationals, the traction seemed so good, everyone was practicing without wings, so I started without a wing. The car seemed almost controllable. I said almost. It seemed fast in some corners, but I was making small mistakes in other corners. It was a little too twitchy for me. So I put a wing on. It smoothed the car out. I need a smooth driving car to help eliminate as many of my driving mistakes as possible. Jim Aguirre was in the same practice heat with me and earlier he was easily able to pull away from me. When I put the wing on, I was easily able to pull away from him. He said, "Gene, what did you do?" I told him to try a wing, but he said he thought his car felt good. We finally put a full wing on his car, then we narrowed it up to about 2/3 size. Jim went on to win the Winternationals. He can tell you the importance of a correct wing. You should take the time to do a little experimenting here. It's an area that's overlooked by too many racers.

I did a whole article on batteries and charging about 10 months ago, so we'll just do a quick run through here again. The current, most popular, method of charging is to start with a set of batteries that are fully discharged down. The batteries can be fully discharged by attaching a discharge resistor to the battery pack and leaving the resistor on the battery pack overnight. These resistors are sold by BoLink and others. Now charge the batteries at 4 amps constant current for 25 minutes. At the race before your race, peak the batteries at 4 amps constant current for about 7 minutes or until the batteries start to get warm. Run your race. After your race, let the batteries cool down at least 15 minutes or longer and then connect the discharge resistor to the battery pack and let set overnight. Save your best battery pack for the "A" Main and your next best battery packs for qualifying. The battery packs you use for practicing, you can use over and over again all day long, just be sure to leave at least 15 minutes after you run, before you start to charge again.

There is something that's come up over the last year, and that's matched Sanyo packs. Of course the Sanyo's or GE's are matched by the factory when they're made and tested. They must fall within their specifications. So, technically, all the batteries are matched by the factory. But there seems to be claims of every type conceivable of matched Sanyos. Power Matched, Voltage Matched, Weight Matched, plain old Matched Sanyos and Computer Matched Sanyos. Computer Matched Sanyos? I asked my Apple Computer if it could match my Sanyo packs and it didn't seem to know the positive end of the battery from the negative end. If I was going to think of a name, I'd use Laser Matched Sanyos. Sounds awesome. It wouldn't really mean anything, but it sounds awesome. Have you really ever thought about these Matched Sanyo claims? The only way I know how to check batteries is to charge each cell and then discharge each cell. During discharge you record the voltage at each minute of discharge down to 1 volt per cell and a graph can be made. Then if you're lucky enough to find 6 cells that are identical, you have a matched pack. Matched only means that they're alike or similar. Matched doesn't necessarily mean they're good or bad. You can have a matched set of dead cells. They're matched. We could even have a set of Laser Matched dead cells.

Now if it takes 45 minutes to charge and discharge a cell to test, that means it takes 4½ hours to test 6 cells. That means they'd have to charge $80.00 for a set of truly matched Sanyos. Something's obviously wrong some place. For the heck of it, let's say they spent 4½ hours testing a 6 cell pack. Using this method, and after spending weeks checking their stock of Sanyos,

they have them matched. They have a few sets that are 100% efficiency performance matched, some at 95%, more at 90% a lot at 85% and the majority at 80%. Now the 80% group is as perfectly matched as the 100% group. Right? That's right! Now, I wonder who gets the few 100% and 95% batteries? There's not enough of those to sell, so they might logically go to team members. Sounds reasonable. That means the ones that would be sold as matched sets, would be in the 90% to 80% range. This would be no good for the customer. Don't despair. I can't believe that any of these so called matched sets are matched in any way other than they all come in matched yellow sleeves. Hey!! I could still have my Laser Matched Sanyos. They'd all be in matching yellow!

1/8 Gas Cars

Let's talk about gas cars now. One of the mistakes most beginners make is in choosing the wrong body to start with. It's no secret that almost all of the races that Team Associated wins, is generally using an Elfin Can Am body. So the logical body choice for a beginner would be to use an Elfin body on his new RC500 car. But this isn't the best choice for a beginner. The reason is, the Elfin body gives the car a lot of increased nose pressure and thereby a lot of steering. This is an ideal condition for an Expert class driver at a big race with a track that has high traction. But for a beginner on an average track, it can mean way too much steering. A much better body for a beginner would be the Porsche 30KL. This is considered a neutral steering body. It has a well-balanced downforce between the front and rear of the car, which makes the car much more stable and easier to drive.

Beginners should make sure their transmitter has a dual rate adjustment for the steering. This allows you to adjust how much steering you need to control your car on the track. The basic idea is to set up your car so that it feels comfortable for you to drive consistently as fast as you're capable and **no faster.** This means that 50% nitro, the biggest carb you can find, a modified engine, and tall gears will only get you in trouble if you're not quite ready for it yet.

The sensible approach is to start with 10% nitro, a 21 size carb or a larger carb with a 21 size restrictor. You'll still have way more power than you'll need for a while. It's not important if it seems everybody on the track is faster than you in the beginning. It's more important in the beginning to learn car set-up, engine adjustments, steering adjustments and then proper driving lines around the track. It won't be long before a lot of those faster drivers won't be able to keep up with you.

There's a lot of very good, important, useful instructions that come with the car kits. Too much info to absorb all at once. It's a good idea to go back and read the instructions a number of times. The more of the instructions that you're familiar with, the easier it will be for you at the track

to properly set up your car. Pay particular attention to the ride height adjustments and the tweak adjustments. Correctly set, these will make the car much easier to drive.

Having all the suspension arms move freely and the shocks working correctly, can make a big difference in the way a car handles. If the left hand side of the suspension moves more freely than the right hand side, then the car's suspension cannot compress or rebound evenly. This will cause the car to be tweaked while running, even though it might show being tweaked correctly on a tweak plate. The way to check for this condition is, after the car is tweaked flat on the tweak plate and while it is still on the tweak plate, push down on the chassis on the centerline of the car. Watch the bubble. The bubble should not move off center either way when you push down on the C/L of the chassis. If the bubble moves more than 1/16" either direction, then the suspension is not working identically on both sides. The problem must be corrected. This condition must be checked on both the front and rear of the car. If this condition is present on either end of the car, it will be difficult to drive fast.

Associated has some new rear black rubber which has much more rear traction than ever available before. There are three grades available for both 1/12 and 1/8 scales. These are color dot coded red, yellow and green. The red is the softest and is only recommended on very slippery tracks. It also wears the fastest. The yellow is very popular on average tracks and is used on gas cars for qualifying. The green is used for main events because it is the longest wearing while still giving excellent traction. The 1/12 cars use the greens on front and rear. Associated is also experimenting with some new long wearing front tires. Delta has available some new long wearing front rubber called T324 B, C, or D. The B rubber has the most traction, but also wears the fastest. The C rubber has good traction and good wear. The D rubber has the least traction but lasts the longest. You should try these.

If you're having a problem at the track, don't be afraid to ask someone for help. Don't expect them to rush right over and rebuild your whole car for you. Beginners can be expected to have a few minor problems like starting up the engine and setting the carb. Pick a time to ask for help on a practice day when someone's standing around bench racing. If he's got his car apart on the bench find someone else. Most guys will help. They like to see you enjoy the sport too and we can all remember how grateful we were when somebody helped us and now it's your turn. Just ask. □

SPORTSTER 40

A .40 powered high wing cabin design for the sport flier. It is easy to build and has an unusual fuselage shape.

By Richard J. Simmons

The designer and builder is a born again modeler, returning to the Hobby in 1977 after an eighteen year absence. He was born in 1924 and started constructing so-called solid models at the age of nine, progressed over the years through free-flight and control-line up to an unsuccessful experience with a Sterling Wizard, an R/C biplane (Cobb Micro-4 and too much vibration). He was self-employed in the construction field during this hiatus and his creative bent seemed to be satisfied by building an occasional house of his own design. He left that field of endeavor to go to work for the small town he lives in as Board of Health Inspector. (Getting too old and fat for manual labor.)

The model was designed about 1961. It was meant to be a single channel, rudder only, with the O.S. Pet in mind for power. Wing ribs and spars were cut out, then put away in a bureau drawer when interest waned. The winter of '76-'77 seemed to be a long one and out came the long forgotten ribs and spars. The end product was an O.S. 25 powered four channel version with strip ailerons. This proved to be a little too hot to learn to fly on, so the 40 size evolved. It's called the Sportster 40 because it was preceded by the Sportster 25 and, if the designer/builder's wife doesn't find out prematurely, it will likely be followed by the Sportster 60.

The construction is fairly simple though lengthy. A modeler who likes to build should enjoy it, although cutting out the parts is a little tedious. Only two adhesives were used, 15-minute epoxy for all plywood to plywood joints plus the spar joiners to spars, and ambroid for the rest. Other builders may not find the control system to their liking and should feel free to improvise. The designer is addicted to wire control rods with snap links on both ends. (A lot of snap links, 29 to be exact, with a Carl Goldberg pushrod connector at the throttle to round it out.) Twin pushrods to the rudder and a homemade transfer linkage from the separate elevator horns are a little out of the ordinary but the throttle, flaps, and barndoor ailerons have standard hook-ups. Differential ailerons are obtained with the use of 60° Williams Bros. bellcranks. (This ship is old in design but modern in someways. I was slightly insulted when I took the model to the flying field for the first time and overheard another model builder tell his model building son that all R/C planes looked like that years ago.)

One last comment. If you do not fully assemble the fuselage until the wing is finished, you will find the separate power module to be invaluable in aligning and keying the wing's location.

SPORTSTER 40
Designed By:
Richard J. Simmons
TYPE AIRCRAFT
Sport
WINGSPAN
57¾ Inches
WING CHORD
10½ Inches
TOTAL WING AREA
585 Sq. In.
WING LOCATION
High Wing
AIRFOIL
Semi-Symmetrical
WING PLANFORM
Constant Chord
DIHEDRAL EACH TIP
One Inch
O.A. FUSELAGE LENGTH
41 Inches
RADIO COMPARTMENT SIZE
(L) 10" X (W) 3¼" X (H) 2¼"
STABILIZER SPAN
21¼ Inches
STABILIZER CHORD (Incl. elev.)
6¼" (Avg.)
STABILIZER AREA
125 Square Inches
STAB AIRFOIL SECTION
Symmetrical
STABILIZER LOCATION
Mid-Fuselage
VERTICAL FIN HEIGHT
8¾ Inches
VERT. FIN WIDTH (Incl. rud)
7¾ Inches
REC. ENGINE SIZE
.35-.45
FUEL TANK SIZE
8 Oz.
LANDING GEAR
Tricycle
REC. NO. OF CHANNELS
5
CONTROL FUNCTIONS
Rud., Elev., Throt., Ail., Flaps
BASIC MATERIALS USED IN CONSTRUCTION
Fuselage ..... Balsa & Plywood
Wing ..... Balsa & Plywood
Empennage ..... Balsa
Wt. Ready To Fly ..... 80-88 Oz.
Wing Loading ..... 20-22 Oz./Sq. Ft

CONSTRUCTION

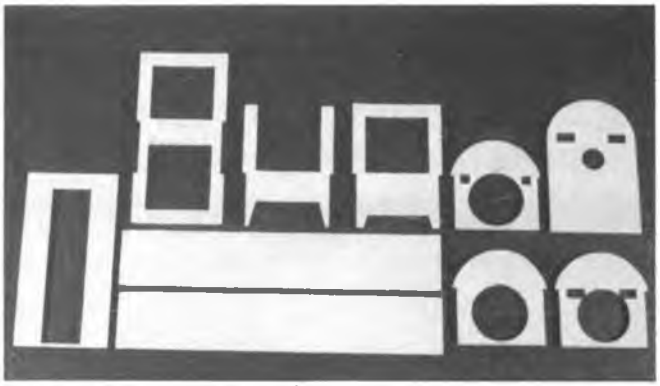
Please read entire article before cutting and assembling.

Fuselage Sub-Assemblies
Power Module:

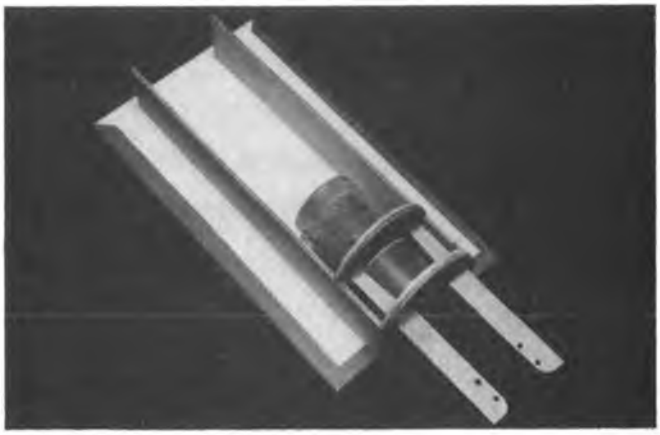
The use of a small table saw will be helpful in cutting out the plywood parts since most of them have a width of 3½". The motor mounts will have to be ripped to fit the engine of your choice. Mine was an O.S. 40 and about 1/16" was removed from the inside of each mount. Cement FW1 to the back of the firewall and A1 to the back of former A. I drilled the engine mounts before epoxying them to former A-A1 use a triangle to true the mounts both ways. A plywood spacer, the same dimensions as the mounting holes, temporarily bolted to the motor mounts may be of assistance. Slide the firewall over the mounts and epoxy into position. Ensure alignment by placing on the edge of a table or box. A weight placed through the tank hole will stop it from falling. This module should be constructed with as much accuracy as possible as it is the keystone of the model. Epoxy the side doublers in position using the edge of a table or a box again. Cement 1/8" x 1/2" balsa strips to the back of former D. Cut out the bottom piece but do not apply at this time. These are spacers to allow clearance for the installation of the landing gear mounting panel after the gear has been attached. The fuel tank must be placed in position before proceeding. You may find it easier to epoxy formers B, C and D to the cabin roof before attaching them as a whole to the side doublers. (Don't forget the fuel tank!) The 1/8" x 1/2" spacers on the back of former D will act as a stop for locating the unit in place. Install tank locks and 1" x 1" x 1/4" wing mounting blocks.

Control Module:

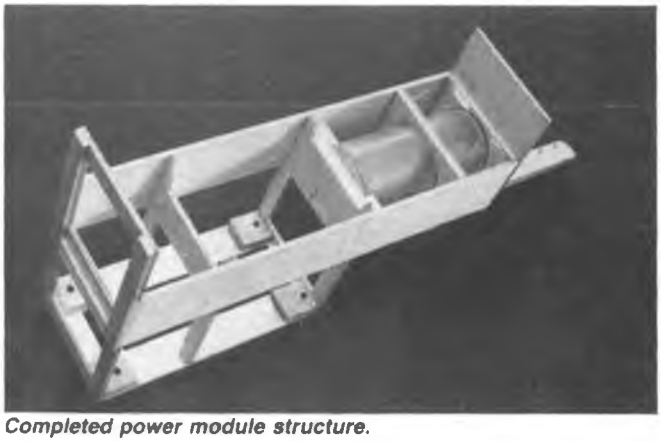
Cement the four sides together using a square for alignment. Cement the doublers in position. Hard balsa or 1/8" plywood should be used for the top doublers as you will be pushing down on these frequently to free the module



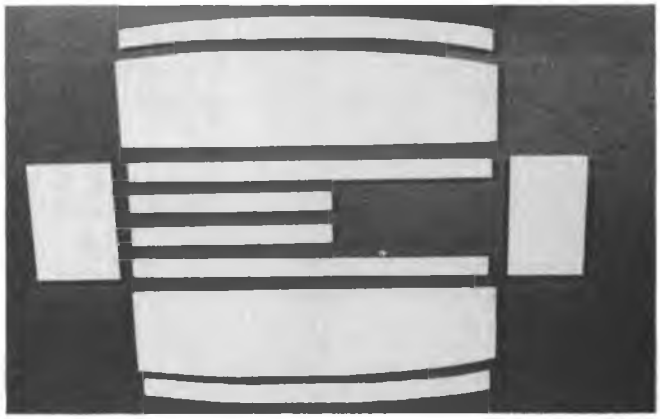
Detail parts for power module.



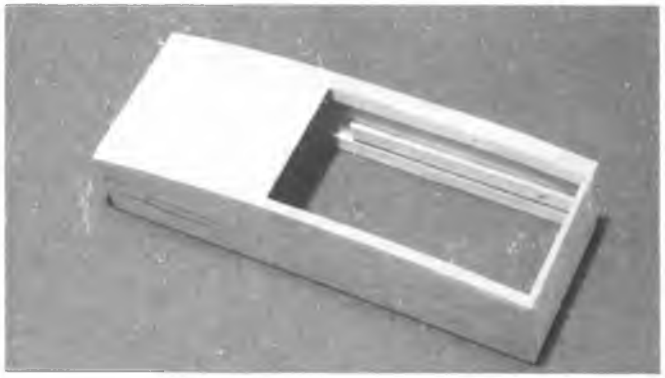
First step in power module assembly.



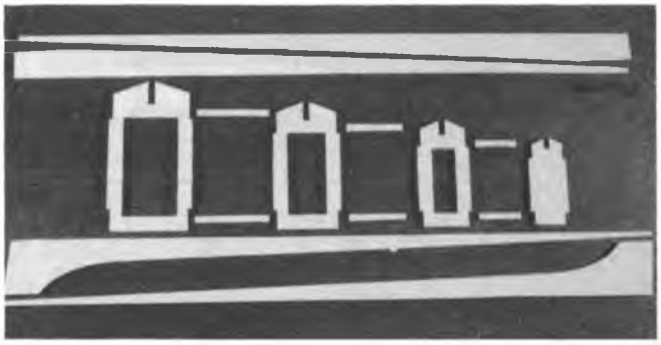
Completed power module structure.



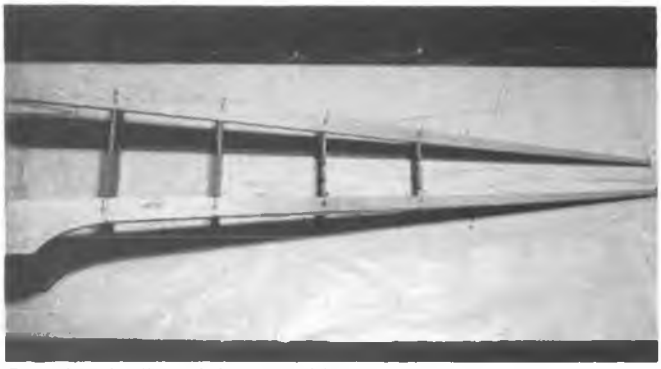
Detail parts for control module.



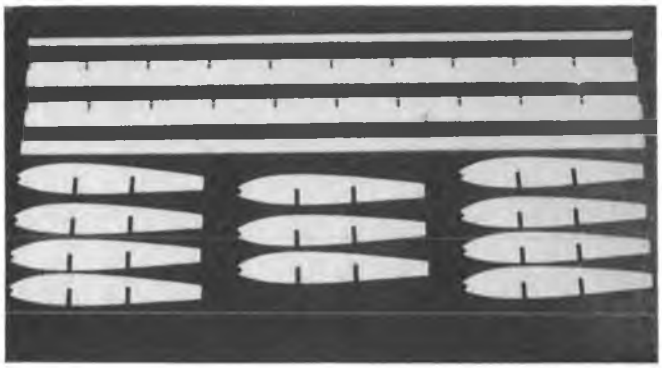
Completed control module.



Detail parts for tail module.

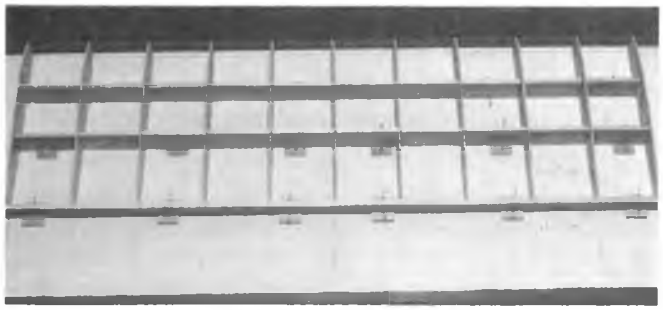


Completed tail module assembly.

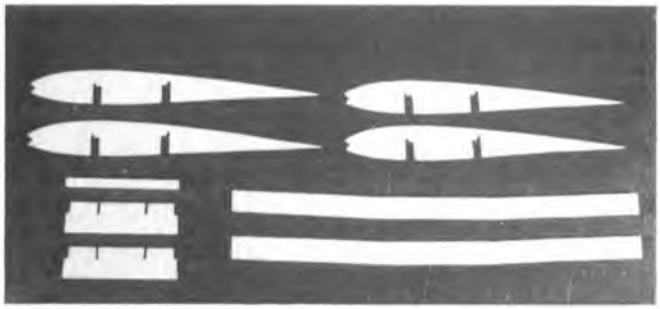


Detail parts for one wing panel.

from its nest. Use the servo tray as a guide while cementing servo tray holders in position. Trays should slide smoothly but not loosely. Cover the bottom with 1/8" balsa applied crossgrain. Recement all joints for strength and add 1/8" plywood rectangles for receiving the module retainer bolts. Movability for balance was the original intention behind the sliding servo tray but it did not work out that way in practice. Tail

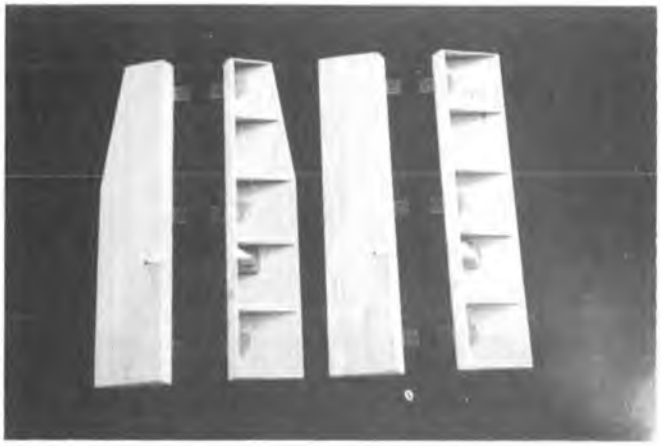


First step in wing panel assembly.

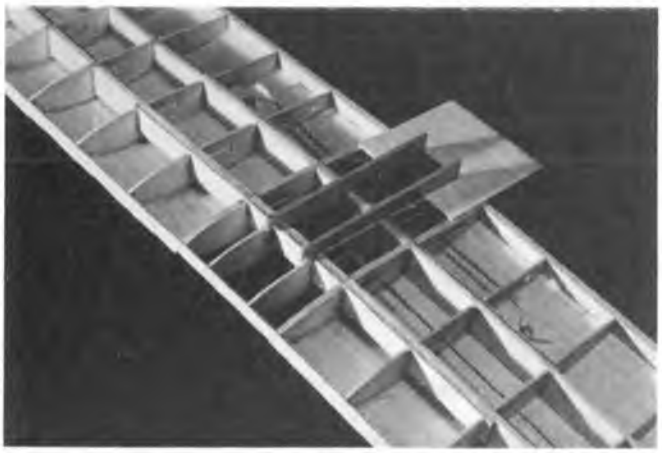


Detail parts for wing center section.

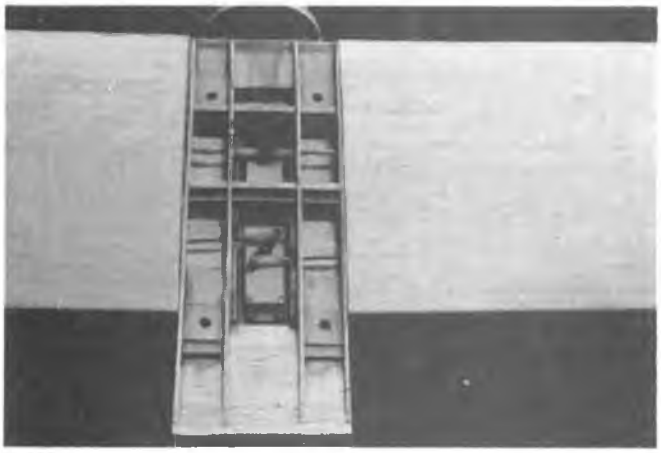
Wing center section assembly.



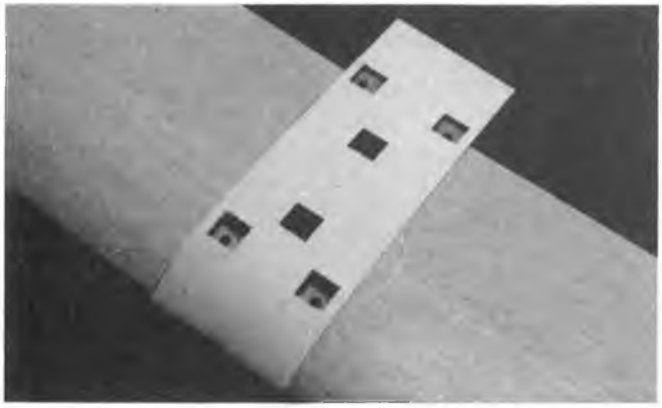
Assembly stages of ailerons and flaps.



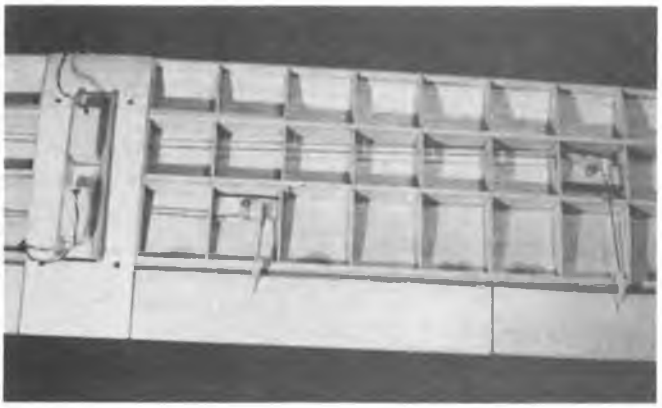
Bottom view of wing assembly showing control installations.



Top view of wing center section showing servos and wing mount details.

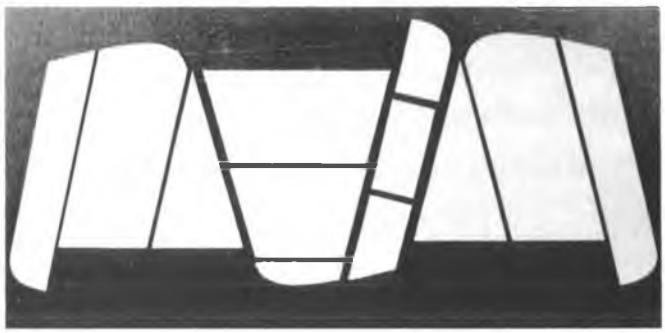


Pattern for access hatch.

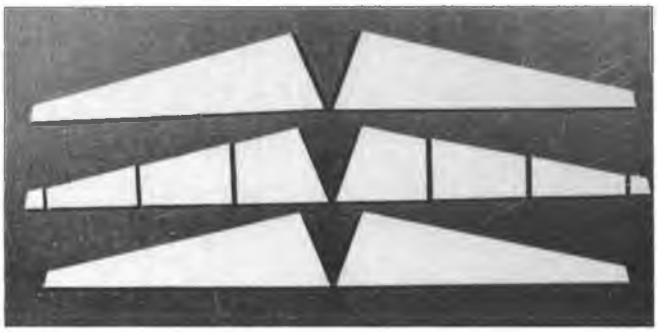


Bottom view of wing showing flap and aileron control installations.

heaviness forced the location of the servo tray at its most forward point — flush with the front of the servo tray holder. A 1/8" piece of balsa was slid in place first to fill the void in the back of the tray. The battery and receiver area are covered by a 1/8" piece of plywood held in place under the top doublers by compressing the padding in that area. The switch, charging jack, and antenna outlet are mounted on the bottom of the module. I used a

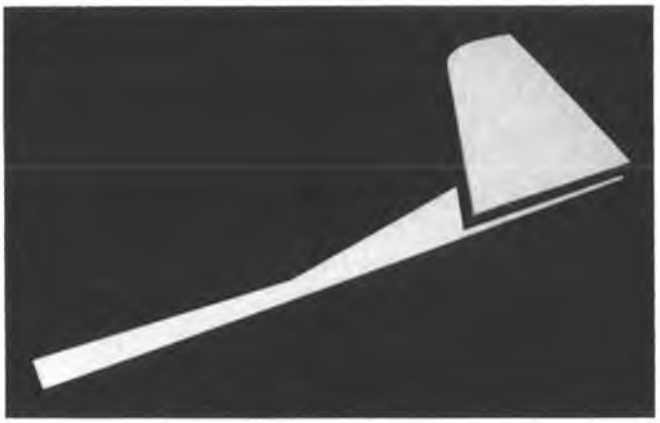


Detail parts for fin and rudder. Parts are laminated for stiffness.

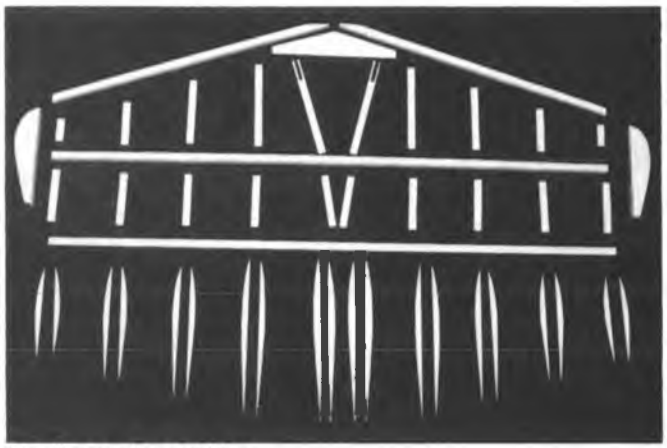


Detail parts for elevator lamination.

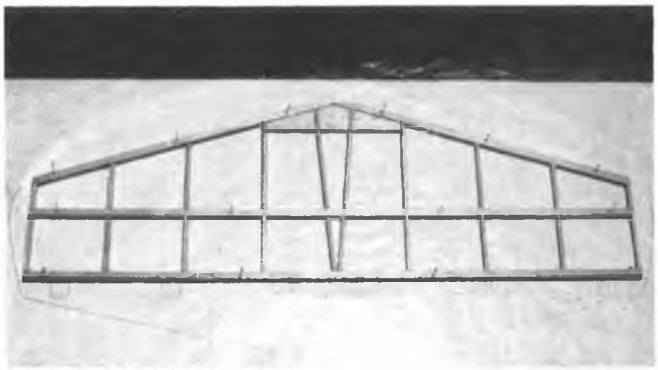
Fin, rudder, and elevator cores have cut-outs for hinges.



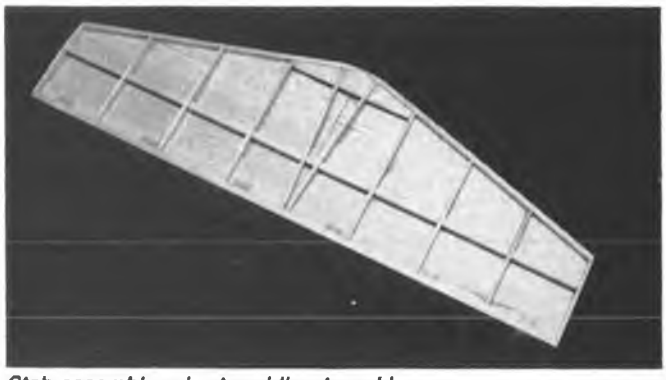
Aft fuselage spline and fin ready for joining.



