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RCM radio control MODELER

THE WORLDS LEADING [illegible] OR THE RADIO CONTROL ENTHUSIAST

RCM MODELER

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This Month's Cover

Miss LeAnn Dobson displays the Bellanca Decathlon, the newest member of the Hobby Shack-Pilot Giant Scale Aviation Series. This is an exact, 1/4 Scale version of the real plane, which features the finest in workmanship and materials. It comes complete with many extras including scale cockpit details, complete hardware, vacuum formed cowl, wheel pants and windows. Ektachrome transparency by Tom Faries.

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FROM THE SHOP

Don Dewey

Among the many joys of publishing this magazine is the frequent involvement of our staff members with exciting projects and activities. Our aged assistant editor became acquainted with Darrell and Merle Meyer in the early stages of their Hughes H4 Hercules (Spruce Goose) project (RCM, March, 1981). A quite happy relationship developed between them during the construction of the Hercules model which has led to our guy being invited to attend several functions related to the full size Hughes Hercules. After attending a recent banquet to promote the planned museum to house the Spruce Goose, he brought in the following far-out story.

It seems that a powerful corporate conglomerate has control of the Hercules and has assumed the obligation for preserving the huge bird. At the banquet an executive of the corporation related that since Hughes Aircraft relinquished title to the Hercules last year, an amazing number of people who were associated with the aircraft have stepped forward with James Bond type stories by the dozen.

An example pertained to the security that surrounded the Hercules. Following the maiden flight in November, 1947, the ship was stored in Pier E dry dock hangar with only a nominal security guard force.

Now the plot thickens. A couple of months later the hangar doors opened, the boat was floated out, engines fired up and, with the eight engines roaring, the Hercules disappeared into the late night skies. Sometime under the cover of darkness during the following night, the Hercules taxied back, was pushed into its hangar, and the doors closed behind it for some thirty odd years.

On board for that mission was the flight crew and another group reportedly to have been C.I.A. agents. Howard Hughes was allegedly in the pilot's seat.

It was at this point in time that heavy full-time security measures were imposed on the Hercules hangar that remained in effect until mid-1980.

Unanswered are a bunch of questions: Where did it go? Why? Were they really C.I.A. agents? How was the mission kept secret so long?

This is just one more item in the fabulous Howard Hughes mystique. Fact or fiction --- who really knows?

●

We received the following announcement from Herb Wahl, proprietor of Herb's Model Motors. Herb has gained world-wide fame for his production of Brown Jr. and Hurleman engines. Each of his reproductions is a masterpiece of craftsmanship and his latest offering should be even more exciting.

It will soon be twenty years that I've been involved with our Old Timer flying and Vintage Engines. During these twenty years I have been able to provide Brown Jr. and Hurleman engines and parts to those who needed them. No one is more grateful than I to have been able to do the things I've done . . . heck, to have been a teenager during the '30's was an opportunity not afforded to everyone. Let me thank all of you who have helped my work by being interested in our wonderful Old Timer flying and Vintage Engine activities.

To those of you who may still be waiting for an engine from me — although this letter will introduce you to my next "Great Adventure" — have faith. With only minor overlap I'll get your presently awaited engines (mostly Hurlemans) to you. Then, however, I will stop building the Brown Jr. and Hurleman engines, except for necessary parts and repairs.

Now, what is it I'm leading up to? During the 1930's and 1940's there was another perhaps even greater line of engines that truly established our accomplishments (or disasters) in model aviation. They led us to competitive free flight — even to Super Sharks and U-control — Ah, the memories. So now, gentlemen, I am absolutely honored at being granted the opportunity to proudly announce to you . . .

With the kindest permission, encouragement, and advice of Mr. Irwin Ohlsson, I announce this limited edition engine. This pre-production announcement is to those of you who I have previously served and is extended to you.

Scene from '80 Rhinebeck WWI Jamboree sent in by C.P. Ricci, FL. The Handley Page 400 on table was designed & built by J. Goodrich, VT. The Proctor Nieuport by Bob Temple.

First, a little about the forthcoming Ohlsson Commemorative: The Ohlsson engines surely were the greatest line of ignition engines ever developed; they spanned the years from the mid-thirties to the early fifties, with the .19's, the .23's, the .60's, front rotary versions and glow plug adaptions. Most would say the Ohlsson and "Ohlsson and Rice" engine line established the production and performance standards for all engines then or now.

*The **first** Ohlssons, the grandest of them all, the .56 displacement "Miniatures," were developed by Irwin Ohlsson in the mid-1930's. Their light weight, nearly "square" bore and stroke design and other features led to excellent performance. In 1937, Irwin Ohlsson won the California State Championship and was awarded the Gold Seal of California, his engines thereby became known as the Gold Seal Ohlssons.*

The "Commemorative," then, will be my re-creation of the classically beautiful Ohlsson Gold Seal engine. The "Commemorative" will have its own identity, engraving and the finest appearance and performance I can create. The cylinder will be finished in genuine 24 Karat Gold, both for beauty and for the thermal uniformity I've found it imparts. In spite of the price of gold, the plating is not a major cost item. The engine will have other features, chosen by Mr. Ohlsson from the best of the several Gold Seal engine versions, which you'll just have to wait to see. Every engine will be test run by me personally; Mr. Ohlsson will sign each certificate which will accompany each engine.

*Final orders will close in November or December 1981. Upon order closing date, the total number of engines will be set, and I shall proceed to provide **exactly and only** the ordered number of Ohlsson Commemoratives; no more shall ever be made.*

*And now, to the big question — just what **will** this little gem cost? Would you say more than the Anniversary Brown of six years ago? Sorry to say, you're right. All my calculations and estimates lead to well over $200. Certainly I will in no way compromise its construction, but I may use some slower techniques of fabrication. Though I have quite a few unturned stones yet to turn, I am going to price the Ohlsson Commemorative at this time — it will be $195. Deliveries and Serial Number sequence will begin S/N Eleven (11).*

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SUNDAY FLIER

Ken Willard

Did you ever hear the story about the guy who came into the doctor's office with the tip of his finger cut off? The doctor bandaged it up, and then asked, "How'd you cut it off?"

"Well, Doc, I've got this big folding hunting knife. Here it is. Isn't it a beauty? I had just finished sharpening it, with the blade extended like this, and then started to fold it, like this, and OOPS! There goes another one!"

All of us have done some dumb things, maybe not as dumb as that guy, but pretty dumb. So every couple of years or so, I like to collect some examples and tell you about them, so you will know you are not alone. And to ease the pain of the guy who writes in about his dumb action, even if he doesn't win the award for top dum-dum, he can read about the other guys. And, for the guy who does the dumbest thing of all, there's a prize. This year it's the RCM Anthology book of his choice. So here are some of the top contenders, along with the winner.

But first let me tell you about one instance, or rather two, that could well have won the award, but the modeler chose not to submit it. However, I know it happened. The modeler had a switch on the side of his plane --- push in for "off" and pull out for "on." One day he started the engine, turned the model around to taxi out, and it didn't go quite in the direction he wanted it to, so he tapped it with the side of his leg. When he did, he pushed the switch in, turning off the receiver. Fortunately, the engine was running at low speed, and the model ran merrily down the runway and off the end, winding up in the grass with the modeler chasing madly after it.

"You oughta reverse that switch arrangement," his companion suggested.

"Nah, it's okay. I just didn't think about it at the time. I was more interested in getting it headed right." Un-huh.

A few days later he was out again. As the model went cross wind, he wanted it to go downwind, but it kept weathervaning towards the wind. You guessed it; he again tried to head it by tapping the side with his leg. Yup --- away it went, receiver dead, off into the boondocks. Sheepishly, he retrieved it. The next time he came out to fly, the switch was reversed. I told him he would win the dum-dum award hands down --- but he prefers to remain anonymous.

Other modelers weren't so shy.

One unusual letter came from Drew Allen of Santa Clara, California. You have to admit it's different from the others.

Dear Ken,

Some time ago in your Sunday flier column you asked for confessions (which is said to be good for the soul) concerning our dumb dumb happenings.

"Well --- so much for building by night and flying by day."

Considerable thought has been given to this in my R/C related activities and the following is submitted for your consideration. It is of a somewhat different nature than the usual pilot, construction or maintenance errors.

When I began the R/C hobby, it was with great zest, enthusiasm, happiness and joy. I was a rank beginner, desiring to become a proficient flyer and learn all there was to know about the hobby.

Several years elapsed in which I puttered around the sky with either an RCM Trainer or a Super Kaos, powered by a reliable, inexpensive K & B .61. When a problem developed with the engine, parts were readily available and the fix was quick, simple, and inexpensive.

One of the pattern flyers in the club then began to encourage me to enter pattern competition. Though reluctant at first, I gradually got the bug and began flying pattern with my Super Kaos and trusty K & B .61. It had fixed gear, muffler rather than tuned pipe, and a standard radio.

Two contests quickly convinced me that arrangement was not competitive. It was fun to fly, but it would not hold a candle to the newer designs powered by screaming Rossi engines with tuned pipes, retracts, and Signature type radios. And this was in **Novice** *class.*

I bought a newer design aircraft, used retracts, but stayed with the K & B .61, though it was blueprinted, PDP ported and Perry pumped for more power. It was a great engine, still inexpensive, but was just not competitive against newer and more powerful engines.

So the plunge was taken. A contest radio was purchased, exotic aircraft assembled, retracts installed, and the almighty Rossi engine with tuned pipe installed for power.

But wait! Now the Rossi is difficult to adjust. There are carb problems which I eventually learn are common to the breed, and the tuned pipe is difficult to adjust properly. Then a mishap occurs, the needle valve is broken off of the carb, and I discover it cannot be replaced. The **whole carb** *must be purchased for only $48.00. Also a new ring and piston are needed. My total outlay is over $100.00 for a few parts of this exotic engine. That is more than I had to pay for the entire reworked K & B .61.*

So what is the dumb dumb?

I am beginning to think it was dumb, dumb, dumb to try to go from the relatively inexpensive and simple fun flying to the fiercely competitive world of super engines, complicated installations, mixture control carbs, tuned pipes which are tricky to adjust, retracts which collapse even though many, many hours are given to installation, and where super radios are needed for precise control over the aircraft's wanderings about the sky.

I used to go to the field, crank up quickly and fly enough to consume a gallon or more of fuel during an outing. I rarely had any difficulties with radio, engine, or plane. My fixed gear never collapsed, so the props didn't break and the paint didn't get scuffed. Now I notice it is a constant tinker, tinker, tinker, and if all goes well, I may burn a quart or two of fuel.

Now it's true, I'm saving money on fuel. But certainly much more is being spent on all the other paraphenalia, and much less flying is being done than before. And for me, flying time in the air is what it is all about.

The hobby used to be fun. It still is, but in a different way. I'm hooked on pattern competition. I'm going to keep on trying to win. It will be costly, time consuming, and much more frustrating than the simple pleasures of non-competitive flying.

But somehow, it seems a dumb, dumb thing to do to leave simple American made inexpensive and reliable equipment and go to the expensive, imported, difficult to adjust, no parts available (or spend a small fortune when they are) world of the exotic competition engine and aircraft.

Life used to be simpler, less expensive, less frustrating, and filled with more hours in the sky and less at the workbench.

Dumb!

Dumb! And I plan to continue subjecting myself to these expensive, time consuming

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CUNNINGHAM ON R/C

Chuck Cunningham

R/C building and flying is fun — but slightly difficult. Right? No argument about that, is there? So, what else is new?

Each spring it seems that a new bunch of men and boys decide that what they really want to do is to learn how to fly radio controlled models. This is really great --- we all want to share the fun of this sport with others. The trouble is that it really is hard to get started, and hard to stay with the program after beginning. There are so many new things to learn. Not only must the beginner decide what engine, airplane, and radio to purchase (often with minimal help) but then he must find an instructor to help him into the air and down again. Then he must be willing to withstand the terrible discouragement of that first crash when his bird has been reduced to a less than pretty state. If he survives all of the beginning hassles, then he must decide upon what the next project will be, and how to construct an aircraft that will fly well, and look good.

It really is a wonder that any beginners survive to become experts. I wonder how many of us "old timers" would have survived if we had come to modeling as grown men rather than to have grown up with modeling all of our lives. I've been trying to think of a more complex hobby/sport, and I cannot. Sure, there are lots of more expensive pastimes in which to occupy yourselves, but for sheer complexity, this one is almost impossible to beat. For the man (or the rare woman) who survives the beginning problems, an entire new group opens up. A letter from Bruce Boon put this pretty well.

Dear Mr. Cunningham,

I've been reading R/C Modeler since September '76. I didn't begin to fly until September '80. I've enjoyed your articles, especially the ones on R/C design. I have, however, some topics I'd like to see discussed. Here's a small sample:

(1) Scratch building

(a) Reading the plans (to think like the designer).

(b) How to transfer drawings to balsa accurately.

(c) How to cut, sand, and shape parts.

(d) How to build accurately.

(2) Use of covering materials.

I've got a wad of questions but I shall draw the line here.

Thank you for your time.

Bruce Boon

Okay, Bruce, for you and all of the other RC'ers who would like the next project to be from magazine plans, or from their own brain, let's take a look at scratch building, how to do it, and how to do it easily.

First, pick out the project that you're going to build. Let's assume that you have decided to build from one of the many plans that RCM has to offer. The next step is to make a material list, if one isn't given with the plans, and then to purchase the necessary balsa wood. (For this project let's assume that it is an all-balsa aircraft.) Purchasing balsa wood can be a bit of a chore unless your local hobby shop carries a good supply. You may have to scout around to locate a good source, and if one cannot be found in your area then I suggest that you give Balsa USA a chance to be your supplier. Their wood is nice, well cut, the price is right, and delivery is very fast.

After purchasing the materials, you come to the real beginning — studying the plans to see just how the aircraft goes together. Read the construction article several times to be sure of the construction sequence. The most frustrating thing is to start sticking parts together only to find that you should have put one part in place before you put in the one that you've already got epoxied in position.

How to read the plans is not all that hard. Most of the plans reproduced in RCM are drawn by the same hard working men. These modelers, who really don't have much time to model themselves, due to the load of turning out plans, take the drawing prepared by those submitting construction articles for publication and re-draw them to exacting RCM standards. Because of the very high quality of the finished plan product, you, the scratch-builder, have a much easier time. Look over the plans several times. Make sure that you understand the plans, make sure that you know just what outline is what, and the size of the parts.

You're now ready to begin slicing balsa wood. You will need some tools. Scratch-building requires that you transfer the plans to balsa wood, then cut out the parts. The very best tool that you can buy to do part of this work is a metal straight-edge. I have a super one given to me by my old pal Helmer Johnson. It is a stainless steel ruler with a light cork backing that keeps it from slipping. It is 18" long and can be used for drawing, or cutting, as the edge never gets knicked. This type can be purchased in an office supply store, or a store that sells drafting equipment. While you're there, purchase a couple of inexpensive plastic drafting triangles. These will help you to lay out your drawings on balsa wood as well as serving to check the alignment of the work under construction. Also purchase a black nylon fibre tipped drawing pen to do the marking of balsa parts. If you do not have access to a copy machine, take a look at the same office supply store, or post office, or some place where you can reproduce copies for a few cents. It is much easier to take the plans to the store, and run copies of the formers and rib outlines than it is to try and re-draw these parts.

Let's assume that the plan that you decided to build has sheet balsa sides, a couple of formers for the fuselage, sheet balsa tail feathers and a constant chord wing. All very easy and straightforward to build. Since you made copies of the formers and firewall on the copy machine, take these copies, cut them out, leaving an edge of 1/4" or so on all sides, and stick them to the balsa sheets, or plywood in the case of the firewall. Stick them to the wood with another product that you purchased at the office supply store --- a Pritt Glue Stick. Make sure that the grain direction on your formers is in the same direction that the plans show. You can cut out the balsa formers with a razor blade, but you will need to saw out the plywood firewall with some type of saw.

For razor blades you can use a good single edge blade such as Pal or Gem, or you can buy an X-Acto or other type razor knife. X-Acto makes a very nice three knife set that offers a number of different blades and three handle styles. This is a pretty good investment, and makes a great Fathers Day gift if you pass the word in the right direction. It comes in a keen wooden box, that will last forever. You can purchase two types of saw blades that will fit the X-Acto handles. One blade has teeth like a sabre saw, while the other has very fine teeth, with a very thin blade. Purchase a package of the snaggle tooth blades and one of the fine tooth type. You can cut out most of the plywood parts with the fine tooth blade. If your shop really doesn't have any power tools, and you're not too interested in investing in any just now, then buy a coping saw to handle some of the small parts if you cannot cut them with an X-Acto. If you stay with this hobby, then you will want to buy a jig saw at some future time. Dremel makes a super one, as well as the standard Dremel tool.

Back to cutting out parts. Cut out the formers by whatever method that you choose. Then you have to lay out the fuselage sides on the balsa sheets that you have selected to be the sides. In selecting this wood, make sure that you have picked out two sides of similar density and grain structure. This helps in alignment of the fuselage once you have it cut out. It is very possible that you will have to square one

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GIVE IT A WHIRL

John Gorham

Well, most of the 1981 model trade shows are now over. For those of you who were lucky enough to be able to attend — what did you think of the obviously renewed interest in the R/C 'chopper'? Just wait — 1981 will produce yet still more new ones and variations on the old. As well as choppers there will be many new accessories and especially radios. Since I last wrote in this column about the R/C helicopter radio I've been looking at some of the upcoming new ones. Believe me, even though it is certainly true that you don't need any more than a very simple four channel radio to learn to fly a chopper, and to do a whole bunch of aerobatics with it too, some of these more advanced radios will provide us with features that can make flying a lot easier and give us the capability for even more advanced aerobatics.

The most important change, however, is the price. Once obtainable only at an 'expert' price, these new 'helicopter' radios are now coming down in price. Even the relatively low cost new radios include some features which are very useful to us helicopter pilots. We will report on some of the features available on these new radios next month. It seems that 1981 will be a very exciting year of advancements for the R/C helicopter fraternity — about time!

The season is now beginning for R/C helicopter competitions and fun fly meets. One new major event that is planned to take place this year is the 1st North American Helicopter Championships. These will take place in Grand Bend, Ontario, Canada, and will be run to the new F.A.I. rules. We will publish these new helicopter rules in next month's column and you should note that the format has just recently been agreed in the 1980 F.A.I.-C.I.A.M. Plenary meeting in Paris, France. If you feel you may like to attend the new championships, drop a line to the C.D. of the event Walter Knaus, 972 Hamilton Road, Fairmount Plaza, London, Ontario, Canada N5W 1V6. He will send you information regarding the event.

It wouldn't be right to talk of competitions without mentioning the 1981 A.M.A. Nationals which will be held in Texas this year, at Seguin Auxilliary Air Force Base, near San Antonio. For those of you who are new to modeling or to R/C helicopters, the R/C helicopter event in the 'Nats' has been a reasonably well attended affair for many years now. You may remember that last year I decided to drive to Dayton, Ohio, from Los Angeles, a distance of 2,500 miles just to see the R/C helicopter flying. Well, with the exception of those who live in the extreme northwest and northeast corners of the country, U.S. modelers will not have to travel such great distances this year. Hope this will result in a much better attendance. There is always a special event for R/C helicopters and while the entry list has never been more than about 20 or 30 people, many more modelers who have an interest in the R/C chopper attend. It is certainly an event that I like to visit every year so that I can talk over the advancements in R/C helicopters and some of the likely developments for the future. So, if you do decide to come — see you there.

One last bit of chit-chat before this column goes technical for this month. I was fortunate enough to be given a book on helicopters (the big ones) the other day. The book was written by H.F. Gregory who was very much involved in the development of helicopters during the 1938-1944 period. Much of the text of the book will also be very familiar to those who have been involved in the development of the model R/C helicopter. Many of the problems of the real ones are identical to those we all experience at some time or other with our models. For instance, read this and see if it's familiar to you. It is an extract from the book and it concerns the author, Capt. Gregory, and Igor Sikorsky, when Capt. Gregory is given the opportunity to fly one of Sikorsky's first helicopters.

. . . I had seen (it) the year before inside the factory — that unique, queer-looking rotor test rig — was in actuality the VS-300's control system. For years the big problem in making a helicopter successful was to build the aircraft light enough for the power installed therein, proper correction of torque, and adequate control for all conditions of flight. Torque, it might be well to explain again, is that force which

Publicity photos of Cricket in Universal's "All Night Long" starring Gene Hackman and Barbara Streisand. Photos courtesy of Universal City Studios, Inc.

attempts to turn the aircraft in the opposite direction to which the rotor is being driven by the engine. Propeller torque was not as difficult to whip in the design of the conventional airplane. The Wright brothers got around it by using two opposite rotating propellers on their first craft. Others had tried the same idea with the helicopter. The VS-300 introduced something not completely new, but successful.

Flying the helicopter was something new to me, and I was cautious. I very carefully opened the throttle to that predetermined engine speed which Sikorsky had told me was about 2400 revolutions per minute. Slowly and cautiously the lift lever was pulled back. The aircraft began to rise. First I could feel it as the shock-absorber struts began to extend. But as the pressure of the wheels on the ground began to lessen, the VS-300 tried, it seemed, to go sideways. This not being in the book according to Sikorsky's instructions, I pushed forward on the lift lever which, in turn, closed the throttle slightly and reduced the pitch of the main rotor, and the aircraft settled back on its haunches.

"Doctor," I shouted to Sikorsky, "it doesn't do exactly as you said." He was alongside of me almost instantly.

"Well, Captain Gregory, all you have to do is to pull the lift lever more positively and the aircraft will leave the ground without that side motion." I tried it. The aircraft went straight up off the ground and, if I am not mistaken, the altitude record for the VS-300 was broken, certainly not intentionally. When this kangaroo-like take-off was effected with such a novice aboard his craft, I'm quite sure that Igor's heart was in his throat and he began to think that he had made a big mistake allowing this fellow to fly his pet.

There was more truth than I like to admit in that thought. Once in the air there was a slight disturbance and the nose of the aircraft seemed to come up too quickly, so I moved the stick forward. In so doing, the nose went down all right but, to my complete surprise, the aircraft started moving forward and climbing. In all my experience with flying heretofore, when I pushed the stick forward the airplane had always gone down, but this one was climbing with the stick forward and there was no questioning the maneuver. It was halfway across the airport before I finally stopped the machine. Never had an aircraft done so many things. The helicopter, I was convinced, was in a class all by itself.

After about eight minutes of flying I finally got the craft back on the ground, much to the relief of Sikorsky, although, of the group which had been watching my flight, he was the most enthusiastic in his congratulations.

Vic got me aside and whispered, "Don't let it go to your head, Frank. They aren't congratulating you on your flight. They are just damn glad you got the thing back down in one piece." So was I. More than anything else, VS-300 reminded me of a bucking bronco. She had tried to throw me when she leaped into the air right at the start. She was ornery. When I wanted her to go down she went up. When I tried to back her up she persisted in going forward. About the only thing she was agreeable to was getting down again and that probably was because she wanted to get fed and pampered by the mechanics and her maker.

Well, did much of that seem familiar to those of you who are either trying or flying the R/C helicopter? It certainly brought many memories back to me.

Now to return to answering some of the beginner's questions. A number of general ones arise frequently in various letters I receive. Two of the most common ones, it seems, are (1) what kind of fuel is best for use in an R/C helicopter with regard to the percentage of nitro, type of oil, etc.? and (2) would you describe how you set the needle valve in an R/C helicopter?

Well, concerning the type of fuel, I believe my fellow columnist Clarence Lee covered this in an answer to a letter in his column in the May issue. But I'll add my own thoughts to his comments. When we first started flying the R/C model helicopter, around 1970 in this country, we certainly had problems with regard to the right choice of fuel. Remember, however, at that time R/C helicopters were very power limited. That is to say, the engine had to be run to produce as much power as possible to even get the helicopter off the ground. While this is not true these days (at least below 5000 feet), successful helicopter flights still depend very heavily on good engine performance. Following many, many, experiments by flyers all over the United States we seem to have now settled down to the use of about 12% of Nitro in our model helicopter fuel. Naturally, this can be varied up or down, but with nitro the price it is, it doesn't seem sensible to put more nitro in if we are not to obtain much more advantage from it. On the other hand, with an R/C model helicopter, provided that the engine size is about right, it's always prudent to get the best performance from the engine with regard to power output and reliability. 12% nitro seems to do it.

So far as lubricating oil is concerned, we each have our own preferences on this, I guess, but mine centered on Klotz oil many years ago, and like a lot of other people who find something that works for them I'm reluctant to change from it. There are others, of course, who believe that a percentage of castor oil should be used in the early flying in order to make the running in of the engine more efficient and I certainly don't argue with that. My only problem with the use of castor oil is the trouble in getting the sticky mess off the helicopter afterwards. Klotz has always given me satisfactory performance and it cleans off easily. The fuel that I use for planes and helicopters — (yes I fly planes too) is a mixture of 12% nitro, 22% Klotz and the rest methanol. Sometimes we add up to 2% of propylene oxide which helps the engine to start more readily. We all know the frustration of not being able to get the helicopter engine to start. Remember, of course, that we always have to start our engines at an idle setting which makes it that much more difficult.

Now the second question was how to set the needle valve. Well I don't believe there is really any difference between the settings of the needle valve(s) in an R/C helicopter from that in a plane. I suppose it is more critical in an R/C helicopter since it depends so much more heavily on good engine performance. An engine 'flame out' can be expensive, to say the least, with a helicopter whereas a plane can at least be landed safely (even if it is in the middle of a cornfield a week away from harvest time). One very important point in setting the carburetion of an R/C helicopter is that when the transmitter controls are set at zero throttle and zero throttle trim, the throttle barrel should be **completely** closed and not just a little bit open as some people prefer to set it for an R/C airplane. The reason for this is mainly a safety precaution so that you will have the chance of stopping the engine remotely. It is also more convenient to be able to stop the engine when you have finished a flight this way rather than having to wait until the blades stop turning. So the throttle barrel should be closed and the engine stopped with all the throttle controls set at zero, and there should be a reasonably slow idle on the helicopter when the throttle trim is advanced to full. Now the idle adjustment screw of the carburetor should be set so that the engine runs consistently but, more important, does not 'load up' if it is left running for some time at idle. 'Loading up' means that it gets richer and richer and finally gurgles and stops just when you open the throttle to take-off in front of your (by now) large audience of watchers.