Detail parts for stabilizer.



First step in stab assembly.



Stab assembly prior to adding top skin.

Stab completed with elevators installed.

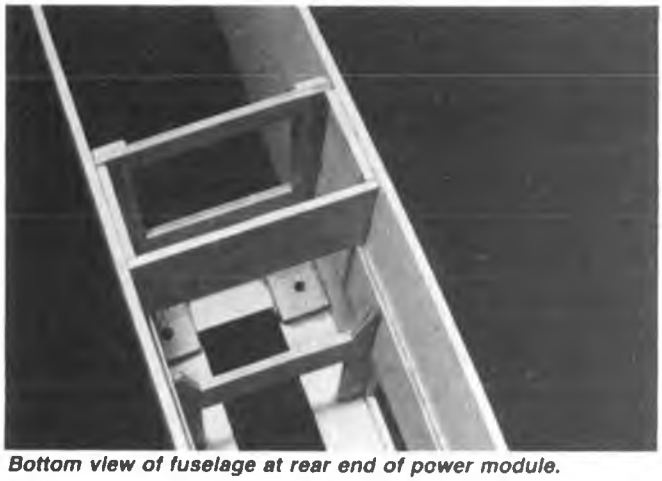
polypropylene hinge inserted at the tail to hold the end of the antenna which I just laced through the two bottom holes.

Tail Module:

Cement the 1/8" x 1/4" stiffeners to the fronts of formers E, F, and G. Position the left side doublers on the plan and scribe the former locations on them. Remove from plan and pin the right side doublers in place. Scribe the former locations again. Cement the

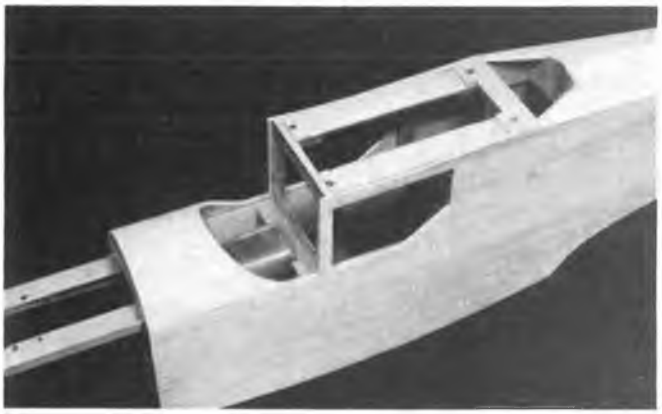
Finished nose cowl is made of several pieces.

Power module is shown assembled to right hand side.

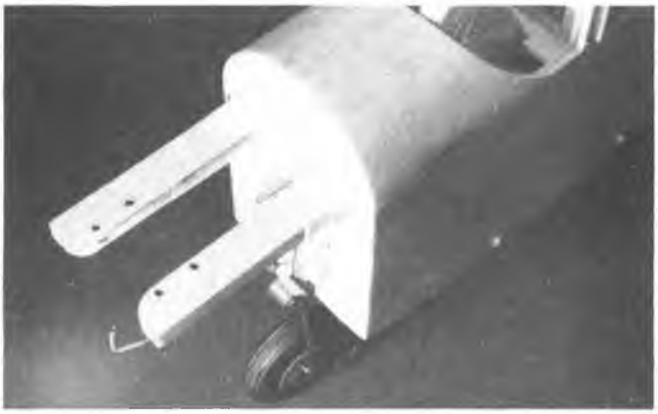


Bottom view of fuselage at rear end of power module.

Tail module with aft fuselage spline and fin installed.

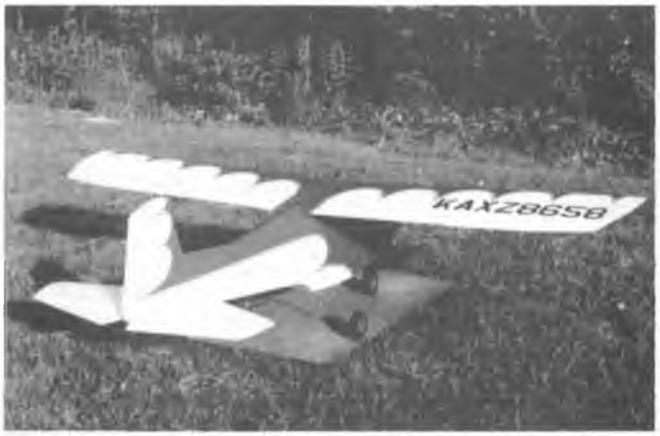


Finished fuselage in cabin area.

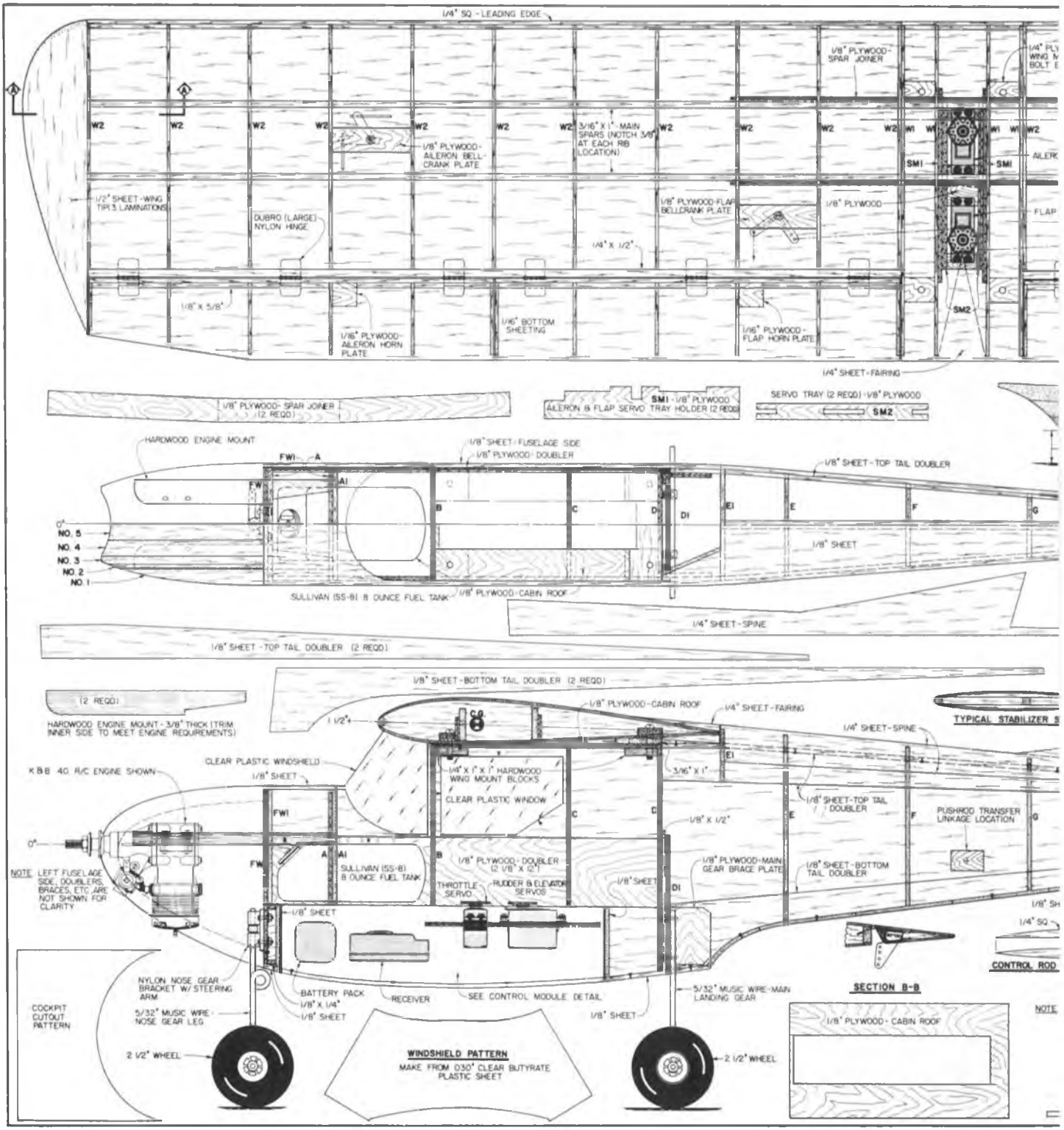


Forward fuselage with nose gear installed.

Bottom view of cabin area.



Finished and ready to fly!



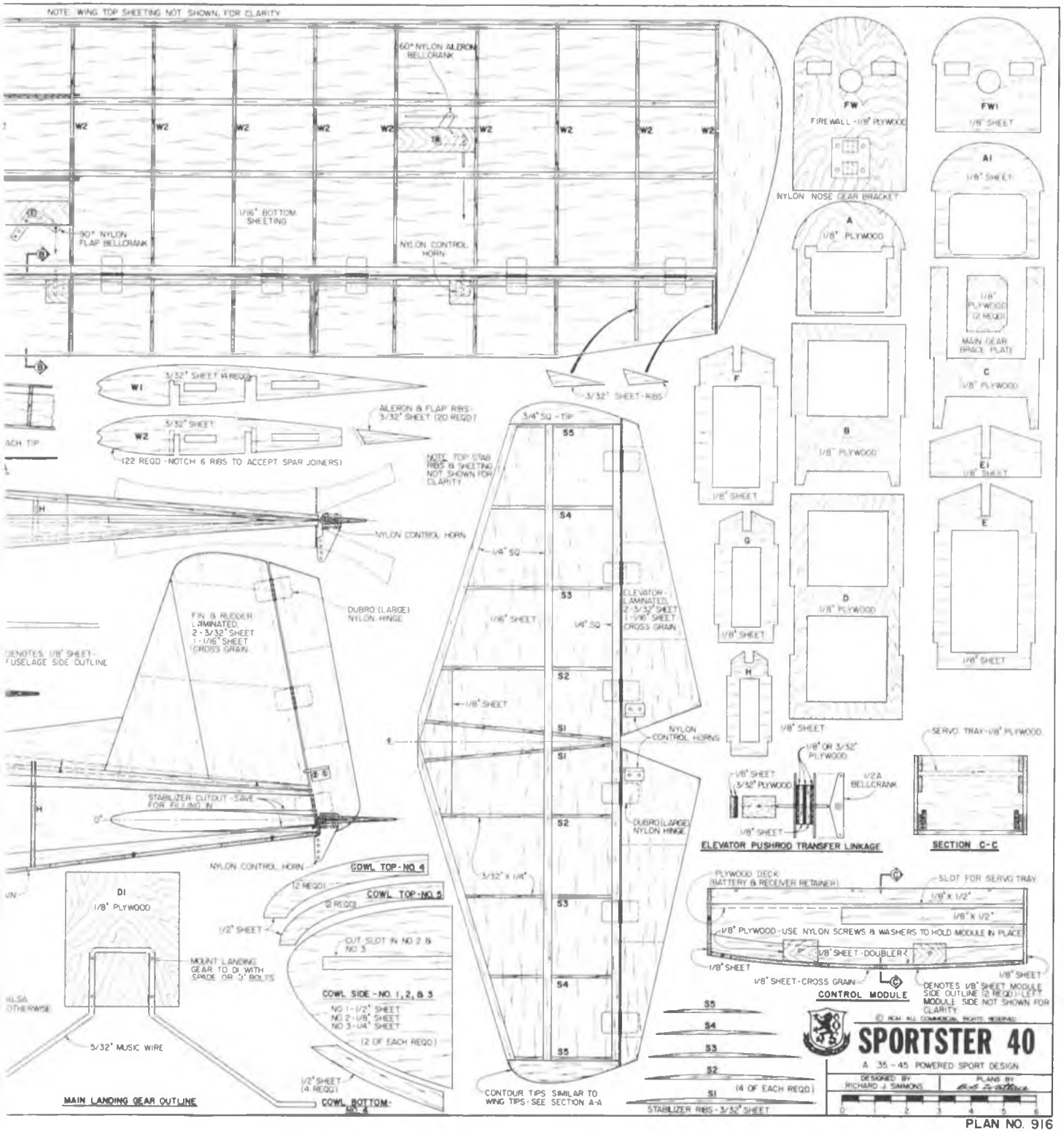
formers in position. Do not cement former E1 at this time. Cement the left side doublers to the formers and pin the tail ends of the doublers together to ensure alignment.

Wing:

Cut all necessary slots for control linkage in the ribs and notch main spars to proper depth. Pin the front main spar in place on plan. Pin the rear main spar in place using 1/32" scrap balsa shims for alignment. Pin the rear spar in place using 1/8" scrap balsa as shims. Cement the ribs in place making sure they are perpendicular to the building surface. Cement 1/4" square leading edge spar in position. Cement bellcrank supports in place. Remove from plan and construct the second wing panel in like manner.

Pin the center section front main spar over plan. Pin the rear main spar, again using 1/32" shims. Pin scrap 3/16" x 1" stock on plan. Cement ribs in place, tilting outer ribs for proper dihedral and pinning ends of ribs to 3/16" x 1" stock. Cement leading edge spar in position. Remove unit from plan and epoxy the spar joiners in place. Return unit to plan and pin in place again to ensure proper alignment. After epoxy is set remove unit from plan and cover the bottom rear section at this time to protect the ribs.

FULL SIZE PLANS AVAILABLE — SEE PAGE 212



PLAN NO. 916

Make up control rods to proper length and install bellcranks and rods in place. Trim all slots for necessary clearance in wing panels and center section.

Join the wing panels to the center section with epoxy. Block up outboard ribs with scrap 3/16" x 1" balsa for proper dihedral. Shim the rear main spar with 1/32" scrap at these points and the center section to make sure the wing is joined true. Weight the ends and the center section until epoxy is cured.

Cut the aileron and flap spars from 1/8" x 5/8" balsa and bevel edges to angles shown on plan. Notch to receive hinges. (Kraft polypropylene hinges were used on the model rather than pinned hinges since I believe the control surfaces can be installed with almost no gap with this type of hinge.) Cut the aileron and flap panels from 1/16" balsa to the dimensions shown on the plan. Pin top panels in place on plan and scribe rib locations. Panels are identical so you can build left panel on right side of plan and vice versa. Cement the ribs and spars in position. Cement hinges, horn bases, and horns in place. Notch bottom panels for horns and cement them to upper section. The ailerons and flaps were covered and clear doped at this time.

Install servo tray holders. These

also serve as keys to hold wing in position. This is where the power module comes in handy. The servo tray holders must fit snugly but not tightly in the opening of the cabin roof. Make any adjustments at this time. This is also a good time to measure the distance from the ends of the wings to the forward engine mounting holes to see that the alignment is shaping up.

Construct the aileron and flap servo tray out of 1/8" plywood. The tray must fit snugly inside the holders. Mount the servos on tray and install tray in position using four small flat head screws or notch cabin roof for clearance of round head screws.

Notch the rear spars of the wing panels to receive hinges. Sheet top of wing panels, lapping balsa over leading edge spars. The top of the wing panels were fabric covered and clear doped at this time. The fabric was carried to the bottom of the rear spar.

The wing mounting bolts were recessed inside the center section on the model for appearance. Access is gained through small hatches cut in the wing covering. Similar hatches are used for access to the aileron and flap servos. If you do not wish to recess the bolts, you must block in that area solid with scrap balsa. Finish sheeting the bottom of the center section, again lapping balsa over leading edge spar. You will have to bevel the bottom of the leading edge spar first, so sheeting will follow contour of ribs. Fill in the area of the front mounting bolts with scrap balsa even with top of spar joiner. A piece of 3/32" plywood is cemented over balsa and spar joiners to serve as a bearing for mounting bolts. The front portion of the center area is filled also, because you will be cutting a circular groove in the underside to receive the top of the windshield. A 2" length of scrap balsa plus the 3/32" plywood bearing is cemented in place for the rear mounting bolts. Place the wing in position on the power module and drill and tap for 1/4-20 mounting bolts.

Install ailerons and flaps. Hinges are cemented to rear spar and top covering. Hook up all aileron and flap control linkages and test the operation of the servos. Make sure the flap servo is at limit of travel before flap reaches full extension. Down aileron movement should be about 1/2" with about half that for up movement because of the differential bellcranks.

Make a pattern for the access hatches out of heavy paper. The hatches are centered over the mounting bolts and servo arm retainer screws. Sheet the top of the center section, again lapping balsa over leading edge spar. Secure the hatch pattern in place and cut through the balsa at the front side of the hatches only. This is the hinge side. After fabric covering is applied and all painting is finished, the pattern is again secured in place and the remaining three sides are cut at that time. It is advisable then to apply several coats of clear dope to the underside of the hatches so they will retain any curvature. I have had varying degrees of success with this innovation depending on the fabric used. The plastics would probably work best. If the hatches don't stay in place, a piece of Scotch Tape will keep them closed for flying.

Sheet the bottom of the wing panels after first beveling the bottom of the leading edge spar as you did on center section. Round the leading edges and finish fabric covering.

Make each wingtip from four pieces of 1/2" sheet balsa or from balsa block if you can find very light stock. Use the center section rib as a pattern, making it slightly oversize to allow for sheet balsa covering. Carve and sand to the shape shown on plan. Do not bevel the top of the wingtips in any way and do carve bottoms in a concave shape as is also shown. Cement the tips to the wing and finish sanding and clear doping the entire wing.

Fin, Rudder and Elevators:

These are a sandwich of 3/32" balsa with a 1/16" balsa cross-grained core that has cut-outs for hinges. When the 1/16" core pieces are joined, a straightedge along the hinge line will be beneficial. After the fin is assembled, it should be joined to the 1/4" spine before shaping. The rudder and elevators are beveled to a 1/16" edge at rear, using the core as a guideline. All of these parts were covered and clear doped at this time.

Stabilizer:

Pin all 1/4" spars in place over plans and cement 3/32" x 1/4" rib cores in proper locations. The center cores must be notched for leading edge spar joiner. Remove from plan, sand, and add ribs top and bottom. Sand ribs for conformity and bevel the leading edge spar in preparation for sheeting. Groove the rear spar for hinges and cement them in place. Sheet the bottom of the stab. Do not attempt to cover the full length of the stab in one piece. Cover the top of stab similarly. Shape the stab tips to match the wing tips. Round the leading edge and finish sanding the entire stab. Apply the fabric and clear dope. Elevators may be added at this time.

Cowling:

Assemble the sections of the cowl as shown on plan. If you cement the four inner sections, top and bottom, you will find it easier to shape and sand the interiors prior to joining them to outside sections. Use a piece of scrap motor mount stock when assembling the sections that are grooved to ensure a snug fit in that area. Rough sand to profile shape. Cut an opening in front to fit the engine you are using. The O.S. 40 required the removal of the glow plug, needle valve and retainer, muffler and muffler extension, to make cowl removable. This is a good time to locate and drill the necessary holes for tightening the mounting bolts, attaching muffler, etc. Cut hole for nose gear, and shape and sand to finished contours. Cut slot for muffler and any necessary grooves in interior to provide clearance for removal. Finish and paint the cowl to your preference. Slim balsa wedges (1/16" x 3/8" x 1") are cemented to the outside of the motor mounts where they meet the firewall to hold the cowl in place. Bevel the front of the shims and sand them down until they hold the cowl snug without spreading it.

Fuselage Assembly:

Cement the power module to the right fuselage side, making sure cabin roof is flush with flat portion of fuselage top. Remove all excess cement from windshield mounting area and bottom of cabin doubler. Lay left fuselage side on building surface and cement power module to it, again removing excess cement. Use a triangle to ensure fuselage sides are in alignment at tail.

Place the 1/8" x 1/4" spacers and the control module front stop in position but do not cement. Insert the finished control module in place and inspect for a flush fit. If it is not a flush fit, trim the spacers until it is. Cement the spacers and the stop in place. Do not fill in bottom at this time.

With control module in position again, cement control module rear stop flush with rear of module. Be careful not to cement to module. Cut and fit rear stop doublers and cement in place. The control module should now fit flush but not tight; the module moves freely in and out. I strengthen the opening by heavily cementing 2" strips of nylon fabric in the four inside corners. Make sure area is smooth and then sand corners of module until it again moves freely in and out.

Cement tail module in position making sure doublers are up tight against former D at top and separated at bottom by width of main gear mounting panel. Place mounting panel in position temporarily to

ensure this. Pin or tape fuselage sides together and weight down to ensure good bonding.

Place wing in position on cabin roof and cement former E1 to fuselage sides flush against rear of wing. Cement spine and fin in place.

Cement stab in position and measure from wingtips to ensure correct alignment. Fill in the area at the rear of the stab with pieces from original stab cut-out. Attach rudder and elevators now if you have not already done so.

Install control horns, elevator pushrod transfer linkage and control rods. Test for operation.

Cover top rear of fuselage in continuous pieces. Bevel edge that abutts the fin and spine. Cover the area in front of the windshield in two pieces by soaking balsa in warm water for a few minutes and letting it dry overnight, taped to a can or bottle of the same diameter. Cut out for windshield using pattern on plan.

Attach the main gear to the gear mounting panel at location shown on plan. I drilled two holes in four places and attached it with thread and cement. Foolproof! You will also have to drill mounting panel for control rods. Remove rods while installing panel. Cement mounting panel braces in position and reinstall control rods. Cement bottom 1/8" x 1/2" spacer between panel and former D.

Locate and cement nose gear mounting panel in place so model sits level with thrust line. Drill mounting holes and install gear. Before filling in bottom of area behind gear, you may want to consider it as the place for adding weight necessary for balancing the model. After that, fill in with 1/8" x 1/4" spacer and final 1/8" sheeting.

After rudder and elevator servos are hooked up and tested, sheet the bottom of the fuselage. Cement balsa cross-grained. Curved area behind main gear is covered in one piece, again by the soaking and drying method. Leave a little opening around main gear to allow for its movement.

Cement a piece of 3/16" x 1" x 3½" balsa across rear of cabin roof. Bevel it and the top fuselage sheeting until wing fits flush. Do not trim 3/16" thickness at rear since this governs incidence. Cement a piece of 1/8" x 1/4" across front of cabin roof and trim this until wing center section rests on cabin roof. Cement a 1/8" x 1/4" piece of balsa on both sides of the cabin roof. Trim and sand to make wing saddle. Redrill holes for wing mounting bolts.

Windshield and windows were installed after all covering and painting were completed. Cut a semi-circular groove about 3/32" wide and 3/16" deep and 3½" in diameter in the underside of the wing center section to receive the top of the windshield. Use a paper pattern of the windshield until you get a perfect fit. The windshield should protrude about 1/8" above the wing saddle. The windshield was attached by just running a bead of cement down where it meets former B.

The window frames were made from 3/32" x 1/8" balsa to fit snugly inside window cut-out. Butyrate was cemented to the backside after painting and they were installed so the 3/32" facing protruded slightly from fuselage sides.

Bill of Materials

1 — 1/8" x 6" x 48" Plywood — Fuselage formers, spar joiners, servo trays.
1 — 3/32" x 1" x 8" Plywood — Wing mounting bolt bearings, transfer linkage.
4 — 3/16" x 1" x 36" Strip Balsa — Wing main spars.
2 — 1/4" x 1/2" x 36" Strip Balsa — Wing rear spars.
4 — 1/4" sq. Strip Balsa — Wing leading edge spars, stab spars.
8 — 1/6" x 4" x 30" Sheet Balsa — Wing sheeting, fin, rudder & elevator cores.
2 — 1/16" x 3" x 30" Sheet Balsa — Stab Sheeting.
1 — 1/2" x 3" x 36" Sheet Balsa — Cowl & wing tips.
1 — 1/4" x 3" x 36" Sheet Balsa — Cowl & spine.
3 — 1/8" x 4" x 48" Sheet Balsa — Fuselage sides, formers, control module.
2 — 1/8" x 3" x 36" Sheet Balsa — Formers, stops, doublers, cowl.
2 — 3/32" x 4" x 36" Sheet Balsa — Wing and stab ribs.
1 — 3/32" x 3" x 36" Sheet Balsa — Fin, rudder, elevators.

Miscellaneous

3 — 2½" wheels, 5/32" steerable nose gear, 5/32" wire for main gear, 22 polypropylene hinges, 8 large control horns, 2 — 90° bellcranks, 2 — 60° bellcranks, 2 — 1/2A bellcranks, control rods, snap-links, 4 — 1/4-20 nylon bolts, 4 small nylon bolts and washers, 3/8" x 1/2" x 18" hardwood motor mount stock, butyrate plastic, * 8 oz. fuel tank.

Most of the Balsa and plywood was purchased from Balsa U.S.A., the rest from the local hobby shop. * The fuel tank was homemade from a tapered plastic bottle found in those de-mineralizing filters used by the housewife for her steam iron. (Deem was the trade name.) The taper must go to the front to provide a sump for the fuel. The neck was cut off and Sullivan's Innard's used. An 8 oz. round tank of your choice can be substituted if you can make the necessary alterations in formers FW1 & A.

The model was covered with a polyester fabric and finished with Aero-Gloss. The wings and stab were completely sheeted on this version although the original was only sheeted to the front main spar and ribs cap-stripped. The stab was sheeted in the same manner. Your readers can take their choice. □

SCALE VIEWS

Col. Art Johnson

Art's X-100 was built as an experiment leading to a jet scale model. Makes a good practice model. In this case, figuring out when and where to find the drag chute switch.

Prop engined model has the appearance and speed of a jet but T.O. and landing characteristics that let you practice as if it were any sport model.

Practice For Scale Flying:

Yes, this is the Scale Views column and no, the Editors did not get the photos of the Sunday Sport-fly type model airplanes in the wrong place. The photos are there because we thought that scale builders might be interested in opinions on what type of sport model could be used to help brush up on scale flying techniques. I think everyone would agree that there is no substitute for practice with the actual scale model that you plan to fly in competition. Scale fliers who fly the same model or the same type of model over long periods of time tend to do rather well. Practice may not get you a perfect 100 score, but it certainly helps.

If you are a scale flier fortunate enough to have access to a full scale aircraft runway for your practice flying, then the risk to your prize scale plane is much less than if you (most of us) have to practice from a short narrow model runway or from a not too smooth grass area. Long wide paved areas such as the Mile Square flying site in California or the Air Force runways at the last several National Championships give a flier a chance to angle a bit into a cross wind or to play out a landing flare for just the right touchdown speed. Under the same conditions at a typical local flying site the flier will have to fight whatever cross wind is present and there may be a tendency to plant the model on the approach end at too high a speed for fear of running off the other end. Repeated practice with a complex model having a high wing loading under adverse conditions may sharpen your skills, but the model could also end up looking like a piece of junk when it goes in the static judging circle.

We strongly recommend that you become very familiar with the flight

For a long time the Kougar has been one of my favorites for practicing scale routines. Speed similar to scale fighters and heavy enough to not get you into bad habits. This one by John Roush.

Better to practice single engine procedures with your sport Double Kougar than with a more critical scale twin. With this one you can make mistakes without a scale disaster. (RCM Sept. 82.)

O.S. Max .25 powered "Tommycats" provide an inexpensive practice for ducted fan scale flight. One covered with Micafilm, one with MonoKote and one silk and dope. Weight varies from 3.5 to 4.5 pounds but flight performance is similar for all three.

Sport model has the look and speed of a scale jet and can teach you how to land a scale double-delta. Exposed ducted fan pod is easy to operate for practice sessions. Model by Bob Walter.

characteristics of your new scale model before taking it to a contest; in fact, a speaking acquaintance with its flight performance is mandatory in the AMA rules. However, for those days and field conditions where you do not wish to risk the Number 1 model, you might be better off practicing with something easier to build and less expensive. Now, before anyone hollers too loud, I know that if your favorite model is one of the popular light aircraft, without retracts and with a low wing loading, it probably can survive as much practice flying as any of the trainer or sport type models. This is particularly true if modeled in the larger sizes with a gas engine for power. The gasoline fuel mix does not bathe the model in heavy oil every flight. Unburned oil soaking into a glow fueled scale model is as likely to give a case of terminal ugliness to the model as is a number of poor landings. So, if large models of fixed gear light aircraft are your bag, practice away with your scale model while we offer

some suggestions for the poor guy with the retract equipped hot landing fighter, the modeler who sweats every time his twin engine scale bird coughs in the air, and the jet jockey who thinks about bankruptcy when he buys fuel for his ducted fan practice sessions.

What kind of models may help you better your scale flying skills? The obvious is that it should be inexpensive (as compared to a scale model), fast to build, and rugged enough to survive under those less than perfect conditions that seem to be most of the time. The "Ugly Stik" fits all of the above but it is not the kind of model I had in mind. The one additional characteristic you want in a practice model is that it performs at least a little like the full size aircraft that you have modeled. An overpowered, lightly loaded model capable of hot dog snap maneuvers, that no full scale pilot would recognize, is not going to teach you much about simulating the flight of a man carrying aircraft. In fact, models of this type can get you into bad habits that you discover too late when your P-51 on a flaps down approach does not respond to sudden power application and rough control movements in the way that the "Stik" model did. My personal preference is for a model that has a power and weight combination requiring it to be flown rather than pointed. Most pattern type model airplanes would serve the purpose but there are many easy to build sport type models that are even better. I have used the Sig Kougar as a practice model for many years simply because it builds fast, is economical to operate with a .40 engine and it flys at about the same speeds as many of my scale models. With a model of this type you can practice your scale flight routines in just about any weather and field conditions.

When you have practiced the scale flight patterns and landing approaches with the sport model until they become routine, then pick a good day and get familiar with your heavier scale model. Now you can concentrate on handling the faster sink rate on final of the scale model, experiment with the effect of flaps and practice the operation of the switches for retracts, bomb drop, or whatever. When the cross wind gets too rough at the local site, go back to practice with the sport model, you will spend less time fixing retracts and refinishing wingtips.

Just thinking about what can happen if an engine quits on your latest scale twin can make most scale fliers nervous. I am talking about a twin where the engines are set some distance apart. Push-pull twins like the Cessna and Dornier configuration or side by side engines like many jet fighters are no sweat as they do not have asymmetrical thrust when one engine shuts down. If your heart is set on toughies with an engine out like the P-38, Douglas A-20 or Martin B-26, then by all means build a sport twin first and get some twin engine practice. In fact a practice twin is a good idea even if you are building an easier bird to handle like the Cessna 310 or a Piper Twin. A sport twin like the "Double Kougar" (RCM September 1982), or a Duellist, can get you past the dead engine heebi-jeebies with minimum risk to the model, but still providing practice with off center thrust and the loss of power accompanying an engine out condition. Of course you have to short the fuel in one tank to guarantee this practice or, in the case of the Double Kougar, just take-off on one engine. You will learn which way to trim the rudder to offset the dead engine, how the model will pull off track at slow speed with full power on one engine, how to recover if you push too hard into a snap situation and, with the Double Kougar, you can even practice flaps down single engine approaches.

When you return to flying your

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scale twin, you will have the confidence that you have mastered twin engine procedures even though the actual control response for a heavier scale model will always be more critical than with the sport model. If you have practiced with the sport model, you will know what to do when an engine goes out, now you can concentrate on how much to do with the more difficult scale model.

The operation of the engines and the flight characteristics of ducted fan models of jets are enough different from prop birds to make specialized practice models worthwhile. Even if your jet model can stand the rigors of repeated practice flying, the pocketbook might take a beating. Fan engines in the large sizes burn glow fuel like there is no tomorrow. A Rossi .81 can easily go through a gallon of fuel in an afternoon flying session and even in the smaller sizes the high rpm of the fan will use more fuel than will a similar size engine with a prop. In addition, a newcomer to jets might want to get familiar with the flight performance of highly swept wings, flying stabs (stabilators), dive brakes, drag chutes, or whatever, using something easier to build than an all out scale jet.

I had easy to build — plus most of the above in mind when I put together the X-100 sport model shown in the photos with this column. It has the moments, flying surface areas and sweepbacks of an F-100 with just enough slab fuselage to hold it together around a piped .46 engine. The model was built originally to experiment with stabilator movement and control linkage and the effects of C.G. movement on an over 45 degree swept wing. It turned out to be a fast, groovy, sport model that can be flown in any Sunday session at the local field. It flys faster than most ducted fan models, yet slows up well for landing due to the low 6.5 pound weight. It has enough of the characteristics and lines of a jet to make a good practice model for those days when you would not want to risk the all-out scale jet.

If you are not into scratch building, there are ducted fan kits for sport models available that are easy to build and cheaper to operate than the larger scale jets. The Kress designed "Tommycat" with the RK-20 fan unit is one of these. This little fun jet uses only three radio channels and, with a 20 to 25 size fan engine, is a whole lot cheaper to operate than even the .45 powered fans in a scale model. The small Tommycat will maneuver as well as the scale jets, operate from small flying sites, and sharpen your eyes with its jet look in the air. As a practice model for jets, it will get you familiar with setting piped fan

engines and teach you a lot about slowing a Double Delta winged aircraft to the right attitude for landing.

In touching on just a few models that are suitable for practice scale flying, I recognize that there may be dozens more that would be useful. The important point is that you should practice scale flying with something and fly it as though it were a scale model. Very few of us can get all of our practice on scale models and still have anything left to take to that special contest. If you are like me, you can destroy the usefullness of a scale model just getting it in and out of the car for repeated practice sessions.

Scale at the Tangerine:

By the time you read this, Florida will be back into the ninety-ninety weather. That is 90 degrees and 90 percent humidity. It was not that way for the start of scale competition in Orlando on the last day of 1983. A couple of days before when RCM's Dick Tichenor called for a weather report, it was 85 degree beach weather. When we unloaded our models for static judging on Saturday (New Year's Eve), it was down in the thirties and a strong gusty wind was blowing straight from the Arctic. Not your postcard Florida weather but it was clear with the sun out and everyone did their best to convince themselves that they were really having fun and that they were not crazy going to a contest over the New Year's weekend. Actually there was a good turnout in spite of the weather. After all, this is the only contest around for months on either side of the year-end and what is there to do that is better than flying R/C scale?

There were thirty-eight scale models actually flown in the cold winds and more models were on hand with contestants who elected to wait for a better day. Contestants were fairly evenly divided between the Sportscale Expert, Sportscale Sportsman and AMA Giant Scale classes. As in most recent East Coast contests, AMA Giant Scale had the top number of contestants. New models that I had not seen before included Maxey Hester's new Giant Scale Cub that he brought down from Iowa, Frank Thomas' original design 1/6 scale Spitfire powered by an O.S. .90 and Dave Platt's latest version of his Japanese Zero with a 1.2 Supertigre 2000 for power. All of these models flew very well. The Supertigre 2000 added some weight to Dave's 1/5.5 scale Zero putting it into the AMA Giant Scale class, but the model seemed to handle better than with the previous .90. The new Supertigre appears to be designed for scale with adequate cooling area and the ability to swing large props. Fuel

Maxey Hester flew this model of a Cub at the Tangerine. Entered in Giant Scale, the model flew well in the gusty windy weather.

Ramon Torres of Miami, had all the bugs out of his original design T-34C-1 done in Argentine Air Force colors. The .90 powered model with Ramon's own design retracts and brakes was first in AMA Giant Scale at mid-winter Tangerine.

1.2 Super Tigre 2000 powers Dave Platt's latest 1/5.5 Scale Zero. Dave's first entry in AMA Giant Scale, the Zero flew well for a second at the Tangerine.

Frank Thomas of Niceville, Florida, brought his original design 1/6 Scale Spitfire to the Tangerine. Flaps down and easing to a nice touchdown in the windy conditions.

Greg Namey's P-51D at the Tangerine static table. Chocks are to keep model from blowing off the table.

Jackets and parkas are not your usual Florida contest attire. A few of the around forty scale models at the year-end Tangerine.

consumption is also much less than we have come to expect with the faster turning glow engines designed for the pattern applications. The Xenoah-Quartz G-38 was another new engine that performed well in Mario Yederlinic's latest version of his Giant Scale PT-19. The G-38 ignition engine seemed to have more power than the Quadra Mario used in his previous models of the PT-19, even though this one weighed 27 pounds.

The club sponsoring the Tangerine contest has promoted ducted fan competition over the last several years by offering a $500 cash prize for the best scoring ducted fan model of a jet. All of the models competing this year were from fiberglass fuselage kits, equally split between Jet Hangar Hobbies and Byron Originals products. This is a good time of year for jet model competition as the fast turning engines thrive on the cold dense sea-level air. Each of the models was of a different jet aircraft with Bill Williamson's model of the Navy A-4 attack aircraft coming out on top.

The Tangerine unexpectedly gave me a chance to personally check out. rule 9.4 in the Sport Scale rule book that pertains to scoring if an engine quits on a multi-engine model. This is not the sort of condition that you go out of your way to check out so I often wondered how the judges would handle it. The book says that, "the multi-engine score will be based on the contestant's ability to continue flight." Sounds good, but in most cases when an engine quits on a twin, you are only too happy if you get safely on the ground again. This time it was the last flight, the left engine quit in the Figure Eight but the other engine was still screaming its little heart out. I knew that the original F-82 would do anything on one engine that it would do on two --- so why not? The 18 pound model did complete the flight on one .60 engine including loop and rolling

maneuvers and the flight judges did score the flight okay which proves that they really do read the book, even those obscure seldom used paragraphs.

The FAI Scale Rules Mystery!

I have just read the report of our scale delegate to the latest FAI meeting in Paris. With dismay I discover that there will be no change to the FAI Scale rules until after January 1, 1988, by FAI decree! Now the FAI is not run by a dictator and a "decree" sounds pretty arbitrary. Does this country or the majority of scale modelers in this U.S. of A. support such a freeze? I have a feeling that FAI scale is now pretty far from the mainstream of scale modeling in this country and destined to get a lot farther if not changed for another five years.

Perhaps my problem is that I do not understand the system by which an American proposal is developed for submission to the FAI. The system by which changes are made to the AMA rules are well-publicized and scale modelers throughout the country feel they can participate. If the AMA rules do not reflect what the modelers want, it is the fault of the modelers or the appointed contest board members who filter and approve any changes. AMA lets everyone know what has been proposed and who voted which way on what. I am not aware of any similar system for insuring that our proposals for change to international competition reflect a real national position.

I do recall that the current R/C rules for FAI Scale (F4C) are based on a UK modeler's proposal that was floated in the model press of this country as a possible point of departure. This UK proposal is now the only FAI R/C scale event replacing the two scale events of the year before. While the UK proposal was reported in the press, I also recall a U.S. proposal by Bob Underwood for changes to the FAI rules that was reported in the N.A.S.A. publication and in a model magazine. Bob's proposed changes reflected the trend in this country towards slightly heavier models with larger displacement engines, a trend which I suspect is going on world wide. (The Europeans are planning an international contest for large models, up to 22 pounds, this year in Paris.) Anyway, I suspect that if we had a system for determining such judgments with respect to FAI rules in this country, Bob Underwood's proposals would have met with greater acceptance to the majority of scale competitors in this country than do the UK modeler's rules which are now engraved in stone by the FAI. Somehow, it seems ridiculous to me that such outstanding scale models as Tom Cook's F-4C Phantom are not even eligible for FAI International competition because of the rule limitations. At least that is my opinion, what is yours?

New From Hobbypoxy:

Four new Hobbypoxy camouflage paint formulas this month are the long-awaited colors for Japanese Naval aircraft of WW II. These colors will be correct for all models of the popular Mitsubishi Zero, as well as

other Japanese Navy aircraft of the period.

From 1933 through 1941, the standard scheme was an overall Light Gray N10. From 1942 to the end of the war, Black Green N1 was used on upper surfaces, usually as a solid color, but sometimes applied in a blotch pattern over the Light Gray. Light Gray N10 continued as the standard color for undersurfaces.

Cockpit interiors, and the insides of doors and hatches, were primed in a translucent Blue, which --- when applied over bare aluminum --- produced a metallic effect. Our formula uses Hobbypoxy Custom Metalizer to duplicate this metallic appearance. Both Army and Navy aircraft used this primer, but on Navy aircraft it was often painted over in cockpit areas with an opaque Gray Green N4. Primed surfaces, other than the cockpit, remained in translucent Blue.

Here are the formulas:

Light Gray N10 — 16 parts H10 White; 13 parts H70 Gray; 8 parts H55 Cream; 1 part H47 Bright Yellow.

Black Green N1 — 6 parts H33 Stinson Green; 2 parts H81 Black; 1 part H65 Bright Red.

Primer (Translucent Blue) — 5 parts H24 Dark Blue; 2 parts H99 Custom Metalizer; 1 part H33 Stinson Green. (Use H06 or H02 Gloss Hardener with the above formula.)

Gray Green N4 — 20 parts H70 Gray; 2 parts H49 Cub Yellow; 2 parts H65 Bright Red; 1 part H33 Stinson Green.

Be sure to mix the above formulas (except **primer**) 1:1 with H05 Flat Hardener for an authentic matte finish.

□

POWER BOATING

Howard Power

If you ask any hobby shop owner what competitive model boat kit he has sold the most of, he probably will answer the Dumas Hot Shot. The reason is not too tough to figure out. The little tunnel hull is very inexpensive and the power train (the K & B 3.5 outboard) is the simplest known to man. This combination may have started more people in model boating than any other. The Hot Shot was always fast; in fact, too fast for its own good. In smooth water it really moved but when the wind came up, and the water was a bit choppy, it did some of the most spectacular aerobatics ever done by a model boat.

A few months ago Dumas released the latest 3.5cc Hot Shot design. It was designed by outboard design expert and NAMBA Hall of Famer Jerry Dunlap. This new plywood construction kit is named the Hot Shot IV. It has some of the latest outboard design features. The hull has the proper airfoiled center-section and a 25% pickel fork design that helps prevent blow-offs in rough water or windy weather. The boat has an overall hull length of 28½", not including the engine, and a width of 14". The tunnel has a width of 6¾" and a maximum depth of 7/8". The planing surface of each sponson has three transverse steps which help free up the boat during acceleration. These steps have three functions. The steps cut down the wetted hull surface because they cause water to miss a part of the forward surface of the following plane. They also break any suction that might be generated by the planing surface and they increase sponson lift. Increased lift comes about because of the fact that every planing surface has a lift distribution that is a maximum at a point close to where water first strikes the planing surface. If you increase the number of these leading edges you can increase the lift capability of the planing surface. The steps therefore, generate more lift and less drag than a non-stepped surface of the same area.

The kit is a typical Dumas wood kit. All wood is aircraft or mahogany plywood with hardwood nose and cowl blocks. In the interest of lightness we substituted balsa for these relatively heavy blocks. Our boat weighed five pounds ready to race.

The first photo shows the completed boat at rest in the water. The boat was constructed by Dean Ellis of Salinas, California. Dean had a couple of fiberglass boats under his belt before I commissioned him to build this kit. It was his first all wood kit and he had very little trouble constructing it. It was built using Sig 15-minute epoxy glue on all joints. The only critical

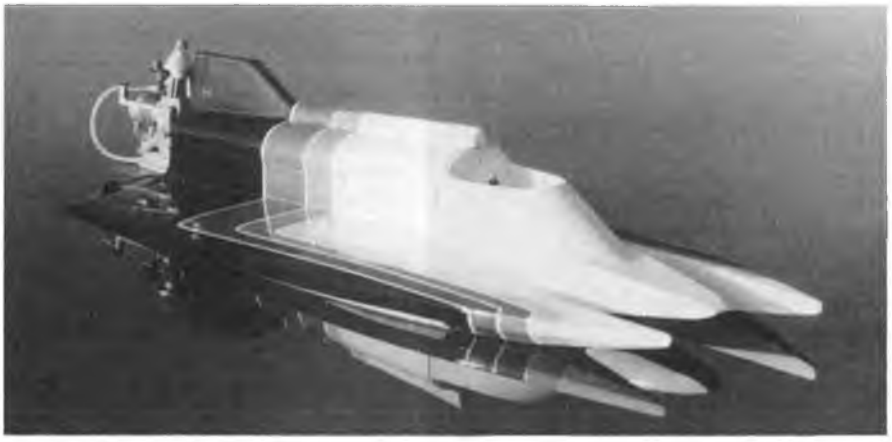

Photo 1: Dumas Hot Shot IV at rest.

Photo 2: Outboard adjustable mounting system.

thing you have to watch out for is that the planing surfaces must be constructed true. We planked the bottom surfaces after the top sheeting was in place and after we made sure that the hull was not twisted. The sponson bottoms were carefully sanded until they were exactly at the same angle of attack. The bottoms were then planked and the steps were added. If the sponsons are not right, the boat will never perform as designed.

The second photo shows the rear end of the boat. We used a Prather 3.5cc adjustable engine mount so that we could trim the hull. The ability to change engine angle and propeller depth easily are, in my opinion, absolutely necessary when you are trimming any tunnel hull design. Since we run NAMBA outboard events, the engine used was stock. During testing we have been reducing the lower skeg fin area. With the shape shown in the photo, turning is very quick but accurate. Latter runs made with a smaller depth fin showed plenty of turning capability. The smaller fin creates less drag and, therefore, more speed. We tried a JG E20T and an Octura X440 propeller during the test runs. They both worked great but the best speed and handling was achieved by the X440. During testing we had to make a change in the fuel tank mounting system. The plans show the fuel tank mounted on the bottom of the hull. We could not keep the engine running reliably with this set-up. We went to our local drug store and looked through the shelves until we found a plastic eight ounce oval shaped bottle that would fit into the rear of the top cowling. We cut off the bottle neck and used a Sullivan fuel tank stopper to build the tank. The tank was glued to the cover using silicone rubber cement. This mounting gets the fuel tank on the same level as the carburetor. After this modification, the engine has run flawlessly. I would definitely recommend this tank set-up.

The third photo shows the boat in action. As you can easily see, the hull performs very well. It sits on the back of the sponsons and gets on down in the water. It has no tendency to rock or hop up and down. It rides clean and is fast. We have run it in choppy water and it is very stable. It ought to make a very fine competitive race boat. We think our boat is great and hope you agree if you build one.

★

The use of "unusual" materials has been on the increase in all modeling fields. One of the newer materials in use is graphite. Graphite, in the form of carbon fibers, can be used to strengthen critical load areas in outboards. Twinn-K (P.O. Box 31228, Indianapolis, Indiana 46231) supplies such a graphite laminating material to the hobbyists. Graphite material properties are nothing short of miraculous. Its flexural strength is five times that of aluminum, it is twice as stiff (tensile modulus), and is 40% lighter. Twinn-K supplies this material in solid rods and in unidirectional tape that is .007" thick. The tape form is what we have used with great success to stiffen the aluminum sponson extrusions used on our Marlin Hydro.

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The aluminum sponson support extrusions supplied with the kit are the same as those used by Ed Hughey's line of hydros so the procedure to be outlined here is also applicable to those of you out there running Ed's designs. These extrusions have a cross section that is hollow and is rectangular in shape. They have a nasty habit of bending when you hit the beach, buoys, or the water at Warp 4 speed. If they bend, the sponson angles are changed and the boat usually makes like a submarine until the supports are bent back into alignment. In an effort to strengthen this area of the boat (so that I could crash more effectively), I began experimenting with the use of carbon fibers. In most of the cases of damage that we have observed, the sponson bracket was bent upward in a crash. The solution, therefore, was to increase the bending strength of the extrusion. When the bracket is loaded in bending by a force applied to the sponson in the upward direction, the support has a tensile (a pull) load on the bottom aluminum material and a compressive (push) load on the top material. If we glue carbon fibers to the top and bottom of the extrusion we can use their superior properties to add strength with very little weight increase.

We took a 2" wide by 48" long strip of the Twinn-K ultra-ply material and cut its width into three equal sized pieces. This gave us three pieces that were just a bit bigger than the 5/8" width of the sponson support. These strips were cut to match the overall length of each extrusion. Gap filling Hot Stuff Super T adhesive was used to bond two layers of the ultra-ply material to the top and two layers on the bottom surface of each sponson bracket. The aluminum was sanded to remove any oxidation and to supply a clean surface. The graphite sheet was laid on the work bench top. The glue was applied to the carbon fiber in the form of a single line down the center of the graphite sheet. One end of the aluminum extrusion was placed on the graphite sheet without touching the remaining surface. The extrusion was aligned with the graphite sheet and pressed down along the entire length. Another graphite layer was glued to the first. This procedure was repeated on the other surface of the extrusion. Now you have an aluminum extrusion with a .014" layer of graphite on the top and bottom surfaces. You can use an X-Acto knife to trim the edges and sandpaper to finish the job.

How much increase in strength did all this effort achieve? To find out, we took a stock extrusion and a carbon fiber reinforced one and clamped them to our work bench edge. We took the heaviest object we could find around the shop (our tool box) and hung it by a hook at a distance of 10" from the bench. The 23 pound tool box caused the aluminum extrusion to bend 1¼" downward. It amazed me that the bracket sprang back to its original position after unloading! I then tested the carbon fiber reinforced bracket. The resulting deflection was measured to be only 5/8". We had increased the bending strength by a factor of almost 2! Subsequent running tests (translated high speed crashes) have proven that the

brackets are now almost impossible to bend. This is only one example of how these new materials can make our models stronger without a big weight penalty. If anyone else out there has another application be sure to let us all know how you are using this great material.

★

Dear Mr. Power:

I am what you could call a "rookie" to model boating. For my first attempt at R/C boating I have purchased a Dumas Dragon Fly 40 Mark II hydro. I am now in the process of building the hull. The boat is going to be powered by an O.S. Max 40 SR marine engine. I want the boat to really fly and I would greatly appreciate any help you could give me on how to "build up" the engine. The engine is completely stock. Should I add a Perry pump carb or a Perry oscillating pump and a Perry carb? What about a Tarno carb? Is a Robart Super Pumper MK V any good? What is the timing for my engine? Can it be changed? If so, what should it be changed to for maximum performance? What type of pipe should be used to obtain the most performance? By the way, my engine has a side exhaust. What size fuel line should I use?

Now for the hardware. Should I use a Dumas hardware kit with a flex shaft or buy other brands of hardware? What prop would work best with the boat? Which is better for performance, a straight shaft or a flex shaft?

One last question. Would the addition of a fully adjustable spoiler (like they use on top fuel dragsters) located in the back of the boat be helpful in keeping the boat in the water? The spoiler will be made from balsa (if it will help). How wide should it be? How long? How thick? How high above the removable cowl should it be? I would really appreciate any information you could give me. I have been reading your articles for only a short time now and think you do a super job. Keep up the good work.

Yours truly,
Russ Hiser
Gahanna, Ohio

As a "rookie" I would not recommend that you try any hop-up on your engines. The O.S. 40 SR Marine will power your boat to racing speeds in its stock condition. If you do not know what you are doing, you will, in

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When writing to RCM, send an SASE for a prompt reply.

all probability, do more harm to your engine than help it. It is very important to get your boat set up with a stock engine and trim it so that it rides on the water properly. Almost 90% of boat performance is a result of a properly set up and adjusted hull. The carb on the O.S. is great so all you need to do is use tuned pipe pressure connected to the vent of your fuel tank. Don't change what the manufacturer knows will work unless you have utilized the stock engine to its fullest. I would recommend that you use either a Prather 7.5cc tuned pipe or the Steve Muck 7.5cc tuned pipe on your engine. Pipe length will depend on the fuel and propeller combination you choose. I would suggest that you try 25% to 40% nitro fuel. A good place to start would be with the pipe at a distance between the exhaust port and the maximum diameter of the pipe set at 10". An Octura 1460 propeller will work well with this set-up. The Dumas flex drive set-up is fine but you could substitute similar hardware made by Octura. Use the plans as a guide and don't make changes without experience. Try it the way the manufacturers suggests and then if you don't like it, experiment. We use medium size silicone fuel tubing on our 40 sized engines with good results. The fuel tubing should be small enough so that it doesn't easily slip off the carb nipple. Most fuel tubings have a large enough inside diameter to flow enough fuel even for 60 sized racing engines.

In my opinion, an adjustable spoiler is not practical on model boats. You can use an adjustable wing on the rear to help lift the rear end up and to obtain some stability. A spoiler is usually defined as a device that "spoils" lift and creates drag. Neither of these properties are helpful. The boat will stay in the water only if you control the running attitude. You cannot allow too much hull lift caused by running at too high an angle of attack. This is adjusted by the propeller strut depth and angle. Another difficulty is that the wing must be strong enough to sustain the loads caused by impact with water at high speeds. Sometime or another the boat will enter the water and cause destruction of the wing. Balsa is definitely not strong enough. I would not recommend the use of these devices on your hull.

Photo 3: The Hot Shot in action.

Dear Howard:

Although my first interest is R/C planes, I have read your column every month out of curiosity and for the valuable tips it contains on various engines and their operation. After visiting my father in Florida last winter and watching some boats run on the myriad of small lakes available there, I decided I needed one too. I wanted to get in on the fun while vacationing, even though the opportunities to run it here at home in Colorado are few and far between. I haven't been able to discover any experienced boating enthusiasts locally, so I'm writing to you with all the hypothetical questions that I've been able to dream up.

I'm building a Dumas U-1 scale hydro, mainly because I like its looks, since it'll be spending most of its time on static display. I got a good deal on an O.S. 46 VRM, which ought to make it go. I really like the design of the hex/ball universal on the O.S., compared to the standard pin/ball type. This got me to thinking about the vibration that might be created there in two ways. One, the torsional oscillation created by an angular misalignment of a Hookes-type (yoke/pin) universal, although this is probably insignificant when compared with the engine vibration, at least for reasonable shaft alignments. Two, the whirling vibration of the unsupported shaft between the shaft log through the boat bottom and the universal joint, which could be considerable if there is a resonance in the operating rev range. This could be eliminated in two ways, both of which, however, have disadvantages; One is that if the shaft were curved (i.e., inside a bent support tube), the resonant frequency could be increased far beyond the operating frequency (remember the thin, curved driveshaft of the original Pontiac Tempest?). This would mean increased friction in the support tube; or else the shaft could be clamped in the engine drive nut, giving a stiff, cantilever-type support there instead of the simple pin-type support of the universal, but this could lead to tolerance problems creating stress between the engine and the thrust bearing on the strut due to the shaft twist. The question: Is the whirling vibration of the unsupported shaft a potentially serious problem (I'd hate to tackle the calculations), and what is the best way to avoid it?

Next, the Dumas plans show the engine under the cowling in the cutaway view, but the photographs show a completed model with the engine clear up in the cockpit? Which leads to a question about the longitudinal C.G. location not shown on the plans; in what range should it be (my airplane experience probably makes me paranoid about this!), and should it be adjustable (via ballast) for different water conditions?

Lastly, I want the boat to be able to get up on plane by itself, as I don't like the idea of the thrown launch. I'm sure this will take just the right combination of prop selection and pipe tuning to match the engine torque band, but I'm prepared to do a lot of experimenting. In fact, I have an O.S. 46 VF engine also, and will try out the VF vs. VR port timing with both a tuned pipe and a Magic Muffler (and maybe a Martin carb, too!) on the bench first, of course, to try to get the best combination of midrange torque and throttle response while retaining a decent top end. But this leads me to wonder --- if hydros are meant to run with surfacing props (i.e., with only the lower half of the props in the water), then why not run the shaft out the stern. This appears to be the case with the deep vee hardware from Magic Boats, thereby totally eliminating the drag of the underwater shaft and strut, and more importantly, unloading the top half of the prop as soon as the boat starts moving, to help keep the engine from bogging down in the midrange?

Hope you can help me out of my puzzlement.

Sincerely yours,
Bob Moll
Pueblo, Colorado

P.S.: I expect you are going to get some flak over your comment in the November column about an increase of humidity requiring a leaning of the needle. Some might confuse the effect with that of using water injection to increase power on some large IC engines, not realizing that what's actually happening is that part of the atmospheric oxygen is being displaced by the inert water vapor.

You are right to be worried about vibration caused by drive line rotation. If your drive shaft is improperly set up you can lose lots of power vibrating the hull. In the worst case you can actually destroy the bottom of your hull when your shaft is driven to its resonant frequency. At resonance, a solid shaft starts whipping and severe damage can occur. You can increase the resonant frequency of a solid shaft drive system by supporting it with bearings along its length. This increase in resonant frequency means that you can drive

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the shaft to higher rpm without whipping. This technique also decreases vibration. If you space your bearings at no more than 5" intervals you will not have resonant vibration troubles until you reach over 30,000 rpm. Remember also that each of your U-joints is effectively a clamped restraint of the shaft. Their position with respect to the stuffing box bearings is also important. If you really want all the details you can look up any engineering text on forced vibrations. To go through the complete theory here would be out of the question due to space limitations.

The simplest way around these problems is not to use a solid shaft. The bearing supported solid shaft has an advantage in that it is a very free rotating system. Shaft drag is minimal. This system does, however, waste engine power because of vibration development. Boaters have successfully used the flexible cable drive system for over 10 years. The system theoretically has a higher rotating friction but the flexibility in the shaft and its support system (the brass stuffing tube) virtually eliminates vibration problems if properly installed. You don't even have to use Locktite on the drive line set screws like you must do when using the solid system. The cable system is "soft" and doesn't transmit vibrational forces as directly as the solid shaft system.

When installing either system be sure that the drive shaft and engine crankshaft are aligned perfectly. Don't use your U-joint or cable nut to turn a corner between these two drive elements. Any misalignment here causes vibration and drag which will reduce the speed of your boat. I have not been able to prove to myself that the solid system is any better than a properly installed flex drive system. When you compare similar boats with each of these drive systems, the speed is the same. The flex drive system is the simplest system to install and to maintain. I recommend it highly.

The longitudinal Center of Gravity location (fore and aft location) for a boat is not nearly as critical as that for an airplane. An aircraft is supported only by its lifting surfaces that are completely submerged in the air fluid medium. To achieve stability, there is a fine balance of wing and tail forces with respect to the aircraft Center of Gravity. Our boats are supported on the water surface by buoyancy and by planing forces that are equal to or smaller than the weight of the boat. Some hulls also have aerodynamic forces that support a portion of the weight at speed. These aerodynamic forces are controlled by the running attitude of the hull and must be

smaller than the weight of the boat or else it will become an airplane.

Hydroplanes are usually supported primarily by their front planing surfaces and by propeller lift. Stability is insured as long as these elements are in contact with the water. If the Center of Gravity is in front of the propeller, the weight of the boat tends to return it to its original planing position on the water after it is disturbed. It takes large amounts of weight (ballast) to move a boat's Center of Gravity very far forward or backward. If you move the C.G. forward, the front sponsons must create more lift and there will be less weight on the propeller. A good rule of thumb that you can use is that a hydro's Center of Gravity should be behind the front sponson rear edge at a distance of about 1/4 to 1/3 of the distance from the rear edge of the front sponson to the transom. If you get the balance too far aft, the prop load is too great and the boat will drop its stern excessively while turning.

My advice is to build the Dumas boat as shown on the plans. The Center of Gravity location will come out very close to the best position if you use normal radio gear and the recommended engine. I would not recommend adjusting the balance point of most hydros for different water conditions. Their three point suspension gives them sufficient stability in rough water if trimmed properly. If you load up the front of the hydro with weight you will move the Center of Gravity forward for more stability but the prop load may become too light and a spin-out can result when turning. It might be more desirable to add weight at the Center of Gravity to increase boat weight. Increased weight will load the front sponsons higher and the boat will sit more firmly on the water. Increased weight will also slow down the boat's reaction to disturbances.

There is no reason for you to have to throw a hydro to launch it. If this is the only way your boat will work then you have the wrong prop on it or your strut angle and depth are improper. The biggest mistake most people make is to use a propeller that is too large. If you have to throw the boat hard to keep the motor running you should either lengthen your pipe, use more nitro in your fuel, or go to a smaller size propeller. If your propeller seems to slip and cavitate at low forward speeds, you should try another type or series of props. We have had great success using the Octura X series propellers on Sport 40 and Scale hydros. I would recommend that you try a X450 or X452 prop on your boat. These props usually show no tendency to cavitate upon launch and are small enough to allow you to leave the beach easily without a thrown launch.

If you run the propeller shaft out of the stern of a hydro, the rear of the boat will sit down on the water creating drag at this location. In addition the hull will be at a positive angle of attack with respect to the water. As speed builds up this creates too much lift and the hull will fly off backward. The hydro, therefore, should be set up so that its hull attitude is level or even a bit nose down when the boat is running. Since propeller lift tends to make the prop run with only one blade in the water, the propeller shaft location must be approximately at the same level as the sponson bottoms. The strut is, therefore, mounted so that the prop shaft is below the transom. Strut angle is used to make small adjustments of rear end lift. Tilting the strut to a higher angle increases lift at the rear since a component of prop thrust is in the upward direction. Leveling the strut angle reduces lift at the rear of the boat. Strut angle allows us to control the riding attitude of the hydro if it is adjustable. A hydro set up this way lifts its rear end clear of the water with only part of the strut hub and one prop blade in the water. The drive line and strut blade are completely out of the water and do not contribute to the underwater drag. This has proven to be the most efficient way to set up a hydro for maximum speed.

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. Phone (408) 394-1200. □

SOARING

Al Doig

Last month we visited Airtronics; this month let's see what Kraft is up to. Kraft is located in the north of San Diego County in the city of Vista so it was only a 75 mile drive from the Airtronics facility, located in Irvine to the north.

My last visit to Kraft was in December of 1981 and was in response to persistent rumors that Kraft was about to close its doors. During my 1981 visit I met with Kraft President, Arthur Leighton. Art was understandably upset with all the rumors of Kraft's demise. He explained that it apparently all started with a shift in sales policy, from distributors to dealer-direct sales. Kraft began to sell directly to hobby shops, eliminating the so called "middleman." When distributors were eliminated, Kraft took back all distributors' inventories. This created a large inventory and Kraft suspended production. Most of the production workers were furloughed, giving rise to the rumors that Kraft was folding. At the end of 1981 Kraft was building only the top of the line KP-7C and Signature Systems. The less expensive K-Line Series was imported from Japan. R/C system production was very low and most of the production facility was devoted to building computer "joysticks" for the newly emerged small computer systems.

The Kraft facility occupies 50,000 sq. ft. in three buildings. One houses the offices; management, sales staff, accounting, etc. Another is the manufacturing facility. The third contains die-casting, parts warehouse, finished goods stores, and shipping.

Since my last visit, two years ago, several significant changes have been instituted.

First: Kraft will manufacture no

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Kraft Systems' facilities — Vista, California.