One test to check that the idle setting is correct is to 'punch' in some throttle very briefly (standing well back from the helicopter, of course) and see that the engine does respond and accelerate without any real delay. Now the take-off power position of the setting is more difficult to check with the R/C helicopter unless you have very long arms because you cannot hold it while you are doing this; at least not without the risk of chopping your own or somebody else's head off. You could, of course, make a stand on which to clamp the helicopter, very firmly, and then open the throttle to lift-off power. At this point, the engine should be running in a full time two cycle mode but with an occasional burble of four cycle operation. This will indicate that the engine is turning at the rich end of adjustment while still being lean enough to provide the full power output which you need.

Now the other way of doing this, if you can hover, is to note that your engine will be running with an occasional 'hiccup' due to rich running until lift-off, and as soon as the helicopter is actually in the air, the engine should be running mostly in a two cycle condition. So, if you set your idle for

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ENGINE CLINIC

Clarence Lee

Over the years I have received many letters from fellows wanting to know if our model engines really develop the actual horsepower claimed by the various manufacturers — how are these horsepower figures derived? Are there any commercially available testing devices for measuring horsepower, etc?

Many years ago, when first starting this Engine Clinic column, I did a complete article on horsepower, torque, and how we measure the horsepower of a model engine. This original article was reprinted in the Anthology series booklet "The R/C Engine" Volume I. However, many fellows have not purchased the book and more recent readers of the column do not know that the article was ever written. So the letters keep coming in asking questions related to horsepower.

Horsepower is a function of torque times the rpm of the engine. If you could grab hold of the crankshaft of your engine while it is running and apply a load, the engine itself would want to rotate in the opposite direction. This is called torque. By measuring this torque at various rpm ranges, a horsepower curve can be plotted for the particular engine.

There are two ways of measuring torque: with a dynamometer as used with full-sized engines, or with a torque stand. A dynamometer is a mechanical device that can be attached to the crankshaft of the motor and a variable load applied. Some dynamometers are electrical, some hydraulic, and others friction, using a series of clutches running in an oil bath to keep them cool. They all do the same thing — apply a load to the engine which, in turn, makes the dynamometer itself want to rotate. This, again, is torque, and by measuring can be converted to a horsepower reading. Dynamometers for model engine use are a little hard to come by. I know of none made commercially, and the few that are in use have been handmade.

However, for model engine use we do not need a true dynamometer but can use a torque stand which is very simple and yet very accurate. A torque stand is simply a means of mounting the engine so that it is free to rotate. If you were to stick an arm out the side of the mount and attach it to a measuring device you could measure inch/ounces of torque as a load is applied to the crankshaft of the engine. As an example, if the arm is 12" long and you get an 8 ounce reading on the scale you would have 96 inch/ounces of torque. Being unable to grab the crankshaft while the motor is running, we simply use propellers in various sizes to

apply the load. You start with a propeller considerably larger than would normally be used on the engine and gradually use smaller sizes until a size too small for the engine is used. This will give you maximum torque at lower rpm and maximum horsepower at higher rpm. Maximum horsepower usually occurs at a higher rpm than you normally run the engine. In the case of a .60 size engine you would start out with a 14/6, then 13/6, 12/6, 11/6, 10/6, and 9/6 with an rpm and inch/ounce torque reading taken with each propeller. With these figures, a torque curve can be plotted on graph paper and horsepower, in turn, figured. By using the equation — horsepower = Torque x rpm ÷ 63,026, we come up with a horsepower reading. We must first convert our inch/ounces to inch/pounds. If our engine developed 96 inch/ounces of torque this would, in turn, be 6 inch/pounds. If this occurred at 11,000 rpm, we would have 11,000 x 6 ÷ 63,025 or 1.05 horsepower. By making this computation with each size propeller and plotting a curve on a piece of graph paper you will find the rpm where both maximum torque and maximum rpm occur. The maximum torque will occur at a considerably lower rpm than maximum horsepower. This is why, in many instances, horsepower is a meaningless figure as it occurs at an unusable rpm. Torque being the more important factor. It is torque that turns the big props. In the case of a racing engine intended for high rpm operation you would want to prop it to turn near its horsepower peak in the air. On the other hand, a pattern type engine would be propped a little under its horsepower peak to take advantage of higher torque that occurs at lower rpm.

So what is all this leading up to? As far as I know there have been no commercially available torque stands for measuring the horsepower of our model engines. I have made several myself over the years as have many other fellows seriously into the development of model engines. Several years ago a gentleman named Dan Armstrong wrote to me regarding the feasibility of producing a model engine torque stand. I felt that although there would be a limited market I was sure a considerable number of fellows who liked to work with model engines, make modifications, etc., would certainly like to have a means of checking the horsepower of their engines and see if their modifications have gained them anything.

After building several prototype models to finalize on the design, Dan is now ready to start selling model engine torque stands. This past month I received one of the first for testing.

Basically the design is the same as a torque stand I have used for years being of the pendulum type. I prefer this type as the weight of the pendulum helps to dampen out engine vibration. A beam or arm type attached to a spring scale often has excessive vibration unless something in the way of a dampening device is also attached. The pendulum type, although requiring room for the over-hang of the pendulum, has always proven to be the best method as far as I have found. On my own torque stand I use the pendulum itself with a pointer and scale for torque readings. Dan has made his fancier by using a separate scale and pointer. Overall construction is very massive and workmanship first class throughout. Dan has put a lot of refinement into his stand that I never bothered with on ones I made myself. One feature in particular is a fully adjustable mount to hold any size engine. The width of the motor bearers can be changed to fit any engine width and are guided by a steel rod that also serves as a small counter balance for zeroing the scale pointer. The adjustable mount is, in turn, attached to a 3/4" steel shaft that is, in turn, supported by two massive ball bearings. The whole unit is, in turn, bolted to a 3/8" thick aluminum base plate.

The torque stand will handle any engine size from 1/2A through the more powerful .60's. This is accomplished by varying the pendulum weight and length. You will note in the accompanying photograph that there are two readings on the scale. The inner reading 0-50 and the outer 0-150. These readings are in inch/ounces. For small engines you completely remove the pendulum weight which is located by a steel

pin and retained by an Allen set screw. Readings are then taken on the 0-50 scale. Medium size engines require the pendulum weight to be placed in its top position on the pendulum rod and you double the readings on the 0-50 scale making it then 0-100. For the larger engines, the pendulum weight is moved to its bottom position on the pendulum rod and the 0-150 scale used. Dan uses a horsepower formula that differs a bit from those found in engineering and machinist's manuals that I have seen but, upon cross checking, I found the result to be the same when carried to three decimal places which is certainly accurate enough for model engine purposes. Dan's formula does take into consideration the conversion of inch/ounces to inch/pounds which does simplify the calculation. Dan's formula is Horsepower = rpm x scale reading ÷ 1,000,000. This struck me as real funny as I have always used the formula found in engineering handbooks which required converting inch/ounces to inch/pounds and then dividing by the 63,025 figure mentioned earlier. To think that all these years I have been doing the conversion the hard way — up until the pocket calculators came along which made the conversion much easier.

Dan's torque stand, as pictured, uses a lock pin inserted through the back of the front bearing support that, in turn, goes into the back of the motor mount. The locking of the mount is necessary for starting the engine. I felt that this method might allow vibration to let the pin come out before one might be ready for its removal and it could end up going though a prop, etc. So the method of locking the mount for starting will be changed on future stands to a vertical pin passing through the 3/4" support shaft into the aluminum base plate. This way the pin cannot come out unless removed by the person using the stand.

Only one thing about the design of the stand did cause me some reservations and that is the over-hang of the motor mount itself, i.e., the distance from the front ball bearing support to the engine. On my own torque stands I used individual mounts (radial) bolted to a face plate so there was considerably less over-hang. However, in Dan's design he wanted to utilize a universal type motor mount and the extra length was required. Due to the length of the mount it is very important that a perfectly balanced propeller be used. The same thing applies to a spinner if used. However, there is no need for a full spinner — just a spinner nut for an electric starter if one is to be used. I checked the mount out using a K & B 6.5 Formula 1 engine (the new O.S. .45 ABC rear exhaust engine pictured) that I had been making some timing modifications to and did not experience any excessive vibration problems with the long mount. The unit seems to be built heavy enough with enough mass to handle this. Securely mounting the base plate to a solid surface is of extreme importance in order to achieve accurate readings as is an accurate tachometer for taking rpm readings.

Dan is producing the torque stands on a limited production basis so if orders exceed the number on hand you may have to take a number and wait your turn for delivery. The price of the torque stand is $170.00 which includes shipping in the U.S. Send your orders to Dan E. Armstrong, 2123 4th Ave. North, Irondale, Alabama 35210.

Some of you may flinch at the $170.00 price but if you had the equipment and capability to build one yourself you would find that the cost of materials and amount of time involved makes this a real bargain price. Especially when you take into consideration the prices some of our model engines are now selling for.

Already Dan has sold torque stands to Cox Hobbies, Shamrock Competition Imports (OPS), and Draper's R/C, which speaks pretty well for the quality of the unit.

I realize that this is not an item that every modeler will want to add to his modeling accessories, but for those modelers who are interested in working with model engines, an accurate means of measuring the horsepower and the rpm at which it occurs is now available to you.

★

I have received quite a few letters in the past couple of years since both the Robart pump and later Auto Mix units came on the market, which question the simplicity of the internal parts --- particularly the Auto Mix. Most fellows want to know how this unit can regulate fuel pressure — if it actually does regulate the fuel pressure, etc. One fellow with whom I have corresponded for many years was actually a little upset over the simplicity.

Clarence:

I've been admiring Robart's products for awhile and decided to get one of their pumps for my next project. Then they came out with the Auto Mix regulator and I said to myself, that sounds like a worthwhile addition, get one of those, too.

Upon initial inspection I found out that there is nothing — zero — inside this little aluminum block that does anything. There is a silicone one-way valve with a brass expander (for retention I gather) stuck in one end, but it does not regulate fuel flow, it just acts as a plug to keep fuel from escaping.

I sent it back to Robart with a note stating that the item had to have been mis-manufactured as there were no functional pieces inside, e.g., you could accomplish the same exact thing by soldering up a "T" from brass tubing.

Robart sent my unit back (or an equivalent unit) assembled exactly the same way. There was no letter of explanation with it. The more I thought about it, the madder I got. That one-way silicone check valve (I assume it's from the pump assembly which should have two of them to function) could have been used as a pressure relief, but wasn't.

What happened? Did someone screw up on the design, order all the stuff made and they had it marketed even if it didn't work? If I'd made my own out of brass tubing I could have regulated it by soldering up the return line and drilling larger and smaller holes until I had it regulated to my set-up.

Sincerely,
Phil Mahony

Phil, there was nothing wrong with your Auto Mix unit. Basically it is just a "T" with a one way valve. The valve lets air into the tank as the fuel level drops due to the tank being a closed system. However, as simple as the darn thing is it does work very well in conjunction with the Robart pump. Without the Auto Mix in the system it can be a bit difficult at times getting the pump pressure set properly for a good idle, acceleration, and top speed --- particularly on the smaller displacement engines. With the Auto Mix in the system, excess pressure in the line is bled back to the fuel tank. I guess this might be interpreted as a form of regulation although not regulation in the true sense. Thousands of guys are using this system with complete success.

As simple as the unit is, it does improve engine performance considerably and this is what most fellows are looking for. So, before condeming the unit, give it a try. You might be surprised at how well it works. Things do not necessarily have to be complicated or complex to do the job. In fact, there is an old saying, "you can always tell an engineer — they know how to complicate simplicity."

Dear Mr. Lee,

I am scratch-building a 6' span WW II fighter which will weigh over nine pounds.

I don't believe that an O.S. Schnuerle .60 which I have will provide enough power and I would rather avoid a .90 Schnuerle if possible. The engine will be mounted inverted with only the head exposed.

I have been thinking about converting the as yet unused O.S. .60 FSR to diesel for this plane. I would appreciate your opinion about this conversion and your answers to these questions:

(1) What effect does the higher compression of diesel operation have on the mechanism over the long haul?

(2) Is there much more vibration in diesel operation?

(3) Is fuel readily available and what does it cost?

(4) Will a converted .60 FSR really turn a 15" or 16" prop at high enough rpm's? I am especially interested in this because I plan to build a 5½ ft. span fighter which has a nearly 9" diameter closed cowl.

Thank you very much for your help.

Sincerely,
Warren V. Gureghian
Watertown, Massachusetts

There seems to be considerable misunderstanding over the advantages of diesel conversion.

First off, converting a glow engine to diesel operation does not increase the overall horsepower of the engine. It does increase the torque at lower rpm. This, in turn, translates into turning a larger prop in the lower rpm range. This is what many

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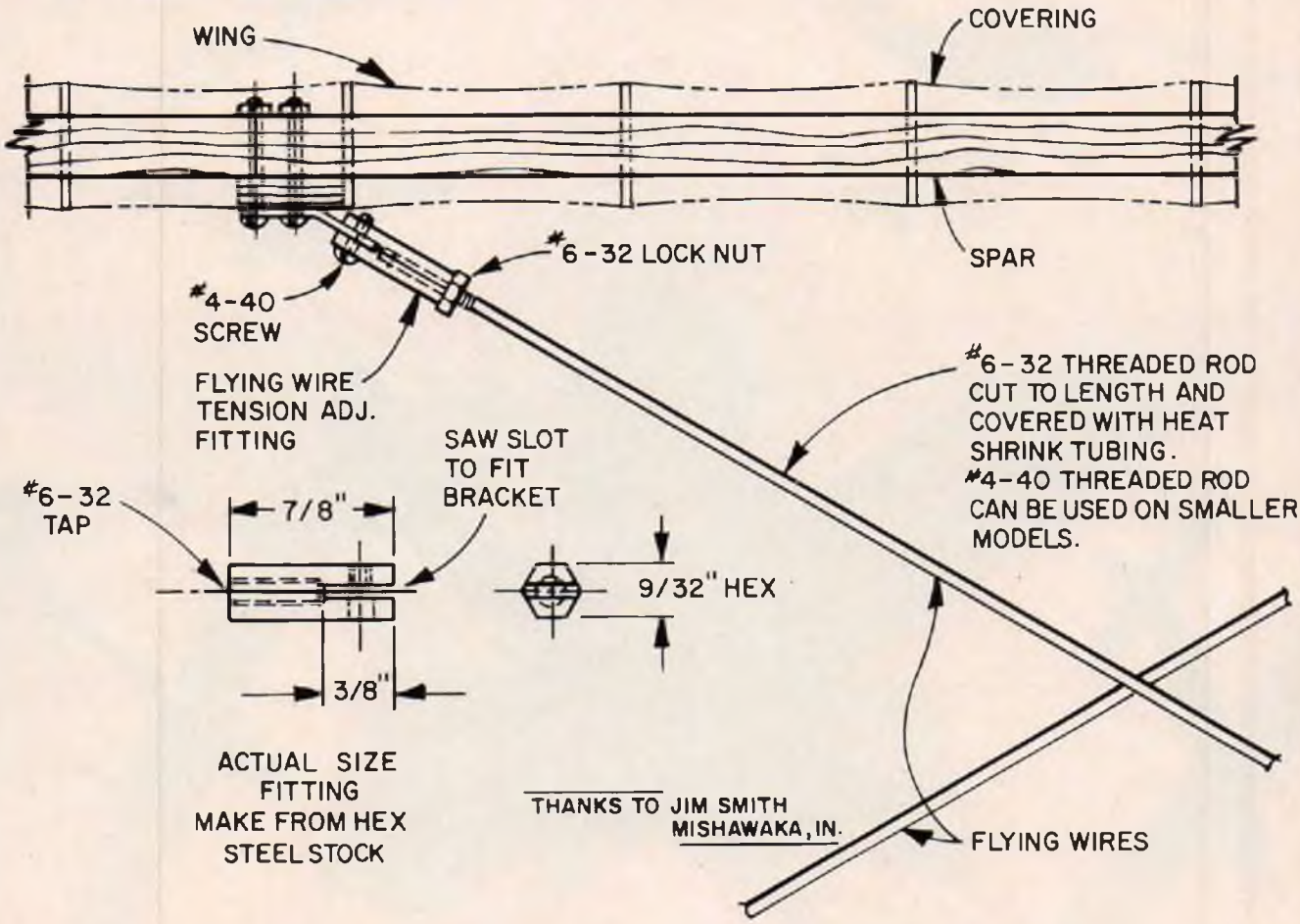
HERE'S HOW

By Jerry Smith

FLYING AND LANDING WIRES



NOTE: THE ABOVE IDEA IS NOT TO BE USED FOR WING STRUTS – USE ONLY FOR FLYING & LANDING WIRES

Gone are the days of stringing elastic thread or fish line between wings for flying wires. That is, for those who are interested in Quarter Scale and larger. The flying wires become a functional part of the aircraft and, therefore, must be of sufficient strength to support the air loads on the flying surfaces. Anything less would certainly jeopardize a costly investment on the part of the builder. So, when you are at the point of consideration, with regard to wing fastening and flying wires, think strongly about the safety of your aircraft. You have a considerable investment and want to fly it around for many hours of pleasure.

A good friend of mine, Jim Smith, owns a Fleet bipe, just a hair larger than the Concept Fleet. The original flying wires were made from music wire with metal clevises soldered to each end. After a few flights he began to have trouble with them. They just weren't hefty enough to do the job. Always coming loose and constantly whipping in the air stream. Jim gave considerable thought to this problem and solved it in the following manner.

Jim's underlying basic idea for a flying wire is just plain threaded rod that can be purchased in 3' lengths. Either 6-32 or 4-40 rods, depending on the size of your aircraft, will work out great. Threaded rods provide threads at either end without having to solder clevises or fittings to them. This is exactly what you are after. One continuous unbroken flying wire that will give you no worrysome troubles about coming apart. It will provide the necessary tensile strength to hold your wings in place.

The adjustment fittings required for the 6-32 rod are made from steel hex stock. They can be made with basic hand tools, hacksaw, drill, tap, etc. The basic dimensions are shown in the sketch, actual size. When using 4-40 rod, metal clevises are available making things a little easier. However, don't forget to use the locknuts. They keep the rod from rotating. If properly installed, it cannot go too far, but the locknuts do help.

And, finally, after the flying wires are cut and fitted, slip a piece of heat shrink tubing over the unused threaded portions. This will hide those ugly threads and lend a smooth appearance to the completed wire. No one will ever know there are threads underneath. Black heat shrink tubing looks good although it is possible to buy in other colors. Use 3/16" diameter for 6-32 rod and 1/8" diameter for 4-40.

Obviously, there are other ways of making flying wires. This happens to be one way that is easy to construct. In the coming months I will present other methods as I run across them. In the meantime, check your airplane constantly for air-worthiness. Make sure it's sound before you take to the air. Check it out good! Safety is **no** accident. □

SCALE VIEWS

Claude McCullough

Engines For Scale
Technopower II Spark Ignition

When a new multi-cylinder model engine comes out, trust Paul Johnson (Des Moines, Iowa) to be first in line to buy one for his extensive collection. This is literally true in the case of the sparkling gem shown in the accompanying photo, a 1.18 cu. in. 7 cylinder ignition version of the Technopower glow radial engine. It is Serial No. 2. (The manufacturer has No. 1.) Kalt sparkplugs, as used in Kalt's 1 cylinder 4 cycle, are fitted, fired by a vintage Wilco coil. I was interested in the instruction book caution to drain the oil that seeps down into the lower cylinders between flying sessions before trying to start the engine. Hydraulic lock from neglecting to do this can result in a "non-warranty" breakage of the master rod, something that has been known to happen in full size engines. Incidentally, if you haven't found it out, a common single cylinder glow engine can be ruined by cranking with a powerful starter when it is flooded.

We hear that Technopower (16650 South 104th Ave., Orland Park, Illinois 60462) is working on a larger radial for 1/4 Scale purposes with a 1" cylinder bore. Stand back for the stampede on that one! You can get in line behind Paul.

Two Tone Props

Models that call for a laminated type of wooden scale prop don't look very realistic with a plain variety. When Paul was in California he ran across the Y & O line, which features some nice looking laminated props. Y & O props have been around for a long time but don't seem to be as widely distributed as some other brand names. Considering the considerable extra effort that must go into making them, prices are quite reasonable. 9/6 are $1.75 and sizes range on up to 16/8 for $3.75. One place you can get them is Hobby Horn, P.O. Box 3004, 112 Main St., Seal Beach, California 90740, who have a 50 page mail order catalog of Old Timer electric and RC items available for $1.00.

Scale Bookshelf
Bombers of World War II — Vol. 1.

8½" x 11", 120 pages, softbound. Published by Squadron/Signal Publications, Inc., 1115 Crowley Drive, Carrollton, Texas 75006. Also available from aviation book dealers. $9.95.

Cockpit and canopy detail, color profile for the JU-88.

I reviewed a similar volume by the same publisher, "Fighter of World War II — Vol. 1," in the March issue of RCM. The favorable impression it made is equaled by the general excellence and quality of this latest collection of monographs. Twenty pages is assigned to each of these aircraft: Boeing B-17G, Avro Lancaster I & II, Heinkel He 111P & H, Consolidated B-24 C & D, Handley Page Halifax and Junkers Ju 88A. The format is the same as "Fighters" --- 4-view drawings, color profiles, cockpit details and historical data. Unlike many historical aviation series, the producers have wisely decided not to follow the less than satisfactory practice of combining the color profiles with the scale drawings. Instead there are separate fine-lined black and white scale drawings by A. Grainger, who must be classed in the top rank of the world's aircraft draftsmen. The color 4-views and profiles are from the skilled brush of artist Roy Mills. Highly recommended as indispensible for builders of these particular aircraft as well as scale data collectors.

F-86 Sabre In Color By Larry Davis. 8½" x 11", 32 pages, softbound. Published by Squadron/Signal, available from aviation book dealers. $5.95.

This latest edition from the "Fighting Colors" series is a little specialized but I'm a sucker for series books along the lines started by the Profiles. "F-86" is such a great example of the type of publications needed by scale modeling that I'm going to urge every serious builder to get it. Excellence of this calibre should be rewarded by receiving enough sales so the series will continue on to cover more popular aircraft, your favorite maybe, or mine. And I don't need to tell book collectors that a series is more valuable complete rather than as an assortment of odds and ends. I would hope that every aircraft monograph author would follow the example provided by the appearance in "F-86" of a page showing the exact wording and location of the many stenciled instructions to be found on a military airplane. This kind of rare data is

indispensible to proper precision reproduction of a subject. The book has 4-views on the inside of the front and back covers, black and white photos, history and 16 pages of color. Color reference numbers from Federal Standard FS-595a are given. And don't I wish I had the following quote from this section when I was writing last month's Scale Views column (which discussed the matter of slippage from standard): "Please note that color designations in the above text apply only to factory fresh aircraft. Once an aircraft entered service, variations from standard appeared on every aircraft." Incidentally, in ordering books directly from the publishers, add $.50 for one, $.75 for two and $1.00 for three or more.

Scale Data Bank

Bungee Cord. We have previously mentioned the work of the Vintage Sailplane Association, a division of the Soaring Society of America, in locating and making available a wide range of 3-view drawings of sailplanes. (Scale Views, Aug. 1980 RCM.) Now comes a copy of their 8½" x 11" newsletter, edited by Bob Storck, a most impressive effort considering the fact that the group has only 300 members. This Winter Edition has a main feature on Hawley Bowlus and his gliders. It reminded me that Bowlus helped Claude Ryan design the Ryan M-1 and was plant superintendent at Ryan during the time that Lindberg's Spirit of St. Louis was built. The newsletter notes an upcoming mid-1981 book, "Vintage Sailplanes 1908-45" by Martin Simons, which will have 80 finely detailed drawings of sailplanes. I'll try to get this book for review. And, as soon as this column is finished, I'm sending $8.00 to Vintage Sailplane Association, 3103 Tudor Rd., Waldorf, Maryland 20601, for a year's membership to help support their activities. Dedicated scale glider fans should consider doing the same.

On Top Of Old Smokey

The reader interest on the subject of smoke generation continues to startle me. Every chapter we've run has brought in more comments. For instance, Bob Bailey (Mason, Michigan), writing before the April column appeared (which told about airshow performer's use of Corvis oil and similar concrete oils), says he favors them. Concrete contractors put these oils on their forms to prevent sticking. He found them at concrete companies, contractors, local oil companies and even at a steel yard for $2.00 to $3.50 per gallon. Airshow announcers have told him that this stuff is approved by the EPA for airshow use since it burns clean white and is non-toxic. A recent oil being tested in his area appears to linger longer than concrete form oil. It's called Mineral Seal Oil by Americhem Corp. at around $2.00 per gallon. Now over to Bob and some good information:

Our next problem was to find an effective means to pump the stuff into the muffler in the right mixture to get the desired smoke trail that would hang in there like the pros do. Well, we solved that one too, by using a Robart pumper to pump the fluid out of the smoke tank into the exhaust stack. I'm using this set-up on a Max .80 currently and it leaves a beautiful white trail 500 to 600 feet behind the airplane about the same diameter as the fuselage. Considering the fact the airplane is an old Skyglas Bearcat that hums along at about 90 or 100 per, that's pretty good.

Robart Gasoline Super Pumper is compact — body is only 3/8" sq. x 7/8" long. Pressure tap is included.

A friend of mine recently machined an aluminum manifold and exhaust stack for his Quadra with about 18" of pre-heating passages for the fluid to flow through before injected directly into the flame of the exhaust and he is now able to produce enough smoke to rival the big boys at the Oshkosh fly-in. Instead of using the Robart pumper to actually pump the fluid he decided to use it as a check valve between the crankcase pressure tap and the smoke fluid tank and it works perfectly. Just be sure to use the "Gasoline" pumper though, as the regular alcohol fuel type will last about two flights before the diaphragm in the pumper disintegrates.