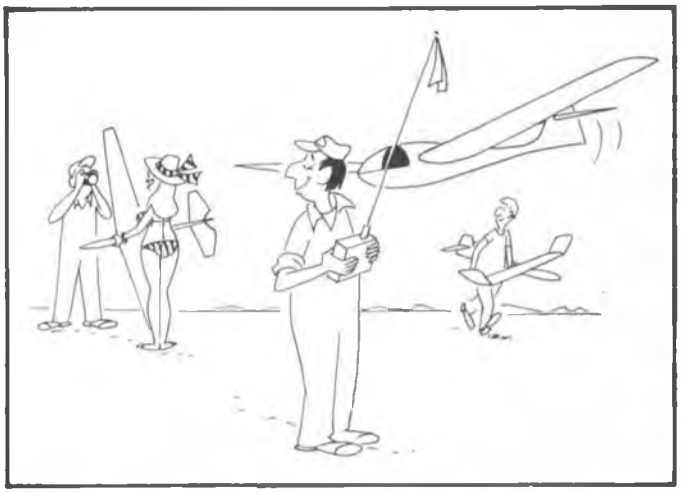
Plastic injection molding — Kraft.

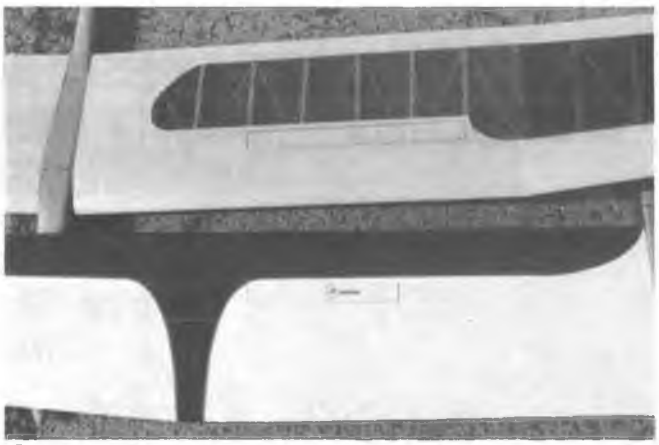
Computer joystick assembly — Kraft.

Finished goods storage — Kraft.

Servo repair and refurbishing — Kraft.

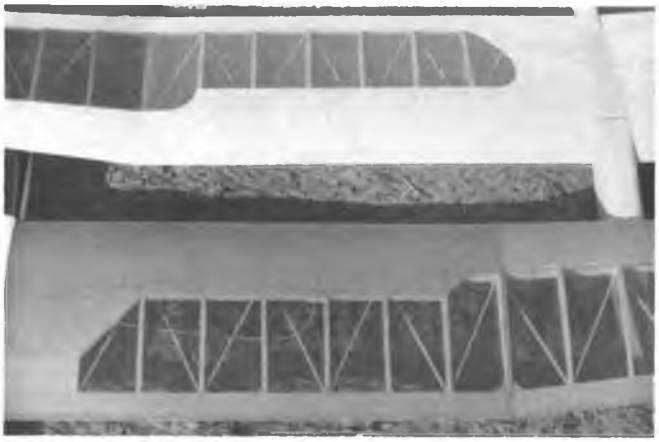
Screen room repair station — Kraft.





Sagitta spoiler mod — shortened 1 bay inbd. — compared with stock spoiler above. Jim Leuken photo.

Sagitta spoiler mod — shortened 1 bay but centered — compared with stock spoiler above. Jim Leuken photo.



Sagitta spoiler mod — same place and length but narrowed 1/8" — compared with stock spoiler above. Jim Leuken photo.

more R/C systems in the U.S. They are phasing out the manufacture of the KP-7C and Signature Systems and all radios will be imported from Kondo, in Japan. Kraft President, Art Leighton, said he regrets this move but the volume of only top of the line radios made it impossible to be competitive.

Second: A separate company has been formed to handle service. The service facility has been moved from the Vista factory to a facility in Oceanside, California. This facility, as well as some 60 Factory Authorized Service Centers worldwide, report to Kraft's Jack Albrecht. Jack is a long time R/C flier and a member of the AMA Frequency Committee since 1974.

Third: Kraft has apparently beaten competition to the punch by announcing a new narrow-band FM radio with frequency synthesis which is switchable to any one of 49 frequencies. This announcement is a departure from the past policy of Kraft that I know. Kraft has always been "tail end Charlie" on new features, taking a conservative "wait and see" approach. To announce a product

A study in sheer amazement. Steve Manganelli seems astounded at Fred Stahlheber's launch. North County Clouds field, San Marcos, California. Jim Leuken photo.

before they have it in the warehouse is a new bold approach. It's one of those situations where if the product is right you've got a big jump on competition; if not, you're a sitting duck.

Kraft also distributes a line of kits; the Windsurfer 100, Windsurfer 2-Meter, and the little Tercel, designed for R/C hand launch fun. They also distribute five power kits and a set of floats. In addition, Kraft makes a comprehensive line of accessories, fuel tanks, motor mounts, clevises, etc. For a complete list, write for their catalog.

I've heard some concern expressed that Kraft has leap frogged the AMA phase-in plan by releasing a product capable of transmitting on frequencies not yet authorized by the AMA plan. Kraft has listed authorized frequencies on both receiver and transmitter with warnings not to use other frequencies until authorized by the plan. I'm sure there will be people who don't quite get the word and will cause problems. It's like a gun manufacturer; he can either make a gun that doesn't shoot or he can tell the purchaser to make sure it's not loaded, and don't point it at another person; it's then up to the purchaser to use it safely.

Anyway — Kraft looks alive and well and we will follow the progress of the new system. It will sure relieve the situation where everyone shows up at the field on the same frequency.

★

One thing that seems to be universally agreed is that the spoiler system on the Sagitta 900 needs modification. When deployed on landing, turbulence over the stabilizer degrades pitch control and the spoilers

are overly effective. Jim Leuken, president of the North County Clouds (San Diego County), sent some pictures of modifications he and others in the club have made; some more effective than others. In any event, they should be moved outboard on the wing and shortened. This will decrease the change in pitch when they are deployed and tame them down a bit. This change was also noted by Cal Posthuma of the GVRC club in Michigan. Cal says to move the spoilers out one bay and cut them down one bay.

Another change that Jim Leuken advises is to install a positive spoiler control. The "string and weight" caper is simple but it's disconcerting to see the spoilers raise on launch. Jim uses Sullivan cable pushrods. He installs them in a gentle arc to directly drive the spoiler horns. The spoiler servo is installed at the wing root under the access hatch. The cables are terminated with Du-Bro ball links which are easily snapped on and off for wing removal. They are also very nicely adjusted for tight spoiler fit.

★

I received a very interesting letter from Michael Perez who lives in Volcano, Hawaii. I'm sure others are doing it but this is the first volcano soaring site I've heard of. Let me quote from Michael's letter:

. . . I slope soar in an active volcano known as Kilauea Iki Crater. The cliff is about 600 feet straight up from the floor and has pockets in the face releasing steam. When you toss a glider it goes in about 15 feet then straight up about 60 feet to 100 feet. Then you can soar back and forth or continue up and clear out of sight! The crater is about 4 miles across and 5 or 6 miles wide. The floor is all black hard lava so you know what happens when it soaks up sun all day --- yup, you can fly away from the cliff into the crater and find lift almost anywhere. There is one hitch, the wind must be a south or southeast wind for the cliff to work; if not you go down like a rock. You can retrieve it off the floor, but it is a 4 mile walk. I know because a friend lost one and I got it back for him. But, since the crater is round, you can always drive the rim road to the other side and slope soar there or wherever the wind is on the face. But none of the cliffs are as good as the 600 feet steamer.

Anyone coming to Hawaii for a vacation ***bring your glider*** *and try it. I live only 5 minutes from the crater and would be happy to show you the spots. The winds are from the south during the winter months which is when the big cliff is at its best! Feel free to call me if anyone plans a vacation to*

Mike Perez's slope site — Kileuea Volcano. Halemaumau firepit in foreground — legendary home of Madame Pele, the Hawaiian Goddess of Fire. Mike's slope is in upper left hand part of picture — Bud Thuener photo.

Volcano slop site, Hawaii. You can wrap your lunch in foil and lower it into the vents to cook. When you finish flying, lunch is ready. Mike Perez photo.

Hawaii. Aloha — Mike. P.O. Box 614, Volcano, Hawaii 96785; (808) 967-7194.

Boy, if that sucker blows it would create one stump lifter. Sounds like fun so everyone bring your gliders and fly up a volcano. Me? I'm going to the beach and watch the girls.

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

Launching at volcano slope site — Hawaii. Mike Perez photos.

GIVE IT A WHIRL

John Gorham

Kiss And Saal
And Puyallup

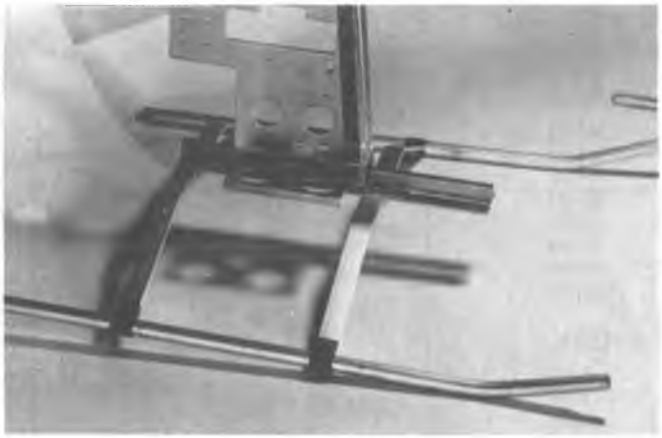
Last month we discussed the new Futaba PCM helicopter radio and we still have a way to go to complete the description of this fine equipment. Since writing the last column a couple of things have happened. One has been, of course, the advent of the many trade shows which start off the year and which have necessarily taken a lot of my time, and the other is that I have not been able to obtain all the information I require to finish off our description of the new Futaba system. So, I promise you, we'll do this as fast as we can in a later column.

Kiss And Saal

During 1977/78, new R/C helicopters such as the "Heli-Boy" began to be available. These new machines had a much higher performance capability than the ones we were used to and, hence, had the potential of encouraging many more people to learn to fly. However, despite their much improved performance, these new helicopters were quite large and complex and, hence, were sometimes intimidating to the would-be fliers. I began to be convinced that we still needed a small, simple and inexpensive chopper if R/C heli flying was to really take hold. So, believe it or not, nearly a whole year was spent in the concept and design phase pondering upon such a chopper. Since the configuration of the engine to rotor drive train influences the rest of the design, this was considered first. After much deliberation on various methods, I always returned to the simple mechanical system which was then used in the English "Lark" R/C helicopter. It offered the simplest, lightest arrangement of them all and was finally the one that I adopted.

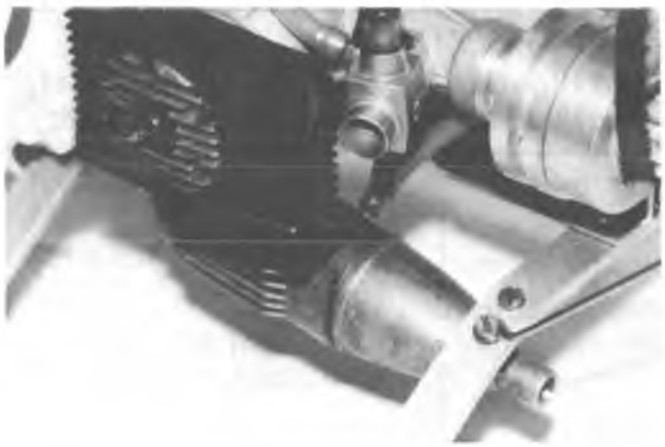
I have been an aircraft systems designer for many years and, like many engineers, I have become convinced over the years that the best and most successful designs are usually the simplest ones. However, the simplest designs always take the most thought and effort if they are to finally result in a productionable and marketable item. There is also one other factor which is important in the design of an aircraft, especially, and

Single main frame — the heart of Cricket.



The whole framework.

Simple mechanical arrangement of drive train.



Heat sink cooling.

Simple fixed pitch rotor head.

this is — keep it light — do not add any unnecessary weight. So to produce a product which must fly successfully it is important to be sure to design to basic KISS and SAAL principles.

KISS, as many of you know, means "Keep It Simple, Stupid!" and is a well-known principle used by many engineers. SAAL is more familiar to aircraft engineers and designers but it stands for "Simplificate And Add Lightness." While working upon the concept of our new small helicopter, I followed very closely these two principles and that is why it took so long in the conception and design stage. Actually, because we had resolved so many details during the study and design work, the first prototype took only a few days to build. Working up the concept and turning this into a productionable design (at the right cost!) took so much longer.

As an engineer I also have been trained not to be hypnotized by current designs and follow them "blindly." So, as it has been my practice, I started off from first principles while keeping an eye on the design methods my peers had been using. Cooling of the engine, for instance, was done in current designs by fitting a cooling "fan" on the engine shaft, which then rotated within a plastic chamber. The resulting "forced" air flow is then "blown" or passed over the engine cylinder head, hence, cools it rapidly. This offsets the effect of the generated heat by our hard working engine and keeps the temperature down to a reasonable level. A very sound idea. However, using this technique takes power away from the engine but, more important, a cooling fan system also adds weight and complexity and, hence, challenges our KISS and SAAL principles. The loss of power due to the aerodynamic drag of the cooling fan system is equivalent to adding weight to our 'chopper. Not inconsiderable, too, since with my new little helicopter the power used up by the cooling fan system was equivalent to about 8 ounces of helicopter weight (10-12% power loss in a helicopter weighing around 64 ounces). And then the complexity of installing the fan and the cooling shroud on the helicopter designs at that time had caused problems for some beginners. If not fitted properly, the cooling fan system could be worse than any system at all. The power loss would still exist but the cooling effect could become very small.

Various ideas concerning the mounting of the engine were also passing through my mind with the KISS and SAAL objectives — to try and reduce the number of parts in the helicopter so that the beginner would

have the best chance of success. Most helicopters at that time used two main metal side frames and, of course, all of the relevant nuts, bolts, etc., to hold the mechanism, landing gear, tail boom, and engine. After much thought I finally finished up with one very small, simple main frame and mounted the engine on sturdy aluminum blocks so as to form an efficient thermal "bridge" to the main frame and the other attached parts. I calculated that the heat generated by the engine when running would be absorbed into the thick metal frame and then dissipated by radiation and convection of air over the frame and the other metal parts which were attached to it. I then decided that if the engine was mounted sideways so that the cylinder head was in the air flow, we could increase the cooling surface of the cylinder head just like the car guys do. Hence, the heat sink. Now a heat sink adds an additional 3 ounces to our helicopter but the net weight saving was still at least 7 ounces and, in addition, we now had a much simpler helicopter for the beginner to build and fly. It's hard to mess up a heat sink installation! Of course, the engine could still overheat if it was run too lean or not bench run-in before installing, but, then, so could it when fitted with a cooling fan and chamber, as any helicopter flier can attest to.

Please note that the foregoing argument does not criticize the use of cooling fan systems, in general, since if the helicopter engine is in any way buried within the main frames or the fuselage, there really is no other choice but to fit a system which will force cool the engine. Many of my other helicopters use this technique. With my new little helicopter, however, since this was not needed I didn't do it.

I also made a very conscious decision to stay with fixed pitch since, if you'll look at any typical R/C helicopter design, the difference in

complexity is quite considerable between a collective pitch helicopter and a fixed pitch one. "Collective" pitch is when the pitch angle of both main rotor blades is changed at the same time to produce an instant lift change. This results in a faster vertical response than we obtain when we speed up the main rotor system of a fixed pitch helicopter by adding engine power. I did not overlook the fact that to offset the simplicity gained by using fixed pitch the vertical acceleration of my helicopter would now be inherently less. Calculations showed, however, that if I could keep the power/weight ratio (SAAL again) high and the weight of the blades and rotor system low, then the main rotor system could accelerate faster because of a lower rotational inertia. We could achieve, perhaps not quite so fast a vertical performance, but one which would certainly be very adequate. Consequently, I could retain the simplicity which I was striving for. Overall, we could have a slightly less responsive helicopter in vertical performance but we would gain the benefits of a much simpler and lighter helicopter for the beginner to "get his teeth into." After investigating the different woods available for the main rotor blades I discovered one which had not been used before on model helicopters. This new wood was called "Gelutong" and provided us with a stable, very lightweight rotor blade material. Using this light material allowed the fast speed-up that we needed because our rotor blade system now had a very low inertial value.

Finally, we had to name our new heli and you've guessed it — we called it "Cricket." The fact that these principles have worked well, I think, are clearly demonstrated by the fact that the 10,000th "Cricket" will roll out of the factory within the next few months and I cannot think of any country in which "Cricket" is not flying. "Cricket" has been the subject of some recently published criticism in several model magazines concerning its design concepts which, I feel, has been biased, distorted and certainly unwarranted. Any engineering design can be readily criticized by taking parts or features of its design in isolation and comparing them with parts or features of other equipment. The concept behind "Cricket" was a **total** one and, at the time of its introduction, provided a much needed factor in the growth of R/C helicopter flying. I believe that "Cricket" contributed considerably to that growth and still does. The steady sales levels of "Cricket" prove this. The object of the foregoing is not to try and impress readers that "Cricket" is great or perfect, because it isn't. The object is to explain that considerable deep and, I believe, realistic, engineering effort went into its design as I'm sure goes into the design of most of the helicopters available. The fact that "Cricket" is loved and flown by many thousands of people all over the world has shown that the total concept behind the design was sound — and still is.

I do not ever intend to criticize another designer's helicopter in print nor will I probably ever again discuss the merits of one of my own in this column. The criticisms which have been directed at one of my designs, however, have been so pointed and hurtful that I decided, with the editor permitting, I would at least take this one opportunity to give the designer's rebuttal to the criticisms. "Cricket" has its shortcomings but it also has many good points. It has brought pleasure to many people and, I realize, irritation to some. For the latter I'm sorry and for the others I'm very glad to have been able to help them have a little additional fun out of life and to try out this great sport of ours, R/C helicopter flying.

To reinforce the foregoing I'd like you to share with me the following letter which is one of many that I receive every day concerning "Cricket."

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This looks like the "King Kong" movie all over again.

American R/C booth with John Simone Sr., George Broker and Curtis Broker presiding.

The GMP booth before the crowd arrived.

Tom Schoonard at Miniature Aircraft Supply booth.

Dear Friends at GMP,

I have just returned from my fifth trip to the flying field (deserted parking lot) with my Cricket.

I felt I had to let you know how happy I am with your fine product.

I have been flying fixed wing R/C for about 5 years (sport pattern).

I have always been interested in helicopters, but was not sure I could fly one. After reading a great deal and talking to everyone I could, I decided to try so I bought a Cricket kit, an OS 28 FSR-H and Kraft gyro from Riders Hobby Shop in Kalamazoo, Michigan. Riders also has a store in Lansing, Michigan, with an expert flier named Ray Hanchett who was also very helpful in set-up and checking out my new Cricket. As we have no expert in Kalamazoo, these people as well as Heli-Center East were a great deal of help. Thanks to them, my Cricket has all the latest mods. I use a Futaba 7 GK radio.

I started learning by using your one stick method. When I felt comfortable with this I started adding some forward cyclic. The other day I got brave and got airborne for just a moment. I was surprised to find the 'copter seemed smoother in the air than on the ground.

Soon I found I could go up and down without breaking anything and was starting to see real progress.

Now back to today. With calm winds and 4 hours of engine-on stick time I decided to try for 2 feet high and 5-10 second short hops.

At first things were a little squirrely. Tail left, nose left, Cricket here, Cricket there. But soon the winds calmed down and so did I. The Cricket couldn't have been better. The fourth flight was the best and the last. The lift-off was smooth and almost straight up to 3 feet. A little forward, a little backward, back and forth. But close to a hover and about 30 to 40 seconds long. The next lift-off involved a little luck and a lot of fun. As Cricket started to drift slowly left, I allowed it to continue as there was now ***no wind*** *and followed it around to complete a 360 degree nose out circuit around myself ending with a soft landing (WOW!).*

Very excited at this point, I thought I should quit but I was having too much ***fun.***

I accidentally and unknowingly bumped the tail trim lever to the right.

Next lift-off right turn correct — over correct. Things getting very squirrely. I think I better set it down.

Oops --- a little hard. Tail strikes ground. Result --- cracked tail blade. End of flying for today.

Score to date:

Five hours engine run time; 30-35 short hops; 2 short if lucky 30-40 second hovers?; one very happy student R/C heli-pilot; one broken tail blade.

Not too bad if I do say so myself. But I owe it to a lot of people. And I would

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RADIO SPECTRUM

Jim Oddino

I am writing this in February and the good news is that it is going to be 85°F in Southern California today. The bad news is I'm on my way to Georgia, where the temperature is 23°F. Yes, our weather has been great in January and February (so far) this year, with the net result of making it very tempting to take off work to go flying. That is what I did last Tuesday and I have to admit I came home more enthused about pattern flying than I have been in the last ten years.

I'm not sure where to start the story. I made a lot of re-discoveries that were the result of a lot of things coming together. I have to give some credit to Wayne Sakamoto who had been test flying his new Super Scepter. I might mention that this is a new design by Rusty Van Barron that looks like it ought to make a great turnaround airplane. I had been thinking about a new plane and I had planned to use Jim Kimbro's Deception wing and stab. That is what Rusty did, only he increased the size to a span of 70 inches with an area of over 800 square inches. I flew the plane on one of its early flights and it felt great right away. One of the characteristics of the Deception that has always impressed me was its ability to pull square corners. Kimbro and Dave Wilson always excel at square loops with half rolls and square horizontal eights. If you look at the turnaround pattern I think you'll agree the emphasis is off of the rolling maneuvers and on the square corners. Anyway, Wayne's plane had one slight fault which was the common problem of pulling towards the canopy when flying knife edge with the left wing down. After trying the usual trimming techniques of drooping both ailerons, etc., with no effect, Wayne called and asked if we could modify his transmitter to put in some cross-coupling so that when he hit right rudder he would get some down elevator. He flies a Futaba J which has end point adjustments, so I said sure if you can get the schematics and board layouts. I had really never been inside a J series before. In about an hour we had added a pot and resistor and he was on his way. By the way, we adjusted it so that the elevator barely moved. The flying results showed that it was still too much and after the final adjustment you have to feel the movement because it is so little you can hardly see it. What someone needs to build is a protractor and pointer that can be clamped to wing or stab and control surfaces for measuring the deflections similar to the servo testers.

The bottom line is that Wayne is happy with the plane and I went over to R & L Performance Products, 20115 Nordoff St., Chatsworth, California 91311, who plan to kit it, and picked up a wing and stab kit so I could get started. Richard Verrano of R & L showed me the first fiberglass fuselage which I have to admit looked better than Wayne's balsa job.

The next thing I did was to program my new Futaba PCM system so that my rudder coupled to my elevator in my good old Curare which is now a radio test bed. With the PCM you don't have to get inside. You simply put jumper plugs in the master channel (rudder) and slave channel (elevator), throw the programming switches, hold the rudder stick hard over and adjust for the direction and amount of elevator travel you want. In my case I, too, wanted down with right rudder but I also needed a little up with left rudder. End of part one of our story.

Years ago (in the May 1981 issue) I published a circuit for what I called an Automatic Rate Changer. The idea was to eliminate the need for rate switches. You would essentially be flying in low rate all of the time until you needed high rate for a roll or square corner. I remember how great it was doing Cuban eights and maneuvers where you wanted low sensitivity during most of the maneuver but still wanted a quick roll in the middle. Well, the PCM has what Futaba calls Variable Trace Ratio (VTR) which is exactly the same function as my Automatic Rate Changer. I wasn't sure how it would work so I set up the three position aileron rate switch to give me VTR in position 0, low rate in Position 1, and high rate in Position 2. I haven't tried it on elevator yet because I had high and low rates set the same and wasn't using elevator rate. However, I plan to put the VTR in effect on elevator also. End of part two.

Last month, I believe I mentioned that I was planning to couple my strip ailerons to the elevator, control-line fashion. The theory was to pull square corners better and maybe even allow the airplane to fly at a lower angle of attack by providing some undercamber in both normal and inverted flight. Well, I spent a lot of time getting two servos plugged into two channels (ailerons and flaps) to track the elevator channel. I felt this was very critical because obviously you don't want to induce roll when you command pitch. Right?

Okay, out to the field. After some adjustments the rudder coupling into elevator is about right and not only are knife edge and four points easier to do, but slow rolls and even stall turns are better. Now the plane doesn't pitch when I put in a rudder correction while climbing vertically. It does want to roll towards inverted slightly on the left wing low knife edge so I need to couple in a little right aileron with right rudder. Unfortunately, you can only program one master and one slave in the PCM so I'm going to have to get inside to accomplish that trick.

So re-discovery number one: The idea of cross coupling rudder into the pitch and roll channels really works and can fix a not so good airplane. See the article in the July 1983 issue of RCM on the Keet. If you were like me and said here is a good idea and then did nothing, get with it. I predict it will become commonplace. Later in this column we'll show you a simpler, not so elegant way of doing the same thing if you have a JR Unlimited or Futaba J series transmitter. I'm sure it can be adapted to other transmitters that have end point adjustments but I don't have schematics for any others.

What about the VTR? Well, I haven't touched the rate switches since setting up the VTR and that really helps in the turnaround pattern 'cause you are really busy. It doesn't give you a mushy feeling around neutral like exponential because it is just like your normal low rate. It is difficult to explain how much more predictable the airplane stops rolling in a Cuban eight or in a square loop with half rolls. I guess it figures because you are in low rate as you approach leveling out.

The bottom line is that I believe you can eliminate rate switches, at least in the turnaround pattern and once again I will predict VTR or Automatic Rate Changers will become standard equipment. Re-discovery number two.

Well, this is going so good I suspect you think the flap idea worked as predicted, too. The only two places where I could really feel the effects of the flaps were in landings which were improved and spins which I couldn't do with the flaps coupled. My Curare has a very sharp leading edge and pretty thin wing and never did land well, so the flaps helped. In the spins I suspect the wing wouldn't stall but I'm sure I could use more elevator throw because the spins are marginal without the coupled flaps. If I try to take the ailerons out after the spin starts it will stop spinning. As far as the square corners I didn't feel that I could tell much difference. Perhaps the chord of the ailerons is insufficient and then, too, it may be that when we slow these birds down a little more, the flaps will be what makes the difference. For now I wouldn't recommend that you go to all the trouble. However, the fact that I tried this set-up provided me with one of the most logical discoveries of all.

Picture the situation. I'm out there testing the airplane performance in square corners, both upright and inverted at fast and low speeds (horizontal and vertical). What I re-discover is that my old Curare never was worth a damn when pushing down elevator. It always did roll and it still does. In fact, it never would fly level inverted if the ailerons were trimmed for upright flight, and I had to do a lot of correcting particularly when going from inverted to vertical as on the bottom of an inverted top hat. I had always blamed this on a crooked fuselage but I suspect all airplanes have this problem to some degree because of torque, P-factor and gyroscopic procession. (The aiplane wants to roll left when pushing down elevator.) Well, it occurred to me, with the two servo, two channel set-up I could induce a roll moment by decreasing the amount of "up flap" on the left aileron when I push down elevator. So I open the panel on the PCM, switch to ATV (Adjustable Travel Volume), switch to channel 6 (flaps — the channel controlling the servo in the left wing), hold full down elevator and decrement the travel about six steps. You need a PCM instruction manual to understand this. Anyway, I take off, roll inverted, push down and what do you know, I went too far and the plane rolls right. But am I happy. Three steps on the increment button before the next flight and she is perfect. This airplane is now so much fun to fly I don't want to go home. I may even have to go back on my word to never fly it in a contest again. If I had this set-up when I flew it at the Celina, Ohio Masters I would have been dangerous.

Now, let's think about this. First of all you don't need to have coupled flaps to achieve what I did. I could have accomplished the same thing by programming the master and slave mixing so that channel 2 (elevator) drove channel 1 (aileron) only on down elevator command. Unfortunately, the PCM allows only one master and one slave and I was using that for knife edge (rudder coupling into elevator). What you would like, is to be able to couple any channel into any other or more than one other channel, and be able to control in which direction and how far the slave channels drive. You could use a Super Keet type circuit to do this but in as much as we are committing a transmitter to one particular airplane there is a simpler solution. Before I show you how to do this there are a couple more things I'd like to discuss. I was having a lot of difficulty getting a good snap roll whether inside or out using the joy sticks. I was skeptical of using the snap "button" (actually a momentary toggle switch) on the PCM because there was no adjustments. However, it works great just the way it is. It would be better if it were timed (I think it is a dumb rule to outlaw things that make airplanes do maneuvers better) but it is acceptable the way it is even though the throws aren't adjustable like they are on the JR Unlimited.

Just so I don't sound like I'm on the Futaba factory team (I don't think they have one) I would like to mention one complaint. There is no roll button. I haven't been without a roll button since I can remember and if you haven't tried to do two rolls in opposite directions from inverted you can't appreciate how tough it is for a guy who is accustomed to doing rolls with a button. I have added a center off-momentary in both direction toggle switch. I still haven't mastered the maneuver, but the switch will help a bunch. It gives you the same advantage as the Mode I flier. You can essentially hold a fixed roll rate (pre-set with the button) while feeding in elevator corrections with the stick. Of course, you can set the throw different for left and right if your plane doesn't respond the same in both directions. Another problem with the PCM is the lack of flexibility as far as adding switches or moving them. Most of the switches are soldered to PC boards so you can't make changes simply. I had a hard time getting the roll switch in and it is not in a very handy position human factor-wise.

Okay, what I am going to show you now is a poor man's way of coupling any channel to any other. In fact, you can go both ways. You can have rudder couple into elevator for knife edge flight and elevator couple into rudder to counter P-factor. The idea is to get pure roll, yaw or pitch out of the total R/C airplane system not out of just the R/C system. So the R/C system is set up to yield equal and opposite cross-coupling to that of the airplane. We're going to put Don Lowe out of work yet. Not really. There is always room for better airplane design but hopefully with all the electronic cross-coupling we'll never have to take Wolfgang Matt's famous advice and "discard the airplane" if it doesn't respond to the normal aircraft trimming.

First of all this scheme assumes you know the polarity of cross-coupling you want. That is you know that you want down elevator with right rudder for instance. You might also want down elevator with left rudder and you can do this but you need to know ahead of time which means you must fly the plane first. Someday maybe we'll have a Kalman filter in the plane along with a simulation of how it is supposed to fly and it will teach itself how to respond. Not so far out as you might think, but no need to start proposing rules to outlaw it. I still wish everyone would read the objective of R/C competition. It is to do beautiful maneuvers not to test only the pilot's ability to push sticks. But I've said that before.

The second assumption is that you have a transmitter with end point adjustment such as the Futaba J series or JR Unlimited series. In them you will find circuits that isolate the voltages developed from right vs. left and up vs. down commands. A typical circuit in the JR looks like Fig. 1, with Fig. 2 representing the Futaba. The points in these circuits that you must connect to are designated in the figures. The points marked (A) will be one polarity with (B) being the opposite. That is: The voltage on point (A) will vary when you move the stick one way and the voltage on (B) will change when the stick is moved in the other. Down stream in each channel in the JR you will find two OP amps. If you feed a given polarity into the first you will drive the output one direction. If your slave servo moves in the wrong direction, feed the input into the other OP amp. The inputs are marked with a (C) and (D). The inputs in the Futaba are also marked (C) and (D). All we need to do is connect a series resistor and POT from point (A) or (B) in the master channel into either (C) or (D) in the slave channel and every channel can be master or slave or both. The block diagram of Fig. 3 might help visualize what we are doing. This is just an example, you may want a different combination. Unfortunately, even if you had board layouts it is really not an easy task to make these mods so I don't recommend you try it unless you really know what you are doing.