*With our many experiments on various smoke fluids and systems, we've found two critical factors that make all the difference between a wispy little trail that looks more like a rich engine run and a full blown airshow type smoke trail --- **heat and mixture.***

The Max .80 I mentioned is running with a Semco Pitts muffler that I had previously used on a Max .60 on an Aeromaster with equal success. The thing that finally started producing super smoke for me was to wrap fiberglass insulation around the muffler can and both exhaust stacks. Some minor tweaking of the fluid flow to get the mixture leaned down just right and the smoke began to roll. I've used this system for two years now and the spectator reaction (and inquiries from fellow modelers) is always the same --- "Great smoke! How do you do that?" I use no preheating of any kind on this system and it works fine. My friend with the Quadra, however, does use pre-heating and it does seem to help. On the Max .80 powered ship I'm using about one ounce of fluid per minute. On the Quadra powered Nosen Big Stick we're using about 3 ounces per minute. We do feel, however, the mixture in this Quadra system can be leaned down some for even better smoke and fluid economy as we are throwing a lot of raw oil all over the bottom of the plane unnecessarily. You wouldn't believe the smoke from this Quadra. It leaves a column about two feet in diameter for about 800' behind the plane before it begins to dissipate. Even on windy days it lingers very nicely.

George Giesey wrote about smoke and asked if I had any late information that had not appeared in the column. I'm putting new material in as it comes in, but I sent him a copy of Bob Bailey's letter in advance of publication to help him along with the problem. George poses a very good question: "What do parachutists use in drop demonstrations at airshows?" Having seen the billowing smoke trails following some of the parachute teams, I think this ought to be looked into. My recollection is that they often have colored smoke. Color is a much desired effect for which we don't seem to have much of an answer. It is possible that some members of the Golden Knights or other service jump team is a modeler and is reading this? As George Giesey said in his letter, "Help!"

My guess is that the parachutists use a smoke bomb of some sort. They must not be very dangerous or the teams wouldn't use them. In this regard, the ban that the AMA had previously imposed on the use of pyrotechnic materials with model flying has been lifted, providing that any local requirements for permits are fulfilled and AMA Air Show Team Advisory Committee guidelines are followed.

Museum Piece

The ultimate compliment for a scale modeler is the honor of having a model on display in a museum. A new facility, "Southern Museum of Flight" is opening

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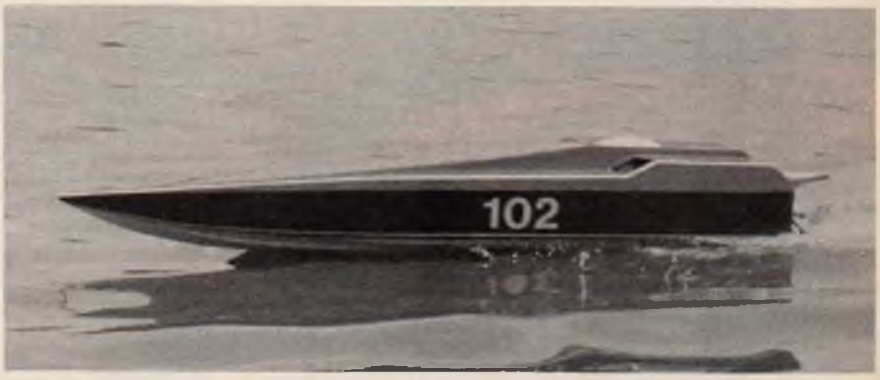
POWER BOATING

Howard Power

Another great new product has been announced by the Fly-By-Night Boat Works. A couple of months ago I mentioned the beneficial aspects of loosening the glow plug while starting your motor with an electric starter. This new product — the electric rechargeable glow plug wrench — will make this task an easy one. I haven't had a chance to try this product but the promotional photo they have sent tells the whole story. Those guys at the FBN Boat Works sure keep on top of the model boating accessory business.



Another one of the top model boat designers, Frank Ward, has also announced a new product: a 44" Offshore Racer. This boat is the latest in his series of fiberglass deep vee designs that have dominated monoplane heat racing and deep vee straight-line races. This latest boat is designed for the higher power output available with today's .65 and larger engines. It is a big boat and should be able to stay upright and still go fast through rough water. Its aerodynamic deck design provides down-force that will tend to delay blow-offs at high speed.

Frank ran this design for the first time at last year's Tacoma NAMBA Nationals. Even when powered with a .40 size engine, the boat showed real promise. It features a unique flow-through top design which keeps out water spray and provides adequate air cooling to keep the engine and pipe at a reasonable operating temperature. The boat is available for $159.00 with deck and hull joined, the hatch cut out, framed and hinged. An unjoined deck and hull version is also available for $129.00. Both versions feature the engine mount rails and transom plate already mounted in position in the hull.

Frank also has a hardware kit available for these boats which he modestly calls "60 MPH Hardware." This kit includes cavitation plates, turn fin, strut assembly, rudder brackets, rudder, and a flex shaft driveline assembly. The hardware is made of really heavy duty heat treated stainless steel. The strut is line bored for accuracy and has needle bearings installed. The rudder bracket has teflon bushings to keep this important piece under control. It is priced at $74.95. Tell your favorite hobby dealer that these boats and hardware will be distributed by G & M Models and Hobbies . . . unlimited. Both the hulls and hardware will be available by the time you read this.

I also received the following letter:

Dear Howard:

I have just recently gone into power boating and received a Dumas PT109 for Christmas. I have built one or two other boats but have been a little disappointed in performance. I have been using electric power but can't seem to get any kind of speed. My first boat was also a PT109, but I tried to get a little scale by using two screws with a motor supposed to be built for this. Once again no performance.

What I would like to know now, if possible, is which would be the best electric motor to use — the Dumas Pittman 6V motor or the 05 from Astro Flight?

I have read up on each but can't seem to find rpm turned up by Dumas.

Any information that you could furnish would really be appreciated.

Thanking you in advance I remain.

Yours truly,
Bob Swayer
St. Albans, Vermont

Well, Bob, I am afraid that high performance electric boats are a little out of my field of experience. You don't indicate what performance you expect from your PT boat. I doubt that you will be able to exceed 10 to 15 mph with an electric system you can physically install in this boat. Both the motors you mentioned are usable, but the Astro 05 might be your best choice considering cost. Many scale boaters in my area have been very successful using this motor and a homemade gear box made from pinion and drive gears that are replacement parts for 1/12 Scale R/C cars. If you use a 6 cell R/C car nicad battery pack and this motor, you will have a very serviceable system with good performance.

To get the best performance from an electric motor you must load the motor properly. Electric motors tend to produce their maximum horsepower at approximately 50 to 60 percent of the free running speed (the rpm attained when the motor is not driving any load). The free running speed is associated with minimum current drain and, therefore, the longest possible battery life. If it is desirable to maximize running time, therefore, an electric motor should be geared so that the prop speed is many times slower than motor shaft speed. If you wish to maximize speed you should select a gear ratio and a propeller load that allows the motor to operate at 50 to 60 percent of the free running rpm.

Another interesting property of electric motors is that the current drain is usually linear with rpm. We may use this fact to help select an efficient load for a particular application. Using an ammeter wired in series with one motor lead, you may measure the free running current. You may similarly determine the current drain when the motor is stalled (no rpm). The stalled current should be taken several times so that an average stall current can be determined. Don't stall the motor for very long or you will burn it up. Once you have determined the stall current (SC) and the free running current (FC) you can determine the current at 50% running speed by calculating the average of these measured currents. This will closely approximate the desirable operating current for maximum horsepower.

$$\text{OPERATING CURRENT} = \frac{SC + FC}{2}$$

If you know the free running rpm, you

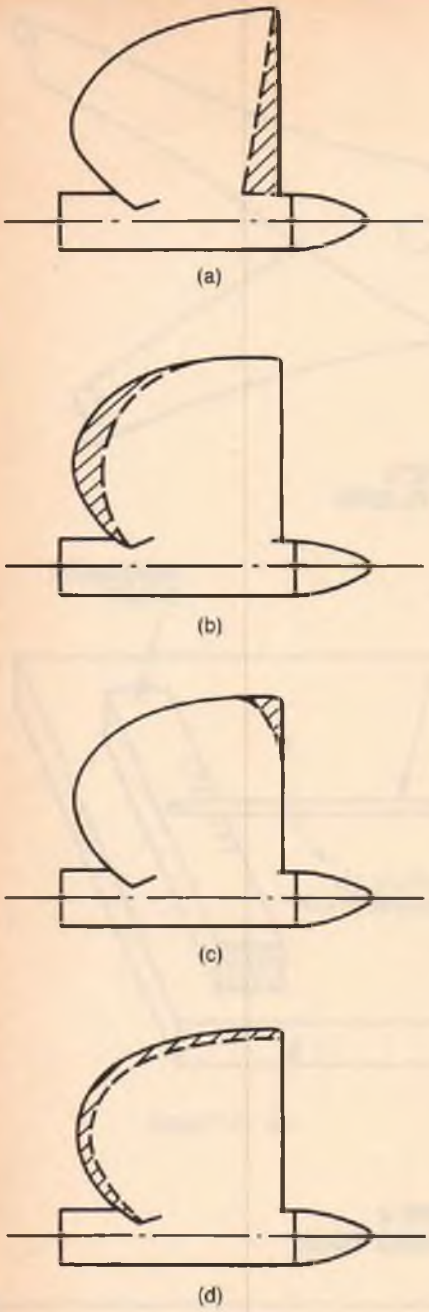


FIGURE 1
BLADE AREA REDUCTIONS

can use the propeller pitch equation to determine the pitch required for any desired boat speed assuming that the motor will operate at half the free running rpm. Try different props with this pitch and measure the motor current drain with the boat held in the water. Pick the prop that results in the closest match to the operating current you calculated earlier. In reality this current measurement should be taken with the boat under way but the running current won't be too different from the stationary one.

In the previous discussion I have assumed that the motor operating voltage has been fixed. In general, the motor power output increases proportionally as you increase battery voltage. However, a given motor will stand only so much voltage and current before it heats up to the point of damage. For this reason use only the manufacturer's recommended voltage in your boat.

★

Last month we discussed the propeller force system and its effect on boat handling. We also pointed out that by trying various propellers, and by keeping track of the estimated speed resulting, the best propeller could be picked. Many times a better propeller can be found by modifying a stock propeller. In this way a finer selection of props can be made available to the boater that fills in any gaps that exist in commercial sizes. Existing props can be modified by reducing blade area, by cupping, and by re-pitching the blades.

Many times you will find that the propeller you would like to use is just a little too much load because your engine cannot reliably turn the rpm needed. In this case a reduction of blade area can be beneficial.

Figure 1 shows the blade geometries that can be changed. Blades that have high trailing edge rake angles may have their blade area reduced by removing the shaded wedge shaped area as shown in Figure 1a. This reduces progressively, area toward the hub which lowers the rake angle and tends to reduce propeller lift. The area reduction promotes an increase in rpm which usually more than overcomes the loss of thrust due to loss of blade area. If this area reduction is not enough, area can be removed from the leading edge as shown by the dotted lines in the Figure 1b. Removing this area usually decreases the entry angle of the leading edge into the water and can increase lift. Area may also be trimmed by rounding the prop tip (Figure 1c). Decreased area at the tip has a most powerful effect on rpm because the area loss occurs at the maximum radius of the prop. Unfortunately, reducing area at the tip may also reduce the pitch and thrust of the prop more than the previously mentioned methods. Propeller area may also be reduced by trimming the entire blade outline and, thereby, reducing propeller diameter. A reduction in diameter of 10/1,000 of an inch can make a noticeable change in propeller load so caution is advised when trimming. Any combination of these area reduction techniques can and should be used to adjust propeller torque required and, therefore, rpm.

Another useful prop modification is that of cupping and reflexing. Reflexing is bending the prop blade trailing edge so that the camber is reduced or in some cases actually reversed as shown in Figure 2a.

Reflexing propeller tips reduces the local pitch and, therefore, the torque required to rotate it. In this way you can control the operating rpm upward. Cupping can be used both at the leading edge of the blade and at the trailing edge of the tip section as shown in Figure 2b. Cupping involves bending the blade to increase the camber of the section. Cupping the leading edge area of a blade reduces the effective blade diameter and increases the angle at which the blade enters the water (if it is used in a surface piercing mode). Cupping the leading edges usually

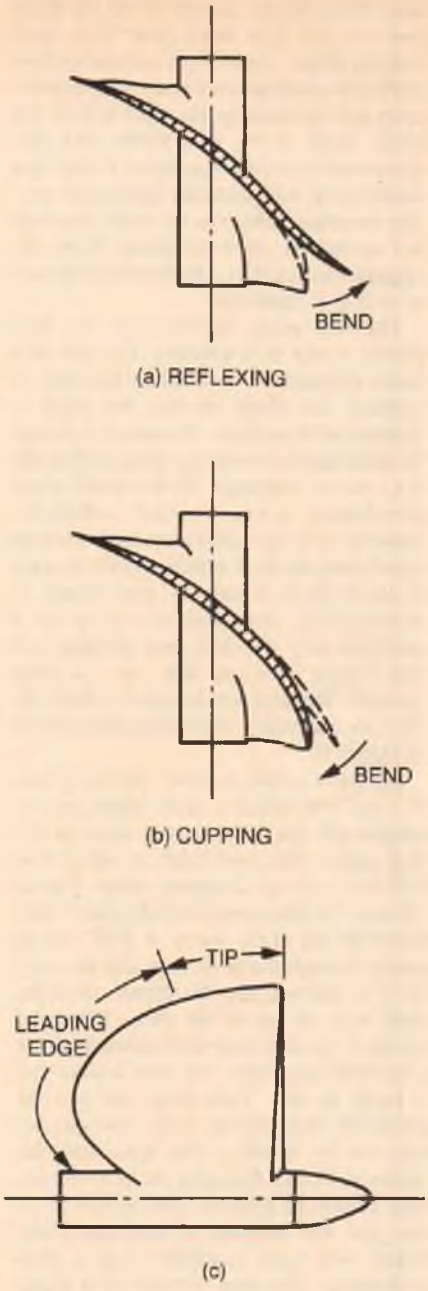


FIGURE 2
CUPPING

adjusts the operating rpm upward and at the same time tends to decrease prop lift development. Cupping the tip section of the blade increases the local pitch which results in more speed but increased torque load (lower rpm) on the engine. Cupping the tip also tends to reduce lift production.

Don't be afraid to bend on your props as long as they have not been heat treated. I use a homemade "cupping plier" that is made from a cheap pair of common pliers.

Figure 3 shows the approximate shape required. The dimensions are not critical and with some practice you will be able to cup by eye both blades equally. The pliers are made by brazing a lump on the surface of one jaw. File or grind this surface so that it is more or less round. You then grind the other

jaw surface concave so that the jaws fit each other when closed. Round off all the sharp corners and you have your very own cupping pliers. You will be amazed by how much you can improve a stock prop in some cases just by bending the right area of the blade. Some of my prop blades look like spoons but it is sometimes better to cup-up a smaller prop than to use the next larger size. The resulting reduction of blade diameter but increased pitch resulting from the cupping can result in a better handling boat as well as a faster one.

The last prop modification we will discuss is that of re-pitching. For lack of a better definition I will define pitching as bending the blade so that the pitch is changed at all sections. We can also change the pitch locally at only one area of the blade (i.e., as in cupping). If the blade pitch distribution is not changed uniformly, however, it is very difficult to estimate boat speed using the pitch equation since changes in local pitch results in uncertainty in determining the effective pitch of a modified prop. The best prop pitching tool that I know of is one that you can make yourself. This tool was designed (I think) by Mr. J.G. Propellers (Jim Gale) and is shown in Figure 4.

The tool consists of a 3/4" plywood base (3" x 8") on which a small square dam is constructed that is at least as deep as the prop radius. The prop blade is coated with STP oil to act as a parting agent. Plastic "Bondo" is then poured into the dam to just below the top of the wood. A 3/16" rod is placed through the prop hole and the prop blade is inserted into the Bondo until the shaft rests on top of the dam. When the plastic is set to a semi-hard condition, you remove the propeller. The next day the tool is ready to use. Your prop can now be pitched by inserting the 3/16" rod into the hub and by inserting the blade into the hardened Bondo. Rotating the hub with the shaft causes the blade to bend at the hub so that you can increase or decrease pitch. Check your work carefully using a good pitch gauge. The most accurate pitch gauge I have found is the one made by Ed Hughey. Be sure that both blades are at the same exact pitch. If not, keep working until they are equal!

These prop modifications can result in considerable increases in speed. I have seen 10 mph jumps in speed by hydros using these techniques. If you run monoplanes you may see 5 mph changes. How much you actually realize depends upon how well the best stock prop is suited to your particular boat, engine and pipe combination. Only by trying some of these modifications can you find out just how good your stock prop is.

Well, that does it for another month. Send all your questions, comments, race results and letters to the address at the end of the column. Remember to include a self-addressed stamped envelope if you wish an answer to your questions. Howard Power, Hobbies Unlimited, 766 Broadway, Seaside, California 93955, (408) 394-1200. □

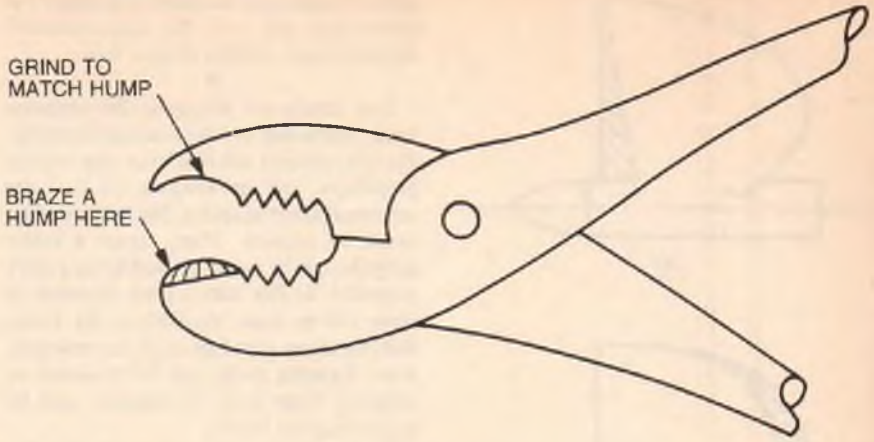


FIGURE 3
CUPPING PLIERS

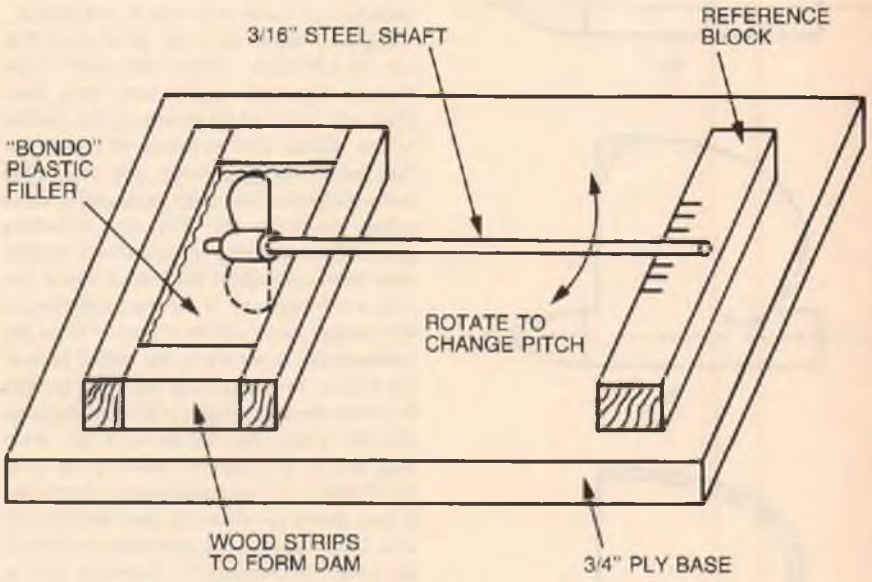
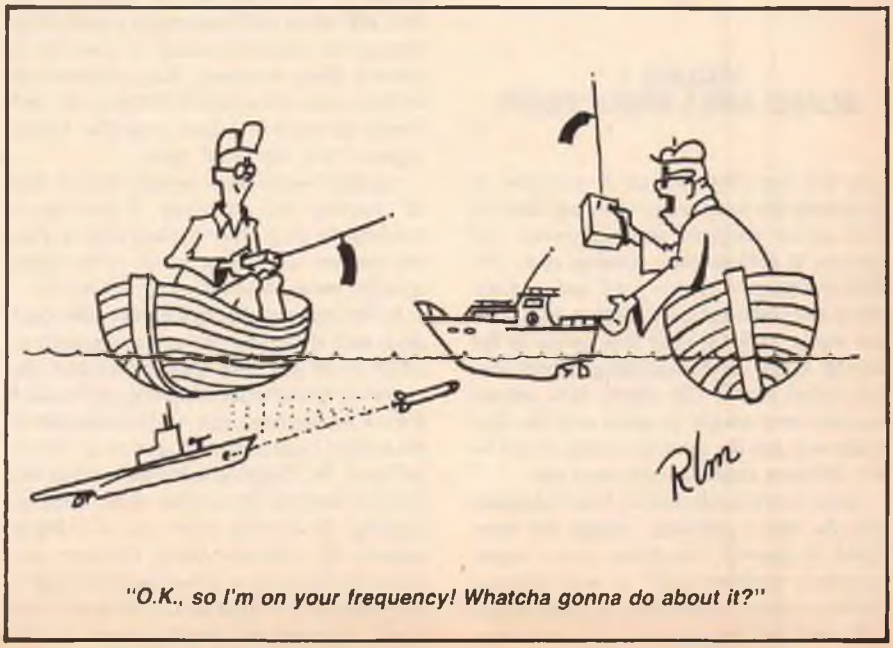


FIGURE 4
PROP PITCHING TOOL



"O.K., so I'm on your frequency! Whatcha gonna do about it?"

FLYING LOWE

Don Lowe

This month we're continuing our discussion of trimming and pattern flying. We have previously described some basics of model design and control systems as well as basic trimming for loops and rolls.

A few words in regards to spins and snap rolls are in order. The spin and snap roll character of a model is largely "designed in." Essentially, to spin and snap well, the aircraft should have a fairly aft C.G. (also best for rolls), plenty of elevator and rudder throw and, preferably, minimal wing weight. Spins and snaps are stalled maneuvers where rotation is forced by rudder and aileron throw. The principle reason for encouraging low wing weight is to reduce wing inertia effects in the maneuvers and assure more predictable maneuver exit. In other words, when you neutralize the controls, the ship should exit the maneuver almost instantly. It should be noted that the character of the spin and snap can be influenced by the amount of rudder and aileron throw that are used. Essentially, the aileron gives the maneuver a more axial roll character. If it is used, a quicker maneuver exit is accomplished. It's also possible to "cheat" on the maneuvers by leading and lagging the aileron to smooth the entry and more precisely exit. In spite of some comments I have seen to the contrary, "over spinning" can be helped by the use of aileron — which quickens the exit. Usually the use of aileron steepens the model attitude in the spin and reduces the tail motion or radius of gyration.

We have really learned about snaps and spins through the Las Vegas Circus Circus Tournament of Champions experience. These aircraft have very low wing loadings but plenty of control throw, plus other design tricks such as stall strips or sharpened wing leading edges. If you really want the flying experience of your lifetime you should build one of these designs — they can do absolutely anything — and with great precision. They are touchy, however, due to the very high maneuver rates achievable. To sum up: trim for spins and snaps by using an aft C.G., plenty of elevator (most important), rudder and aileron throw. You don't need a high wing loading to snap and spin, in fact just the opposite. If it's still reluctant to spin and snap, try stall strips, which I've discussed before. I might add that stall strips properly applied do not hurt any maneuver but considerably aid in snapping and spinning. They provide a more precise quicker entry and exit.

A good compromise set-up for spins and snaps would be to optimize the C.G. for other maneuvers such as loops and rolls, as previously discussed, and then either use lots of elevator throw (with a dual rate set-up) to force the stall and/or use stall strips on the wing leading edge. It is advisable to have dual rate capability on both your aileron and elevator so that the high elevator rate could be used only for spins and snaps. Some also have dual rate rudder for this reason, as well as to provide proper rudder effectiveness at high and low speed conditions.

As I have previously stated, your rate of progression up the proficiency ladder can be strongly influenced if you have access to an experienced competition flier who will spend some time coaching you through maneuvers. If you don't have this, then it will be tougher, but we will try to help. You must understand that everyone doesn't progress at the same rate, nor do they reach the same proficiency level. Some folks never will be a national or a world champion even though they strive very hard to achieve it. Call it natural ability or whatever, those are the facts. Everyone can be better, however, with diligent effort so let's get at it!

When you fly a pattern ship, always fly with purpose — never barnstorm. Every time you perform a take-off or any other maneuver, do it to the very best of your ability — don't allow yourself to get sloppy. You will find a great deal of satisfaction in learning to perform maneuvers with accuracy and consistency. To me, it never gets boring but is a constant challenge. It's kind of like playing golf and trying to get that score down in the 80's or 70's (?), it's all up to you! Fly under a variety of wind conditions and perform maneuvers in two directions, also cross-wind — never do it the easy way! Fly your patterns in a set fashion and in a fixed track, don't meander all over the sky. Always place your maneuvers in optimum judging position as described in the rule book. Most maneuvers are performed in a "balanced" manner right in front, equally spaced right and left. Never perform a maneuver in a haphazard position; remember, position is just as important as the maneuver itself. Also you will find that the maneuver will be easier to perform if optimally positioned. Your progress will be swifter also since you will always be looking at the maneuver in the same way.

Read the rule book thoroughly and make sure that you know what the judges will be looking for. Do not begin serious practice until you are thoroughly acquainted with the requirements.

One of the most common mistakes of all pattern flyers is the inability to judge when the aircraft is level. A very common fault is flying with the aircraft in a banked attitude toward you and thinking that the ship is level. Due to the geometrical relationship of the model relative to your eyeballs it will appear banked away from you when level — and you can't perform well tracked loops or any other positive and negative G maneuver without being basically level. If you want to get a good view of what I'm talking about, walk out to where you can view your buddie's maneuvers end on. You will be shocked at how the rolls move in and out and especially how badly "unlevel" the loops are.

My best suggestion on this score is to perform some looping maneuvers with an observer "end on" to coach you. Pretty soon you will begin to get a feel for how the ship should look to you all the way around a loop. Many a modeler has complained about inability to trim for loops and all the time he was flying his loops in a banked attitude! I have coached a number of experienced fliers who were consistently screwing up maneuvers because they didn't recognize level attitude! It would be nice to have a wing leveler that would do this automatically for us. Without that you will have to practice until you get used to it.