The important thing to know is that it can be done and can make your flying a lot better and therefore more fun. No one likes to fly poorly. I recommend you find a local expert or radio service center that is willing to take this on. I might even consider doing some custom work but I warn you I'm expensive. Maybe someday someone will build these features into their systems so you don't have to pay for custom work. However, no one will ever build a system that will satisfy everyone so don't hold your breath.

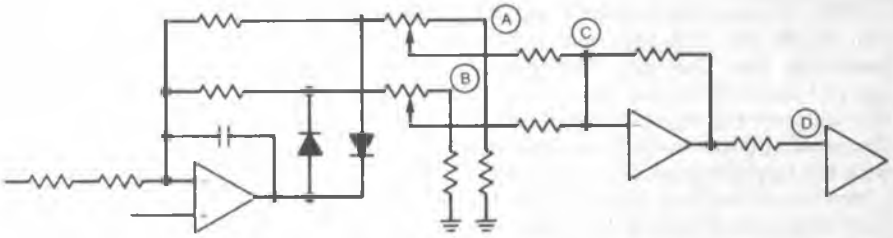


FIGURE 1
(JR UNLIMITED SERIES)

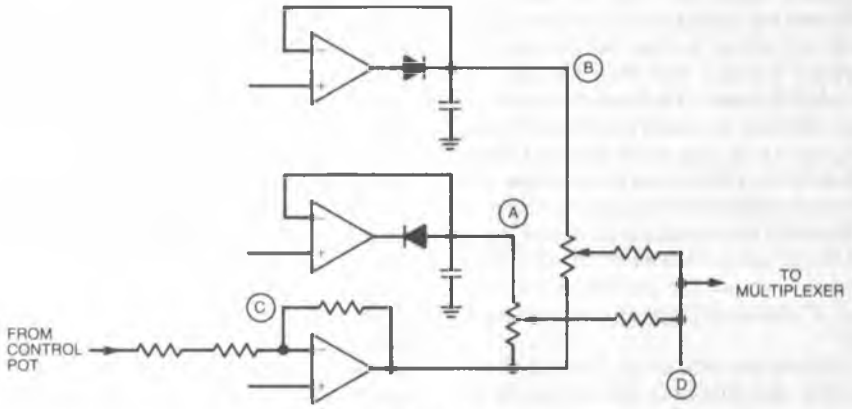
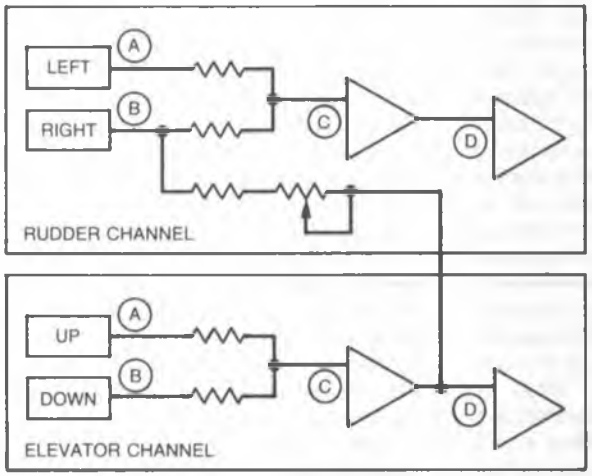


FIGURE 2
(FUTABA J SERIES)



EXAMPLE:
RIGHT RUDDER AND ONLY RIGHT RUDDER DRIVES ELEVATOR DOWN. (DEPENDS ON SERVO REV. SWITCH POSITIONS)
LARGE VALUE RESISTOR AND POT COMBINATIONS WILL GIVE FINE ADJUSTMENT. START WITH VALUES OF APPROXIMATELY 500K.

FIGURE 3

This column is getting a little long this month but the following letter suggests something so close to what we've been talking about I thought I would add it. I don't think it should be called a mixer (vs. a coupler) but we won't argue the point now.

From the Eastern Iowa Soaring Society Newsletter.

Flap/Elevator Mixer for Kraft KPT-7C Transmitter, by Terry Edmonds

The Kraft 7 channel transmitter is one of the finest units available. Unfortunately, it does not come standard with some "bells and whistles" desired for specialized sailplanes. Kraft does have circuits for some functions that they custom build in their Signature Series radios that can be easily adapted to the standard 7 channel transmitter. However, they do not have a mixer circuit design for a flap-elevator compensator that I am aware of. A mixer of this type can be adjusted to automatically retrim the elevator at any flap setting. It can also do the same for a spoiler if so desired.

Kraft does have a circuit for a helicopter coupler used to correct yaw with various throttle changes that could be used for a flap/elevator mixer. However, this circuit has the characteristic of changing elevator trim (except when flap pot is centered)

position). Switch in the mixer and adjust the elevator zero pot for the same servo neutral. Switch the mixer on and off and there should be no trim change. Now lower the flaps all the way. Adjust the mix gain pot for the approximate elevator compensation. Now you must go fly and experiment for the final correct compensation adjustment.

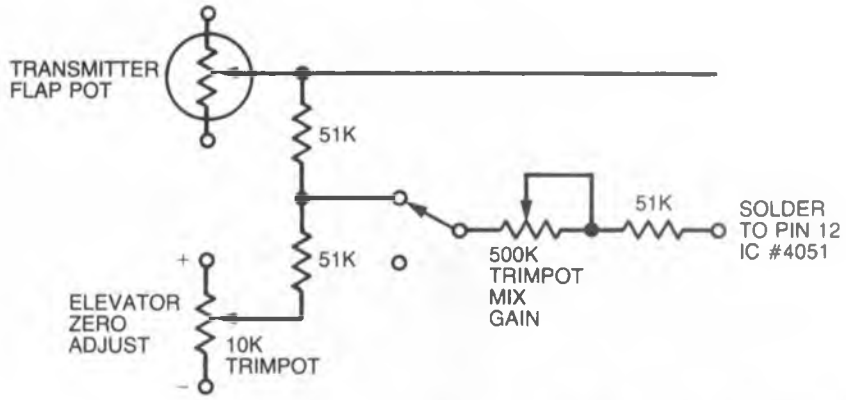
I suspect that the gain adjust might be quite sensitive to airspeed and in fact that could be true of all of the cross-coupling combinations we've talked about. Please share your experience with our readers.

One more thing before we sign off this month. I'm not getting a warm feeling that anyone is reading this

if the mixer is switched on or off. I wanted the ability to switch the mixer on and off at will, so I designed the mixer as shown in the drawing.

If you don't have some expertise in R/C electronics, you should have someone who does install the circuit.

The flap pot is the only component in the drawing in the existing standard transmiter. All other components must be installed. The two other pots are small trim pots. Ten turn pots are desirable. To set up the system, first turn on the radio with the mixer swtich out. Note the elevator neutral position (flap stick should be in the 0° flap



stuff. I think it is time to give you guys a problem. (The most mail I ever received was the result of passing on my daughter's sophomore, in high school, math problem. I hate to tell you how old she is now to tell you how long ago that was.)

Let's say my local club puts on an annual speed contest where I have to fly my airplane upwind and downwind through the speed traps. Since I fly pattern I don't care about winning but I am curious about how fast my plane flies. So I go out and fly the course upwind and then downwind. When I finish I'm told that my average speed (the definition of average speed is twice the distance of the course divided by the time to fly up plus the time to fly down), was 100 mph and that the wind (straight down the course) was 30 mph. What is the **airspeed** of my plane? (I don't have any more kids in high school thank God. This one was inspired by a problem in Delta Airlines Sky Magazine.) 'Till next month — solve that problem — add cross-coupling to your transmitter and stay tuned. ☐

RCM PRODUCT REVIEW

Hobby Barn
TOTAL CHAOS

SPECIFICATIONS

Name	TOTAL CHAOS
Aircraft Type	Sport/Pattern
Distributed By	Hobby Barn P.O. Box 17856 Tucson, Arizona 85731
Mfg. Suggested Retail Price	$59.99
Available From	Direct from Mfg.
Wingspan	65½ Inches
Wing Chord	10¾ Inches
Total Wing Area	699 Sq. In.
Fuselage Length	58 Inches
Stabilizer Span	23 Inches
Total Stab Area	98 Sq. In.
Recommended Engine Range	.61
Recommend Fuel Tank Size	12 Oz.
Recommended No. of Channels	4
Rec. Control Functions	Rud., Elev., Throt., Ail.
Basic Materials Used In Construction:	
Fuselage	Balsa & Plywood
Wing	Balsa
Tail Surfaces	Balsa
Building Instructions On Plan Sheets	No
Instruction Manual	Yes (6 pages)
Construction Photos	No

RCM PROTOTYPE

Radio Used	Futaba 7FGE
Engine Make & Disp.	H.B. .61 PDP
Tank Size Used	12 Oz.
Weight, Ready to Fly	6 Lbs. 3 Oz. (99 Oz.)
Wing Loading	20.4 Oz./Sq. Ft.

SUMMARY

WE LIKED THE:
Quality of materials, built-up tail surfaces.

WE DIDN'T LIKE THE:
No problems encountered.

The term Total Chaos refers to three things: (1) A club meeting when someone suggests increasing the dues, (2) this reviewer's pattern flying and (3) a new sport/pattern kit sold by Hobby Barn. It is manufactured for Hobby Barn by Model Aircraft Designs, 23625 Pineforest Lane, Harbor City, California 90710. The 37" x 6" x 3½" box was completely filled with materials, allowing no opportunity for any shifting of pieces to cause damage. Accessories and small parts were separately bagged, the canopy was protectively wrapped in paper, and landing gear were also wrapped to prevent damage. All that was missing was a ribbon and bow.

Construction:

Plans were on one sheet with 36" x 58" dimensions and instructions covered six pages, one of which listed all materials in the kit. The instructions were sufficient to enable someone with some kit building experience to handle the job. This is not meant as criticism since this kit should only be flown by an experienced pilot.

All items in the kit were of excellent quality and the machine cut parts were accurately done. There are no die-cut parts and the entire construction is wood. Hardware includes an engine mount and all the usual nuts, screws, and gear. Elevator and rudder horns were 4-40 machine screws with a nylon connector that threads on the screw. The nylon connector accepts the clevis from the pushrods making an easy to install system.

The fuselage is a conventional balsa affair with lots of triangular reinforcement. A little shaping is required to attain the contoured look on the nose, but it is nothing that will keep you up late. The fin and rudder are 1/4 balsa but the elevator and stabilizer are built up from strip stock. This is a little more work but really helps keep the total weight down. As noted later, this plane came out light and was actually nose heavy. The last time that we actually built something that turned out nose heavy, was a Honker with a Quadra on the firewall!

The wing was standard design with two balsa spars which provide the initial anchoring point for the ribs. This is the most critical step in the whole construction process as the wing is double taper and symmetrical. Once the ribs are home, slap on the sheeting, leading and trailing edges, and look for the sandpaper.

The basic construction job was four days of spare time from opening the box until sanding commenced. Pacer Zap-A-Gap and GMP 6-Minute epoxy were used throughout the project.

continued on page 219

BY CLARENCE LEE

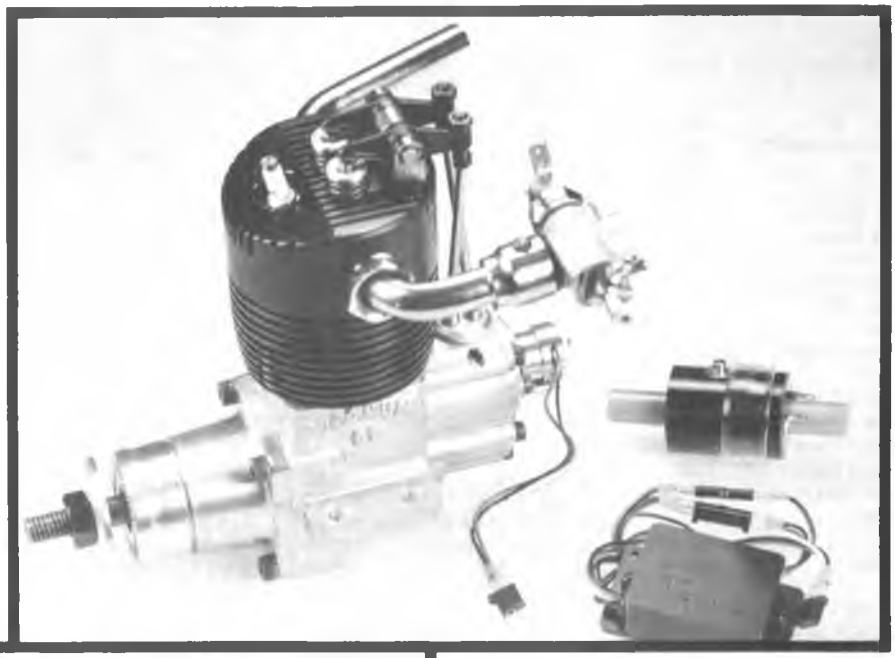
MAGNUM .91 FOUR STROKE

SPARK IGNITION VERSION

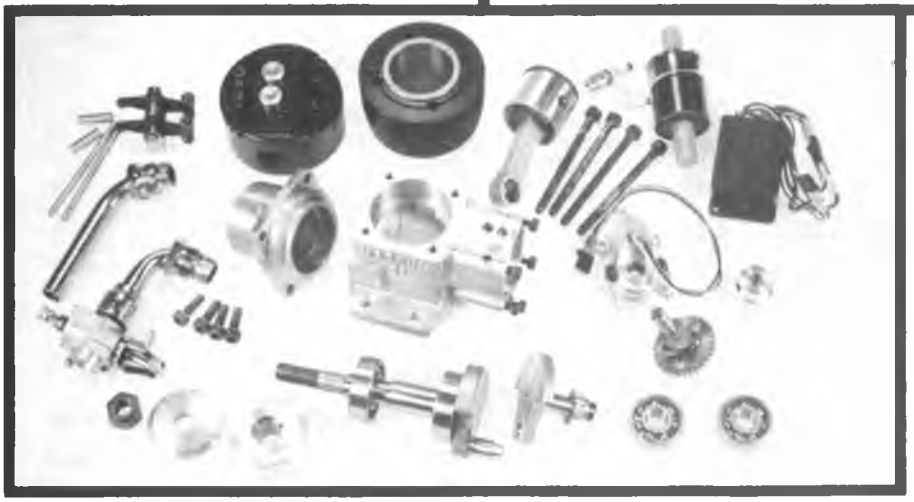
Tom Pearson, of Pearson Power Products, was kind enough to submit one of the English made Magnum .91 cu. in. four stroke engines for our review this month. I had heard quite a bit about the Magnum .91 as it is England's most popular four stroke engine, but this is the first time I have actually had one in my hands for examination. Tom Pearson imports the Magnum line of engines into the U.S. and other engines in the Magnum line include the 1.82 cu. in. "V" twin and 2.73 cu. in. three cylinder radial type engine. Soon to be released will be a 1.2 cu. in. version of the single cylinder engine and, if the market demand exists, a 2.4 cu. in. version of the "V" twin. There are no plans at the present time for a larger displacement three cylinder engine.

Both the single cylinder and "V" twin engines are available in glow and spark ignition versions. Magnum Engines is the only four stroke engine manufacturer to offer a single cylinder spark ignition engine. The engine Tom submitted for our review was the spark ignition version. Both the spark and glow versions are basically the same engine with only minor differences. These differences are a slightly smaller venturi diameter on the spark ignition engine and a cam shaft extension to drive the ignition sensor. I tested the engine on both spark ignition and glow plug and I believe you will find the results interesting.

The Magnum engines are manufactured in England by two gentlemen named Peter Roffe and Brian Stammer. Peter Roffe designed and built the first prototype engine in 1980 and put the engine into production in 1981. The engine was designed with the scale enthusiast in mind. That is, a cool running engine with more than adequate cooling surfaces so that the engine could be used in enclosed cowls and retain the scale cooling intake openings. I have received many letters over the years from scale modelers wanting to know when some engine manufacturer is going to take their interests under consideration. Peter Roffe and Brian Stammer have done just that! The engine runs exceptionally cool and I should imagine that, if used in an uncowled installation, some of the cooling fin area might have to be blocked off on a cold day --- especially the glow plug version. The spark ignition engine, when run on gasoline, does run somewhat warmer. More on this later in the review.



Spark ignition version of the English made Magnum .91 4-stroke engine — the most popular 4-stroke engine in England. Can be run on spark ignition or glow.



The disassembled Magnum .91 4-stroke engine described in this engine review.

As can be seen in the accompanying photographs, the Magnum .91 has an individual appearance all its own. Unlike the Japanese O.S., Enya, and Saito that all have a basic resemblance, the Magnum has an appearance more like a full size engine rather than the typical model engine. This is brought about, in part, by the two piece crankcase/cylinder assembly, rather than the typical one piece crankcase design, and the large cooling fin area.

It is a little difficult to tell, but the crankcase appears to be either a permanent mold casting or a very clean sand casting that has, in turn, been given a glass bead blast finish. The upper cylinder is composed of a machined aluminum finned barrel and separate head also machined from bar stock aluminum. A steel sleeve or liner is a light press fit into the aluminum finned barrel. The head and cylinder assembly, in turn, is secured to the crankcase by four long machine screws. The black anodize finish given the head and fin assembly making a striking contrast with the bright silver crankcase. The result is an overall very attractive appearance. The engine uses a removable front housing with two large ball bearings to support the crankshaft. The rear bearing has an o.d. of 1.102" (28mm) and an i.d. of .472" (12mm) and the front bearing has an o.d. of 1.024" (26mm) and an i.d. of .393" (10mm). The front bearing is of the single shield type to seal off the front of the crankcase and keep foreign matter from getting into the front bearing.

The hardened steel crankshaft has a constant thickness crank disc cut away on either side of the ground crankpin for counterbalance. An extension of the crankpin drives a secondary drive shaft that, through the use of spur gears, drives the camshaft. The secondary drive shaft is mounted in two .866" o.d. (22mm) by .315" i.d. (8mm) ball bearings and, like the crankshaft, has a constant diameter drive disc cut away on either side for additional counterbalance action. In effect, a double counterbalanced crankshaft utilizing four ball bearings.

The single camshaft rides in what appears to be two split steel bushings. Normal practice is to use either bronze bushings or small ball bearings. With the four ball bearing crankshaft/drive shaft assembly I was a bit puzzled as to why the manufacturer would resort to a split steel bushing for the camshaft. A letter to Tom Pearson which was, in turn, forwarded on to Magnum Engines brought back a reply and specification sheet on these bearings. Initial appearances are a bit deceiving in that these are a special dry bearing that can actually be used without lubrication. They are actually composed of sintered bronze fused to a steel backing and impregnated with PTFE (Teflon). Although intended for use without lubrication in dusty dry environments, the use of a lubricant such as oil, or even water, enhances their performance. The bearings are actually formed from flat stock which accounts for the split.

The camshaft, in turn, operates the pushrods, rocker arms, and stainless steel valves. The valves ride in phosphur bronze bushings pressed into the aluminum head. Most of your four stroke engine manufacturers have been going to enclosed valve assemblies but the Magnum still retains the open valve mechanism. The manufacturers feel that fellows have a tendency to forget about oiling the valve mechanism when it is enclosed and, by being out in the open, will lubricate more often. I think there may also be a leaning towards "old world charm" that the English are noted for. Actually, it is sort of neat watching the valves operate, especially with the engine idling. A nice feature of the engine is the ability to operate in either counterclockwise or clockwise directions by reversing the pushrod positions. The positions of the carburetor intake and exhaust stack can also be reversed (if the application calls for it) by reversing the pushrod positions. This is brought about by symmetrical valve timing.

As mentioned earlier in the review the engine uses a steel sleeve or liner --- a feature I like. I still have some reservations about the latest tendency in many of the larger displacement engines to use direct chrome plating of the die-cast aluminum cylinders. I noted in the review of the Saito FA-90

four stroke twin that Saito, who had pioneered the AAC set-up, had gone to a steel sleeve. When it comes to holding roundness, wear qualities, etc., you have a hard time equaling a steel sleeve. The ABC set-ups are the exception. Of course, the penalty is a slight increase in weight.

The piston is turned from a high silicon casting and uses a single Dykes ring. The wrist pin was actually a forced fit in the piston so all motion was handled by the con rod. The wrist pin is retained by two wire cir-clips.

The con rod is machined from bar stock aluminum and bushed at both ends; the big end with a bronze bushing and the small end with what appears to be one of the dry lube bearings as used on the camshaft. This bearing is without the split, however. An interesting feature here is the ability to replace the rod bushings if they should become worn. Exactly how an individual is to go about this I do not know, but the replacement bushings are available from the manufacturer and listed on the parts sheet, as well as being mentioned in the operating instructions that this is possible.

The manufacturer lists the bore as 27mm (1.063") and stroke as 26mm (1.024"). The actual measurements of the engine tested were a bore of 1.066" and stroke of 1.028" for an actual displacement of .9175 cu. in. or 15.04cc. The measured compression ratio using the full stroke for computations was 7.43:1.

With the technicalities out of the way, let's get to the actual testing.

For fuel, the manufacturer recommends 8% castor oil and 5% nitromethane for glow operation, the same for spark ignition if glow fuel is used, and 5% motorcycle type oil if spark ignition and gasoline are used. To try and stay a little more uniform in fuel used for these four stroke tests and to give a more equal performance comparison, I opted to use Fred Wilson's "Red Max" 10% nitro four stroke fuel for the glow running and straight white gas (not unleaded) mixed 12:1 (approx. 8%) with Amsoil two stroke motorcycle oil which is one of the 100:1 type oils for the spark ignition running. I am not sure of the oil content of Red Max four stroke glow fuel, but I imagine it is in the 12% range judging from the exhaust residue. Previous experience has shown the four stroke engines to run best with oil in the 12% range and nitro in the 10%-15% range. Naturally, if you are going to really lug an engine down with a big prop, then more oil and less nitro would be desirable.

The engine was given an initial thirty minute break-in period operating on glow plug. Being of Dykes ring design, I would guess that the engine would not be fully broken-in until acquiring at least two to three hours of running time. However, as mentioned in several previous reviews, breaking-in an engine by bench running is not one of my favorite fun things to do. The initial thirty minutes does give enough loosening up time to make comparative power checks. After being fully broken-in, the engine could be expected to pick up another 300-500 rpm. The version of the engine intended for glow operation with the slightly larger intake could also be expected to turn slightly higher.

The results with glow fuel and glow plug were 8,600 with a 14/6 Zinger; 8,200 with a 15/6 Zinger; and 6,700 with a 16/6 Zinger. The difference of only 400 rpm between the 14/6 and 15/6 was surprising but would indicate that the engine is developing its maximum torque right in the rpm range of the 15/6 propeller. I could not check this out on my present dynamometer as the .90 size engines are getting beyond the engine size that it can handle. In fact, some of the latest .60 size engines are pressing it to its limit having initially been built for .45 size engines.

Idle with the 15/6 propeller was 2,500 with the starting battery disconnected. With the starting battery connected, the engine could be gotten down to 2,000 rpm. Initially the engine was run with the O.S. four stroke glow plug. A Saito P-3 four stroke plug was also tried and performed about the same as the O.S. I would have to give the edge to the Saito in that there was less of an rpm drop upon removing the starting battery at idle. Both plugs showed a slight drop in rpm upon removing the starting battery. This is most likely due to the cool running characteristics of the engine. Next, a K & B idle bar glow plug was tried and there was less of a drop in rpm when removing the starting battery and the engine could be idled at 2,400 rpm. However, the top end was down about 200. This is the first time I have had a regular idle bar glow plug show an advantage in a four stroke engine. Since I intended running the engine both with the NGK spark plug supplied with the engine and an old Champion V-2 spark plug for comparison, I thought it might be interesting to also try an old Champion VG-2 glow plug. I have always known the Champion glow plug to be an exceptional plug in years past, and present testing proved this to still be true. With the Champion glow plug there was no drop in rpm at idle upon removing the starting battery, and the engine would hold 2,200 with the starting battery disconnected. The top end was the same as with the O.S. and Saito plugs. It certainly is a shame that the Champion people withhold their glow plug from the hobby industry. This plug is still manufactured or at least was up until a few years ago for other applications. However, for reasons known only to those at Champion Spark Plug, the plugs are never to be resold or allowed for use in the hobby industry. There is an interesting story along this line regarding a large number of Champion glow plugs a friend of mine acquired some years ago under the guise of using the plugs for another application. I, in turn, received 200 of the plugs and other friends in the hobby received varying amounts. Champions reactions when they found out the plugs had been resold to the hobby industry was quite interesting. I will go into more detail in a future Engine Clinic column. Any of you fellows still having an old Champion glow plug around might want to give it a try in your four stroke engine. You could be surprised at the improvement in performance.

Next, the fuel economy and cylinder head temperatures were checked. With a 15/6 propeller and mixture set for normal flying, the engine would run one minute and forty seconds on one ounce of glow fuel. The cylinder head temperature taken at the glow plug was 275°. Naturally the exhaust side of the head was hotter and the intake side cooler but this would represent the overall average. Most two stroke engines run hottest at the back of the cylinder but with four strokes we have a different set of circumstances. As a comparison, most two stroke .60 size engines have cylinder head temperatures in the 360°-380° range and really skyrocket past 500° if run too lean. The air temperature at the time of testing was 72° and relative humidity at 40%.

The Magnum spark ignition engines use a Hall-effect sensor mounted on the back of the engine and driven by an extension of the camshaft. This is, in effect, a revolving magnet that triggers the electronic module into firing the spark coil and plug. This is the same type of ignition unit that Ford first introduced in 1974 on some of their trucks and top of the line cars. The unit used by Magnum Engines is actually manufactured for Super Tigre by Mick Wilshere who imports the Super Tigre line of

engines into England under his company name of Tigre Engines. Also supplied with the unit are a Japanese made NGK spark plug and Modelectric spark coil made here in the U.S. No high tension lead or switch are supplied as Magnum feels that modelers have their own individual preferences when it comes to these items. Frankly, I do think a high tension lead should be supplied.

With the glow testing out of the way we were next ready to give the spark ignition running a try. Connecting up the unit is simply a matter of soldering two wires to the coil, two others to the 4.8 volt battery pack (not supplied) and connecting the polarized plugs. With everything set and ready to go, the spark plug was checked for spark. Nothing! The high tension lead was held with the fingers while grounding another finger on the engine. No kick! Battery voltage was checked as well as wire continuity. Everything appeared to be okay but no spark at the plug. Thinking that possibly the high tension lead I was using had a break, the output terminal on the coil was touched while touching another finger to the end of the battery pack. **Now** we had a jolt. Then the light bulb lit — there was no ground wire from the battery to the engine crankcase and none was shown in the wiring diagram. A wire was connected from the negative side of the battery to the engine crankcase and now we had a nice hot spark at the plug. A later call to Tom Pearson who, in turn, called Magnum Engines in England verified a goof somewhere along the line in printing the wiring diagram that accompanies the engine. This, naturally, will be corrected right away but for any of you who have purchased spark ignition versions of the Magnum engines — remember, a ground wire not shown in the wiring diagram is required. A shielded high tension lead with one end of the shielding connected to the engine and the other end to the negative side of the battery will also do the job.

Now, with spark at the plug we were ready to proceed with the testing. First the engine was run on the Red Max four stroke glow fuel with spark ignition. Rpm figures were identical as with glow operation. The magnetic pick-up on the back of the engine can be moved 15° either side of the factory setting to advance or retard the timing. This was tried but the initial factory setting of 80° proved to be the maximum rpm position. Incidentally, although the 80° setting would seem to be rather far advanced, this is necessary to compensate for a lag in the firing of the electronic module. Idle was somewhat higher at 2,800 rpm. This is due to the spark being too advanced for good idle operation. Retarding the timing improved the idle to the 2,500 range but now the top end was affected both in rpm and smoothness of operation.

Next we changed fuels to the white gas/Amsoil mix and the following results were obtained: 8,200 with the 14/6 Zinger; 7,800 with the 15/6 Zinger; and 6,400 with the 16/6. This amounts to only a 400 rpm drop with the 14/6 and 15/6 propellers and 300 with the 16/6. A lot has been said about the ability of an engine to swing a larger prop when converted to spark ignition but this applies only to the two stroke engines. The four stroke engines that already develop their maximum torque and power in the lower rpm ranges do not show the increase as our testing verifies. The addition of a little nitro propane to the gasoline mix could easily bring the rpm figures into the same range as with alcohol fuel.

When changing from alcohol base fuel to gasoline fuel the carburetor settings have to be changed. The mixture adjustments also become far more critical. Whereas with glow fuel, the high speed mixture adjustment has over a full turn between running

very rich and fully peaked, with gasoline this was narrowed to about one quarter turn. In fact, this could provide initial starting problems finding this proper range; if not within the quarter turn running range, the engine will not run. The setting for this particular engine was exactly one turn open. Adjusting the idle mixture became even more critical. Less than an eighth of a turn leeway. So, when working with gasoline, be prepared for critical adjustments.

The idle speed with gasoline was higher than with glow fuel with 3,200 being about as low as we could get the engine to idle reliably. As with the glow fuel, retarding the spark would lower the idle but affect the top end. By very slightly retarding the spark to show a 200 rpm loss at the top end, the idle could be improved so that the engine would hold 2,700. This, with the 15/6 propeller. With the 16/6, the engine could be idled at 2,500 due to the extra flywheel action helping to overcome the spark lead necessary for good top end running. Actually what is needed here is an automatic advance system that retards the spark timing at idle and advances it at high speed the same as the centrifugal advance does on your automobile.

The engine Tom Pearson supplied us with came equipped with a Super Tigre .29-.35 size two stroke carburetor. The Magnum .91 glow engines comes with a Irvine carburetor. The S.T. carburetor was used on the spark ignition engine due to a slightly smaller venturi size not available in the Irvine carburetor. However, future spark ignition engines may come with the Irvine with a smaller intake diameter. Past experience with both carburetors would cause me to give preference to the S.T. carburetor. It is easier to adjust and more reliable at idle. With the extremely critical mixture adjustments caused by the use of gasoline fuel, the S.T. carburetor would be the more desirable choice, in my opinion. Actually, for gasoline use, the taper of the needle valves should be changed — gasoline requires a more gradual taper than alcohol. Hopefully, the Magnum people will take this into consideration for the spark ignition engine.

The main advantage of gasoline fuel is the fuel economy and resulting lower operating cost. A fuel economy check showed the engine to run slightly over six minutes on one ounce of gasoline. Three ounces of fuel were run through the engine twice to check this — and this was with the engine set on the rich side. If fuel costs are of major concern to you, then spark ignition and gasoline is certainly the way to go. A check of the cylinder head temperature with the engine peaked for maximum power indicated 310° at the glow plug. This is considerably higher than the 275° glow operation reading but still well-under the operating temperature of a two stroke glow engine.