Never enter a maneuver (in practice) unless you are properly set up for it: level, on track, and properly positioned. Give yourself plenty of room and time in the turn around so that you are not rushed. Never enter a maneuver unless properly trimmed. Make sure the airplane will fly absolutely straight and level hands-off, before attempting maneuvers. This is important because pretty soon you will find that stick pressures and timing of control deflections will become very important in maneuver consistency. Personally, I feel that one does develop a "feel" for the aircraft by relating maneuver character; i.e., loop size, roll rate, etc., to control pressure. Fly the maneuver on the basis that the aircraft and its trim is doing most of the work and you are only "disturbing" it a bit. I cannot fly precision maneuvers with a badly set-up airplane and/or one that is not trimmed to the hands-off condition. You must develop your skills to the point where you "feel" the aircraft and are providing minimal guidance inputs.

Okay, let's try a maneuver — take-off — since it's usually the beginning. This should be easy if the ship is properly set up. In fact, you must do this well enough to get 8's and

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FIREBIRD

Two for one — well almost. Firebird is certainly two airplanes. The flight characteristics of the full span wing and the clipped wing versions could hardly be more different. And all for the price of one very small and simple wing which can be substituted on the spot for the full span wing in forty-five seconds without tools.

So, if it is a lazy Sunday afternoon and you have just enough pep left to fly, slip on the full span wing and relax with a docile, stable, but responsive Sunday flier.

If competition appears you land, refuel, remove the full span wing, slip on the clipped wing and hold your own in any pylon race or three channel aerobatics contest in the aircraft class. Don't let the parasol design fool you. It's a very fast, adroit little bird with the clipped wing.

With the full span wing, Firebird will glide at 15-17 mph and true out at 45 mph at full throttle. With the clipped wing it has been timed at 61 mph. While on the subject of performance the O.S. Max 10 FSR engine swinging the usual 7/4 propeller gives excellent R.O.G. performance with either wing on a not too smooth sod field. In fact, the prototype has never been hand launched.

With the full span wing any three channel maneuver is easily accomplished. Cruising is comfortable at approximately one third throttle.

With the clipped wing, Firebird is an aerobatic airplane. In a fast roll it performs as though on a tight wire passing through the fuselage centerline with rudder input only.

However, the airplane is very stable in all modes and forgives almost everything but a heavy hand.

When wings are changed no other change is necessary except a possible trim adjustment when airborne which is well within the limits of the trim levers of your transmitter.

The design of the airplane started, as many R/C models designed by oldtimers do, with memories of Heath Parasols, Long Longsters, Corbin Baby Aces, Pietenpol Air Campers, etc. So many shapes got built-in that, at one time, the writer considered naming it a Helocopi using the first two letters of the names of Heath, Long, Corbin, and Pietenpol. Another not too bright idea was to call it a Heathenpol. Any such combination seemed a little "cute" and, after flying the first time with the clipped wing, the name Firebird seemed most appropriate, so that is what it became.

With its small engine, low fuel consumption, and overall low cost combined with outstanding performance and versatility, it would take some doing, in the writer's opinion, to get more practical flying and fun per dollar than with Firebird.

Construction

Firebird is admittedly over-built in some places to take a "trainer beating" and keep flying.

Most construction is pretty standard with the possible exception of the cabane struts and engine cowling. The wire cabane struts and center section attached to the fuselage by being "fiberglassed in" have proven to be very rigid and almost indestructible.

The aluminum cowling was chosen because, in the writer's opinion, it comes close to looking like the old single curvature cowls of the Heaths and Pietenpols. If you don't subscribe to this, a carved balsa cowling will work just as well.

The finished airplane should weigh somewhere between 30 to 35 oz. The prototype came out at 33 oz. with the clipped wing, and 35 oz. with the full span. These weights are with Futaba radio gear using S-18 servos, a 4 channel receiver, a 500 mah battery pack and, of course, the 2 oz. fuel supply. With smaller radio gear it should be possible to get well under 30 ozs.

The wings and empennage are about as simple as anyone could get and, therefore, are not covered more fully by construction photographs.

Fuselage:

Cut out and mark all necessary parts. Begin assembly by cementing the 1/4" triangular longerons to the side pieces. Note that the top longerons stop and butt against F3 and the bottom at F2. Leave out the top longerons between F2 and F3 at this time. Top longerons between F1 and F2 can be installed. Be sure to make right and left hand sides.

Next cement F2 and F3 to one side and be sure they are square with the fuselage side. When cured, cement to the other side and install the 1/8" ply doubler between F1 and F2 flush with the bottom of the sides. Add 1/4" triangular longerons between F1 and F2 and the 1/8" doubler and sides. Two vertical 1/4" triangular struts at F1 are now added.

The top of the upper longerons define the reference or "waterline" of this airplane. Since the fuselage sides are flat from F1 to F3, they (and the top longeron plane) can be used to sand the nose frame parts square to these surfaces and epoxy the firewall F1 in place.

Add the 1/16" ply bottom piece between F1 and F2 and assemble and install the access door.

Bend the forward vertical cabane strut assembly using 3/32" music wire to size as shown in the drawing. Important considerations are the fore and aft location of the 3/16" OD x 5/32" ID brass tube and the squareness with the fuselage centerline. Use a simple jig (balsa wood and pins) to hold the tube parallel with the plane of the two side wires and the correct fore and aft position. Solder with Sta-Bright or equivalent. Install in the fuselage by sliding each side up or down until the tube is equidistant from the longerons on both sides, and tack cement.

Follow the same procedure building and installing the aft cabane assembly using 1/16" and 1/32" music wire and a 3/32" OD x 1/16" ID brass tube as shown. When both assemblies have been checked for proper location and squareness "glass in" with 3/8" x 1¼" 2 oz. fiberglass and epoxy.

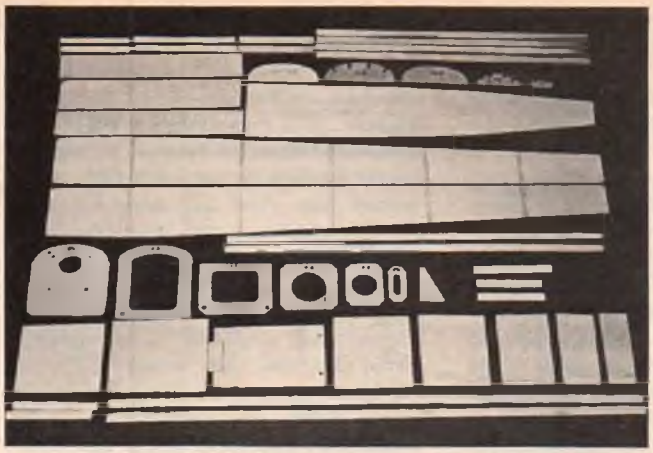
Install the longeron sections between F2 and F3, notching around the struts and butting against the frames. Install the 1/16" sheeting between the instrument panel and F3. This is not shown in the photographs. Stop this sheet at the center of F3 to allow for support of the aft planking.

Since a relatively stiff forward section has now been established, the aft end of the fuselage can be drawn together without any appreciable distortion between F2 and F3. Pin the fuselage to your work table on the bottom plan view and draw together, checking alignment, and cementing in the tail skid block. Lightly sand the inside ends of the fuselage sides so that the joined width at the rudder post is 5/32". Some of the longerons will be cut away to accommodate the tail skid block. Add frames F4, F5, and F6. Install the four #4 blind nuts for the engine mount. The throttle cable is the standard Du-Bro nylon sleeve and 1/16" steel cable epoxied in at F1 and F2. Although the bend radii look extremely sharp this assembly works very well.

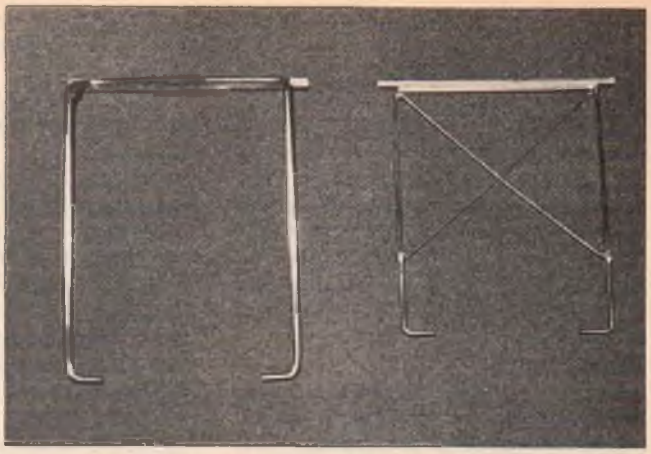
The cross bracing from F1 to the tops of the vertical cabane struts is simply bent 1/16" music wire formed so the pieces will lie in place against the firewall F1 and the top of the longerons and line up with the bend in the vertical strut. Wrap with a few turns of very fine copper wire and solder. "Glass" in the forward wire tabs with 2 oz. fiberglass cloth and epoxy cement at F1. As the drawing shows, add a turn of fine wire

This two-in-one parasol design can give you a relaxing day of flying. Put the clipped wing on and you have an aerobatic airplane.

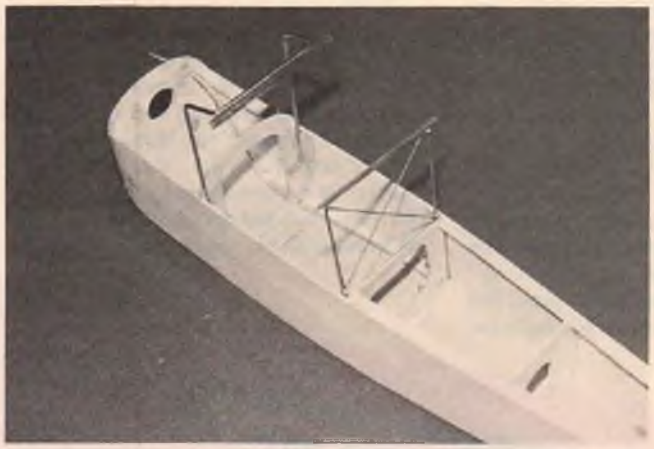
By Joseph M. Mergen



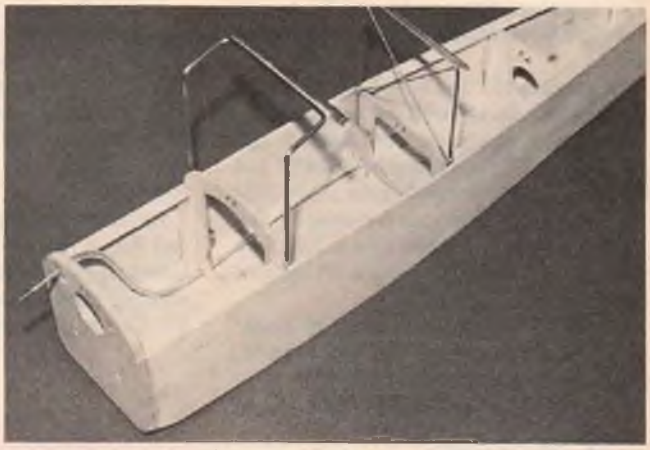
Pre-cut all fuselage parts before assembly. It's a surprising time saver.



Bend cabane strut assemblies over plans. Exact length is unimportant. Width and squareness is. Wrap 1/32" wire once around each strut (aft assembly) before soldering.



View showing forward cabane struts "glassed into" corner of F2 and side. Also see engine mount blind nuts and throttle cable installation.



Aft cabane struts "glassed into" corner of F3 and side. More detail of throttle cable. Note slight inward and downward angle of forward end of throttle cable tube at F1.

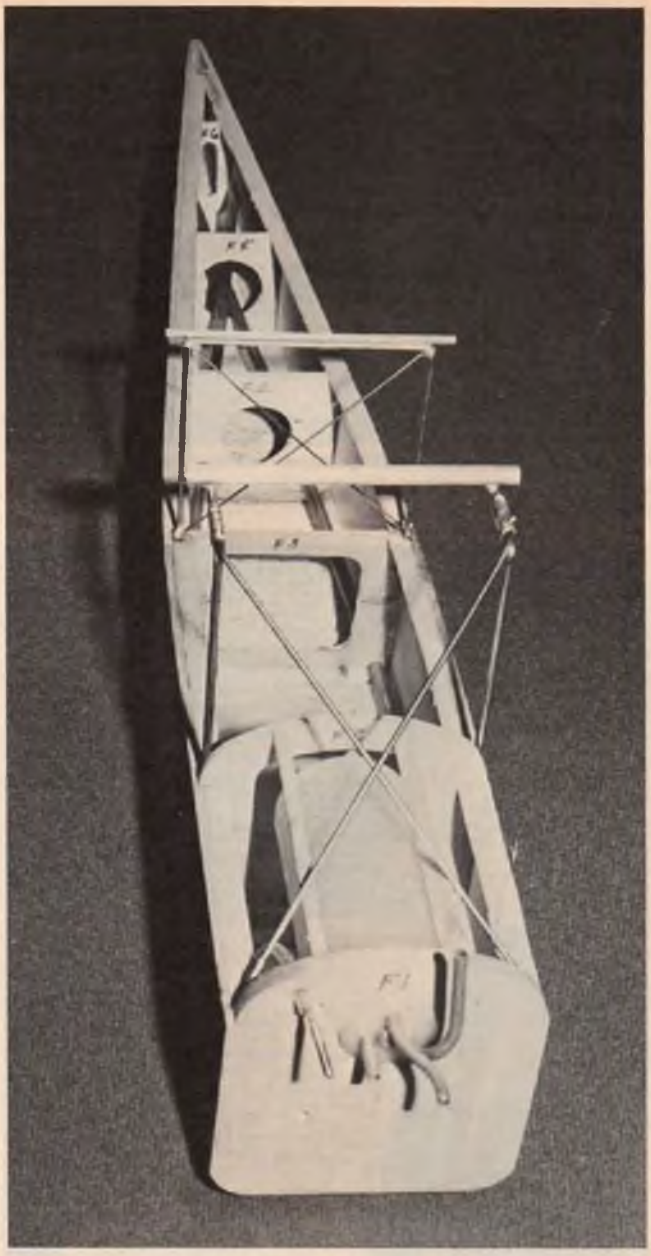
Bill Of Materials

(4) — 3/32" x 3" x 36" balsa — ribs, fuselage sides
(5) — 1/16" x 3" x 36" balsa — wing and fuselage planking, spar webs
(1) — 1/8" x 3" x 36" balsa — empennage, F4, F5, F6
(2) — 1/8" x 1/4" x 36" balsa — stringers
(3) — 1/4" x 36" balsa triangular stock — longerons, braces
(2) — 1/4" x 3/4" x 36" balsa — trailing edge stock or strip
(1) — 3/16" x 3/4" x 12" balsa — spar gusset
(3) — 1/4" x 3/8" x 36" balsa — leading edge, etc.
(1) — 1/2" x 1½" x 8" balsa — tail skid block, wing block
(1) — 1" x 18" balsa triangular stock — wing tips
(1) — 3/4" x 18" balsa triangular stock — wing tips
(1) — 3/16" x 2" x 2" balsa — fairing
(4) — 3/32" x 3/16" x 48" spruce — spar caps
(1) — 1/8" x 1/4" x 12" spruce — rudder post, etc., reinforcer
(1) — 3/32" x 6" x 12" plywood — frames, ribs
(1) — 1/8" x 3" x 4" plywood — doubler
(1) — 1/4" x 5/16" x 6" pine — servo rails
(1) — 1/16" x 3" x 12" plywood — fuselage bottom, door
(1) — 3/16" x 3" x 4" plywood — F1
(1) — 1/4" x 1/4" x 4" hardwood — cowl mounts
(1) — 3/32" dia. x 12" music wire — front cabane
(1) — 1/16" dia. x 36 music wire — rear cabane, cross struts, tail skid, carry over wire
(1) — 1/32" dia. x 12" music wire — rear cabane, cross wires, clips
(1) — 3/16" OD x 5/32" ID x 12" brass tube — wing carry over
(1) — 3/32" OD x 1/16" ID x 6" brass tube — wing carry over
(1) — 5/32" dia. x 10" music wire — wing carry over
(1) — 2" x 3" x 2 oz. fiberglass cloth — strut mounts
(1) — .010 dia. x 24" soft wire — wrap for soldered joints
(1) — #B105-2 Hallco landing gear
(3) — #6 x 1/2" nylon screws — landing gear retaining
(4) — #4-40 blind nuts — engine mounts
(2) — 2" Sig aluminum engine mounts
(2) — 2½" dia. Golden Age or Vintage wheels
(2) — #2 x 1/4" screws — access door
(13) — #0 x 1/4" flat head screws
(8) — #4-40 x 1/2" bolts — engine mount, engine
(1) — 1/16" Du-Bro nylon/steel throttle cable assembly
(1) — 3/16" dia. x 30" NyRod — elevator, rudder pushrods
(3) — #2 x 1" threaded control pushrods
(2) — Small nylon horns — elevator, rudder
(2) — #2 x 4" threaded control pushrods
(1) — 2" x 4" x .020 windshield material
(1) — 2 oz. Sullivan round fuel tank
(1) — 12 sq. ft. MonoKote (as desired)
(3) — Small nylon clevises
(1) — 6" x 8" x .010" or .015" aluminum sheet — engine cowling
(1) — 5" fuel line
(1) — #2221 x 3" aluminum arrow shaft — for muffler extension
10 cu. in. engine, propeller and radio of your choice
Epoxy, cyanoacrylate, aliphatic cements, Sta-Brite solder, foam wrap for RX and battery as required

Wings are attached and wholly supported by cabane wires and are not dependent on any wood parts of center section for strength or position.

Forward cross struts "glassed" to F1 and top longerons. Keep ends at F1 "in" enough to avoid interference with front cowl sheeting. Note servo rails.

View showing access hatch and servo rails from the bottom. Be sure NyRod elevator and rudder sleeves extend 2" forward of F3 as shown.



Forward crossed cabane struts wrapped and soldered to vertical struts. Fuel tank and forward stringers added. NyRod tubes in place. Note tubes are crossed. Vertical tube in fuel tank is optional filler.

each way at the intersections of the crossed wires of the forward and aft cabane systems and apply a small drop of solder.

Small elevator and rudder NyRod sleeves are installed through holes in F3 and F4. The aft exits through the fuselage sides should be just ahead of F6 and approximately 5/8" from the bottom of the fuselage on both sides. Let the forward end extend 2" ahead of F3 to prevent pushrod interference with the RX foam wrap. Sand tubes and epoxy cement at F3, F4, and the aft exit point. Sand flush at exit later. Note that the tubes are crossed to permit use of right hand servos.

The front stringers and fuel tank are installed next. Be sure to seal the front flange of the tank at F1 with silicone or epoxy.

The servo rails are now epoxied in place to accommodate your servo brand.

The fuselage is completed by adding the instrument panel, F2A, and the front cowl sheeting, carving the cockpit and adding the tops of F3, F4, F5, and the 1/4" x 1/8" stringers.

Next shape (6) W1, (4) W2 and (2) W2A ribs together, drilling the 3/16" and 3/32" diameter holes for the brass tubes at the same time using the lower flat surfaces of the ribs for reference. Two of the W1 and two W2 ribs are for the second wing. Use two W1 and two W2A ribs to form the center section. Add the 3/32" x 3/16" stiffener, leading and trailing edges and planking. Drill the 5/16" holes through W1 and W2A on each side as shown. The flat bottoms of the center section ribs should be parallel to and equidistant from the top longeron.

The Hallco B 105-2 landing gear should be reworked by flattening the two center bends and rebending at a 3" width to match the fuselage, drilled as shown and attached with nylon screws. Install 2½" William Brothers Golden Age or Vintage wheels.

The aluminum engine cowl is begun by adding the attaching blocks to F1 and installing the engine, less muffler. Laminate two pieces of 3/32" plywood to form the 3/16" engine nose ring NR2 and NR3. One piece should be bored to have a tight fit on the engine nose and the other a clearance hole for the propeller flange. Shape to clear the carburetor when the front face of the nose ring is 1/4" aft of the propeller flange face. Both pieces should be slightly oversize so they can be tapered to line up with the outside contour of F1. Press the nose ring on the engine nose in the correct fore and aft location.

Trace the cowl pattern on the drawing on

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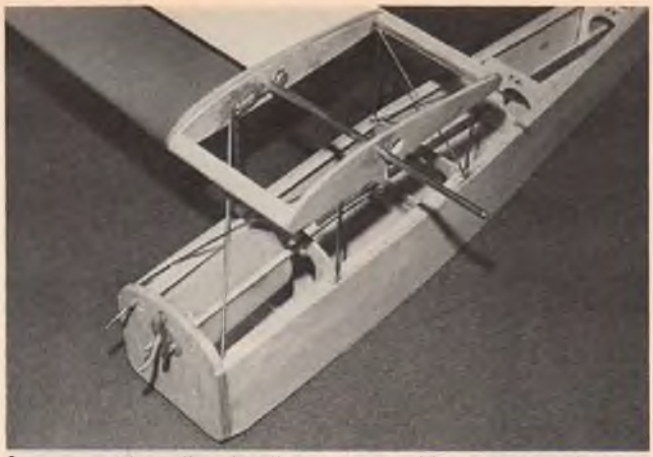
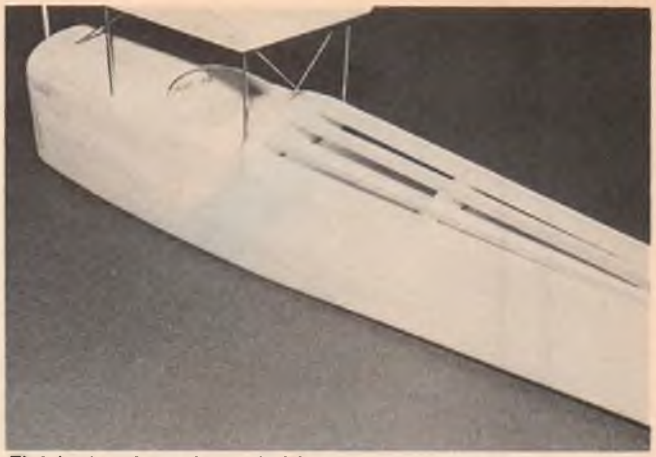
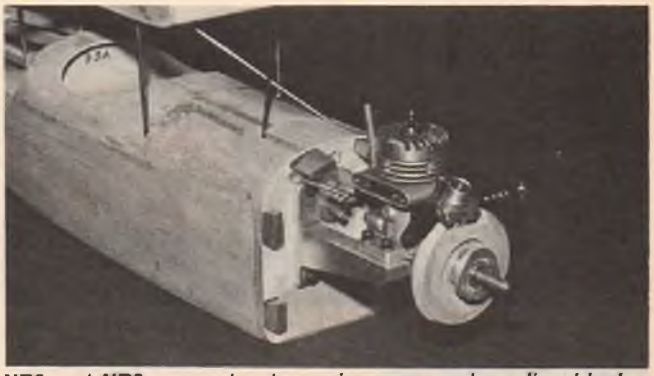


Center section ribs, leading edge, trailing edge, and wing carry-over wires in place. Wing retaining clip shown just aft of front carry-over tube.



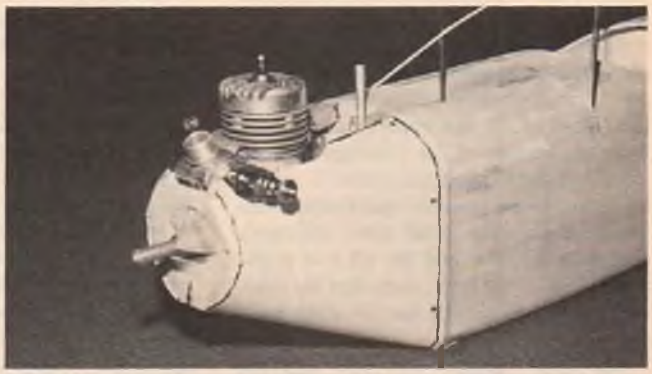
Finished and rough sanded fuselage.

Finished and rough sanded fuselage and center section.

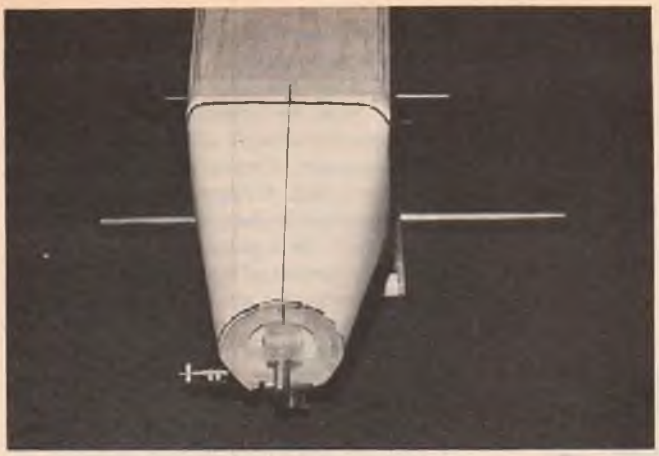


NR2 and NR3 pressed onto engine nose and cowling blocks mounted on F1. Cowling pattern can now be fitted. Note blocks are off-set thickness of cowling material for smooth joint.

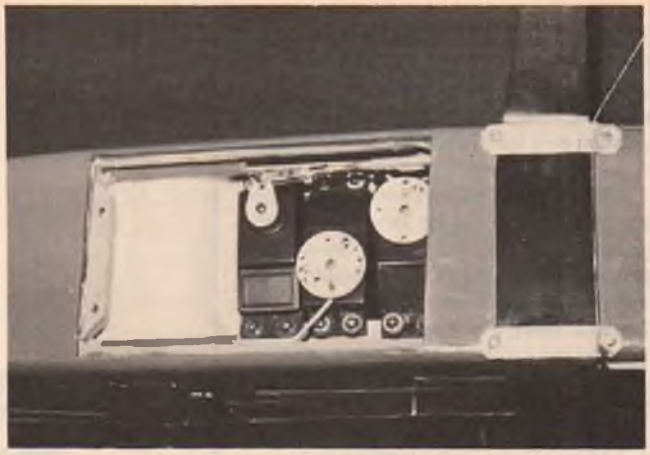
Oversize vellum pattern taped to nose ring and F1 blocks. Note pattern has been marked at F1, to clear the muffler, and that the centerline at the bottom of NR2 has been defined.