One final test was to run the engine with the previously mentioned Champion V-2 spark plug. The top end was improved by a little over 100 rpm and idle lowered by 300. The engine would hold 2,900 with fully advanced spark and the 15/6 prop --- again proving that Champion sure knew how to make model engine spark and glow plugs. Although I did not think of trying it at the time of the testing, past experience has shown that a little file work on the ground electrode of a spark plug having a heavy ground electrode (as does the NGK) will prove beneficial. Whereas the Champion plug has a gradually tapering to a point electrode, the NGK is a constant diameter. Filing this to more of a point should help retain heat at the tip and, in effect, work similar to a glow plug. Of course this can also cause detonation at the top end if filed too thin. If you like to experiment, this is an area to work with.

Overall handling of the engine on glow fuel with glow plug was very nice. Hand starting at first was a little difficult due to the ring seal being a little soft. After the initial thirty minute break-in period the ring had begun seating and compression was very good. Hand starts were now much easier with the backwards flip start following a heavy prime giving the best results. Mixture adjustment was quite broad and there was no tendency for the engine to detonate or knock, even when the mixture was leaned too far. The engine would just slow and stop. The same thing pertained to spark ignition and alcohol fuel. A nice starting, easy handling engine with no bad characteristics.

Gasoline fuel did change the character of the engine. Although the engine still ran very well, mixture adjustments were extremely sensitive. Some of you guys who like to turn the needle valve half turn at a time would run into problems. Once the proper running range has been found, further adjustments are to be made in very small increments. If spark ignition and gasoline is your thing, then you should consider the Magnum .91. You could fly all day for only a few cents.

The Magnum .91 is a ruggedly built engine and every effort has been made to give it a long useful life expectancy. Tom Pearson says he has five to six hours on his and it keeps running stronger every flying session. The fact that the engine is the number one four stroke engine in England says something for the design, workmanship, and running qualities of the engine.

The Magnum line of engines are available from Pearson Power Products, RR 2, Box 64, Effingham, Illinois 62401. □

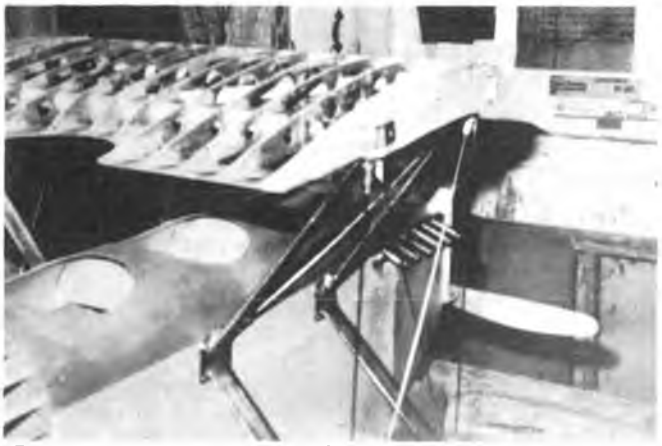
Keep America Beautiful

The woods, the fields and waters of America don't need a carpet of litter left by inconsiderate persons. Hunting, fishing, camping, or boating, keep America's outdoors clean and green.

BIG IS BEAUTIFUL

Dick Phillips

Grumman Duck by Dick Hershey, Lakeport, California, model is static version, built for Dick's son. Good example of the kind of work he puts into his models.



Flying model of Douglas World Cruiser by Dick Hershey. Note the work in the wing ribs. Exhaust stacks are functional. Nice workmanship in the struts as well.

I had a letter from Bill Kawai in Japan recently and he has been good enough to supply me with the accompanying material from the Japanese magazine, R/C Technique.

The YS 11 is Quarter Scale which is a bit unusual. Most of us building a model of a relatively large airplane would choose a smaller scale than that. This "model" is most impressive as I'm sure you'll agree when you hear the dimensions. The span is a little over 26', fuselage is a tad longer than 21', and the height to the top of the fin is just over 7'. The model weighs 132 pounds and flies on two, 22cc Tartan engines. The cost of the project was one million yen which equates to around $4,400.00.

The model was built by four pilots who fly for the airline represented by the model, TOA, and they spent a year on the construction.

This behemoth flies on a four channel radio, so it does not have flaps nor retracts. It is certainly a very ambitious and striking project which apparently flies very well. Take-off distance for the initial test flight was approximately 150'. I wonder what they'll tackle next after this success. Bill has promised to keep us in touch with developments in Japan which might be of interest to us. Thanks Bill for your input.

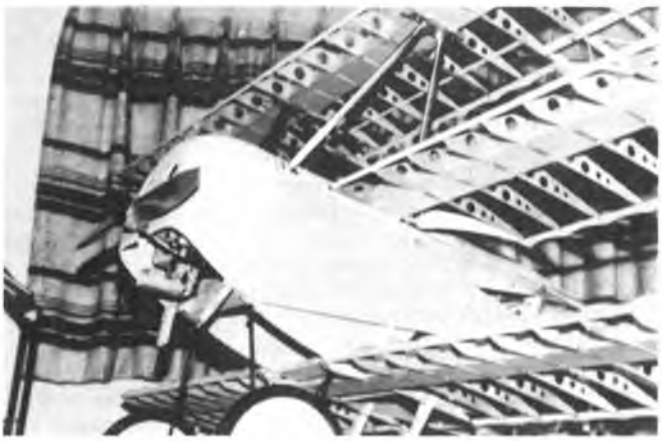
Another little gem gleaned from the pages of R/C Technique was a picture of a flat four cylinder opposed glow engine. My informant, who cannot read Japanese and was therefore not able to tell me much about it says it looks like a pair of O.S. Gemini engines in a single crankcase. No other information is available at this time, but it certainly sounds exciting.

★

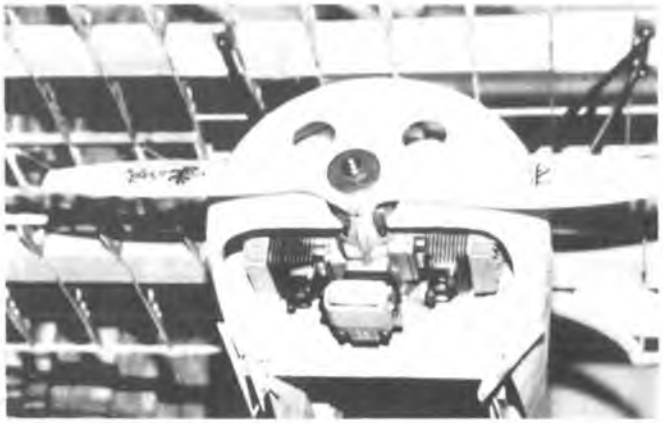
In a conversation with a hobby shop owner recently I was surprised to hear from him that Quarter Scale is dying! He said there is little activity and what there was is on the decline. He was referring to activity in his local area, of course, and was referring to such activity in Canada. It points up the sort of misconception that can exist when only local information is available. My incoming mail points to just the opposite conclusion. Judging by my correspondence, more and more people are getting involved in the building and flying of large models and, surprisingly, many of the newcomers are first time model builders, or are people who dropped out a few years ago and have had their enthusiasm revived by the sight of a large model in flight.

The growth of IMAA and its chapters world-wide indicates that

Jan Janacek of Seattle, Washington designed and built this Fokker Triplane. Note the machine gun detail. The clothespins are not part of the airplane.



As if building one or two wings with that amount of work isn't enough, there are three of them here. Not the box spar as in the original.



Tartan Twin neatly cowled. Jan does great looking work and builds most of his models from his own plans. Many excellent plans available from R/C Model Shop (14020 NE 21st St., Bellevue, Washington 98007).

DeHavilland Beaver by Jim Barr of Vancouver, Canada. Quarter Scale beauty weighs 35 pounds, flies on 35cc Quadra. Flaps and ailerons both lower as flaps applied. Flies much as the full scale does. Glass fuselage, foam wing, much detail.

Rivet detail on fuselage and floats, Electra-Starter, control surfaces static balanced, floats are scale Edo floats as used on the full scale. Note the scale waves!

Copy of announcement from Japanese magazine "R.C. Techniques." Span of model is over 24' and weighs 132 pounds, flies on two 22cc Tartan engines using 22/8 props. Cost 1,000,000 Yen or about $4,350.00.

Paul Butcher, Sault Ste. Marie, Ontario, built this Fairey Swordfish. Torpedo bomber was used right into WW II by Fleet Air Arm (British Navy).

Rear gunner did not have much protection from weather or enemy attack, probably needed the sheepskin flying suit to stay alive.

big is very much alive and doing well almost anywhere you care to look. My incoming mail includes many "one time" letters which are answered and that's the last I hear from the writer. There are an increasing number of correspondents who continue to write me and their comments indicate that the building of larger than conventional models continues to expand all over the world. I suspect my conversation with the hobby shop owner is a figment of his imagination. He'll probably assume he is right about his conclusions, cut down on the minimal number of items for the **big** builder he now carries and fulfill his own prophecy.

★

My Balsa U.S.A. Der Jager is progressing well; it's now at the point of being ready for the paint shop. I mentioned in a previous column that a local video firm had asked me to tape a series of programs on building Big. The first of these has now been completed and details the covering method I have described to you here in the past. The taping went very well and we are very enthusiastic about the possibilities of the program. The intent is to produce a series of about ten tapes, each of about an hour's duration, completely covering the subject of large models from selection of building method to trimming and flying. The first demo tape is now on its way to a group of major manufacturers in hopes they will see

This Swordfish is no hangar queen even if it looks as if it should be. Swordfish must have looked like an anachronism even early in WW II. Courageous fliers took on the Bismark in the Swordfish.

Paul's Swordfish at rest, wings folded. His fine workmanship is obvious in this immaculate rendering of a historic fighting machine.

fit to market the tapes, either singly or in total. It was a real experience to be working in front of the cameras and the taping and editing quality is excellent.

Some of the manufacturers have indicated to me that they have been asked about the availability of such tapes in the past. It's the type of thing which would be a valuable asset to a club's training program and which would provide consistent information to newcomers to the hobby. With the proliferation of VCR's today, the tapes could be loaned out for use at home, providing everyone with first class instruction. The obvious value to the many individual modelers who are located in remote areas where there is no one they can ask questions is readily apparent. I'd be pleased to hear your ideas on this project.

Covering the Der Jager on camera was a bit of a risk. The model has an ABS turtledeck and I had no idea if I would be able to seal the Dacron down to the ABS. As I had suspected, acetone softened the ABS enough to make the Dacron stick to it quite well. This, despite the rather oddball shape of the turtledeck. It went down completely despite the mixed concave/convex surfaces involved and will produce a finish that will look the same on all surfaces of the Der Jager. The model took about three yards of material to cover, a yard each for the wings and fuselage and the tail feathers were covered with the scraps from the major assemblies. Under $10.00 worth of covering material for a 1/3 scale model. Not too bad at all. Not to mention that the Dacron shrinks so well that the covering job on all areas looks great.

★

I have managed to obtain several of the little ignition modules I have mentioned here in the past. I haven't had the chance to use them myself yet as the weather is too cold to permit running engines outside. (Actually they'd run fine, it's me who doesn't work too well in the cold!) Those to whom I have spoken about the module say it gives them 100 to 200 more rpm, but the biggest value is in the smooth running provided by the spark advance provided by the module. Don't ask me how this is done, the interior of the module is a mystery to me. The directions come with the module and are quite straightforward as to how it is installed. They are $15.00 each and can be ordered from Al Alman (605 East 168th St., Space 95, Spanaway, Washington 98387).

★

Some engine news from Quadra through Klaus Nowak who is now in charge of marketing the Quadra's through Quadra Aero Engines. In the past, it has been a little difficult to track Klaus down when phoning the factory. They do have a significant business in engines for uses other than models. This new arrangement will provide a separate entity for the engines and more convenience for those of us who need information about them.

Klaus can be contacted at the following address and telephone number. Quadra Aero Engines, P.O. Box 958, Uxbridge, Ontario L0C 1K0, (416) 852-3500.

Several new developments will be released and should be available by the time you read this. There will soon be a Q35X and Q50X, both of which will burn glow fuel for the benefit of those of you who like large models but don't want to use gasoline. These engines will produce more power as glow versions than was available using gas as a fuel. In addition, the new Q50SM will be released shortly. This is the marine version of the 50cc engine. Those of you into power boats may have noticed in a recent issue of RCM, a large racing hydro designed to be powered by the Quadra engines. It was noted as being capable of 80 mph on the 35cc Quadra. I suspect the addition of the 50cc engine will give it even more dramatic performance. The comments in the product review suggested that seeing this rather large model burning up the water is pretty impressive. The 50 engine would be even more so and a good deal less costly to operate on gas. It was also suggested that you get some experience with smaller boats before taking on this giant scale hydro.

The Q50 is also being reworked to provide more power. Klaus tells me they are expecting 4 hp from the newer version and that they are deliberately keeping their estimate of its performance conservative. Additional changes are being done to the Q35 to improve its performance and to effect some cosmetic changes as well. It's going to look better, although if I had a choice between looks and performance, I'd take the performance every time!

The Q50 engine has had a few changes made for our benefit as well. The head has been reversed so that the carburetor (and, therefore, the throttle linkage) are now on the same side of the engine as the Q35. No more having to reroute the throttle pushrod in order to make it work on the Q50. In addition, a rewind starter has been added to the engine making it a good

German magazine "Modellflug" featured Jorg Vogelsang (L), Manfred Topp (R) and author at Las Vegas last October with Jorg's fantastic performing Siemans-Schuckert WW I fighter. German visitors at Las Vegas have always been great modelers and fine friends, it was a privilege to be with them.

deal easier to start. These changes and additions have been made at no increase in cost which is good news in these days of ever increasing prices.

★

A letter from an old friend I haven't heard from for some time turned up in the mail recently with some pictures of his latest projects. Dick Hershey of Lakeport, California, and I have never met, but we've been corresponding for quite a few years. Dick, you may recall, is the guy who built the very large Grumman Goose depicted here some time ago. The really good looking twin was finished in Coast Guard colors and was flown once with disastrous consequences. It has since been sold and the buyer is working to return it to the air.

Dick, is not one to let any grass grow under his feet and he has been busy with the two models pictured here. The J2F-5 Grumman Duck is a display model only built for one of Dick's sons. The control surfaces operate from the cockpit, and the lights all work and are controlled from the rear cockpit. Details came from H. Dchonenberg, Grumman Museum Historian. (Another good documentation source for Grumman machines?)

The other is to be a flying model of the Douglas World Cruiser. Dick has seen the Cruiser's predecessor, the Cloudster, but did not manage to see the World Cruisers when they were in San Diego a good many years ago. Scale of the model is 1:2.16. The exhaust stacks are functional and provide egress for the exhaust gases from a 6.1 cid Kioritz. Much of Dick's information came from the Douglas Museum. Dick tells me he is making both wheels and floats (as flown round the world) for the World Cruiser. Great guy and good modeler. Nice to hear from him again.

Another West Coaster who does really fine work is Jan Janecek of Seattle. Jan sails between Seattle and Alaska (Merchant Marine) and in his time in port builds great stuff. I had the chance to stop and see him in Seattle last October and Jan's home is something to see. There isn't a room in this compact house that does not have a modeling activity in it. The living room is drawing and construction. Kitchen is drill press and cooking, bedroom is sleeping and band saw, bathroom is the usual and welding. No space is wasted and you can see by pictures, Jan is a great builder. We've had the chance to meet him a couple of times and enjoy his company a great deal.

Also in Seattle stopped in to see Bob Florence, who works with Jan in modeling and operates the R/C Model shop in Bellevue. A visit with these two is always a great pleasure. It was pouring rain in Seattle the day we were there but it didn't dampen our enthusiasm for spending a few hours hangar flying.

Jim Barr has created a superb flying Quarter Scale Beaver on floats. Jim lives in Vancouver B.C. and the Beaver he modeled is berthed at a float plane base only a few blocks from his house. How's that for source material? The Beaver weighs 35 pounds, uses a 35cc Quadra and flies off the floats much as the full scale does. Super detailed, it is hard to tell from full size in the pictures. The fuselage is glass, as are the floats and the wing is foam sheeted. Detailing is very fine indeed. The hope is to have the machine kitted in the U.S. in order to satisfy all of you who have written over the years wanting to know where you could find a good Beaver. If kitting comes to pass, you'll hear it here first.

Paul Butcher of Sault Ste. Marie, Ontario, is a scale builder of some skill as will be obvious by the pictures presented. Paul's rendering of a Fairey Swordfish is as good as anything I have seen for a while. It is obvious from the pictures that Paul is a capable and meticulous builder. You can imagine the work required to make the wings fold and still retain sufficient integrity for flight. The model has been flown and is very realistic in the air. I don't have a lot of detail on the model as to whether the torpedo can be dropped, what engine is used, and so on. But it's a feast for the eyes and I felt you too might enjoy seeing it as much as I did. It's a bit out of the ordinary as far as subject choice is concerned and must have represented a good deal of research on Paul's part to be able to duplicate the original so well. You might be surprised to learn that the Swordfish was in use by the Royal Navy in the early years of WW II and, if memory serves me correctly, the Swordfish took part in the British Naval attack on the Italian Naval base at Taranto and was involved in the attacks on the Bismarck. Not too shabby for a "between the wars" biplane with a top speed of about 140 mph!

Considering that the air age spans about a lifetime in human terms, there have been as many different flying machines as hairs on a dog's back. The source of subject material for our modeling is all but infinite. There must be literally hundreds of aircraft that have not been modeled yet and on which sufficient material exists to base a good scale model. I suppose that's one of the things that keeps so many of us interested in the hobby. It wouldn't matter if you lived to be a hundred, you still couldn't get to all the projects you'd like to build.

I'd bet there are few serious scale modelers who don't have drawers filled with material on projects they are going to get to "someday!" I don't doubt that there are literally hundreds of good plans out there which have been built or not, but which would make great additions to the material already available.

If you have such a set of plans in your collection, let me know about it if you are willing to share them with others. I've said it before and I'll repeat it again, I wish there were a place where all such good stuff could be collected to be available to one and all. Plans, documentation, and assorted material laboriously collected over a lifetime and then perhaps lost when the the collector goes to his reward. I'd like to see such a repository made available to us all and it just might be that it is a project that should be undertaken by, for example, the IMAA. As a new Vice President (they don't usually do much but stand around waiting for something to happen, you know!), it could be the sort of thing I should try to get IMAA to sponsor. We'll see . . .

Well, guys, another month past and you still haven't finished that special model you were working on, so better get at it, just as I should. And what about that "someday" model you were going to do. An old and good Scandinavian friend of mine used to say, "take time . . . before it takes you!" Might be some good advice for us all in that.

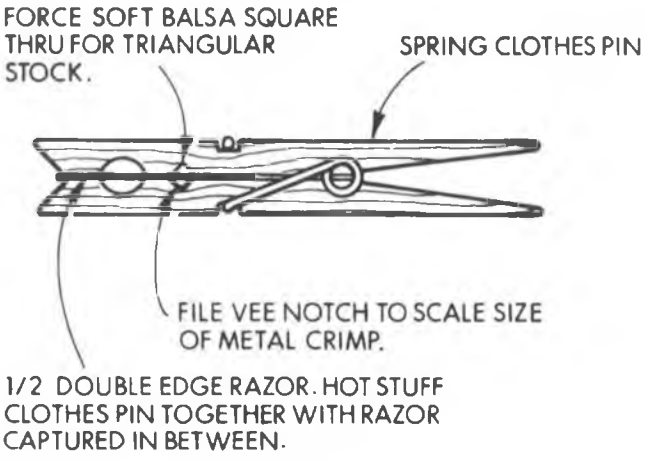
'Till next month, concentrate on **safety** . . . it's no accident. □

FOR WHAT IT'S WORTH

From RCM Readers
Edited By Jerry Smith

To duplicate the crimped metal effect on Cessna aircraft, take apart a spring-type hardwood clothes pin. With a triangular file, make a "V" cut only as deep as your scale model requires. Now make an identical cut into the other half and reassemble. Trim half of a double edge razor blade so no sharp edges protrude using a scissor or tin snips, and place it precisely in the middle with the cutting edge buried, glue both halves together. Then take a piece of square soft balsa, force it through the hole, pull from the other end and out comes two triangular pieces. These can be readily tacked with Super Jet or Hot Stuff to the previously marked surface. A coat of dope will permanently attach them in place. See sketch.

In case the desired triangular strip is, for instance, between a 1/16" and 3/32" wide, just make one side of the clothes pin to that measurement. The half of the resulting strip will be waste, but the good half will surely make your model Cessna more authentic! Dale Willoughby, Santa Ana, California, sent us this idea.



★

Dick Foxenberger, Whitesboro, New York, tells how he protects the nose of his sailplane.

He uses 5/16" stove (not carriage) bolts to resist the dinging, crinkling effects so commonly seen on the noses of sailplanes --- resulting from collisions with rocks, brick walls, and other obstructions which too frequently throw themselves right in front of landing ships. (Carriage bolts have a square shoulder and no screwdriver slot --- rendering them unsuitable for the purpose.) The 5/16" stove head bolt head is exactly the legal minimum FAI/AMA radius for sailplanes. Dick just drills out a 1/4" hole and then taps it by screwing the stove bolt in and out a few times; epoxy can be applied to strengthen the threads if desired, but the bolt should be coated first with a light film of oil or soap so that the bolt is removable.

Not only does this provide virtually impregnable protection for the sailplane nose but (1) by varying the length of the bolt some fine tuning of the C.G. can be achieved; (2) nose blocks can be carved from balsa instead of harder woods like pine; and (3) the bolt head provides a handy reference for shaping the nose accurately. If desired, the screwdriver slot can be filled with a wedge of balsa or some micro-balloons.

★

The following is a procedure used by Al Sievers, Oregon City, Oregon, for installation of aircraft windows. This method yields an authentic scale appearance and makes window replacement and/or removal a snap.

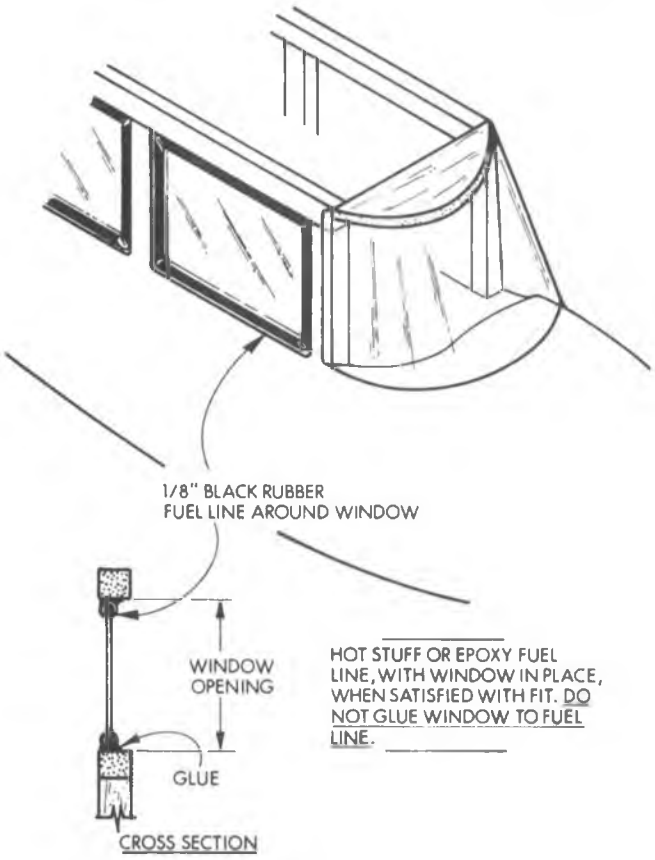
The suggestion involves the use of 1/8" black rubber fuel tubing which has been slit to hold the "glass" securely, without gluing the rubber to the "glass." See sketches.

The procedure is as follows:

1. Clamp one end of a long length of 1/8" black rubber fuel tubing in your vise.

2. Carefully slit the fuel tubing, on one side only, with a #11 X-Acto knife.

3. Cut-out the windows slightly undersized for the fuselage opening. Use K & S butyrate sheets in .030 thickness. This thickness works great for flat windows;



however, for curved windows, a somewhat more flexible material must be used.

4. Form the slit tubing around the window edge and cut to exact length.

5. Trial fit the window with tubing to the window opening. If satisfied with the fit, apply glue to the edge of the tubing and presto you have authentic scale looking windows. If for any reason the window needs to be replaced, simply pry out the old one and fit in a new one.

★

Most spring tail wheel assemblies have leaves sheared from flat stock (Fig. 1), leaving a square sharp burred edge. If assembled this way, the leaves bind and scrape against one another.

To present a more scale-like appearance, but, more importantly, better and smoother operation, the following modifications can be made.

The free end of the leaves should be ground to a round or eliptical shape (Fig. 2). The next step is to taper the thickness of the free end of the leaves. Finally, the edges of the leaves should be rounded. From Tom Senften, Middletown, Ohio.

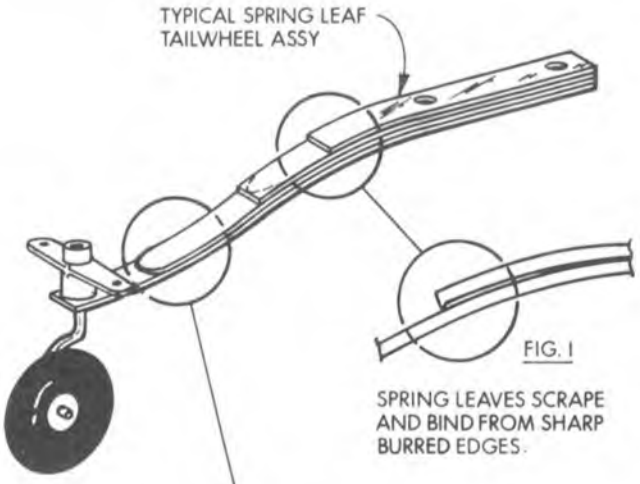


FIG. 1

SPRING LEAVES SCRAPE AND BIND FROM SHARP BURRED EDGES.

FIG. 2

ROUND AND TAPER THE END OF EACH SPRING LEAF. GRIND END TO A ROUND OR ELIPTICAL SHAPE AS SHOWN.

★

From Ake Hellstrom, Columbus, Ohio, comes word of new materials for strengthening balsa wood.

There are two techniques for strengthening balsa wood and achieve **several times** improvement in stiffness and breaking strength; utilizing cheap, readily available materials. You can now design lightweight structures instead of going to thick materials; in fact, 1/16" of 1/8" may be all you need. A description of these two materials is as follows:

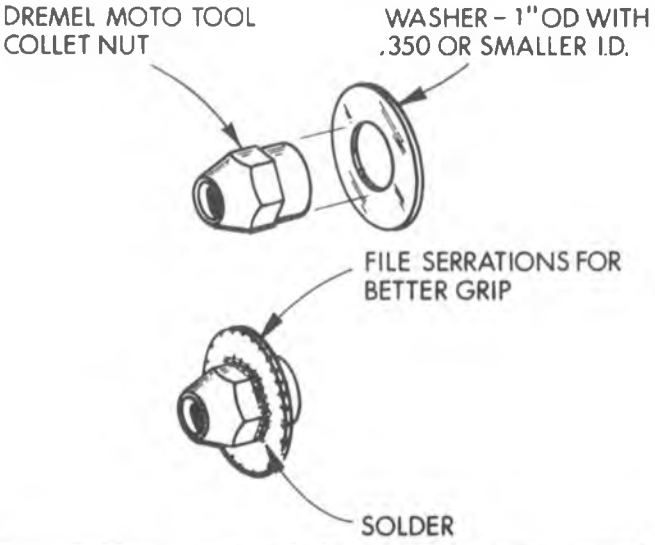
(A) Tuffglass Fabric (Tuff-Kote Co., Inc., Woodstock, Illinois 60098). This material is available in a regular hardware store (like Central Hardware) as a material for repair of **wall cracks.** It is a pre-treated coarse fiberglass fabric that is exceptionally easy to work with on flat or single curved surfaces. A roll of 3¾" x 36' is less than $4.00! Ake uses Lepages Wood Model Cement to glue it on, although many adhesives could substitute. For maximum strength, **both** sides should be covered before you cut your pieces.

(B) Hallmark Ribbon (available in any gift store or drug store). This material is used to decorate gifts, comes in many colors, and consists of many strong, oriented fibers. The Hallmark ribbon can be glued on both sides of wood or used as a single layer if undirectional strength is desired, or in crossed layers if you want plywood-like stiffness! It goes on very flat and smooth, and can, in fact, be used as the direct exterior or, for example, on a wing leading edge due to the many nice colors available. Ake uses CA, but many other adhesives (like epoxy) ought to work fine. A clear protective spray of paint is required for exterior use.

★

A slight modification to the collet nut of a Moto-Tool can be a great time saver. It is also a great convenience, eliminating the need to use the small wrench supplied by Dremel to loosen and tighten the nut when changing tool bits. You know, the one you're always looking for and probably swept into the wastebasket with that last pile of balsa chips.

Obtain a large metal washer with approximately a 1" O.D. and .350" or smaller I.D. Enlarge the inside hole so the washer will fit over the collet nut just below the hex portion. Slide the washer over the nut making sure it is up against the hex, and solder in place. Add some small serrations around the O.D. of the washer for a better grip. Now all your tool bits, drill bits, cut-off wheels, etc., can be held in place by tightening the collet finger tight, as shown in sketch. The wrench can still be used on the original hex. From Robert Bush, Vandalia, Ohio.



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

RCM PRODUCT REVIEW

Balsa U.S.A.
DER JAGER D-IX

The Der Jager is a giant scale rendition of Marshal White's home-built biplane. The Der Jager possesses a unique appearance which combines a WW I look with the more modern features of a present day biplane design. This is an R/C giant scale design that will be particularly appealing to those modelers who are seeking an aircraft that looks different from the present flock of Pitts, Christen Eagles and Skybolt bipes that are seen at most R/C flying fields.

The Der Jager is kitted by Balsa USA, the plain brown wrapper folks from the frozen north. Balsa USA is located in Marinette, Wisconsin, which is right on the Canadian border. The Der Jager is priced at $124.95 direct from the manufacturer only, and is shipped in two sturdy corregated cardboard boxes which measure 5½" x 10" x 50" and 8½" x 12" x 17". As is the case with other Balsa USA kits, the unmarked Der Jager cartons that arrived at our doorstep contained the makings of a small "Ecuadorian lumberyard." The larger carton is chocked full of wood parts, along with a rolled two sheet set of plans which measure 36" x 87" and 36" x 93". A very complete hardware package (except hinges) is included. (The hardware package is so extensive that space prevents listing the various component pieces here.) A seven page (8½" x 11") set of assembly instructions includes an inventory list for all hardware and wooden component parts. Four pages of construction photographs and views of Marshal White's full size Der Jager are also included. We found the packaging to be neat and carefully thought-out and no damage was sustained during shipment via UPS. The wood grade and density consistency in our kit was very good. The die-cutting was good, with most parts being crisply cut and easy to remove from the sheet blanks. The landing gear is a large tempered aluminum unit, which is formed and shaped by the manufacturer. Also enclosed is a page with instrument panel construction details and preprinted instrument dial faces. A full set of water transfer type finishing decals are provided.

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SPECIFICATIONS

Name	DER JAGER D-IX
Aircraft Type	Giant Sport Scale
Manufactured By	Balsa U.S.A. P.O. Box 164 Marinette, Wisconsin 54143
Mfg. Suggested Retail Price	$124.95
Available From	Direct from Mfg.
Wingspan	64" bottom, 80" top
Wing Chord	12" bottom, 15" top
Total Wing Area	1938 Square Inches
Fuselage Length	68 Inches
Stabilizer Span	31¼ Inches
Total Stab Area	328 Sq. In.
Mfg. Rec. Engine Range	2.2 Cu. In. up
Recommended Fuel Tank Size	Not Given
Recommended No. of Channels	4
Rec. Control Functions	Rud., Elev., Throt., Ail.
Basic Materials Used In Construction:	
Fuselage:	Balsa, Ply, Hardwood, Plastic
Wing:	Balsa & Plywood
Tail Surfaces	Balsa
Building Instructions on Plan Sheets	No
Instruction Manual	Yes (11 pages)
Construction Photos	Yes

RCM PROTOTYPE

Radio Used	Airtronics Championship Series
Engine Make & Displacement	Roush Cobra 2.3 cu. In.
Tank Size Used	16 Oz.
Weight, Ready to Fly	22 Lbs. (352 Oz.)
Wing Loading	26.15 Oz./Sq. Ft.

SUMMARY

WE LIKED THE:
Unique appearance, in-flight performance, low price.

WE DIDN'T LIKE THE:
Written instructions, nose-heavy tendency, decals.

Construction:

The Der Jager is assembled via conventional building methods and techniques. Both wings are semi-symmetrical and of balsa rib and spar construction. The tail surfaces are assembled from balsa "stick" type stock. The fuselage is of open frame type balsa "stick" construction that is reinforced with die-cut lite ply side pieces in the forward section. The fuselage forward of the cockpit area is sheeted with plywood. The cabane struts are prebent music wire that is balsa covered after the joints have been wrapped and soldered. The cabane struts are designed to be removable from the fuselage (a nice feature). Both wings are equipped with coupled ailerons, with the servos (one for each wing) being installed in the larger top wing. The cowl, wheel pants, and fuselage turtledeck are molded from ABS plastic.

We found the precut parts fit in our kit to be average. Several points of uncertainty were encountered in the written instructions and on the plan sheet. We would emphasize that none of these were serious or would compromise the structural integrity of the Der Jager. The areas of doubt generally centered on the instructions being somewhat ambiguous and not always sequential. Any R/C'er who has built several kits will have little difficulty in overcoming these minor obstacles. The Der Jager is not a difficult kit to build. However, it is also not a beginner's type kit, nor does the manufacturer intend it to be. In fairness to the manufacturer we would stress that these areas of uncertainty that we encountered in the instructions were minor. We mention them primarily to alert the prospective Der Jager buyer to the fact that he or she should not expect a "place tab A in slot B of former C and glue" type of instruction format.

The basic construction process of our test aircraft was hastened significantly by the use of Carl Goldberg's Jet and Super Jet cyanoacrylate glues and X-Cell accelerator. These fine adhesive products were used for all construction phases except the firewall, cabane strut and landing gear block areas, where Hobbypoxy II was utilized. Although a tail wheel bracket is provided in the kit, we decided to install a C.B. Associates, Inc., tail wheel assembly equipped with a Carl Goldberg 2" treaded wheel. The main landing gear wheels used were 5" Williams Brothers units.

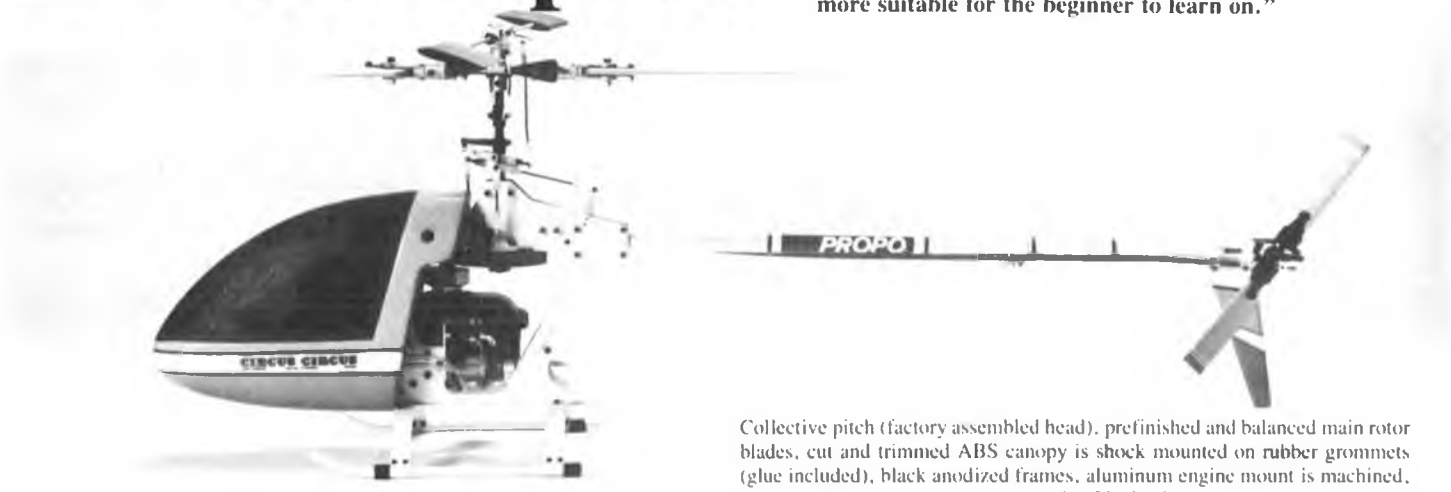
Covering:

We covered our Der Jager with Carl Goldberg's new Colortex heat shrinkable fabric covering material. In the past, this reviewer has used many other brands of heat shrinkable fabric covering material with results that were sometimes lacking. After using Goldberg Colortex once, this reviewer is hooked! It sticks well to itself, is lightweight, possesses a very high shrink rate that is not directional, and is very easy to use. It is prepainted and comes in a variety of colors. We used yellow Colortex which is somewhat translucent, so that care had to be exercised during

Prices subject to change without notice. Limited to quantity on hand.

Kalt Helicopters

In a recent review of the Cricket Helicopter, the Editor of RC Helicopter Magazine made this comment, "Kalts Baron 20 (is) a much more impressive model and far more suitable for the beginner to learn on."



Baron 20 $189.95

Sugg. Retail $284.95

Collective pitch (factory assembled head), prefinished and balanced main rotor blades, cut and trimmed ABS canopy is shock mounted on rubber grommets (glue included), black anodized frames, aluminum engine mount is machined, drilled and tapped to accept most popular .20-.30 size engines, injection molded cooling shroud with molded-in clip for starter belt, shaft driven tail rotor drive, tail rotor blade holders supported by (4) ball bearings, the few wooden parts are machine cut, notched and drilled, all necessary hardware including gas tank is provided.

BARON 50 MK III $299.95

WITH NEW DELUXE ALL BALL BEARING "HUB PLATE" TYPE HEAD

Sugg. Retail $449.95

The kit is quick and easy to assemble, there are no wooden parts to cut out and fit. The main rotor blades are completely finished and balanced. The collective pitch rotor head is factory assembled. The aluminum engine mount is machined, drilled and tapped to fit most of the popular size engines. Vacuformed body and canopy are shock mounted on rubber grommets for longer life.

ÉCUREIL AS 350B $469.95

Sugg. Retail $604.95

Precision fiberglass fuselage with all bulkheads and beams factory installed, factory assembled K1SB collective pitch rotor head, factory assembled transmission, autorotation included, prefinished and balanced main rotor blades, clear plastic windshield, all wooden parts are machine cut, construction manual included, plan view of helicopter included.

BARON 60

Standard Head $469.95

Sugg. Retail $704.95

Two-piece fiberglass fuselage which fully encloses the frame, four-way clutch, heavy-duty autorotation system, machined main gear, C-type mixer, two-piece cooling shroud, tubular landing gear, black anodized frame, double ball-bearing supported bellcrank, machined bearing blocks, machined tail box, ball-bearing tail rotor pitch plate, wood tail rotor blades. Complete with rotor head, flybar paddles and main rotor blades.

With Blackhead $549.95 **Without head $379.95**

Sugg. Retail $824.95 **Sugg. Retail $569.95**

BELL 222 $479.95

Sugg. Retail $719.95

Precision fiberglass fuselage with all bulkheads and beams factory installed, factory assembled K1SB collective pitch rotor head, factory assembled transmission, autorotation included, prefinished and balanced main rotor blades, clear plastic windshield, all wooden parts are machine cut, construction manual included, plan view of helicopter included.

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construction not to use any darker color wood fillers for filleting that might show through the fabric. After covering our Der Jager, we painted the Germanic crosses and trim colors on with K & B Superpoxy enamel. The cowl, wheel pants, cabane and "N" struts were also finished with K & B Super Poxy enamel. As mentioned, the Der Jager kit includes an attractive set of scale water transfer decals. This reviewer has always favored the water transfer type decals over the thicker pressure sensitive adhesive backed (peel and stick) types.

However, some of the decals in our kit were destroyed when we attempted to use them. With the exception of some of the smaller decals which transferred fine, we fractured several of the larger decals when we tried to transfer them to the aircraft from the backing sheet. As the fuselage decals are in pairs with one for each side of the fuselage we would proceed to transfer one decal, only to destroy the matching decal on the opposite side, which was very frustrating. As a result, we removed some of the decals that transferred normally and finished our test aircraft with random decals that we had available, and dry transfer lettering. A thinned-out finish coat of K & B Super Poxy clear enamel was applied to the entire aircraft in order to seal the decals and lettering and to make the fabric covering easier to clean.

Engine:

A Roush 2.3 cubic inch Cobra was our engine choice for the Der Jager. A B & B Specialties (Bennett Built) smoke system was also installed. The B & B system utilizes a crankcase pressure operated diaphragm pump and matched smoke generating muffler. The fuel tank and smoke fluid tank used were both B & B Specialties' units.

Radio:

We installed the Airtronics Championship Series radio equipment in our Der Jager. Two servos were used for both aileron and elevator control, with individual servos being employed for rudder, throttle, and smoke system control. Two receivers were installed with individual 1000 mah battery packs. The control functions were split with one aileron, one elevator, rudder, and throttle being operated by one receiver, with the other receiver operating the opposite aileron, elevator, and the smoke system servos.

The decision to use two receivers and airborne battery packs was made in an attempt to add an extra measure of reliability and safety. It should be noted that the Airtronics' equipment that we installed in our Der Jager (except the battery packs) had all been used previously in racing aircraft, where it had proven to be totally reliable. (This reviewer is convinced that any radio equipment that will withstand the extreme demands and rigors of R/C pylon racing, as our Airtronics' equipment had, will be more than adequate for other R/C use application.)

Flying:

Our test aircraft (less fuel and smoke fluid) weighed in at just over 20

pounds. The Der Jager instructions state that the model will most likely come out being nose heavy and ours certainly did. Being forewarned of this likely C.G. condition we had positioned all radio system components as far back in the fuselage as possible. Only the engine, smoke system diaphragm pump, and fuel tanks were located in front of the indicated C.G. In spite of our efforts to minimize the nose heavy condition, the addition of 22 ounces of lead to the tail was required in order to achieve the indicated C.G. point.

Our test flying was conducted under less than ideal weather conditions. The temperature was close to freezing with a brisk wind of approximately 15 mph.

Our Cobra engine had been run sparingly prior to our maiden flight attempt. In spite of the cold temperature, it started easily on the fourth or fifth flip after being primed.

After range checking the radio system, we proceeded to taxi our Der Jager around the frozen grass runway a bit, in order to evaluate its ground handling characteristics. Despite the frozen bumpy terrain, the Der Jager handled very well on the ground --- certainly as well as any taildragger that this reviewer has ever evaluated. After our taxi tests, the Der Jager was headed into the wind and full throttle applied. With neutral elevator the tail lifted off in less than 15 feet. A slight amount of right rudder was required in order to maintain a straight take-off run. The Der Jager simply flew itself off the ground in about 50 feet. A slight amount of down elevator was required in order to keep the climb-out angle from becoming too steep. A tad of right aileron trim was also needed. After attaining a few hundred feet of altitude, we throttled back to 2/3 throttle and trimmed for "thumbs off" straight and level flight. The next several minutes were spent simply getting the feel of our Der Jager, trying out the smoke system and adjusting the control surface travel limits to our personal preference. We had started with the control surface travel limits that are provided in the instructions and they proved to be an excellent starting point.

The Der Jager proved to be an excellent flying aircraft. It is smooth and predictable with no nasty traits in evidence. Stalls are gentle and our Der Jager had to be deliberately forced into a snap or spin. Landings were equally docile, we just maintained a little throttle and, when we were over the runway a few feet high, we simply chopped the throttle to idle, fed in elevator, and the Der Jager settled gently in for a no-bounce, full flare landing.

Subsequent flights have been equally enjoyable. In addition to its unique appearance, the Der Jager merits top marks in the airborne category. It is fully aerobatic, yet well-within the piloting capabilities of any RC'er who possesses an intermediate level of flying experience.

We were very impressed with both the Roush Cobra engine and the B & B Specialties accessories. The Cobra engine proved to be an easy starting, smooth running unit with impressive

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THE REAL THING FUNNY SCALE MEET

By Leonard Postage

In July, 1983, the Imperial R/C Club of Polk County, Florida, held a Real Thing Funny Scale Meet. There were seven entries, all were scratch-built modifictions of the Real Thing Mock Two, to duplicate in caricature various real aircraft.

The festivities began with a "Beauty Contest" in which the entries were judged for originality of design concept, and workmanship. First Place was taken by Harvey Proper's beautifully detailed Antic, complete with cable operated rudder and elevator. Second was Millard Solomon's P-38, Third Place went to Len Postage's P-40 Flying Tiger.

Three Fun-Fly events were flown with all seven aircraft completing each one. The events were Las Vegas Loops (roll a seven, start up, three loops, and land, shortest time); Toilet Paper Tow (tow a 25' long, 2" wide ribbon of toilet paper and try to get rid of as much as possible in three minutes of flying). Difficult to do. And a spot landing, 8" won.

Some of the aircraft had rather unusual characteristics. In addition to Harvey Proper's work of art (the Antic), there was Billy Manley's Ford Tri Motor with a four wheeled landing gear (the rear pair are steerable) and Gene Hayden's Spruce Goose with eight free spinning three bladed props making a terrible racket in flight.

An additional highlight of the day was a flight lesson given using Len Postage's P-40. The instructor was Harold Carlson and the student was 101 year old Ira N. Kellog. Our club has the "oldest R/C Student Pilot" . . .

While this Real Thing Funny Scale Meet only drew a few entries, every one had so much fun and the models triggered the imagination of enough club members to have another meet scheduled for November 20, 1983. Unfortunately foul weather forced this meet to be postponed to December 4.

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Len Postage's P-40.

Millard Solomon's P-38.

Gene Hayden's Spruce Goose.

Harvey Proper's Antic.

Harold Carlson's The Real Thing Original.

Bob Hunter's P-51.

Gee Bee by Lynn Craven. This is actually a Real Thing fuselage and wing, however, Lynn turned the fuselage upside down and put the wing on the bottom, which meant it was still on the fuselage top. Right? . . . well what do you expect from an architect.

Hell Diver by Solly Solomon. This thing got airborne in about 5' and is much more stable than the original. This model should have been a bipe from its birth.

PBY by Len Postage. The radial engine cowls are the bottoms of Coors beer cans found along the road while driving to the flying field one day.

Billy Manley's Ford Tri Motor.

December turned out much better, 80°, wind directly down the South West runway 15 to 20 mph. The entries were different from the original Fun-Fly and showed again what imagination can do when modifying a standard model. Of course, any modification is a tremendous improvement in a craft as ugly as The Real Thing. The impressive thing was the modifications did not affect the flight characteristics all that much, except for the Gee Bee and the PBY, which could not loop but rolled and spun like tigers while trying.

Building and flying the modified Real Things the past year gave us another "common cause" which always allows members to become better acquainted and discover qualities and abilities that otherwise would go unnoticed. So then activity, inexpensive as it was for the participants, was very gratifying.

The "Beauty Contest" was won by: 1st. Solly Solomon — Hell Diver; 2nd, Len Postage — PBY; 3rd, Bob Hunter — P 39.

The events in the second Fun-Fly were: A timed event, take-off, three loops, and land; a time and distance spot landing; a random drawing for partners in a pylon race against the clock. All of the events in both

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WHAT IS YOUR RCM FLIGHT SKILL LEVEL?

By Ron Rodda

Having read R/C Modeler for a number of years, I feel semi-qualified to offer the following quiz intended to enable you to decide what level of skill you have attained in this hobby. You may be flying in the Advanced pattern class or entering Sport Scale Expert, but this isn't really a valid indicator of your understanding of the R/C hobby.

Pick the answer for each question which most closely describes your situation, understanding, feeling, knowledge, or behavior pattern. If none of these apply, then guess at the answer. You must finish this quiz before the next issue of R/C Modeler is out, so don't spend more than 2 or 3 days pondering any one question.

1. When reading "From the Shop," normally written by Don Dewey, you:
   a. Wonder if he really writes it in his workshop.
   b. Suspect the picture of him is fifteen years old.
   c. Notice there isn't any balsa dust on his shirt.
   d. Spend three weeks camped at your club's flying site because he ends his column with a "See you at the field," and you take him seriously.
2. You receive your new RCM and the first thing you do is:
   a. Scan through the issue looking for new products.
   b. Hide it so your three year old doesn't practice cut and paste with it.
   c. Check to see if there are any quizzes like this one to take.
   d. Spend the next three days gazing at the cover girl, wondering if you could get her phone number.
3. You read Dick Phillips' "Big is Beautiful" column and agree since:
   a. Your giant model eats Honkers for lunch.
   b. You lose sight of anything under a 7 foot wingspan shortly after take-off.
   c. Importing balsa is your trade.
   d. You've gained twenty pounds since going on your new diet.
4. After reading many product reviews, you wonder why:
   a. The kits you build never get reviewed?
   b. The wingspan times the wing chord doesn't equal the wing area?
   c. If any of those review models have "bitten the dust" before the review appeared in print?
   d. The flying section of the review never has a case of crashing on the test flight?
5. You read the "Radio Spectrum" column by Jim Oddino and:
   a. Get a headache from overstress of the brain.
   b. Still forget to charge your batteries the night before the big contest.
   c. Wonder if Jim Oddino ever leaves his transmitter at the field and discovers the error as he pulls into his driveway.
   d. Immediately disassemble your transmitter to see how it works and now have to go without it for two weeks while it's back at the factory for "unplanned restructuring maintenance."
6. Due to Clarence Lee's "Engine Clinic" column, you:
   a. Have stopped tightening glow plugs with a monkey wrench.
   b. Now understand that using a 16/6 on a .40 engine is a case of over-propping or "under engineing."
   c. Have stopped stuffing tobacco in your tuned pipe.
   d. No longer taxi your plane on the lawn to cut the grass because grass clippings entering the carburetor can turn the engine green inside.
7. Following Chuck Cunningham's advice in the "Cunningham on R/C" column:
   a. You design a canard triplane on pontoons, but it doesn't fly.
   b. You take the canard triplane on pontoons and modify it by turning it into a tri-motor; it doesn't even taxi.
   c. You give the airplane from answer (b) to your wife and she plants an artificial flower in it, but the flower dies.
   d. You spend 6 months of intensive building modifying an Ugly Stick kit to look just like a Super Kaos, and someone gives you a Super Kaos kit for your birthday.
8. After reading Don Lowe's column, "Flying Lowe," and practicing diligently on your pattern flying, you:
   a. Succeed in getting your loops to resemble an oval shape rather than your usual trapezoid.
   b. Decide that precision flying isn't as challenging as precision crashing, since you just did the latter.
   c. Notice that you're the only one at any pattern contest using a cardboard box for a flight box.
   d. Re-evaluate your theory of having the retract switch activated by full down elevator.
9. With Ken Willard's "Sunday Flier" column on your mind:
   a. You spend 80% of your flight time practicing downwind turns.
   b. You refuse to fly on Saturday because you don't think you will qualify to read his column.
   c. You build levees so your club's runway floods and you can fly your seaplanes more conveniently.
   d. You refuse to fly your seaplane at the local lake anymore after crashing on the water, doing moderate damage to the plane, and deciding that the lake has hard water.
10. You usually read your new issue of R/C Modeler:
    a. At the flying field so you can be well-versed on current topics.
    b. At work, hidden behind a technical journal or sales report.
    c. While waiting for the epoxy to set, which explains why pages 46 and 47 are glued together.
    d. In the bathroom, which explains the ever present line outside the door.

The hastily designed scoring system is as follows: Score yourself one point for each question to which you chose (a) as your answer, two points for choosing (b), three points for (c), and four points for (d). Subtract two points for each question you didn't answer and add five points if you recognized all the columnists' names.

With this mathematical basis in mind, you should wind up in one of

these scoring categories:

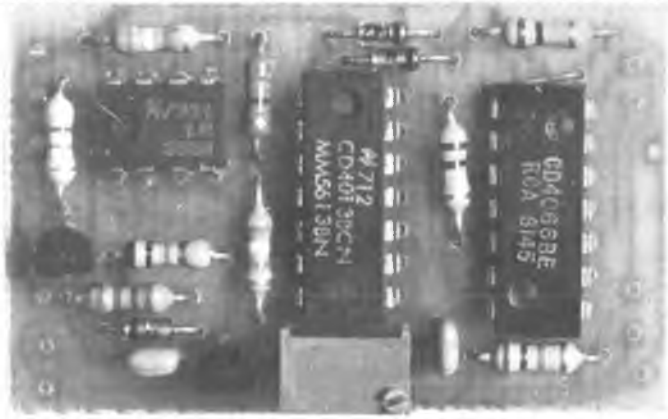
0 to 10 points --- Your RCM flight skill level is at the bottom of the ladder and I suggest you studiously examine back issues for the last 5 years and retake the quiz. If your score doesn't improve, have your family pet take the quiz for you.

11 to 20 points --- There is hope for you and your understanding of R/C Modeler Magazine but further study is necessary. Always carry an issue with you so you can read the magazine at any free moment. Just don't be sitting in your car in front of me when the light turns green and you keep on reading.

21 to 30 points --- With a little effort you can reach the top. Perhaps reading each issue twice and having someone quiz you with randomly selected questions from that issue will improve your perceptions enough to reach the top.

31 to 45 points --- You have reached the pinnacle of understanding of R/C Modeler Magazine. You should fly with renewed confidence and earn trophies at a fantastic rate. If you don't, then your skill at taking this quiz should enable you to create excuses that everyone will believe.

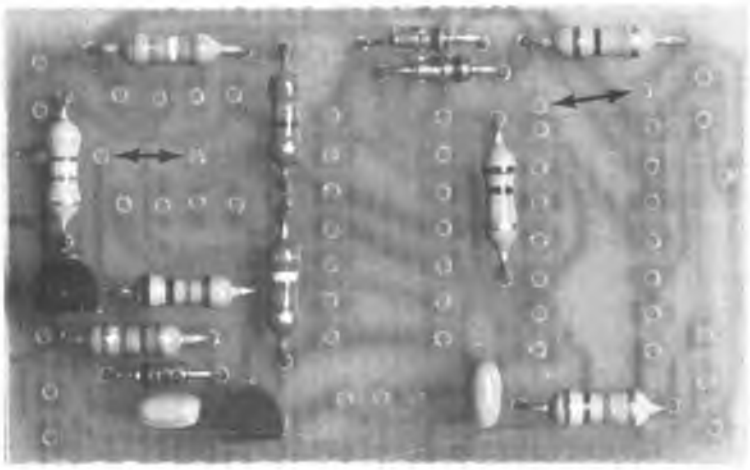
I hope you enjoyed taking the RCM Flight Skill Level quiz and didn't cheat any more than I did. □



Completed C.A.R. System.

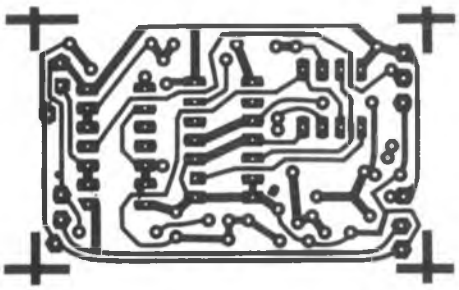
ELECTRONIC AILERON/ RUDDER COUPLER

By
Joe Utasi



Arrows indicate where two jumper wires are located.

P.C. BOARD BOTTOM VIEW (ACTUAL SIZE)



With the current trend toward bigger and bigger aircraft, the need to use full scale flying techniques becomes more important than ever — especially if we want the aircraft to survive its first flight! What I'm referring to is the need to use aileron **and** rudder control to execute a reasonable turning maneuver. Some ships are worse than others, but **any** plane with a span in excess of 8 feet can stand to gain from coupled control, especially if it's a high wing configuration. A lot of "smaller" models can benefit too — any of the "Cub" kits especially.

Without getting too deep into aerodynamic bull . . ., er, jargon, here's the reason why the rudder is needed to turn the plane: The "down" aileron has more drag than the one that's "up" (trust me), and it causes that side of the wing to slow down so the plane ends up skidding sort of sideways instead of just rolling like it's supposed to. The pattern guys figured this out a long time ago and came up with designs and techniques to fix it, but if you're building big, or scale, or both — you're stuck with the problem and you have three choices:

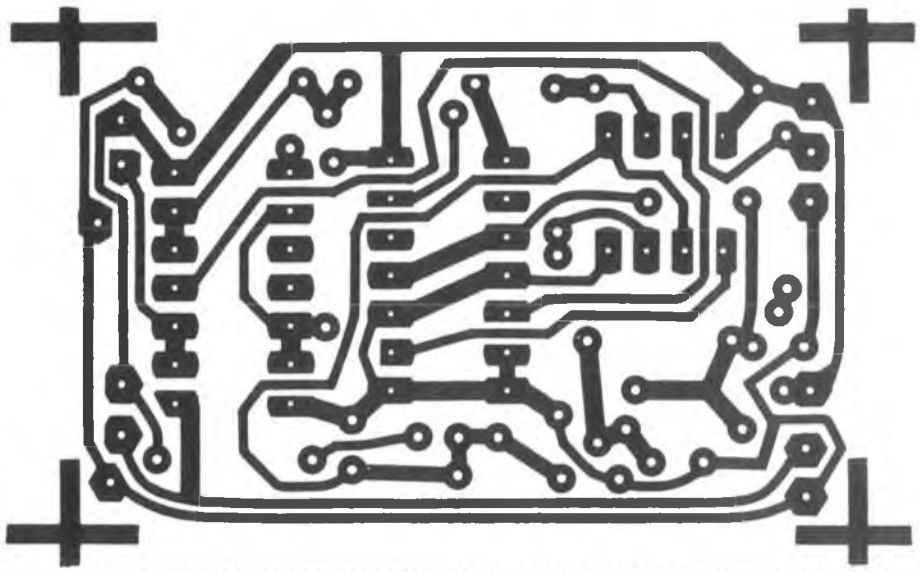
(1) Buy one of the new "super" radios that have all the buttons, bells, whistles, switches, etc.

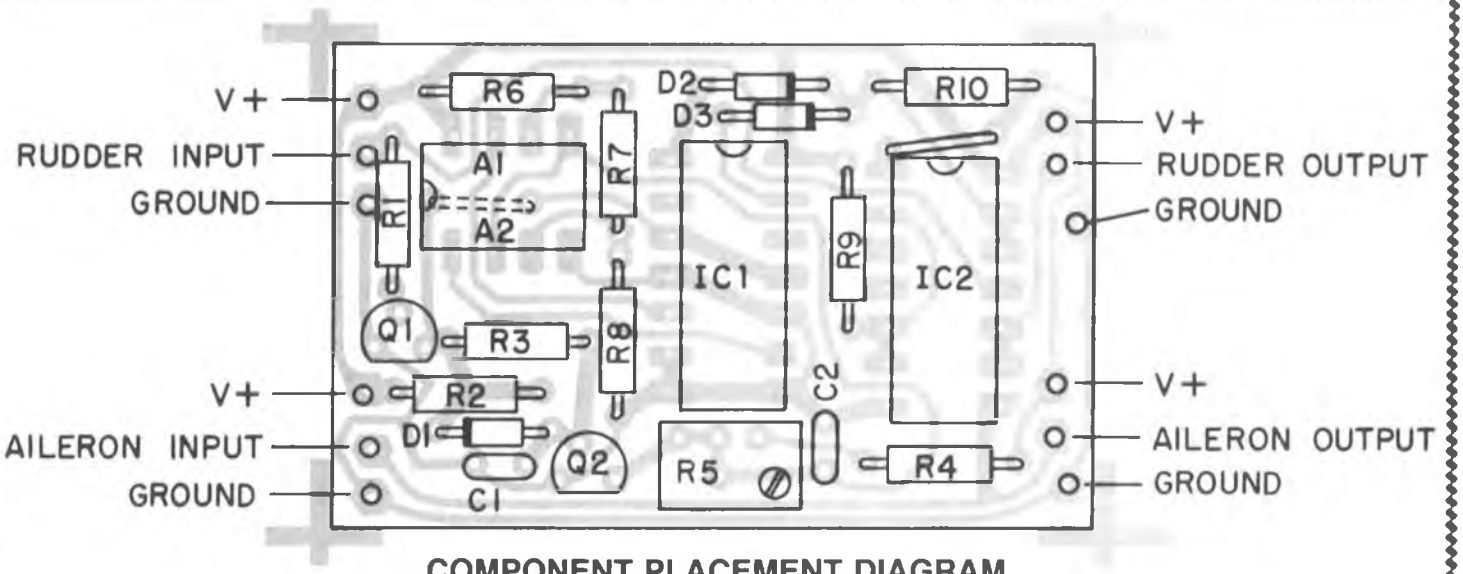
(2) Learn how to use your left thumb and take your chances in the meantime. (This is where the guys who own stock in "Hot Stuff" really start to clean up!)

(3) Build a coupler and use it as a "training aid" or a permanent "crutch!"