Left side of pattern marked at F1, needle valve, NR2, and showing cylinder clearance.



Be sure to mark centerline on pattern, fuselage, and NR2.



Bottom view of servo and receiver installation. Throttle servo is left hand. Right hand servo can be used by turning arm 180 degrees and letting cable bend. Works fine.

Just pick a set of wing panels and go fly.

If you pick this set you may witness the quickest terminal roll in history!

Detail of skis showing music wire spring holding nose up.

Firebird with Sport Wing.

Two views of Firebird with Super-Sport Wing.

vellum or other stiff paper approximately 1/8" oversize. Cut out and tape over the blocks on F1 and the nose ring and establish a bottom centerline. Adjust and trim until satisfied with the fit and then use as a pattern to cut out the aluminum cowl.

Starting at the bottom centerline, shape the cowling up to the top longerons and the centerline of the nose ring. Install two screws at each side of F1 and one on the bottom and each side of the nose ring. Remove cowl and engine. Reinstall the cowling and finish forming and fastening as shown. Trim at F1 and the forward face of the nose ring.

Reinstall the engine and cowl and mark around the engine and muffler boss.

Remove the cowl, trim and sand the front face of the cowl and nose ring flush and install nose ring NR1, sanding to shape. Seal and prime NR1 and, after roughing up the aluminum with fine sandpaper, spray paint with polyurethane. For a fast dry and tough finish, bake between 150°F. and 200°F. for one half hour. The small piece of cowling behind the cylinder is cut to size, joggled to match the edges of the main cowl and finished in the same manner.

Empennage:

The stabilizer, elevators, fin and rudder, are cut from medium hard 1/8" sheet balsa. Note that both the elevators and the fin are reinforced with 1/8" x 1/4" spruce strips.

Regular small nylon hinges can be used, however, the writer was very successful using the covering material (in this case, MonoKote). To do this, sand a 120° included angle wedge on each piece at each hinge line and iron the material into the groove on each side until the MonoKote touches and adheres to itself. A very strong, flexible, gapless hinge is then formed and has been very satisfactory on this and another of the writer's airplanes. When covering the fin, leave about a 1/16" flap at the stabilizer edge and rudder post. Leave a similar flap on the sides of the fuselage where the stabilizer is mounted. After stripping the stabilizer where it joins fuselage and fin, and epoxying in place, these flaps can be sealed down to give a smooth and strengthened joint.

Assuming the fuselage is covered, go to the forward section and seal the cowl, where the cabane struts come through, with epoxy, Epoxolite or other fuelproof material.

The radio installation will vary according to makes. Futaba components were used in the prototype and are shown on the drawing. The aircraft will balance at the fore and aft C.G. location shown with these components so arranged. Switch and charging jack can be located just aft of F3.

An aluminum tail pipe about 3" long will keep the cockpit dry. A #2221 arrow shaft can be press fitted on the O.S. 10 muffler outlet without machining.

Wings:

The writer usually begins building rectangular planform wings by rough cutting all similar ribs and then stacking them and shaping all at once with a plywood

FIREBIRD
Designed By: J.M. Mergen

TYPE AIRCRAFT
Sunday Sport & Super Sport
WINGSPAN
51" & 30"
WING CHORD
7½"
TOTAL WING AREA
370 Sq. In & 212 Sq. In.
WING LOCATION
Parasol
AIRFOIL
Clark Y & Mod. Clark Y
DIHEDRAL EACH TIP
4° Each Panel
O.A. FUSELAGE LENGTH
28¼ Inches
RADIO COMPARTMENT AREA
(L)7¼" x (W)2¾" x (H)2¼"
STABILIZER SPAN
14 Inches
STABILIZER CHORD (incl. elev.)
4 Inches (Avg.)
STABILIZER AREA
54 Sq. In.
STABILIZER LOCATION
Top of Fuselage
VERTICAL FIN HEIGHT
5 Inches
VERTICAL FIN WIDTH (incl. rudder)
4⅛ Inches
REC. ENGINE SIZE
.10 Cu. In.
FUEL TANK SIZE
2 Oz.
LANDING GEAR
Conventional
REC. NO. OF CHANNELS
3
CONTROL FUNCTIONS
Rud., Elev., Throt,
BASIC MATERIALS USED IN CONSTRUCTION
Fuselage ..... Balsa, Ply
Wing ..... Balsa, Ply
Empennage ..... Balsa & Spruce
Wt. Ready To Fly ..... (Full Wing) 35 Oz.
(Clipped Wing) 33 oz.
Wing Loading ..... (FW) 13.6 Oz/Sq. Ft.
(CW) 22.4 Oz./Sq. Ft.

master on each end of the stack to maintain absolute consistency.

Build the full span wing first over the plan. Start by pinning the lower spar capstrip to your work surface. (Don't forget the waxpaper.) Cement all the W4 ribs and W2 in place. Cement the leading and trailing edges in place as well as the top spar cap. Shim the leading edge up until flush with the bottom of the ribs (about 3/32"). Note that ribs W1 and W3 are left out at this time. Add the 3/16" tapered block between the two inboard W4 ribs as shown. Next add the spar webbing. The webbing between W2 and the first W4 rib is 1/16" plywood epoxied in place. Install only the leading edge side at this time and fit the forward end of W3 in place and cement. The triangular balsa tip can be added and rough carved. Also add the 1/2" block at the trailing edge. Build the opposite panel to this point.

Insert the 5/32" carry-over wire in the center section tube and slip the 3/16" brass tubes into the spar cavities through the holes in W2. Be sure to seal the outboard end of the tube with a short (1/8") balsa plug before putting in place.

The fuselage and wings should now be mocked-up by blocking up to obtain the proper incidence (the bottom surface of the center section rib is the reference), dihedral, and squareness with the fuselage. If necessary, sand the face of W2 to fit well against the center section rib. Tack cement the 3/16" dia. wing tube to the 1/16" plywood web of each panel.

Remove one wing without disturbing the incidence of the other. Sharpen a piece of 1/16" music wire and, with the center section tube as a guide, drill a hole to W3 in the 1/2" block for the aft carry-over wire.

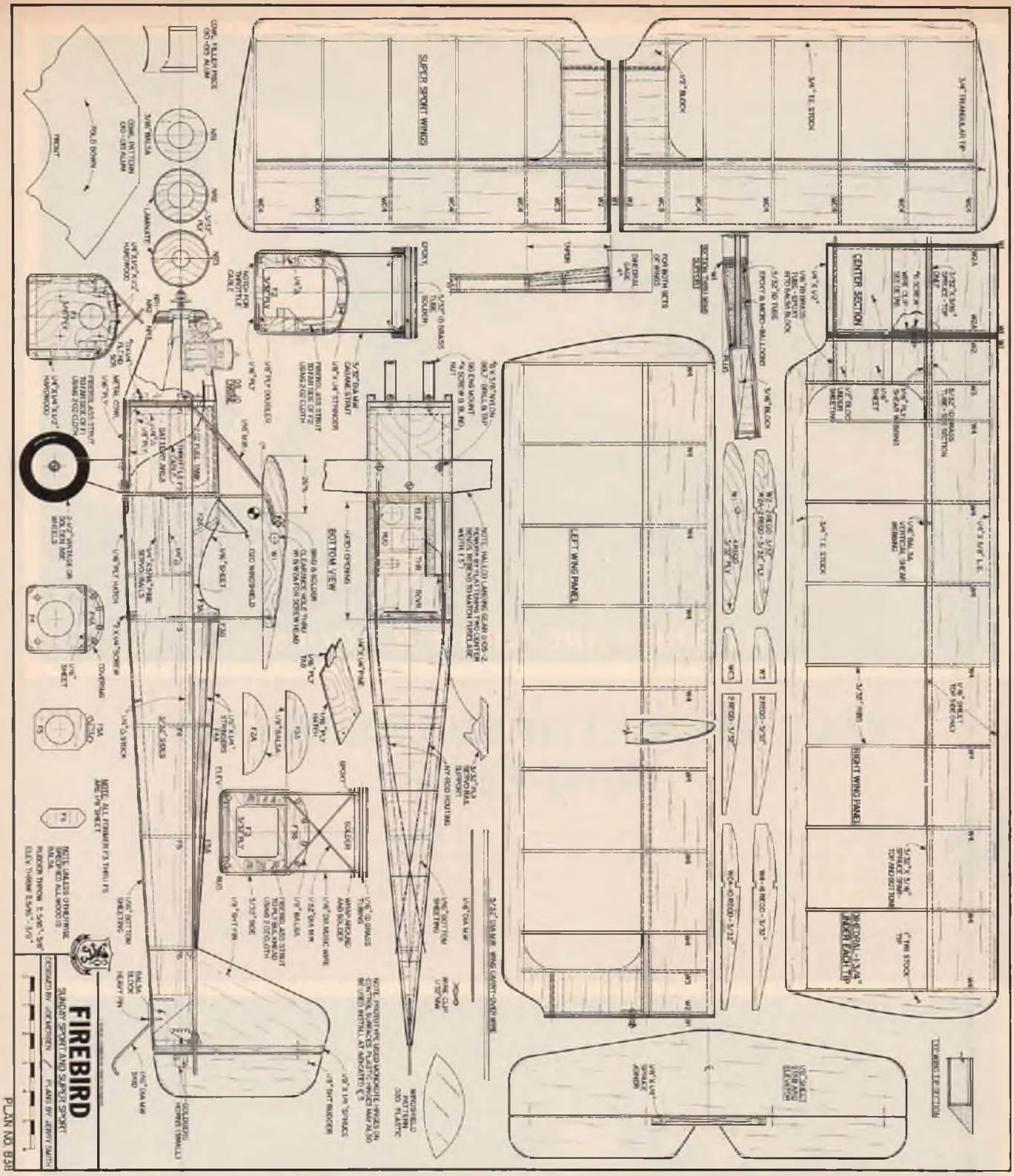
Repeat the process on the other wing. Now assemble both wings using the 1/16" carry-over wire at the rear and, of course, the 5/32" wire forward to be sure of alignment.

Remove the wings, drill out the 1/16" holes to 3/32" and install the 3/32" tubes cementing with epoxy (plug the ends to keep from filling up).

Secure the 3/16" tubes by filling the cavity with a mixture of epoxy and micro-balloons, adding the aft 1/16" plywood webs and the aft section of rib W3. Next plank the wing, add W1 and rough sand.

Assemble both wings to the center section and finish sanding the leading edges, trailing edges, and planking, to obtain a smooth consistent set of surfaces.

The clipped wing is built in the same manner. Note that the outboard sections have a thickness ratio of approximately 8% as compared with the 12% Clark Y of the full span wings and center section. To accomplish the transition between the 8% clipped wing and the 12% center section, the W1's are the same for both wings and a transition rib WC3 is used to help form the taper. A little more care must be used in sanding in the clipped wing to conform with the already finished center section. Cover



the wings as you have the fuselage and pick the graphics you desire.

This completes the airplane except for windshield and tail skid which are shown on the plans.

The prototype turned out to be red and black since those are the colors of a Firebird, otherwise known as a Scarlet Tanager. A Scarlet Tanager doesn't have a white wing but this just appealed to the writer and that's the way it turned out.

Flying:

From experience it seems desirable to start with about plus or minus 5/16" rudder travel and between plus or minus 5/16" and plus or minus 3/8" elevator travel.

Unless you are an expert pilot, don't start with the clipped wing. Feel out the machine with the full span wing and when you have had lots of practice try the clipped wing for a real thrill. When this configuration is mastered, increase the rudder sensitivity to plus or minus 1/2" and look alive. You will have a real performer on your hands. Have fun.

Addendum:

Since this was a fall project, a very simple set of skiis were worked out as shown in the photographs. These are designed for 10 sq. in. per pound and work very well on everything but very light powder snow. The dimensions are 1½" x 8" using 1/16" ply bottoms with 1/8" plywood webs. A single piece of 1/32" music wire holds them up about 10° nose high and allows the skiis to run flat with the tail on the snow. A coat of epoxy cement on the bottom works very well. Try them next winter. □

FULL SIZE PLANS AVAILABLE — SEE PAGE 203

Petty Officer First Class Loren Perry, Jr. (USNR). Public Affairs, U.S. Navy Recruiting District, Jacksonville, Florida.

R/C SHIPS ARE NAVY P.R. TOOLS

NAVY RECRUITER BUILDS HIS OWN MINI-FLEET

Rarely does a Navy Recruiter have the chance to be listed among the leaders of the world's Navies, but this goal may soon be achieved by Jacksonville's Loren Perry, a Navy Public Affairs Specialist attached to the Navy Recruiting District. Perry, whose modelmaking hobby spans more than twenty years, is building a fleet of miniature ships operated by radio control. What started as a personal pastime has blossomed into one of the U.S. Navy's most unique recruiting tools as Perry has been invited by numerous high schools and tourist attractions to demonstrate his model's capabilities before hundreds of interested spectators.

The oldest ship in Perry's fleet is an 8' long working miniature of the World War Two German battlecruiser "Scharnhorst."

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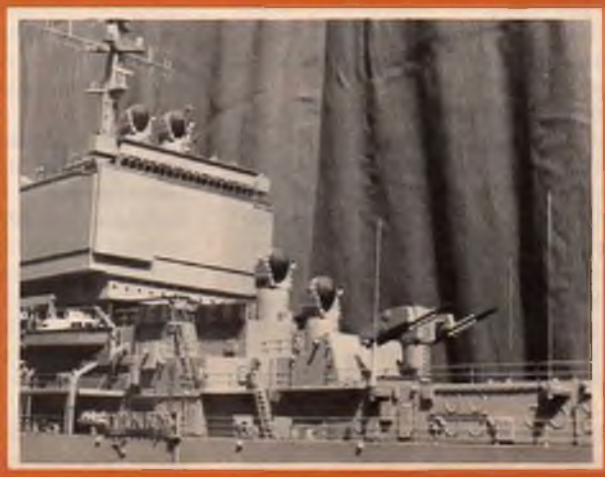
NAVY



BIG IS BEAUTIFUL

Dick Phillips

Did you ever notice that you did things a certain way and the only reason for doing so was that you have always done it that way? The condition is not uncommon, we all tend to resist change (unless we invented a new way, of course!) and the condition is commonly referred to as "tunnel vision." We can't see anything outside our normal experience, much as a horse wearing blinders.

Davis Diesel Development's diesel version of Duke Fox's Twin. Testing was not completed at the time of receipt of the information on this conversion, so we do not have much information on it. Should be a real barn-burner of an engine!

We are all familiar with diesel model engines, many of us have seen one at one time or another, or at least knew someone who had. Well, there is a group of people in the U.S. who have been doing some work with diesels in the past few years and they call themselves, Davis Diesel Development, Inc., and their trade marks is D^3. D cubed, I think that's neat.

Anyway, diesels have not been all that near the forefront in North America although they receive wide acceptance in Europe. This is partly due to their reliability and partly due to high fuel costs (what else is new?). I had a letter from Bob Davis and wrote him asking for some photos I could use. He wrote again recently to send additional information and forwarded some pictures.

Bob also included some figures with the photos and I'd like to pass them along to you. These are not completely new engines, by the way, but conversions of engines already in use. I don't have a complete listing of what can be converted to diesel operation, but a letter to Davis Diesel Developments, Inc., Box 141, Milford, Connecticut 06460, should get you the answers you want. Be sure to enclose a stamped, self-addressed envelope for a quick reply.

They convert many engines in use here in North America and you may well have one in your stable that would lend itself to diesel-izing. They have tested a .90 swinging an 18/6 prop at 7500 rpm, a 20/6 at 6500. The Webra .91 gives similar performance figures.

O.S. Max diesel conversion. There is no real size limitation on what engines can be converted. A Sueva and a Tartan conversion are in the works. Chief benefits are more power and lower operating costs. (More in text.)

Bob also mentions that they will be doing a conversion on the Sueva and the Tartan engine in the near future.

The .90's consume about 1/2 oz. to 1 oz. of fuel per minute depending on throttle setting and the engines are extremely quiet, even compared to the current crop of industrial gasoline engines.

Fuel costs have recently been reduced by Davis from $16.50 to $15.00 per gallon with an additional discount of 20% on 4 gallons (case lot).

Bob suggests that almost any engine could be converted to diesel, including the Quadra. Their choice of the Tartan engine is due to its having a removable head and its internal design.

If you have held back on going to large models due to your unwillingness to purchase one of the industrial engines, then there is a possibility that a diesel conversion may be an alternate route for you. Judging by the figures quoted by Bob Davis, it also appears to be a viable alternative to the industrial gas engine.

★

One of the Quadra engine's shortcomings has been the inability to adjust the carburetor while the engine is running. Getting a screwdriver in-between those spinning propeller blades and out in time to prevent damage just can't be done. There have been approaches made to Quadra to correct this condition but apparently their priorities have lain elsewhere and it has been left to a modeler to come up with the cure.

Bob Constance of Scottsdale, Arizona, has developed a fitting which will permit you to turn your Quadra carburetor at about 90 degrees, which will put the needles in such a position you will be able to adjust them with the engine running. That's an important inprovement. There is no substitute (at least at the field) for being able to 'tweak' the needles to get the best possible performance for the existing conditions. How many times have you fiddled with the needles trying to get it just right and having to shut the engine down to make a minor correction, hoping you were turning the needle in the right direction? It just isn't the same as being able to listen to the engine while the corrections are being made, and I'm sure that adding one of Bob's goodies to your model engine will make things easier and better for you.

Another nice plus is that Bob's accessory will eliminate the need for a bellcrank or some such to permit operating the throttle from a servo mounted behind the engine. The rotation of the carburetor with the device will place the throttle connection where it can be operated directly from the servo. A nice little plus.

Bob Constance's new adapter for the Quadra carb. Small and light, it will permit the carb being adjusted while the engine is running with no danger to the fingers.

Bob Constance's adapter installed on the Quadra. Installation eliminates one plastic part and is easily accomplished in a few minutes. Nicely engineered and well made.

The plate is available from Bob (Bob Constance, 6501 N. 87th Way, Scottsdale, Arizona 85253) for $20, postpaid as long as his stock lasts. I have one on one of my Quadras, and will soon be doing the rest of them as well.

★

Tom Keeling, the "T" in T & D Fiberglass Specialties (30925 Block, Garden City, Michigan 48135), has come up with a plan for the Christen Eagle I and it looks good. Plans will be available at $21.50 and the Eagle will fly on a .90 or a Quadra. The canopy for the Eagle I and II, a cowl, wheel pants, landing gear assembly and the landing gear fairings will all be available for the builder wanting them, and the gear incorporates a coil spring shock absorbing mechanism for those hard landings we all seem to wander into from time to time.

T & D Fiberglass Specialties' Christen Eagle. Plans, cowl, canopy and wheel pants are available (see text for details).

Tom has added a rather unique feature to this model in that all the forward top sheeting is aluminum sheet. This sheeting screws into the fuselage members and is removable for access to the tank, landing gear mounts, or any other items you might need access to.

Tom admits to slight alterations to the model from actual scale. It is a 63" span rather than the more accurate 60" and the area of the stab has been increased slightly. Both changes should make a better flier out of the model and those purists among us should not have any difficulty altering the above mentioned items back to accurate scale sizes. Details for Quadra installation are shown on the plan for those wishing to go that route. Plans should be available at the time you read this and the model was shown at Toledo. I'll have photos of it in a future issue.

★

Good friend and Club President, Mel Van Vianen, here in my area is currently involved in what has all the earmarks of an interesting project. He is in the midst of building a Fokker D VIII which, in itself, is not all that much of a novelty, but as he is building the fuselage out of steel tubing, it is a bit of a departure from conventional modeling practice. The model will be Quarter Scale and powered with a Super Hustler Mel has had for a couple of years now, but has never used.

The tubing used in this case is mild steel hydraulic tubing and, although Mel is using

Mel van Vianen's Fokker D VIII fuselage takes shape in the jig. Sides are brazed in the simple and easily made jig. Holes permit brazing without danger of fire.

Approximate location of Super Hustler engine gives some idea of the size of the Fokker D VIII. It will be BIG. Small plywood cleats from locating stops for steel hydraulic tubing while being welded. (More in text.)

a cadmium/silver brazing rod (which is expensive), ordinary rod should do just as well. The tubing is cut to length and shaped at the ends, to fit over the longerons, laid up in a jig and silver soldered in place. The jig assures that both sides will be identical, of course. Not a bad idea, really, since how many times have you actually built two exactly identical fuselage sides from the same plan?

As you can see from the photos, Mel has cut holes in the jig to permit heating the tubing to solder it without lighting the whole place on fire. He uses a small oxy-acetylene torch, and these are pretty readily available in convenient sizes for hobby use.

Those of you familiar with the older aircraft will know that the fuselages were cross and diagonally braced with wire and turnbuckles. You can imagine the great detail work possible on such a fuselage and the construction points possible in competition. We'll keep in touch with the project and bring you further reports as construction progresses. It has all the earmarks of a rather nice project. Mel is also a very meticulous craftsman, so it should turn out very well indeed.

★

For those of you whose interest lies in the era of the First World War (1914-1918), there is a publication available which should be in your library. It's titled, appropriately enough, World War I Aeroplanes and is published five times each year from voluntary contributions. Articles include almost everything you could ever want to know about those magnificent flying machines. The magazine is printed on an excellent grade of paper and the photos come out very well. Material includes current restoration programs and projects along with a good deal of highly valuable historic material. The magazine is intended for restorers, modelers, and historians, and would be a valuable source of research material for the modeler. Not to mention that the people who subscribe have similar interests and are a source of contacts for additional material.

Subscription is on a voluntary contribution basis and I would suggest that you could not replace the information in each issue for $3.00 a copy, so $15.00 for a year's subscription would not seem out of the way. In the U.S.A., contact Leonard Opdyke, 15 Crescent Road, Poughkeepsie, New York 12601, and in Canada, Wally Batter, 114 Country Club Place, Sault Ste. Marie, Ontario, P6A 6A3. If WW I aeroplanes are your bag, then so is this well done publication.

★

Those of you have been looking for plans for Waco airplanes --- and there must be one heck of a demand, judging from my mail --- be patient. Norm Rosenstock is in the process of finalizing the production of his YKS-7. There have been a few problems (my letters to the firm who were supposed to be getting the kit ready have remained unanswered for some time now) but Norm is working on it and expects to have some good news for us in the near future. Along with many of you, I too am an admirer of the Waco bipes and have built a couple of the over the years. My all-time favorite is the ARE which has to be about the slipperiest looking biplane ever built. If any of you are aware of a plan for it, or for any of the Waco airplanes in the larger sizes, I'd appreciate knowing about it. (So would a large number of other guys if my mail is any indication!)

★

Few, if any of the kit manufacturers, spend much time sitting on their hands, but the progress of some of the smaller and less well known outfits staggers the imagination. Most small firms are in a bind for capital in the early stages of their development and the pressure of financing and developing new products is great. I don't know that this applies to the guys at R/C Kits Mfg. (706 Easton N.E., North Canton, Ohio 44721), but they are sure turning out the new models. A recent news release from them details that their Quarter Scale Chipmunk spans 8 feet, with 1800 squares of area and a weight of 18-20 pounds. It should be a barn burner on the Quadra or larger engine. Actually, that weight is about perfect for the Quadra and the construction of the model should make it a pretty quick machine to build. Balsa sheeted foam wing, rolled 1/64" plywood fuselage over a balsa frame, and foam stab, fin and rudder, along with a clear canopy should have it in the air in a short period of time after opening the kit box. I'm not suggesting that it is ARF, it's a kit and requires some building. The prototype looks very good and aerobatic performance is claimed for it with the Quadra on board. At $179.95 it is certainly priced right in there with the best. It wouldn't take a lot of alteration to turn it into Art Scholl's mount

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RADIO SPECTRUM

Jim Oddino

Kraft System KPS 20H Servo

As I mentioned last month, the folks down at Kraft Systems were nice enough to send out a sample of their KPS 20H for our evaluation. The first thing I had to do then, was build the RCM Servo Travel and Centering Gauge (Plan #702). What this amounts to is a fixture with a large protractor that lets you measure the servo output position very accurately. The input can be measured with the Digital Pulse Meter described in the September 1979 issue. With this equipment you are equipped to measure the deadband, hysteresis, linearity and resolution of the servo. You can also get a feel for the damping.

Back to the servo. The 20H is designed to fit the same mounts as the KPS 15 which means the width and length are identical. However, the case is significantly higher in order to accommodate a ball bearing. The case is very rugged with fairly thick walls. The mechanical backlash in the gear train is about one degree. This is no doubt a function of the gear selection and I would suspect that you might find some that are tighter, but even one degree out of ninety is not bad.

The first thing you notice when you fire it up is the fact that it is fast. The next thing you do is grab the wheel and find out it is strong. A number of people have measured the torque and all seem to agree that it is in the neighborhood of 58 oz.-in., so I didn't bother to measure it.

The non-linearity I spoke of in an earlier column is noticeable on the protractor but as I mentioned you probably would never notice this flying. You must be careful not to blame all the non-linearity on the servo because the transmitter can contribute even if it contains one of the new constant current linear ramp encoder circuits. I have such a transmitter, but found that the stick isn't exactly in the middle of the window so I actually get more throw (and greater change in pulse width) in one direction than I do in the other. Unfortunately, this was in the same direction as the servo non-linearity so it magnified the problem. The solution would be to reverse either the servo or the transmitter and the two effects would tend to cancel each other. The other solution is the new Gold Spectrum 6 transmitter that lets you set the end travel in each direction.

With no load on the servo, the overshoot was about five degrees when going from neutral to full throw or vice versa. This doesn't look very nice on the bench but again, it is probably not noticeable in the air. This is due to the fact that the airplane can't respond to that high a frequency.

Resolution is a measure of how fine (small) a change in input the servo can respond to. The KPS 20H, and I suspect all servos that use the same integrated circuit, is a little better in one direction than the other, but probably better than it needs to be in both directions. The way I measured this parameter was to very slowly move the trim (I have a wheel instead of a lever allowing very fine control) and count the number of steps in a given number of degrees. I measured steps of something like one-third degree in one direction and one-fifth degree in the other. The servo moves roughly 100 degrees for a one millisecond change, so if we translate the measurement back to an input, we see the servo responds to a change of 2 microseconds in one direction and 3.3 microseconds in the other. Your transmitter changes pulse width at the rate of about 15 microseconds per degree of control stick so you can see the servo will respond to as little as .13 degrees of transmitter stick motion. You can't convince me you need something better.