Naturally, I'd recommend the third

P.C. BOARD BOTTOM VIEW (2X SIZE)





COMPONENT PLACEMENT DIAGRAM

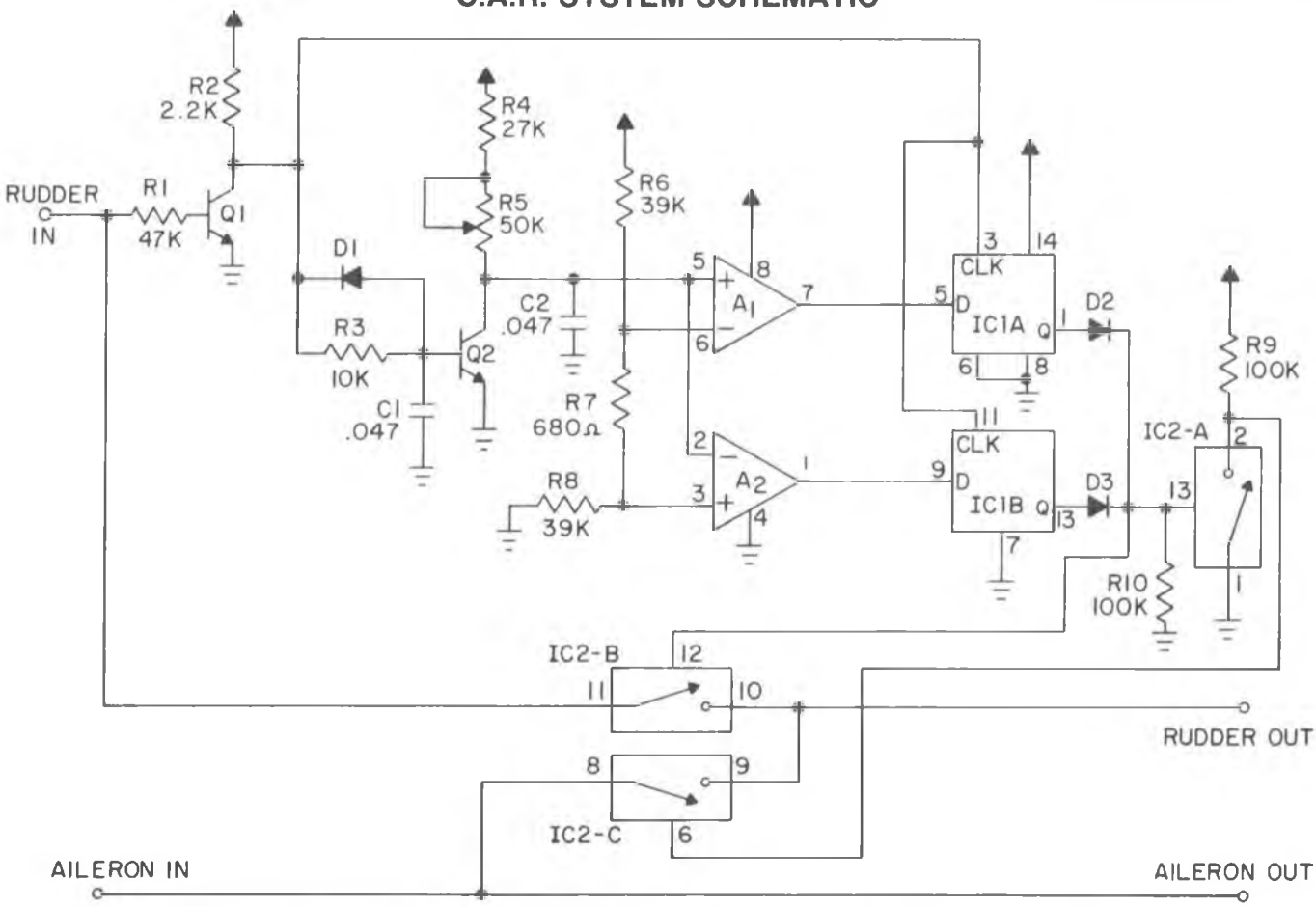
choice since it's obviously the easiest, cheapest way out, and has the most advantages.

Aha!! What are these advantages, you ask? First of all, there's cost — this approach is a whole lot cheaper than a new radio. It's also easy to use, since there's nothing you have to remember when using it (like turning a mixer on or off at that critical moment just before "ground zero"). It's also easy to install — plug it in-between the receiver and servos. And, it can be passed along after you've mastered the fine art of building instinctive response into your left thumb!

Right about now, someone's probably thinking, "The Christy Mixer does the same thing" — but it doesn't! The Christy mixes half rudder with aileron control, and the rudder stick also provides half. If you push both sticks the same way, the rudder goes **all** the way over. **But,** if you want to do a slip and apply opposite rudder stick, the rudder ends up in neutral! I'm not saying that's bad, but it's not exactly what you want in all situations. My mixer allows the pilot to do his own coordination any time the rudder stick is moved from neutral

continued on page 214

C.A.R. SYSTEM SCHEMATIC



THE QUEST FOR A PERFECT MANEUVER

By James V. Reiss, MD

Over the last several years the quest for a perfect maneuver has relentlessly gone on. The mind and body has been subjected to traveling the outback of mid-America. Dirt, rain, wind, potholes, and hail have been encountered along the way. Also a snarling tornado had to be dealt with. Many long night journeys have ended at a remote area facing towards the sun. These morning flights to the Sun God have to be made, it is part of a ritual. On one of these flights you have a perfect maneuver going, your anticipation is high, maybe this is the perfect maneuver? Your plane then disappears, the sun has it. A term you have not used since the rudder only days springs from your subconscious, "I ain't got it."

Time has taken its toll, the mind begins to fatigue, doubt takes over. Maybe there is no perfect maneuver? You are trudging along in a dejected manner on a barren Kansas terrain, looking for broken parts of an aircraft, when suddenly your shoe dislodges an odd shaped bottle. Certainly your sanity is being tested --- as the cork is removed from the bottle a sweet young thing emerges. Not believing your eyes or ears, you hear the following: "The perfect maneuver can be flown if simple logic is used." For your sanity and mine this timely advise will be reiterated.

Follow these guidelines to achieve a perfect maneuver.

A. Study and analyze the rule books' description of each maneuver.

B. Ask yourself what the judges easily see to downgrade your maneuvers.

C. What variables are present at the moment you are attempting your flight sequence?

1. Wind direction and velocity.
2. Density altitude.
3. Position of the sun.

D. Learn to know exactly what your aircraft is capable of doing. This is achieved only by practice.

E. Arrange to have enough control response available to achieve the maneuver, plus correction of the variables present.

F. Have at your command all the flight control variables possible.

1. Aileron — time your rolls so three rolls are flown in 5-6 seconds.

2. Elevator — need maximum deflection for spin maneuver.

3. Rudder — do not exceed 35° of maximum movement. Beyond 35° the rudder is stalled and is not flying.

4. Throttle Control — many maneuvers are best flown with less than maximum speed. This will give you an additional variable to correct a maneuver.

G. Create an illusion of a perfect maneuver. An example of this is to position the stall turn so the judges can see only one view of the vertical climb; if you are close, they will assume you are right on.

H. Take time to perfectly line up and position the entry of your maneuvers.

Now that the guidelines have been presented, let's go through the logic involved for flying, "The Straight Flight Out, Procedure Turn, and Straight Flight Back." This is a difficult sequence to fly correctly.

A. What do the judges easily see? Any unnecessary aileron correction, or changes in altitude.

B. Common reasoning will tell you that the procedure turn flown at full throttle with a headwind or cross wind cannot be achieved without using aileron for correction.

With these facts in mind, let's go through the sequence. The straight flight out, should be carefully established before the aerobatic box is entered. Use reduced throttle, any flight correction on the straight flight out should be done with rudder. The procedure turn is started by a 90° turn, don't force it but make sure it is 90°. After the 90° turn, you fly a short segment of straight flight. You may cheat and lengthen this segment if there is a strong cross wind working against you. Now, roll to establish the bank for the 270° turn. After the bank is established you must use the throttle and elevator to make the necessary adjustments. After the completion of the 270° turn, small corrections of the heading for the straight flight back should be done with the rudder.

At this point, unfortunately, my mind began to wonder, it couldn't decide if that shapely form was worth 10 or an 11. The illusion was broken and the hot sun told me we were back in Kansas. The quest must continue, but now the almost extinct windmill will not be my next opponent, but simple logic will prevail. □

AERONAUTICAL EXPERIMENTS OF ORVILLE AND WILBUR WRIGHT

By C. Peter Handforth

Eighty years ago the Wright brothers made their historic first flight in a powered plane under full control. This was an important step in the development of aviation, but their previous work was equally important even though it has been given less attention. The Wrights found how to control a plane in flight, and they established the beginning of our present knowledge of aerodynamics.

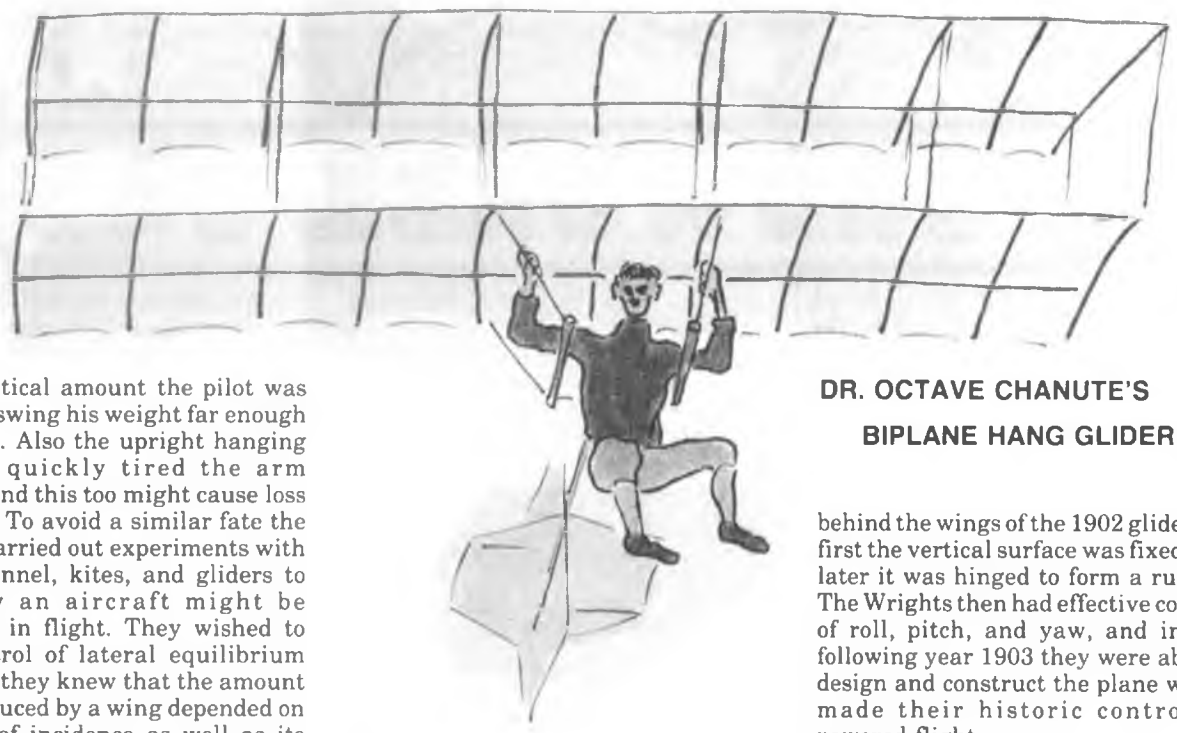
When Orville and Wilbur Wright became interested in flight they were well aware of the difficulties and dangers ahead. Early attempts to fly had usually ended in tragic accidents. Even the pioneers who succeeded in gliding often crashed and died. In 1899, to benefit as much as possible from the experience of others, the Wrights asked the Smithsonian Institute for information and advice. At that time the Head of the Institute was Dr. Samuel P. Langley who had made several model aircrafts which he called aerodromes. Some of these models flew very well, but in 1903 a man-carrying plane designed by Langley failed to fly and fell into the Potomac River. Probably its tandem wings were not strong enough to support its weight in flight. Dr. Langley generously shared his knowledge with the Wright brothers and sent them scientific articles by Lilienthal, Chanute, and other scientists. This information was the starting point from which the Wrights were able to discover many of the principles of controlled flight. Their discoveries enabled them to design and build the powered aircraft which first flew on December 17, 1903.

Otto Lilienthal in Germany and Dr. Octave Chanute in the United States had both flown hang gliders. In these aircraft the pilot was literally hanging upright supported by his arms, and shoulders. This position allowed him to swing his body and legs to produce some control of flight by moving the position of his center of gravity. No other method of control was available. There was no rudder, elevator, or aileron as these had not been invented and their purpose was not understood. Lilienthal started with a monoplane glider which had wings which folded for storage. Later he made a biplane of similar design. With these gliders he flew many times down the slopes of local hills. Also he calculated how much lift could be expected from curved (cambered) wings. Unfortunately, on August 9, 1896, a gust of wind blew Lilienthal and his glider out of control. He fell a distance of fifty feet, broke his back, and died the next day. The Wright brothers obtained Lilienthal's tables of lift from the Smithsonian Institute before starting their experiments.

Dr. Octave Chanute was the President of the Western Society of Engineers. He had made a biplane hang glider in which a lightweight rectangular wing structure was strengthened by crossed wire bracing. This wire-truss method of wing construction was just what the Wrights needed to permit the method of control which they invented, which consisted of twisting or warping the wings. For this to work the wings had to be light, strong, and flexible. Wilbur Wright and Dr. Chanute often corresponded about their work. The Wrights were seeking a location with strong steady winds so they could test their theories by using gliders tethered like kites. This would save them having to drag gliders to the tops of the hills after each flight. Dr. Chanute suggested that they should try the sand dunes on the Atlantic coast of Carolina, and it was this suggestion which helped the Wrights to find the area around Kitty Hawk where their first flights were made.

The Wrights realized that Lilienthal had been killed because he did not have complete control of his glider. When the glider tipped more

LILIENTHAL IN FLIGHT SWINGING HIS LEGS TO THE WING WHICH IS TOO HIGH TO RESTORE BALANCE.



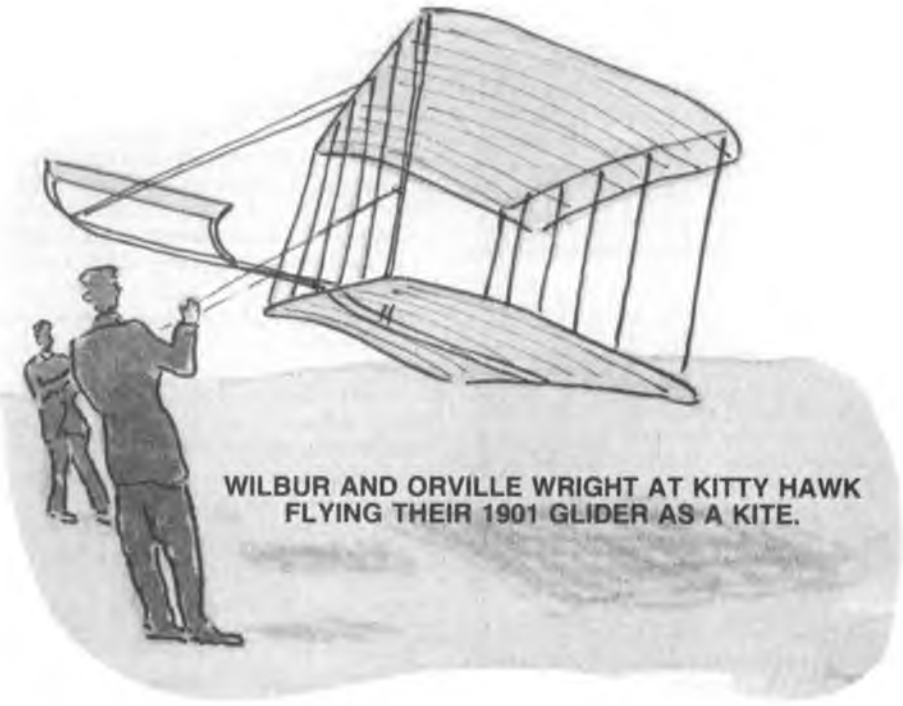
DR. OCTAVE CHANUTE'S BIPLANE HANG GLIDER.

than a critical amount the pilot was unable to swing his weight far enough to right it. Also the upright hanging position quickly tired the arm muscles, and this too might cause loss of control. To avoid a similar fate the Wrights carried out experiments with a wind tunnel, kites, and gliders to find how an aircraft might be controlled in flight. They wished to have control of lateral equilibrium (roll), and they knew that the amount of lift produced by a wing depended on its angle of incidence as well as its curvature. To make use of this they tried to construct a mechanism which would rotate the wings in opposite directions, but they soon found that the strong gears and shafts needed were too heavy. Then Wilbur noticed that a small cardboard box without its ends could be twisted by pressing on its diagonally opposite corners. He realized that biplane wings could be twisted in the same way by control wires, particularly if some of the fore and aft wire trusses were loosened or removed. During 1901 this theory was tested at Kitty Hawk, and it was found that wing twisting or warping gave excellent lateral control.

Fore and aft control (pitch) was also a problem. The Wrights knew that the position of the center of pressure (lift) of a cambered wing moves backward or forward when the angle of incidence changes. In hang gliders this movement had to be compensated by changing the position of the pilot's center of gravity. Instead of moving the center of gravity, the Wrights placed a canard airfoil, which they called a horizontal rudder, in front of the main wings. They were pleased to find that this not only controlled the effects of movements of the center of pressure, but also the horizontal rudder could be angled to steer the glider up or down. Wing warping had given them control of roll, and the horizontal rudder now controlled pitch.

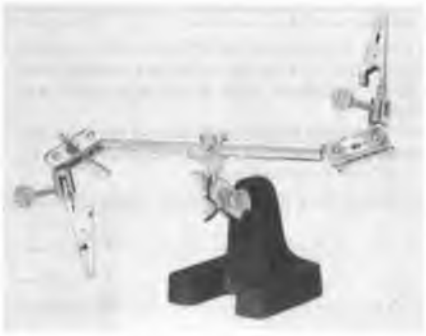
The Wrights had not used a vertical tail because they thought it was not necessary, but during the 1901 flights something unexpected happened. They were using wing warping to control lateral equilibrium, but sometimes the wing which was twisted to a greater angle of incidence would fall instead of rising as it should have done. This usually ended the flight quickly and uncomfortably. The Wrights' explanation was that the greater angle of incidence had caused more drag and slowed down that wing thus giving less lift instead of more. They had not noticed this in tethered gliders because the wing tips were held and could not yaw. The problem was corrected by using a vertical tail behind the wings of the 1902 glider. At first the vertical surface was fixed, but later it was hinged to form a rudder. The Wrights then had effective control of roll, pitch, and yaw, and in the following year 1903 they were able to design and construct the plane which made their historic controlled powered flight.

Looking back, it now seems surprising that the importance of proper control was not realized before the Wrights' experiments. Every radio-control modeler who flies planes knows that control is essential, and beginners learn this very quickly. It seems that many of the pioneer aviators gave so much attention to defying gravity that they overlooked the need to control their machines. The Wright brothers corrected this situation and ensured that after 1903, flight could be safe as well as successful. □



WILBUR AND ORVILLE WRIGHT AT KITTY HAWK FLYING THEIR 1901 GLIDER AS A KITE.

SHOWCASE'84
continued from page 211/206



delicate work for you and leaves your two human hands free for the soldering. You'll find it easy to swivel the work in the trusty grip of "The Third Hand" to just about any desired angle, tipped and rotated for your convenience. It's available for $5.00.

ELECTRONIC AILERON/RUDDER COUPLER
continued from page 197/196

— this shuts the coupler off automatically, allowing maneuvers which require separate rudder and aileron control.

Circuit Description

The rudder input is inverted by Q1, R1, and R2. The rising edge of Q1's collector voltage at the **end** of a rudder pulse clocks data on the D input of IC1 A or B to its respective Q output. Q1's collector also provides drive to Q2 through a network made up of D1, C1, and R3. This makes Q2 turn on slow and shut off fast. When a pulse starts (goes high) back at the base of Q1, Q2 is quickly turned off allowing C2 to start charging up through R4 and R5. The longer the pulsewidth, the higher the voltage on C2 at the end of the pulse. The voltage on C2 is compared with a high and low set point determined by R6, R7, and R8. If C2's voltage is higher than A1 pin 5, pin 7 goes high. If C2's voltage is **lower** than pin 2, pin 1 goes high. If C2's voltage is between these two points, both outputs stay off. These voltage comparisons and output conditions are only important for a brief moment at the **end** of the rudder pulse, since this is when the data (A1 pin 1 or 7) is clocked into the latch (IC1 A or B) where it sits until the next pulse comes along. R3 and C1 slow the turn on time of Q2 to insure that the comparators outputs are valid for the instant the input pulse is turning off.

The latch outputs are "OR" connected by D2 and D3 and direct the switching of IC2-B. IC2-A and R9 act as a simple inverter that provides complimentary (opposite) control of IC2-C. To say this a lot simpler, when IC2-B is **on**, IC2-C is **off** and vice versa. These two gates (you can consider them the same as switches) control whether the rudder output gets hooked to the rudder input or the aileron input. Take a look at the schematic and trace the signal paths — it's really easy to understand, even if you're not an engineer!

Assembly

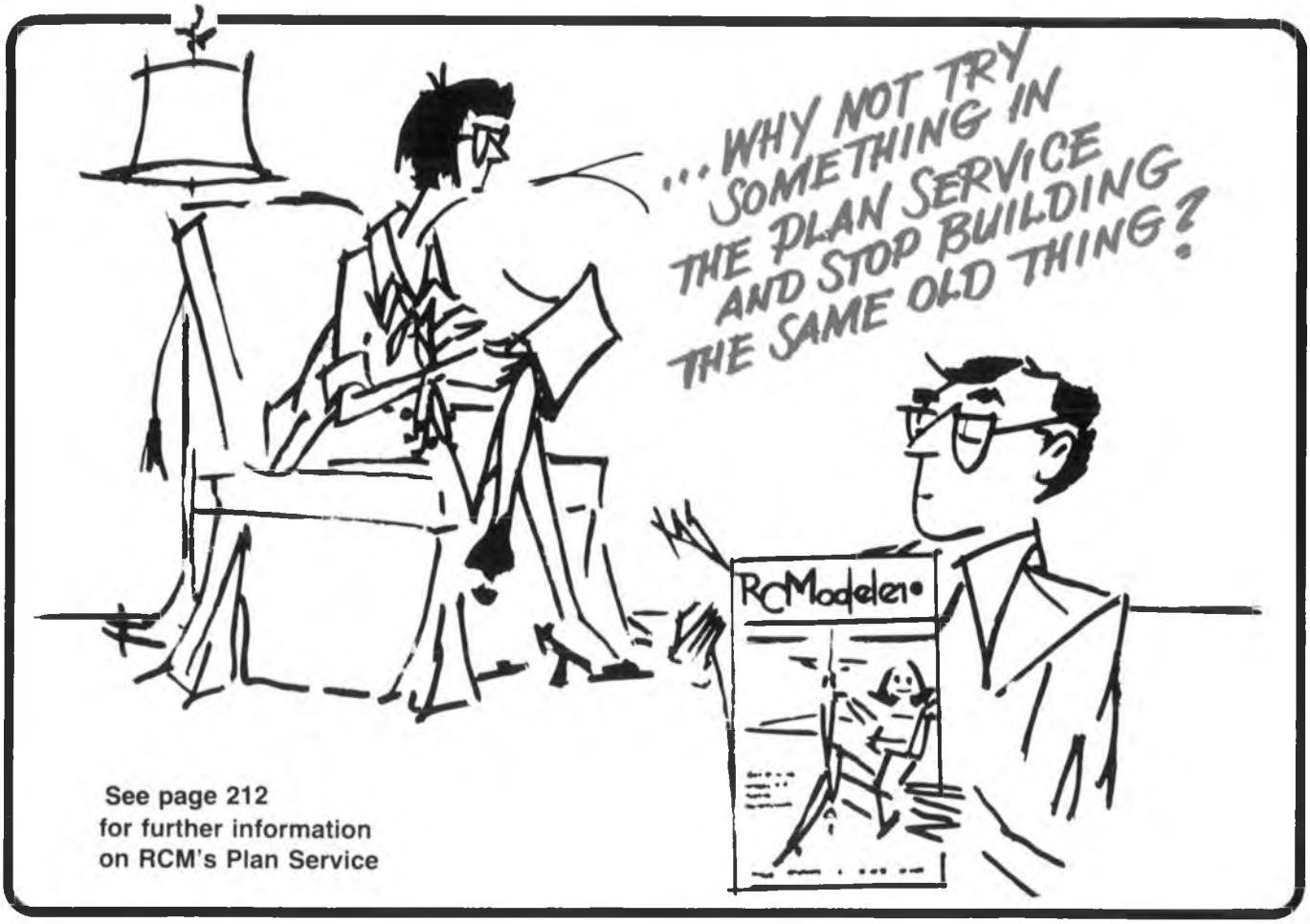
The parts are so widely spaced it really doesn't matter what sequence you use in stuffing the board. Just don't forget the jumpers, especially the one that's underneath A1/A2! This one disappears when you mount the IC to the board.

Use a good rosin core solder and make good, shiny solder joints. Use your soldering iron tip to heat the copper and the component lead **at the same time**, and feed the solder into the intersection until it forms a small, shiny fillet all around the lead.

Clean the flux off the finished board using some acetone or lacquer thinner. Please, don't smoke while doing this!

Hook Up and Operation

Pick up a **set** of aileron extension cables to fit your radio system. Cut



See page 212
for further information
on RCM's Plan Service

them both in half and solder the male (pin side) end to the two inputs as shown. Red is V+, black is **ground**, and the one that's left is the input. The other two halves of the extension cables connect to the coupler outputs in a similar fashion.

Plug the coupler into the R & A receiver outputs and plug the servos into the leads coming from the output of the coupler. Turn on the system and adjust the trimpot (use a small screwdriver) until the rudder moves when you move the aileron stick. Fine tune this setting so an equal small rudder stick movement in either direction causes the rudder to operate separately. That's all there is to it! The coupler is stable from 3.5 to 8 volts and should provide years of trouble free flying pleasure. Enjoy . . .

Parts List

Resistors
R1 ..... 47K
R2 ..... 2.2K
R3 ..... 10K
R4 ..... 27K
R5 ..... 50K 20 turn trimpot
R6, R8 ..... 39K
R7 ..... 680 ohm
R9, R10 ..... 100K
Capacitors
C1, C2 ..... .047 npo or X7R
Semi-Conductors
Q1, Q2 ..... 2N3904
D1, D2, D3 ..... 1N4148
Integrated Circuits
A1, A2 ..... LM358
IC1 4013
IC2 4066
Miscellaneous
PC Board
Solder
Extension Cables

A PC Board (etched, drilled, reflowed) is available for $7.50. An assembled, tested coupler is $38.00. Write direct to: JOMAR PRODUCTS, 2028 Knightsbridge Dr., Cincinnati, Ohio 45244.

□

REAL THING MEET
continued from page 190/186

Fun-Flys were selected to stay within the capabilities of the most novice pilot.

In conclusion, the Fun-Flys were hilarious. Trying to fly an underpowered, not too stable modification of the original was a challenge worthy of applause from the spectators when one got airborne and, again, after completing any maneuver. I don't know how anyone can fly one of these things with an .09 engine. The .15s we were using gave models marginal performance. The Fun-Flys definitely had the emphasis on the **fun** and not on the competition, and we are looking forward to doing it again in 1984. □

DER JAGER
continued from page 182/176

power for its size. A balanced Dynathrust 20/8 prop with the tips radiused provided excellent performance. The B & B smoke system functioned equally well and produced a dense uniform smoke trail that is equal to any of the other smoke systems that are presently available.

Conclusion:

Would this reviewer recommend the Der Jager? Absolutely! In spite of its instructional shortcomings, nose heavy tendency (this is still better than a tail heavy condition), and only average parts fit, the Der Jager at $124.95 is an excellent dollar value. This reviewer can think of several much higher priced giant scale kits (and short kits) that are nowhere near as good as the Der Jager; both from a kit quality viewpoint or where it really counts — in the air! □

TOTAL CHAOS
continued from page 154

Covering:

After a coat of Coverite Balsarite, an application of World Tex provided the outer layer. Dupont Centari enamel automotive paint was sprayed over the entire model. This white base coat was followed by red and blue trim using the same type of paint. The lettering on the vertical tail is vinyl stick-on letters.

Engine:

An H.B. .61 PDP fit the engine mount so it was chosen to fill the cavity in the nose. Using the standard muffler, this combination provides plenty of thrust to make the Total Chaos perform. A Sullivan 12 ounce tank slipped into its compartment.

Radio:

Futaba FGE 7 channel electronics were installed with no problems. Putting the three abreast fuselage servos as shown on the plan and mounting the aileron servo as deeply as possible in the wing is advised. The battery and receiver took their respective locations and it was off to the flying field.

Flying:

The plane turned out nose heavy but was left there for the first few flights. With a total weight of 6 lbs. 3 ozs., a wing loading of 20.4 oz./sq. ft., a good performance was expected. These expectations were met completely; maybe our pattern flying will rise above the Total Chaos category with the help of this airplane. Landings are very easy, thanks to the low wing loading.

Conclusion:

This kit is aimed at the sport/pattern flier and represents a good choice for someone desiring a kit of this type. The quality is excellent and construction goes along very well. Build it straight and you'll appreciate its characteristics in the air. □

GIVE IT A WHIRL
continued from page 140/134

like to say thank you all very much. At age 31 I feel like a young boy who just discovered candy.

Yours truly,
Bert L. VanOstran
Kalamazoo, Michigan

P.S. I am sending some pics of my yellow Cricket and a new Cricket owner who I am now helping to get started. If this letter is any use to you please feel free to use all or any part of it. Again, thank you and may you always hover smoothly.

Puyallup Again — Northwest Modelers Exposition

Now to the Northwest Modelers Exposition. One more time, and I think this is the third year running, we duly made ready and headed up the coast road for Puyallup in Washington state. The Northwest Modelers Exposition is held at the beginning of February each year and consequently everybody holds their breath concerning what the weather conditions are likely to be. We have been quite lucky over the past three years and this year was no exception. We decided to drive instead of fly this time and, lucky for us, there was no snow on the mountain passes because we were unable to find chains for our motor home in time. The show was, as usual, superbly organized and conducted. The Northwest Modelers Exposition has now become thoroughly established as a great show for the modeler to attend. Bob Pfieffer again did a splendid job as the "Maitre D" of the whole affair and you can see a picture of him in the column. American Helicopters, Gorham Model Products, and Miniature Aircraft Supply represented the helicopter manufacturers. I believe that California Model Imports chose to attend the HIA show instead since both were on the same weekend. Consequently, we did not get to see the KKK "Robinson" helicopter fly — a pity. As we have described many times before, to fly at the Puyallup show is to experience something quite unique and this year was no exception. You will see a photo of yours truly flying the Hirobo "Lama" in front of the grandstands which were populated with an enthusiastic crowd. The crowd in Puyallup is always very appreciative of our efforts. Several of the local TV channels covered the show and the flying and we were able to do a few unusual tricks for the Washingtonians. You'll see one of our 'choppers' attacking the Puyallup Chicken which is an inflated device standing at least 60 or 70 feet high. Several of us tried to land our helicopters on the wings of the chicken only to find out that the down wash from the rotor blades moved the wings around and made that maneuver almost impossible. The picture of the fliers show (from left to right) Dick Tristao, Jeff Sands of Denver, Colorado; Ted Schoonard of Miniature Aircraft Supply; Ernie Huber who flew in from Massachusetts; Robert Gorham and Bill Krietzman from California. Two times each day we gave a flying show which lasted at least 45 minutes each time. Oh, you'll also see Jeff Sands flying the Schluter "Super Boy" and Robert Gorham hovering his new GMP "Cobra" inverted for the crowd. Ernie flew the Schluter "Superior" and Curtis Croker flew the American Helicopters' "Super Mantis." So far as the booths were concerned, each one of the helicopter manufacturers showed his products and the booths were well-attended for all of the two days. Great show, Bob, see you next year.

On the way back we stopped off at Portland, Oregon, and spent a day flying with the local modelers. Got to understand some of their views and outlooks on helicopter flying and we tried to give them some pleasure in return by showing them and flying some or our new helicopters.

Well, until next month, happy hovering and by the time you read this we may have already met at "Toledo." If so, it was nice meeting you. I look forward to seeing you again next year. By the way, remember the Annual Westcoast R/C Helicopter Fly-In at Merced reported on in the February 1984 GIAW? Well, we are going to do it again this year — probably October again. We will keep you informed. □