Probably more important than resolution is deadband. I measured this by making a hysteresis plot as shown in Figure 1. Unfortunately, the mechanical backlash (which should be considered as a contributor to deadband) dominates the measurement. The numbers that I measured varied between 5 and 12 microseconds. If we use a value of 10μsec, it means that you would have to move your transmitter stick 10/15 = 2/3 degree when you reversed direction before the servo would respond. Not a bad number. I suspect most guys jitter more than that just due to nerves.

By the way, if you wanted to eliminate the effects of deadband, you could introduce some dither or adjust the servo so it actually oscillates at any null position. The price you pay is high current drain. Ex-pattern champ, Jim Whitley, used to set up his servos this way and then charge after every flight. Don't think this is hokey because it is done in sophisticated guided missiles too.

Well, the real reason for getting the servo was to see how the pot/wiper combination holds up. I now have baseline data which I can use for comparison purposes after the servo is cycled or flown for some length of time. So stay tuned for the results in a future issue. Even if you're not interested in the KPS 20H, you can use the information presented here to see how your servos stack up. Get out your Digital Pulse Meter and Servo Travel and Centering Gauge.

Optimization of R/C Airborne Systems?

There have been a lot of changes in R/C transmitters in recent years, but not much has happened to our airborne equipment since the three wire servo was introduced back in 1968. There have been improvements such as integrated circuits, linear servo amps, better pots and wipers, etc., but no big changes. Hank Lopez, whose name you've seen in this column before, has submitted some ideas that I think are worth examining. His premise is that both receiver and servo performance could be improved, if we had a higher voltage to work with. I think the discussions that follow will convince you that the premise is right. However, you don't get something for nothing very often. Higher voltage implies more battery cells and we must consider what that does to the total system reliability. So we'll discuss all of these aspects and

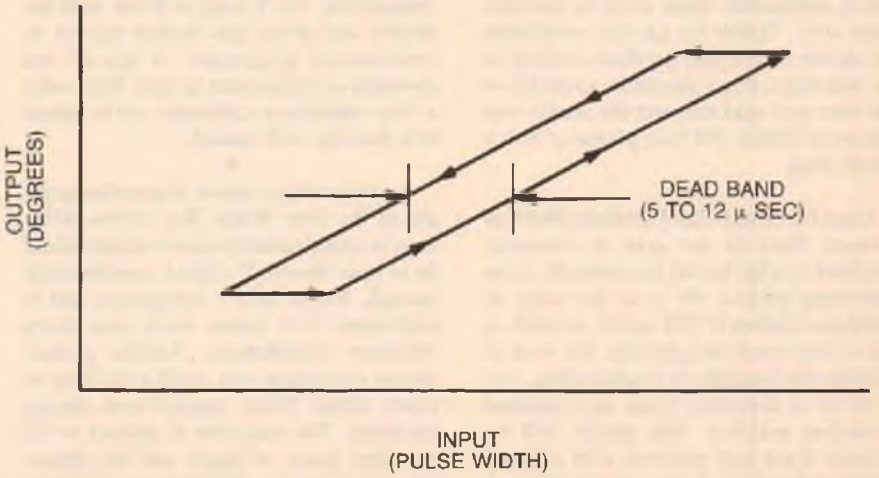

FIGURE 1
HYSTERESIS PLOT

perhaps this will get more people thinking and allow us to get to a conclusion someday.

Let's look at the receiver first. Probably the biggest problem in R/C receivers is their inability to handle very large signals. If you've ever taxied a long way from your transmitter and very close to someone else's and had your throttle open unintentionally, you know what I mean. It is not a big enough problem to make one give up R/C, but receivers could be better. I don't know if I mentioned it in this column before, but I know I have discussed this problem with other modelers before and I think it was Gary Kelson who pointed out that in high performance stereo receivers they use high voltage on the front end in order to improve performance. The guys at Kraft tested 28 different R/C receivers and all failed to pass their intermodulation test (2 strong signals with the frequency difference nominally 460 KHz apart). They then modified a KPR-7M to run the local oscillator and mixer at 9 volts, with the circuitry re-biased to produce comparable gain to operation on 4.8 volts. They found it almost impossible to produce I.M. interference even when the two transmitters were adjusted to produce a 455 KHz mixer I.M. product. Makes a pretty good case, doesn't it?

One of the reasons R/C equipment has improved so much over the years is the fact we can use circuits developed for military, computer and other commercial products. However, if one looks at the various integrated circuits and dual gate mosfets that are used in high performance receivers we see that they like to operate on higher voltage. (One of these days we'll print some experimental circuits for you guys to play with.) Anyway, the point is obvious — we could have a better selection of circuits and, therefore, better performance if we weren't stuck with four cell battery packs.

What about the servos? We've seen a move to lower resistance motors recently, in order to get more torque and speed. Definitely the wrong way to go. Any of you guys remember 6 volt systems in automobiles? Ever wonder why they went to 12 volts when they needed more power? The idea is to improve efficiency. Unfortunately, the transistors in our servos are not perfect switches. When they turn on they have a definite voltage drop and the higher the current the larger the drop. Hank ran some tests that showed a one volt drop, which means you only have 3.8 volts across the motor, when the current was at 550 milliamps. If you could cut that current in half, the voltage drop would be about .4 volts. You could do this and have the same power drawn from your battery if you had a 9.6 volt battery. However, the power to the motor would be higher and thus you would have a more efficient system. Let's look at that again:

Power from battery

At 4.8 volts P = 4.8 x .55 = 2.64 watts.
At 9.6 volts P = 9.6 x .275 = 2.64 watts.

Power to the motor

At 4.8 volts P = 4.8 − 1.0 x .55 = 2.09 watts.

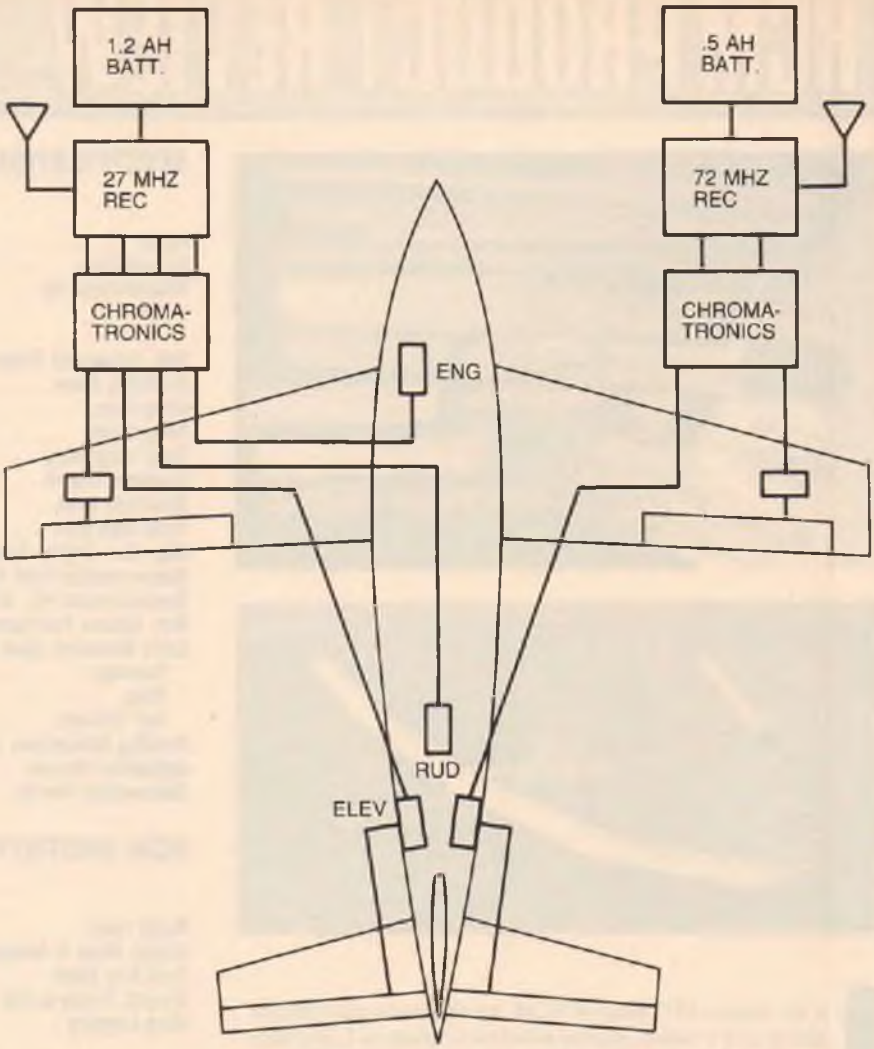

FIGURE 2

At 9.6 volts P = 9.6 − .4 x .275 = 2.53 watts.

Efficiency

At 4.8 volts Eff. = 2.09/2.64 = 79%
At 9.6 volts Eff. = 2.53/2.64 = 96%

For the engineers out there, please note that the real maximum efficiency takes place when you are operating at about half the maximum torque of the motor, not when the motor is stalled (the maximum torque point), and not when there is maximum rpm (no load). However, I think the previous calculations illustrate my point.

Okay, if everything is so great at high voltage, why don't we do it? If you cut the current in half, you could go to eight 250 ma-hr cells and have about the same weight and same operating time. With eight cells, you might argue that the system is more reliable because it would work if one or two or maybe even three cells went dead or shorted out. Certainly a four cell system wouldn't work with three cells out. Well, the biggest argument against this scheme is still the fact that the batteries are the most unreliable thing in the system and you hate to add more of them. My experience also indicates that the more cells you have in a string, the easier it is to wreck them. The problem is that the cells don't all have the same capacity and one will run down faster than the others. The remaining cells with charge will then try to charge the discharged cell backwards. This doesn't do them any good. The way around this is to never let any of the cells become fully discharged.

What is the bottom line? Is there a future for 9.6 volt systems? I think the answer is yes. Especially in big airplanes where more servo power is desired and battery size and weight is not significant. If there were enough big jobs out there I'd be tempted to market such a system. What do the rest of you think? Drop us a line with your comments.

Another Dual System Concept

Just when I say nothing is new in airborne system concepts, I get more than one good idea. The following is from Francis Plessier of France. He has written before describing efforts he and Jean Rousseau of Scale Model fame, have directed toward providing safety in high value models. These efforts involve redundant systems in the airplane, similar to those that have been published before but with one important twist. The two receivers

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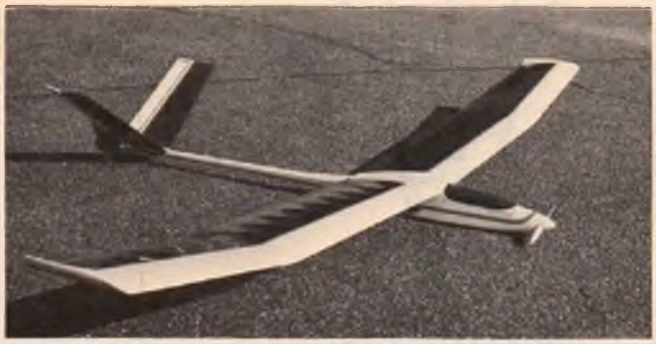
RCM PRODUCT REVIEW

Midnite Models ELECTRA LITE



In the August 1979 issue of RCM, we featured a construction article on a V-tailed, electric powered sailplane by Larry Jolly called the Electra Lite. At the time the article was published, we were impressed by the clean lines and sleek appearance. A little over a year later, we are pleased to see it being presented in kit form by Midnite Models, 5501 W. Como, Santa Ana, California 92703.

The Electra Lite is designed around the Astro .05 Flight System and with a 93" span it is intended to be capable of thermal flight after the motor takes it to altitude. The kit comes packaged in a 43½" x 5½ x 3" box complete with color picture to start the daydreams rolling. Once we got past the picture and opened the box we found that the plans are rolled around the strip wood with the pre-cut small parts and hardware bagged to prevent damage in shipping. The canopy is wrapped and arrived scratch-free.

Construction:

The entire aircraft, including both wing panels, is shown on one 58" x 36" plan sheet. In addition, a two page instruction sheet covers most of the construction detail. Construction photos would be helpful, particularly one of the wing joiner, and tail assembly. The original construction article has photos of these and other areas, so dig back in your library and take a look. Wood quality is excellent and the ribs are machine cut and sanded to shape. Wing loading is a major factor in the success of any electric powered airplane, so avoid adding any unnecessary weight during construction. Cyanoacrylate glues are recommended. We used both Hot Stuff and Goldberg Super Jet in almost all areas, resorting to epoxy only in the wing joint and nose block.

The airfoil is flat bottom so all panels can be built on the plans. One interesting feature is that the leading edge is sheeted only on the top to provide strength while keeping the weight to a minimum. With the exception of the wing joiner, the wing is conventional in construction and should present no problems. The wing joiner is a 1/4" plywood rib and carries the wing dowel, main wing rod, and a 1/16" alignment pin. The main wing rod is first located, then the hole for the alignment pin is drilled in the root ribs using the joiner as a guide. The next step is the most critical and is done after the fuselage is built. The wing is assembled and aligned on the fuselage, then, using a 1/16" drill, make a pilot hole in the bulkhead and slightly into the joiner. The joiner is clamped in a vise and the 3/16" hole is drilled for the dowel. You must use a vise or there will be nothing but splinters left. It also helps to soak the area to be drilled with Hot Stuff.

The fuselage is typical of virtually all box type construction, just remember to keep it light. This is where we found the one part that was mis-matched — the 1/64" ply doublers needed reshaping to fit the fuselage — no major problem since they cut very easily. When attaching the nose block/motor mount, check that you have a straight thrust line. Fitting the canopy took a bit of cut and try since there were no lines to indicate where it should be trimmed.

The stabilizers are built up from stick balsa and have a spruce spar laminated to the leading edge. It always seems a bit strange not building a fin and rudder. Aligning the stabilizer requires a bit of "eyeball." There is almost no way to use an incidence meter, so just get them to where it looks good. The plans call for a 22½" tip-to-tip

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SPECIFICATIONS

Name	ELECTRA LITE
Aircraft Type	Electric Powered Sailplane
Manufactured By	Midnite Models 5501 W. Como Santa Ana, California 92703
Mfg. Suggested Retail Price	$49.95
Available From	Both Mfg. & Retail
Wing Span	93 Inches
Wing Chord	9¼" Root — 7½" Tip
Total Wing Area	818 Square Inches
Fuselage Length	45¼ Inches
Stabilizer Span	27½ Inches
Total Stab Area	158 Square Inches
Mfg. Rec. Engine Range	Astro 05 Electric
Recommended Fuel Tank Size	N.A.
Recommended No. of Channels	3
Rec. Control Functions	Rud., Elev., Motor Cut-Off.
Basic Materials Used In Construction:	
Fuselage	Balsa and Ply
Wing	Balsa and Spruce
Tail Surfaces	Balsa and Spruce
Building Instructions on Plan Sheets	No
Instruction Manual	Yes (2 Pages)
Construction Photos	No

RCM PROTOTYPE

Radio Used	Futaba
Engine Make & Displacement	Astro Flight 05 Electric
Tank Size Used	N.A.
Weight, Ready to Fly	44 Ounces
Wing Loading	7.7 Oz./Sq. Ft.

SUMMARY

WE LIKED THE:

Appearance and performance, wood and parts quality, ample sheet and stick balsa, sliding tray control mixer.

WE DIDN'T LIKE THE:

Lack of construction photos, difficulty in building wing joiner and lack of trim lines in canopy.

SO YOU REALLY WANT TO FLY R/C

by Richard Teneau

When you begin in this hobby, it's difficult to commit your mind and body to the absolute goal of getting your airplane up there in the ever-so-blue with **you** as the R/C pilot. That's tough to do, because all of us tend to be human. We tend to lie to ourselves just a bit. We don't try as hard as we could. We under commit. So, in order to help you toward your goal, here is a series of suggestions.

(1) Don't build anything but a trainer for your first airplane. This is an iron-clad rule --- almost a commandment. A whole batch of people have built P-51's (and the like) to learn to fly with . . . and a whole batch of people have crashed P-51's (and the like) very quickly. To learn to fly, you need a gentle forgiving **slow** airplane. Any other kind just makes it easier to crash. You don't need help in that area.

(2) Build a back-up airplane. As soon as you finish your first trainer, start building another one. R/C airplanes are fragile birds subject to sudden failures at the weakest link. That link may be a clevis, a wing bolt or the brand new pilot. Even though most crashes result in a patched-up, but flyable plane, that final crunch must eventually come. Let's face it nothing lasts forever.

And when that day does come, it's very satisfying to take the radio and the engine out of the wreck and drop it into the back-up. You're all ready to keep on learning rather than just starting to build something new. Besides, if you build exactly the same trainer, you'll find you can build it much more efficiently than you did the first time. You already know the pitfalls of that particular kit; you can avoid them with ease --- and build a better plane because of it.

(3) Pick an instructor and a back-up instructor. Lots of beginning R/C pilots just go out to the field and hope someone is around to help them. And many times the fliers at the field aren't confident or advanced enough to help a newcomer. Often they're badgered into "checking out" a newcomer's plane --- "just this once," and that's the way it winds up. The plane flies all right "just once." Don't let this happen to you. Select your instructor carefully. Ideally he (or she) should be interested in making sure you learn to fly. You don't want an instructor who just loves to fly **your** airplane and never gets around to giving you the box. And, while you're looking for an instructor, find a back-up at the same time. Since people do odd things like have vacations, get sick, go out of town on business, and the like, it's a good idea to have an extra instructor sort of tucked into your back pocket.

(4) Fly, Fly, Fly. Get yourself out to the field and fly, my friend. You need all the stick time you can get. Most beginners fly a bit, then relax a whole lot. They take a short flight with their instructor and then spend most of the next two hours **avoiding** the second flight. They talk to other pilots. They watch others fly. They fiddle with the motor. Anything but fly.

Since you can only learn by getting your airplane into the air with your hands on the sticks, it makes a lot of sense to fly as much as possible. You get used to the feeling. You stop shaking. You begin to control the airplane and actually see what effect your control movements have in flight. Practice may not make perfect, but it sure does beat **not practicing.**

(5) Avoid falling in love with your airplane. This trainer airplane of yours is going to crash. Maybe not for a long time, but your plane **will** crash. Check how many five-year-old airplanes there are at your field. The trainer you intend to use to learn to fly should not become an object'd'art. Making it absolutely gorgeous will not make it fly any better. The laws of aerodynamics say absolutely nothing about beauty. However, the laws of aerodynamics do say a lot about the alignment of flying surfaces. Do make your aircraft as perfect as you can aerodynamically. It will fly easier. It will fly better. But no amount of wonderful decorations have any effect on flight characteristics. Wait to decorate a later plane. Certainly not your first or even the second.

(6) Don't leave your flying education to chance. Make arrangements to fly. Your flying sessions will be much more productive if you plan carefully ahead of time. Don't just go out to the field and hope for the best. **Use** the telephone. Call your instructor and **make sure** he will be at the field when you are. If he can't make it, call your back-up instructor. You are involved in learning a rather difficult skill; make sure your time is well spent. In addition, set short term goals for yourself --- a take-off, a landing attempt, or any other maneuver, and then try to meet your goals. Your instructor will tell you if your goals are impractical but, to keep learning, you need to keep pushing yourself to attempt brand new flying goals.

And while we're at it, learn to recognize your own procrastination. The field of R/C is filled with procrastination. We all know people who eagerly arrive at the field and then (in the six hours they are there) — fly twice. It happens all the time. Don't allow it to happen to you.

(7) Don't let fear interfere. We've all experienced a reluctance to learn new things, but when disaster is added as a possibility, the learning curve gets very nervous. Fear, the kind that turns your knees to jelly and makes your fingers fat and stiff and awkward is part of the radio control world.

Faced with the loss of your prize trainer as a likely result of trying new maneuvers, most beginners tend to clutch a little. But, if

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RC Aerial Photography

By Jerry Smith

Taking pictures from a model airplane is not new. People have been doing it for years. But, taking **good** pictures from a model airplane is technically demanding. I discovered this last year after examining my first roll of film. I had set high goals for myself with regard to picture quality (contrast and resolution) and was very disappointed. You see, my first roll of film was completely blank! How is that for starting at the bottom. Careful examination of my camera module revealed a sticky triggering mechanism. A simple matter of adjustment.

My neighbor saw me tinkering with the camera one day and asked how I was progressing. As he looked over the aircraft and camera installation, the conversation finally got around to how much did the camera cost. I told him approximately $150.00 He was absolutely astounded to think that I would spend that much for a camera just to take pictures from a model airplane, let alone send it up in one. But, I was serious about aerial photography and wanted good results. Later on I would realize that good equipment was only part of the requirement to assure success.

There are two types of aerial photos: verticals and obliques. Verticals are taken with the camera aimed straight down, and with the film plane parallel to the ground. Obliques are taken at an angle. I think most of you will agree that vertical shots are somewhat uninteresting. They are generally used for mapping and other photogrammetric and photo interpretive studies. For this reason all the following discussion will pertain to oblique aerial still shots.

Aerial view of area where Jerry lives. Aircraft took off on street in lower front. View takes in entire block. Ektachrome 400 slide.

Oblique aerial photography serves many purposes and often provides a unique communication capability or an overall view that cannot be obtained from the ground in a single photograph — or even in several. Generally, aerial photos show relationships in size and spacing better than ground views. The angle of view is unusual and attention-getting. Most people are not accustomed to seeing subjects from above. Also, aerial photos can be particularly appealing, just on the basis of their artistic merits.

Aerial photography does present a few differences from ground photography. Some of the things to look for are: Haze is always present to some extent; subject contrast is somewhat different from that normally encountered in ground photography; movement is always present; lighting problems are different; and weather is more of a problem.

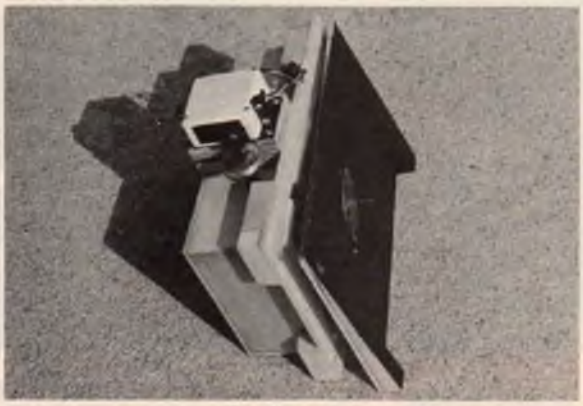
Haze is always present to some degree and causes an overall bluish cast in color photos. It also lowers contrast in both black and white and color photos. The moisture and particles in the air scatter light as it passes through the atmosphere. The blue portion of the color spectrum is affected most, and the result is the strong bluish cast that is often characteristic of aerial photos.

There are several ways of minimizing the effects of haze — the most obvious is to fly on the least hazy days. Haze registers most when the aerial subject is backlit by the sun (the camera toward the sun), and registers least when the camera is pointed away from the sun. However, with the camera aimed directly away from the sun (direct front lighting), the shadows do not provide much modeling of the subject. For this reason a compromise with some crosslighting is usually best. Also, filters can be very helpful in reducing the effects of haze. I generally use a K2 yellow filter or a red filter if I want more dramatic contrast on black and white photos. For color I suggest using a

LEFT: R/C aerial shot of Jerry's flying field. Kodacolor 100.

Front cover, Canon AF 35M and camera module. Rubber foam lining and shutter button can be plainly seen.

Camera mounted in module. Servo actuating mechanism sets right on top. Fundamentally simple and quite reliable when properly adjusted.



Front cover with 5° shim. Good view of module construction and servo mount.

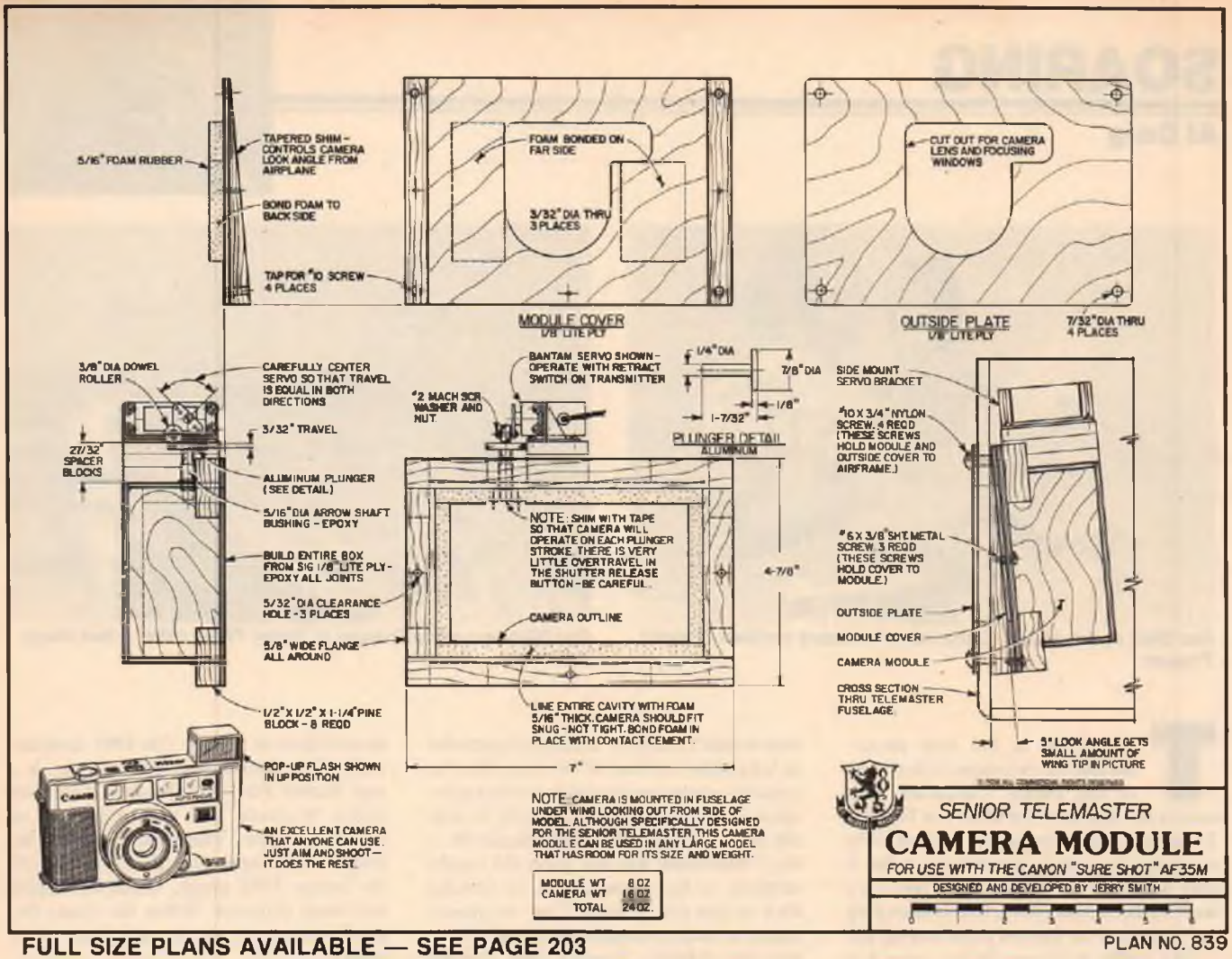
1973 Telemaster that has hauled a number of projects aloft. Webra .91 on front is good for short fields and gets up there quick.

Nice big wing provides plenty of shade on camera lens for back lighted pictures looking toward the sun.

Camera installation in Telemaster. Only 1½ lbs. extra with plenty of spare room.

Air to air shot over Thistledown Field at first IMAA Regional meet at Napoleon, Ohio. A very difficult picture to get. Jerry took 9 frames and only one had the 8' bipe in it. He was lucky. Could he do it again? It would be difficult.

As mentioned in the article, Jerry's practice subject was this set of buildings and house located at the edge of his flying field. Jerry's best aerial photo of it.



FULL SIZE PLANS AVAILABLE — SEE PAGE 203

PLAN NO. 839

Photo practice building complex. Right on! Note wing pointing the way. That's Jerry in the middle. How insignificant one individual can be on this great big earth!

A very slow fly-by netted Jerry this close shot. Perhaps 20' altitude and 30' away. Most pictures were taken at 100-250 ft. altitude. Wide angle lens on camera makes it look higher.

skylight (1B) or an 81B filter which has a slight warming to offset the blue.

Crosslighting or side lighting is usually preferred to flat lighting (sun directly overhead, sun behind camera, or a cloudy day). The shadows cast by crosslighting provide modeling (indication of shape) to objects on the ground and increase apparent contrast.

Backlighting, when properly used, can be very useful. On water scenes, backlighting shows texture in water surface and can break up an otherwise dull background. Backlighting tends to emphasize haze and thus reduce contrast, but in some situations you can use this effect to develop a desirable mood.

Time of day determines length of shadows and, to some extent, determines the amount of haze present. I fly during the summer months and best results can usually be achieved from about 2 p.m. to an hour before sunset or from 9 a.m. to 12:30 p.m. — although haze is usually worse during the morning than in the afternoon. These times assure a high-sun position at noon.

There are several aspects to be considered with regard to motion which, by the way, is your worst enemy. These include the speed of the aircraft, the jolting effect of up-drafts or down-drafts in bumpy air; and the vibration of the aircraft that can be

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SOARING

Al Doig

Rod Mish of San Diego, California, with tissue covered Thermic Trooper.

Rod Mish launching Trooper at Torrey Pines cliffs — San Diego, California.

The fellow in the lead photo, holding the two cuties is Rod Mish of San Diego, California. One cutie is his daughter; the other is a Thermic Trooper. The Trooper is rudder-only controlled by a single channel Ace radio. It only weighs 5 or 6 ounces, and flies very well. In the second photo, Rod is launching the Trooper at the famous slope soaring site — the cliffs at Torrey Pines, near San Diego, California. This launch was made in very light wind, a tad too light. The Trooper didn't make it back to the top, and slid half way down the cliff. Rod had an exhausting, and rather dangerous climb down the face of the cliff to recover his pride and joy. This is one hazard of slope flying at this type of site. There is no such thing as a little bit of trouble. It's probably easier to land on the beach which, incidentally, is covered with nude sunbathers.

The Torrey Pines site has, for a number of years, been plagued by conflict between the R/C glider pilots and the hang glider pilots. The conflict revolved around the use of airspace, and landing areas. At one point, the city of San Diego tried to mitigate the dispute by assigning flying rights to the hang gliders on odd days, and to the R/C flyers on even days. This, of course, didn't work at all; there were immediate violations. Anyway — the thing trailed off into a kind of uneasy truce. The hang glider pilots did respect a request for clear airspace to hold an R/C pylon race. This race featured big, heavy slope racers from up and down the West Coast. It could have been dangerous, without cooperation from the hang glider's. Anyway — this is another type of flying field problem.

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More 2 Meter World Cup — The pictures shown didn't reach me in time for inclusion in last month's account of the meet. They're certainly interesting enough to warrant more space. The photos were all taken by 16 year old Norman Timbs, Jr., who placed 5th. I don't think there was one plain old vanilla sailplane in the whole bunch. In looking back on last year's World Cup, the planes leaned toward the standard kit floater. There were lots of RO8's, Gentle Ladies, 2 meter Mirages, etc. Significantly, though, the winners were more like the 1981 aircraft. Bob Torres flew his Buteo (a Sagitta look-alike) to first. Don Edberg flew a Sagitta in second place. Third was won by Mike Regan and his slippery Lyre Bird. In 1981, Don Edberg won with a Sagitta which was cut down to 2 meters. Jerry Krainock was second with his "Parts" (parts of this and parts of that). Third was Dave Johnson flying a K-Minnow, which is a 2 meter Camano. I don't know what it means, but the first two places were won by non-aileron ships, despite the fact that the majority of entries were aileron jobs. I guess it just means that Don and Jerry flew better than anyone else.

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I received a letter from Gert Schroeter, a German sailplaner in temporary residence in the U.S. Gert sent the final results of the German Championship, which selects members of the FAI World Team. Representing Germany in the 1981 World Championship will be W. Vauth, R. Decker (2nd in 1979), and W. Schaffer. I understand the Championships will be held on the Cloverseed Farm property near Sacramento, California, July 12-17, 1981. Gert also said the Austrian team of Fridolin Fritz as manager, Anton Wackerle (1979 World Champ), and the Sitar brothers, was discontinued as a team. The 1981 Austrian team will be Karl Wasner, Karl Wasner, Jr., and Walter Fiel. So, World Champion Anton Wackerle will not be present to defend his title. The team chief wil be Fridolin Fritz, again. Mr. Fritz was chief of the former AME group, which developed the Dassel Sailplane. Where this leaves the development of the Dassel line, who knows?

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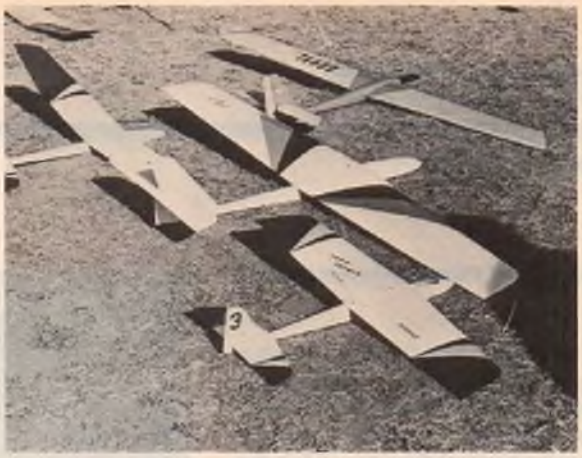
Speaking of speed events, I read a letter written by Skip Miller in *Thermals*, newsletter of the Rocky Mountain Soaring Association. Skip says, in part ". . . I believe the future of R.C. soaring lies in competitors being challenged. When there is no challenge, competitors become bored and stop competing. Of course there are always newcomers who are trying to perfect their skills, but if you lose the cream of the crop, a system is developed for eliminating top flyers. . . . If we remove the luck and make competition exciting then the sport becomes satisfying to all participants. I recommend flying modified speed events in every duration contest in the upcoming season (he is referring to their own local contests). If the format listed below is used, not only will the level of achievement throughout the club improve, but those few gifted flyers who are seeking achievement in F3B will at least have a competition that will keep them interested and not feel they are being discriminated against at having to fly round after round of duration."

Skip proposes one speed event for each thermal event. Also, two launches are permitted. If, on your first launch, you decide not to enter the course, you get another launch, at the end of the group. Scoring would be as follows: Making an

Norman Tibbs and Gam-Blur II flaps, ailerons, flying stab and rudder.



English entry "Yahoo" and other clean looking gliders.

Englishman Sean Walbank's vee tail "Gryphon."

Joe Wurts and his "Ariel."

Bill Forrey and "Slapdash" flaps, ailerons, elevator, and rudder.

A group of slick Sagittas.

attempt, going slower than 16 sec, or crossing the centerline — 700 points; 16 sec — 750 points; 15 sec — 850 points; 14 sec — 950 points; 13 sec — 1000 points. He proposes a later on adjustment of points as experience is gained.

I think I like it. What it is saying is that if I fly up to the capability of my Paragon, someone flying a Bird of Time must fly up to the capability of his ship to beat me overall. My objection to speed events is that I'm beat before I start. As an example, the 1981 Southwestern Regionals in Buckeye, Arizona, had one speed event, and two thermal events. Sunday was 3 rounds of add 'em up. My score was 997 out of 1000. In 8 min. precision, on Saturday, I had 980 out of 1000. Speed was .2 miles out and .2 miles back. Despite a broken line on launch (explaining why I didn't re-launch would take too long), I had a fair run. My 55 sec. against a Sagitta at 29 sec. netted less than 500 points. It's true, I could have done somewhat better it I wasn't worried about enough altitude to get back, but not that much better. So, I finished 4th, out of the hardware.

I can certainly appreciate Skip Miller's points; Dave Wright of Victoria B.C. has made the same ones. I sure don't want to drive all the skilled flyers out of the sport because of lack of challenge. I would hate to compete with nothing but a bunch of turkeys, like me. But, at the same time, don't drive out us mediocre flyers. There are

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PIT STOP

Gene Husting

1981 4th Annual Florida Winternationals

It was time to look forward to another race in Florida again. This annual event, and the Annual McCoy race in Southern California, have both become the most popular races of the year, and in the opinion of most racers, have even begun to surpass our Annual ROAR Nationals. This is in no way meant to put down the Nationals, because the Nationals are definitely the #1 event of the year. The differences are that at the Nationals too many events are crowded into too short a time. If has to be that way right now. However, at the Winternationals and the McCoy races, a full week is devoted to just one event, plus Super Stock in Florida. So the racers have plenty of time to practice and tune their cars to perfection on the track, as it should be.

We always look forward to Florida, because it's a chance to race with fellow racers we haven't seen for a year, as well as meet new racers from different areas. And of course the fellows from the Northern States can't wait until it's Winternational time, so they can leave all the beautiful (?) snow behind and enjoy some Florida sunshine. I wonder if that's why they like the Winternationals so much. It does seem like they're not in too great a hurry to get back home. However, there would be another added interest to everyone here. It would be our first chance to see one of the European fully independent chassis race. The AMPS Team from England was coming over with the current British Champions, Dave Martin and Gary Culver and a third independent driver, Marley Parrant. We'd heard much about the cars and now we'd get a first hand look.

The 1981 Florida Winternationals was hosted by the Central Florida R/C Auto Racers, with this 700' long track located on the parking lot of Florida Festival.

It's beginning to be a habit, as Bill Jianas makes it two in a row, again winning the Winternationals. Peka Lotu from Samoa presents the trophy to Bill.

Last year the Winternationals were on absolutely the best surface we have ever run on in the world, and we were really looking forward to racing there again. However, that parking lot at Sea World was no longer available so this year's race would be held

Bill's Associated RC300 features Futaba radio and Rich Lee built K & B-McCoy engine. Beautiful paint is by Chuck August, on this Elfin body.

You would think that Curtis Husting (left) and Hank Smith were discussing ways to get around the track faster, but they were actually saying who was going to beat who at Space Invaders and Asteroids that night. Really!

The one and only Arturo Carbonell had to work for it, but he got a well deserved 3rd Place.

1981 Winternational Results

Can Am Open Class "A" Main

1 Bill Jianas	Associated	20-0 19-68
2 Hank Smith	Delta	20-0 19-65
3 Arturo Carbonell	Delta	19-65
4 Rick Davis	Associated	19-50
5 Chuck Phelps	Associated	19-45
6 Felix Galavais	Delta	19-34
7 Gary Culver	AMPS	19-22
8 Joe Tassilio	Delta	19-19
9 Dave Martin	AMPS	19-18
10 Ralph Burch Jr.	Associated	19-17

"B" Main

1 Dana Smeltzer	19-9
2 Paul Verger	19-1
3 Jerry Broner	19-1
4 John Thorp	19-0
5 Curtis Husting	18-62
6 Rod Galloway	18-60
7 Dan Dowry	18-51
8 Dale Mooberry	18-49
9 Earl Nester	18-39
10 Alex Manriquez	18-36

Super Stock — GT "A" Main

1 Gary Kyes	MRP	18-19
2 Gene Husting	Associated	18-13
3 Roger Curtis	Associated	17-63
4 Mike Reedy	Associated	17-39
5 Karl Kaiser	Delta	17-32
6 Freddie Rapiana	Delta	17-24
7 Ray Hepner	Delta	17-23
8 Dale Smith	---	17-17
9 Mark Johnson	MRP	17-14

One of the most incredible performances was put on by Ralph Burch Jr., from Texas. In only his 5th 1/8 race ever, and with a brand new stock RC300, never before run, Ralphie made the "A" Main.

The magician, Gary Kyes, pulled it out of the hat again, and on the final round won Super Stock class.

Gene Husting took 2nd in Super Stock with his Corvette featuring Futaba radio and K & B horsepower.

Roger Curtis drove his Vette to a 3rd Place finish in Super Stock.

across the street on the parking lot of Florida Festival. The Florida Festival is a small shopping mall designed for tourists. The layout of the 700 foot track was excellent. The surface was not anywhere near as good as Sea World, but it was certainly a good track overall. And the sponsoring Central Florida R/C Auto Racers club had made new retaining boards out of sheet metal, for this race. Similar to the ones used at the Washington Nationals. Last year we broke so many boards that practice time had to be cut down because they were running out of boards. The sheet metal boards were fantastic. As hard as some drivers seemingly tried, they still didn't break any of the sheet metal boards, and these boards did not hurt the cars. Definitely a step in the right direction.

Monday was open practice. The club had cleaned the track, which helped, but the surface was slippery. However, there were a few guys who looked like they were getting around quite well, considering. Chuck Phelps, from Phoenix, was used to this type of track, and he was looking great. Arturo Carbonell was flying, as was Rod Galloway and Dana Smeltzer. Then the AMPS cars arrived and in a short time Culver and Martin were as fast as anyone. The AMPS cars were a little slower coming off the corners, because of their added weight, but they made up this time by being able to drive a little deeper into the corners with their added steering. It was really quite interesting to watch the cars actually **roll**, as they went around the corners. Our cars don't actually roll, they **lift** until they might lift too high and then tip over, but that's different. The back straightaway was bumpy, not too bumpy, but bumpy. You could see our cars bounce up and down somewhat as they went down the straightaway. However, the AMPS cars completely smoothed out the straightaway, as well as the rest of the track.

There were 2 cars classes at the Winternationals, Can Am-Open and Super Stock with coupe bodies. I had entered Super Stock hoping to promote this class in every way I can. I think in time, the Super Stock class will grow to be the largest class; especially with new independent suspension cars coming out, raising the cost of racing in the Open Class. We must have the Open Class, however, the Super Stock Class is what is going to save this hobby of ours in the long run. Another point. I think that most areas that are now running Super Stock, are hurting the class if they require the use of coupe bodies. Super Stock would be much more popular if Can Am bodies were used. Think about it. What would happen if all of a sudden the Super Stock cars were getting around the track faster than the Open Class cars? Not possible you say. You'd be surprised! 2 weeks before the Winternationals, on this same track, Kim Davis, running a Super Stock carb, was Top Qualifier over Arturo Carbonell in 2nd. Kim also lead the Main Event until his crank broke. This made believers out of the Florida club. And it made my belief stronger in this class. 2 weeks earlier while tuning my Super Stock car at Pit Shop Raceway (formerly Thorp's) I could quite easily drive around Bill Jianas with his Open car. Not because I was a better driver — hardly, but because my car was a lot easier to drive. It was just right for the track, while Bill's additional horsepower and torque was hurting him on the slippery track. When more of the average drivers realize they can get around the track faster with a Super

The 2nd fully independent suspension car produced is this AMPS car from England. You old timers know Dynamic made the first production fully independent car.

Stock car and Can Am body, the Super Stock class will grow quite rapidly. Europe and other countries of the world are becoming aware of this same problem and are also studying Limited Cost racing.

Anyway, getting back to practice, and because it was an open practice session, I was using a Can Am body on my Super Stock and liking it extremely well, because I was able to keep up with most of the Open Class cars. It was a lot of fun. Most of the guys who were going fast in the beginning of the week were running differentials. Those without the differentials would have to bide their time and wait for the bite to come up. And the bite started to come up, and by Wednesday the solid axle cars were almost as fast as the diff cars. The Florida club used an excellent qualifying system — 6 rounds of qualifying were scheduled over Friday and Saturday, with more if time permitted. We actually had 7 qualifying rounds. This was really great! With 7 rounds, everyone was bound to get in at least one good run. The racers loved it!

Super Stock qualifying was first, and Roger Curtis lead the way with his 5 minute qualifying heat netting him 17 laps and 63 sections. The track was divided into a total of 70 sections. I was in 2nd spot with 17-56 and Mike Reedy was 3rd with 17-39.

The Open Class was next and the racing was exciting. The last qualifying heat had Bill Jianas, last year's winner in it, Rick Davis — the 2nd year's winner and Arturo Carbonell — the 1st year's winner. Plus — Hank Smith, Dave Martin, Curtis Husting, Felix Galavas from Venezuela, Dana Smeltzer, and Joe Tassilio Jr. It was almost like being able to watch the Main Event 7 times! It was incredible!

Right from the beginning it was evident

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G.T. Concours winner is this beautiful Corvette by Ivan Bourdier of Lafayette.

CHALLENGER

By Peter Neuer

Introduction

This high performance two meter sailplane has both the eye appeal and flying ability to make it a definite addition to your collection of models.

Challenger! The name implies something new and exciting, and that is just what this new 2 meter sailplane design is. I have always admired the soaring hawks of California. They possess great ability to ride light lift and still have the speed to sail right through sink areas in search of updrafts.

Now you can fly a sailplane that does just that. This high performance sailplane designed for multi-task competition or just plain fun flying is great at both. Soaring slowly in light air or speeding through sink areas.

This is possible because Challenger uses a proven airfoil (which has a very wide speed range) --- the Eppler '205.'

Challenger has the ability to turn into a light flat circle while riding a thermal upwards. You can tell easily when you have entered a lift area with this design.

High starts are an absolute breeze, straight up, no rudder control is needed. Pitch control is very good because of the full flying stabilizer.

The T-tail design was chosen because it lets the flying stab ride in turbulent free air — besides I think they look great.

If you're into slope soaring you will just love flying this machine. The speed it can obtain in even a moderate wind is breathtaking. When some of the other designs are just barely able to penetrate into the wind, you'll be flying patterns with your Challenger.

Construction is pretty easy and straightforward. The use of poplar ply ensures ease of construction as well as strength.

Some Building Recommendations:

A flat building board that you can stick pins into is recommended.

I prefer using cyanoacrylate glues for construction, both the instant bonding type as well as the gap filling variety.

Let's start with the fuselage first. Some

At left, Julie Stephens showing off the Challenger

fitting of the wings and stabilizer will be done later as you progress.

Start by cutting out all the formers and fuselage sides and bottom out of 1/8" poplar plywood or "lite ply" as it is sometimes referred to.

After cutting out the fuselage sides, mark them with a pencil wherever you're going to glue a former. Lay the right and left sides across from each other, then lay a ruler across so that the lines are at a right angle to the wing mount area.

With the fuselage sides laid flat on your workbench, cut and splice the 3/32" x 1/4" spruce reinforcements and glue in place in the servo area of the fuselage. Next, glue the 1/4" triangle stock along the bottom front area. Cut reliefs into the 1/4" triangle stock in the front 1½" portion so it will be easier to bend into place. I do this as I glue; it's easy with a cyanoacrylate glue.

Now glue the two F6 doublers in place.

Next glue the two wing mount formers F-2 to each other. Be sure that the edges are square. Now, using a triangle to line them up squarely, glue to one side of the fuselage. After the glue sets, attach the other fuselage side. Be sure that both sides are parallel to each other. It is best that you do this while both fuselage sides are upside down on top of your workbench. You will have to let the nose extend past your work bench as the F-2 formers protrude above the top. While still in this position, pull the sides together and glue in F-4.

Be sure to check the alignment at this stage. If everything looks good and square, proceed with F-3 and F-5 using the same method.

Now trim the triangle stock at the rear of the fuselage per the plans, using a straight-edge as a guide. Before gluing F-7 at the rear of the fuselage, be sure you leave a 5/16" gap so the vertical fin may be slipped into place. Tack glue, then check the fuselage with a straight-edge to be sure that the sides are at a right angle to the fuselage wing mount area. This is very **important**!

Glue the pine nose block in place. I pull the nose together and hold in position with duct tape across the front. While doing this, place F-1 in-between the sides, line up and then glue. Now you may glue the 1/8" poplar ply bottom into place but **leave the top and bottom planking until later**. This is so that you can slip the vertical fin complete with the flying stab pushrod into place later on.

Cut the two pieces of 3/8" square spruce

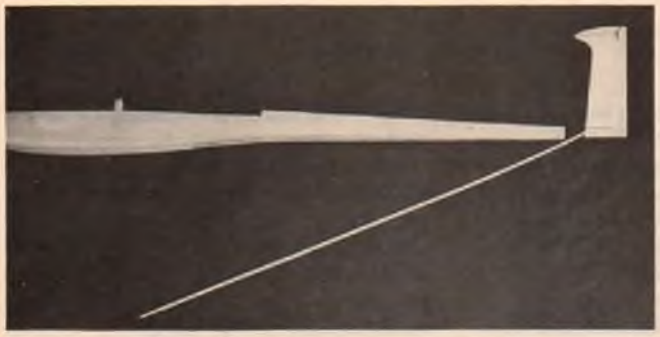
Fuselage sides showing triangle stock glued in place. Note F-2 is at a right angle to fuselage side.

Fuselage sides with formers and noseblock in place.

Su-Pr-Line pushrod with Rocket City ball end link. Trial fit into fuselage before covering sides.

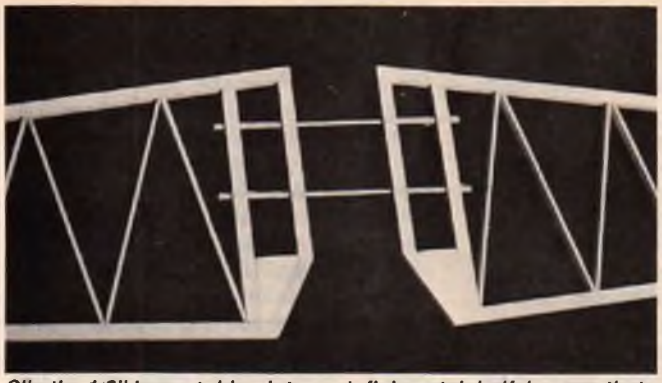
Vertical fin with pushrod installed and side sheeting attached. Notice reference lines used for alignment when gluing to fuselage.

Bottom view showing rudder pushrod location, exit on right side of fuselage.



Glue vertical fin in place before sheeting top and bottom of fuselage.

Fuselage bottom installed with towhook mount in place, note pushrods.



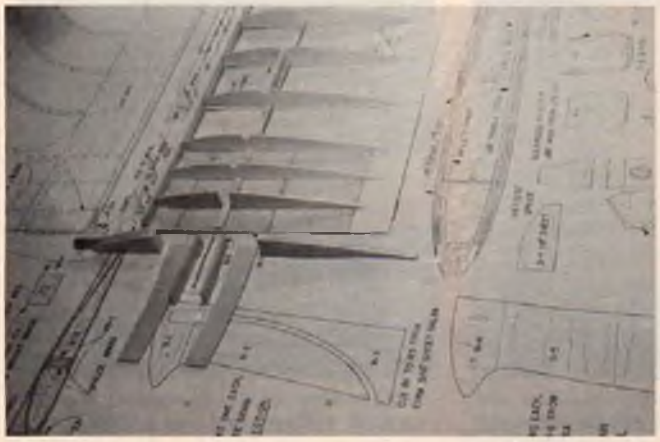
Slip the 1/8" brass tubing into each flying stab half, be sure that they are parallel and 1-7/16" apart before gluing. Use epoxy here.

Flying stab and rudder are trial fitted.

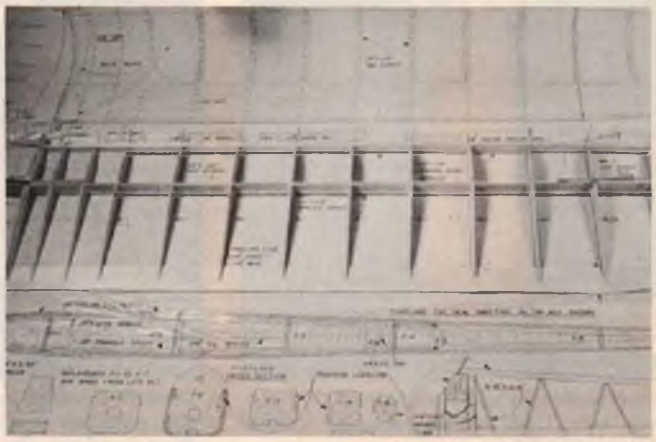
Vertical fin with flying stab mounts in place.

Flying stab viewed from underneath.

Top view of flying stab mount.



Right wing half, the first 3 ribs are cut to clear the 1/16" birch ply dihedral braces. Note the wing mount assembly with the 1/4" dowel in place.



Right wing pinned to assembly board. Shear webs are glued in place.

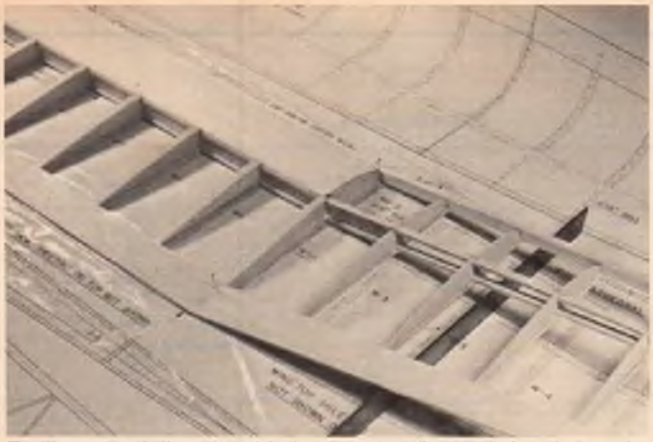
per plan and glue together. Install the towhook assembly into the bottom of the fuselage, between F-2 and F-3. Note that the bottom piece of 3/8" square spruce is flush with the bottom surface.

Install the 1/8" O.D. nylon tube antenna housing in place along the left side of fuselage. Note on plans where antenna exits at rear of fuselage.

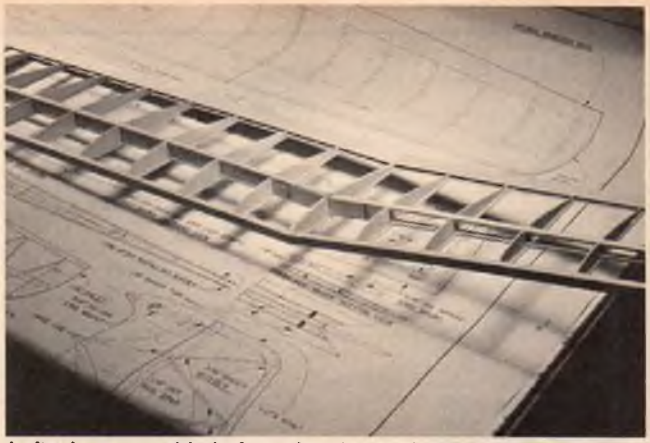
The vertical fin should be made now by gluing three pieces of 1/16" sheet balsa together per the plans, being sure to note the grain direction. Two of these are required. Glue and pin the 3/16" sheet balsa R-3 into place. Now take the 3/16" O.D. nylon pushrod housing (I used Su-Pr-Line's Nyrod®). Bend it to match the contour of R-2 using a gap filling CA adhesive to do this, then put R-1 in place next. The ball end fitting I use is from Rocket City with the 2-56 threaded end. Screw it onto a 3/8" to 1/2" long piece of 2-56 threaded stud. Now drive the pre-cut piano wire through the hole in the ball end. It probably will have to be placed over a hole in a board or into a vise and then forced through.

The whole assembly, including the inner pushrod, should be slipped through the 3/16" nylon outer housing, the 1/16" balsa sheet sides are glued into place. Now sand the fin leading edge to the general contour. Place the fin over the plans and draw two lines indicating where the fuselage sides will be glued; also draw a line where the flying stab mounts will go.

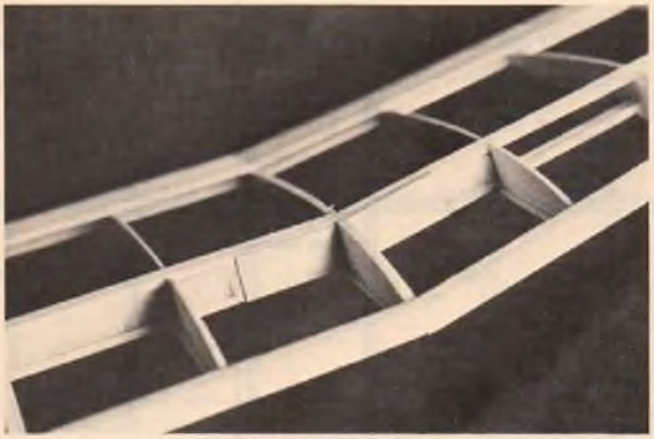
Now place the rear portion of the fuselage on top of your workbench, with the curved area hanging over the edge. Put a right angle triangle up against the side to be sure its at a



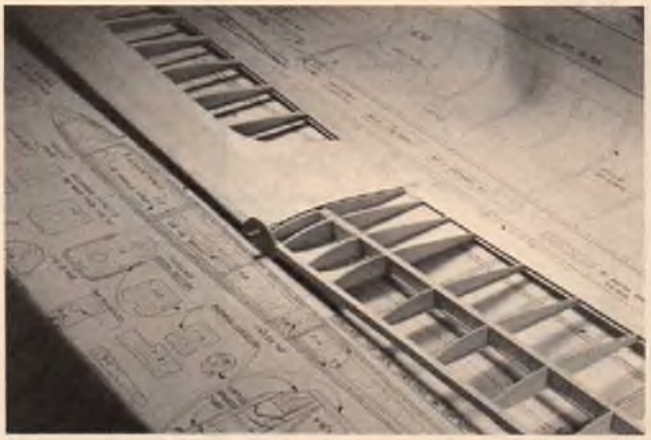
Trailing edge fully assembled, top spar strips and sheeting are in place. Set the outboard dihedral before sheeting the outboard wing panels.



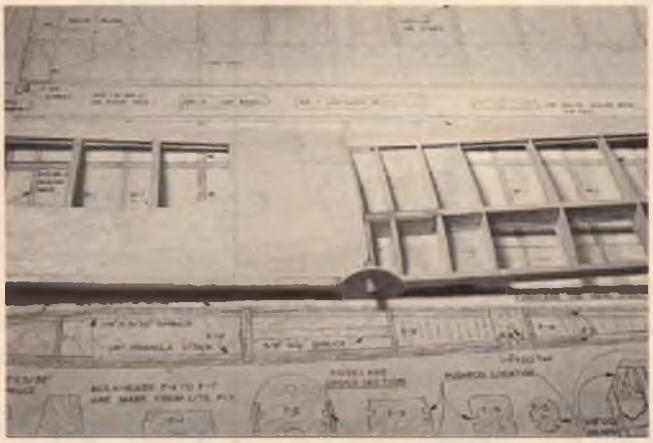
Left wing assembly before sheeting and top capstrips.



Outboard wing panel with 1/16" birch ply dihedral brace.



Wing center joint with F-2A in place. Set dihedral before sheeting.



Another view of wing center section.

Wing center section showing wing mount brace at trailing edge.

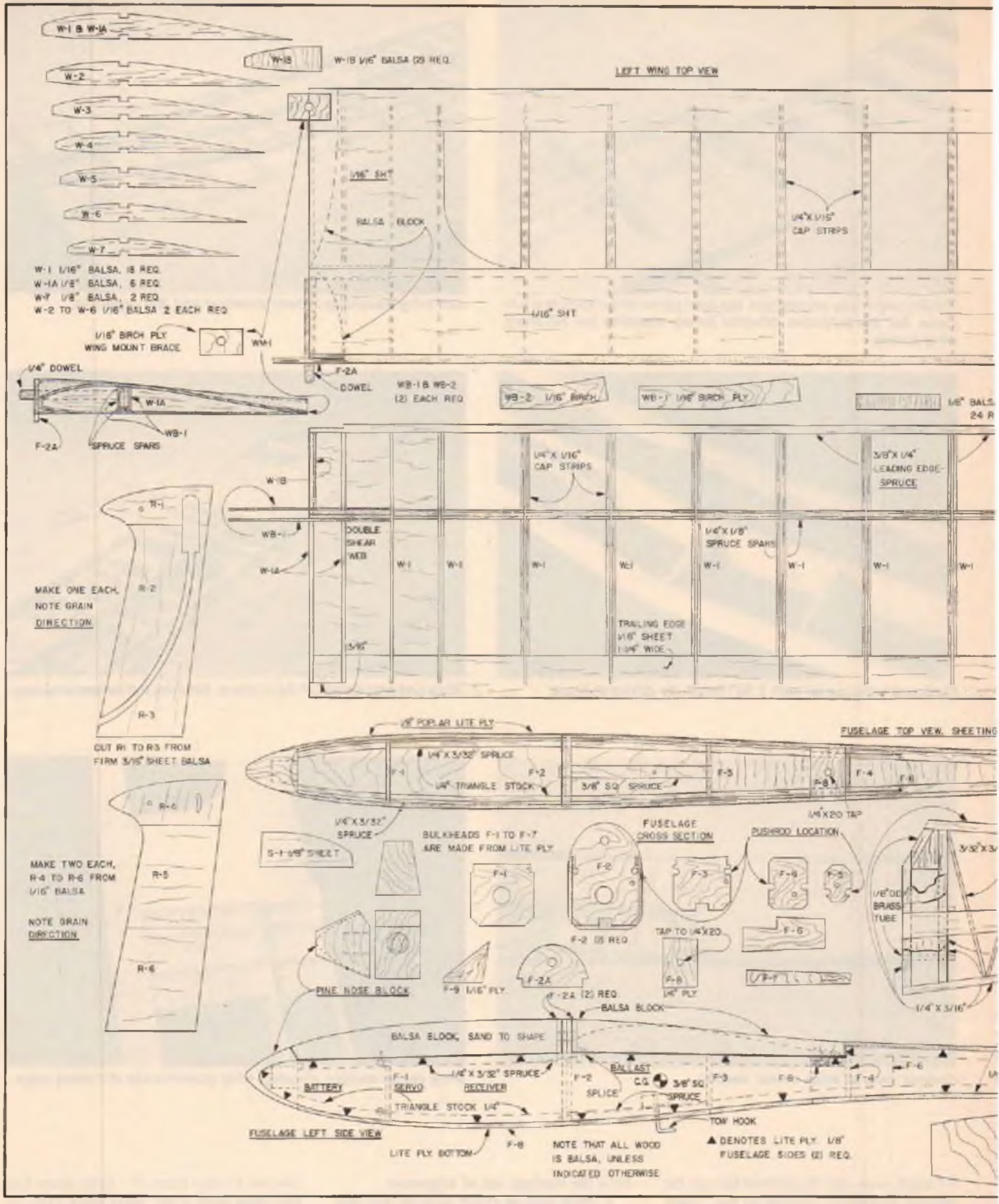
90° angle, now, slip the pushrod through the fuselage bulkheads. As you do this, guide the vertical fin into place and be sure that you check to see that the lines you drew are parallel to the fuselage sides, also check to see that the vertical fin is at a 90° angle before gluing it in place.

The fuselage 1/8" planking on top and bottom goes on next. Be sure that the grain runs crosswise. Be careful that you do not twist the fuselage out of alignment.

A great deal of effort must be put into sanding the contours of the fuselage. I prefer using a coarse sandpaper just to do this part then a 240 grade paper to prep the wood before priming and painting.

Flying Stab:

The right and left sides are the same; build them on the same drawing. Start cutting four pieces of 1/8" O.D. brass tubing 1½" long. Cut two S-1 tips from 1/8" balsa sheet. Cut four spars from 1/16" sheet balsa 11¼" x 3/4" x 1/4". Cut the 3/16" x 1/4" sticks to length, then drill two 1/8" diameter holes for the brass tubing. I stack the balsa sticks on top of each other as well as the 5/16" square stab supports and drill at the same time. Pin everything that has been cut in place and glue the 3/32" x 3/16" diagonals over the plans. After building both stab



halves, slip the 1/8" brass tubes into place with the piano wire inserted in the tubes. Check the alignment to see that the wires are parallel then glue the brass tubes into place. Be careful not to glue the piano wire to the brass tubes. Use epoxy for this step.

Rudder:

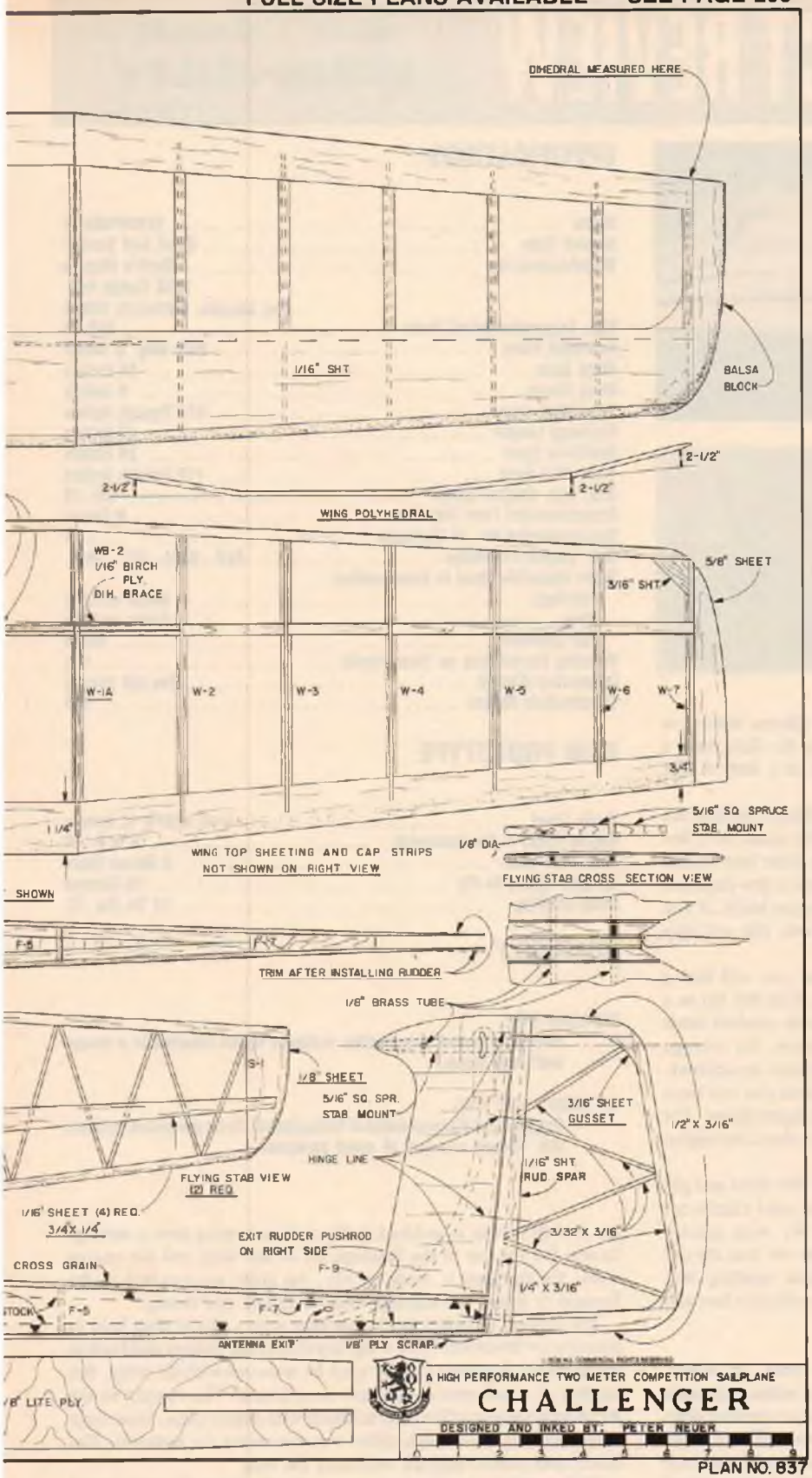
The rudder is built directly over the plans. Build the inner part first. When dry, remove from the plans and glue on the 1/16" sheet spars. Sand completely to shape then set aside for mounting later.

Wings:

Wings are the most important part of any aircraft. Take your time building them and they will reward you with outstanding performance.

Start by cutting out a complete set of ribs.

FULL SIZE PLANS AVAILABLE — SEE PAGE 203



top of the plans. Next pin down the trailing edge halves that are beveled.

Now pin down the leading edge 3/8" x 1/4" balsa. Put 1/8" scrap pieces under the Saran Wrap to hold the trailing edge off the building board. Let the scrap pieces protrude past the inside of the leading edge 1/16" so that it will hold up the front of the bottom capstrips. Note that the capstrips should be flush with the bottom of the leading edge.

Pin and glue the bottom capstrips into place. Cut and fit, then glue the bottom 1/16" balsa sheeting at the center section into place.

Next, trial fit, then pin into place, the 1/8" x 1/4" spruce spars. Notice that you must cut for the outer dihedral braces. Now pin the center ribs together and notch them to fit the 1/4" diameter dowel. Glue the side supports (W-1B) into place. Push the front of the ribs firmly into place, being sure that

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CHALLENGER
Designed By: Peter Neuer

TYPE AIRCRAFT
2 Meter Sailplane
WINGSPAN
78½ Inches
WING CHORD
8 Inches
TOTAL WING AREA
580 Sq. In.
WING LOCATION
Shoulder Wing
AIRFOIL
Mod. Eppler 205
WING PLANFORM
Constant Chord Center
Tapered Tip Panels
DIHEDRAL EACH TIP
Center Panel 1¼"
Tip 1¼"
O.A. FUSELAGE LENGTH
40 Inches
RADIO COMPARTMENT AREA
(L) 7¾" x (W) 1⅞" x (H) 2"
FLYING STAB SPAN
23¾ Inches
FLYING STAB CHORD (incl. elev.)
4 Inches (Avg.)
FLYING STAB AREA
81 Sq. In.
STAB. AIRFOIL SECTION
Symmetrical
STABILIZER LOCATION
Top of Fin
VERTICAL FIN HEIGHT
7¾ Inches
VERTICAL FIN WIDTH (incl. rudder)
6⅜" (Avg.)
REC. NO. OF CHANNELS
2
CONTROL FUNCTIONS
Rudder & Stab
BASIC MATERIALS USED IN CONSTRUCTION
Fuselage ..... Balsa, Pop. Ply & Spruce
Wing ..... Balsa, Ply & Spruce
Empennage ..... Balsa
Wt. Ready To Fly ..... 26-29 Oz.
Wing Loading ..... 6.37-7.10 Oz./Sq. Ft.

Next cut out the trailing edge pieces. Four are cut from 1/16" sheet balsa 24" long by 1¼" wide. Use light to medium grade wood. Bevel the edges on the rear of the lower halves, about 1/2". This is so that when you lay the top half in place it will follow the top rib contour. Next cut the four outer panel trailing edges. They measure 15¼" long by 1¼" at rib W-1A to 3/4" at the tip. Bevel the two lower halves, 1/2" back from the edge as you did the center panels. Place Saran Wrap or waxpaper on

RCM PRODUCT REVIEW

Mark's Models SCORPION IV

SPECIFICATIONS

Name	SCORPION IV
Aircraft Type	Sport and Trainer
Manufactured By	Mark's Models 1518 Osage Ave. San Marcos, California 92069
Mfg. Suggested Retail Price	$49.95
Available From	Both Mfg. & Retail
Wing Span	58 Inches
Wing Chord	9 Inches
Total Wing Area	519 Square Inches
Fuselage Length	47 Inches
Stabilizer Span	20 Inches
Total Stab Area	110 Square Inches
Mfg. Rec. Engine Range	.30-.40
Recommended Fuel Tank Size	8 Ounce
Recommended No. of Channels	4
Rec. Control Functions	Rud., Elev., Ail., Throt.
Basic Materials Used In Construction:	
Fuselage	Balsa and Ply
Wing	Balsa and Ply
Tail Surfaces	Balsa
Building Instructions on Plan Sheets	Yes
Instruction Manual	Yes (23 pages)
Construction Photos	Yes

RCM PROTOTYPE

Radio Used	Kraft w/KPS 12 servos
Engine Make & Displacement	K & B .40
Tank Size Used	8 Ounce Slant
Weight, Ready to Fly	76 Ounces
Wing Loading	21 Oz./Sq. Ft.

SUMMARY

WE LIKED THE:

Well engineered construction methods which resulted in a strong well-built plane.

WE DIDN'T LIKE THE:

Found some discrepencies in instructions. To be corrected in future kits. Hinges and lack of some hardware.

If you are looking for the next step up to an aileron trainer, or just a sport flyer for those weekend trips to the field, take a close look at Scorpion IV. It is the latest in a line of fine products to be presented by Mark's Models.

When you open the standard size box, do two things, remove the instruction booklet and the plans. Lay the booklet aside for a few minutes while you reverse fold the creases in the plans then spread them on your workbench. Allow them to stay there a few days and absorb a bit of humidity so they will lay flat when you build. If you must put them away, roll them with the printing out, this will also help them to lay flat on your workbench.

Open the instruction book to page one where you will find a complete list of needed tools, parts and supplies. Use this list as a shopping guide or, if you would rather, the asterisk marked items may be purchased directly from Mark's. Of course, the average modeler will already have many of the items and tools mentioned.

Get the needed items before you start to build then you will have them to use as they appear in the step-by-step instructions. For instance, it is impossible to build the engine cowl without the engine and mount in place on front of the fuselage.

Now you may look at the remainder of the kit. The balsa and ply are of highest quality, the tail surfaces and engine cowl cheeks are sawed, the wing tips are sanded to contour. We were greatly impressed with the die cutting, for the first time we had die-cut pieces fall from the ply sheets and only minor sanding was necessary. The hardware was neatly packaged to minimize loss and protect the balsa in shipping.

Construction:

The large 50" x 36" plans were printed black on white, profusely illustrated and easy to read. The 23 page instruction book was full of construction photos and in a step-by-step sequence; only one place caused any difficulty and future kits will contain these clarifying instructions. The 5/16" x 1/4" balsa strip glued to the top of the ply wing trailing edge must have the 5/16" dimension vertical rather than horizontal as shown on the plans. Otherwise, no difficulties were encountered in construction.

When building the wing, the instructions say not to worry if any of the long balsa, spruce or ply pieces are bowed, the method of construction will remedy this. They aren't kidding, things lock together and that wing turns out straight.

A wing in which the spars are spruce, the webbing and T.E. are ply and all of this is notched to fit, will be a wing that is **strong.** Except for the top of the fuselage aft of the wing and the engine cowl, the fuselage is made of ply, the sides are notched to the formers to insure the fuselage will be square and strong.

The canopy is keyed to the fuselage with a dowel then held in place by a rubberband from wing dowel over the canopy and back to wing dowel. Since the canopy must be removed with the wing, this method of attachment is the least complicated. The canopy on the RCM prototype was first built to attach with plastic clips, these were later removed. Too much effort was necessary for removal. The dowel and rubberband are definitely the best.

We heard from a reliable source, "If a Scorpion IV came in full power straight down, the only damage would be to the weakest part of the plane, the motor mount."

If we had used sandpaper to round the ply fuselage, as shown on the plans, instead of using a small hand plane, we would probably be sanding yet. The removal of that wood way out there on a moment arm keeps nose weight to a minimum — **do it!**

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AIRBORNE SOLAR BATTERY CHARGER

By Richard A. McGrath

ABOUT THE AUTHOR

The author is an instrument rated private pilot who has been building and flying models of all kinds since the age of 10. He holds advanced degrees from the Unitersity of Tennessee, has performed and published scientific research in the field of Radiation Biophysics and taught at the University of California in Berkeley. Richard is currently a Senior Technical Writer at Bell Aerospace/Textron, Dalmo-Victor Operations, in Belmont, California. His work involves airborne electronics and computer manuals for the US Air Force. The development of solar energy, he feels, should be in the hands of people, households and small business, rather than utility companies.

INTRODUCTION:

This article describes construction and testing of an airborne device that uses solar energy to charge nicad battery packs in radio controlled (R/C) gliders. The device consists of four solar wing arrays, a flashing LED power indicator and regulator-charger module. Component weight is offset by the use of smaller battery packs and longer times between recharging. Sunlight is required for proper operation of the system. Different charging modes are possible by manual switching on the ground and the use of a servo-actuated microswitch while airborne. An additional servo is not required. Changes to existing wiring or circuitry are not necessary. The airborne solar battery charger will support operation of receiver and single servo flight systems without batteries. In normal use, additional servos and a small battery pack are used.

This device can be used on the ground for recharging transmitter batteries and for "jump charging" other aircraft. Trickle charging is possible in the **load off** condition. A short introduction and reference section is included to orient those unfamiliar with solar technology and serve as a guide for further information. Construction procedures are written for individuals with novice electronics experience.

Photovoltaic silicon cells convert sunlight into electricity. Theory of operation has been described elsewhere (see references 6, 10, 13, 15). Application of this theory includes powered lights on trains (9), flight of aircraft (3), on-chip power for integrated circuits (7), and a number of miscellaneous devices (4,8). Despite the high cost of solar cells for large scale power application (13,14), use of solar electric energy with lower power technology seems worthwhile.

The approach taken in this article is one of energy economy and does not assume unlimited funding or resources. The concept of attaching thousands upon thousands of solar cells to wings of airborne craft proves, mainly, that with enough money anything can happen. Most of us cannot afford such systems. Use of a few solar cells, however, for recharging an existing battery pack represents a cost and energy effective system with obvious application in airborne, marine and land vehicles.

Radio controlled gliders represent a clear and practical low power application. Airborne R/C equipment operates effectively between 3.5 and 7.0 volts, with current requirements that range from 30 to 500 ma. Several authors have addressed the topic of recharging either lead-acid (2,5) or nicad cells (1,10) on the ground by solar or other means (11,12). This article deals with recharging of airborne nicad battery packs by use of on-board solar cells. The situation is complex because of variation in light intensity and effects of aircraft movement, as well as fluctuation of temperature, wind, load upon control surfaces and nature of equipment.

SYSTEM DESCRIPTION:

Materials used for construction have been selected on the basis of (1) component quality, (2) ease of availability, (3) light weight, and (4) durability. Nothing in this article is intended to commend or discredit any manufacturer or distributor of parts and materials. The purpose is to describe a system that functions effectively with one particular combination of elements. Many other possibilities exist, which are left to individual discretion.

The airborne solar battery charger consists of the following components: four solar arrays, a flashing LED indicator and a regulator-charger module. These interface with existing system hardware without need for circuit or wiring modification. An additional servo is not required.

Solar arrays: For primary power supply (PS-1), Solarex solar cells were selected. These cells exceed requirements for aerospace application and are supplied with redundant lead connectors already attached. Solarex cells are readily available from Edmund Scientific Company and other distributors under fully guaranteed, no-nonsense ground rules. Edmund provided the cells used for test and experimental evaluation of this project. Each solar cell generates 0.45v under load (0.50v, no-load). Series connection is necessary to develop higher voltages. Each cell provides 90 to 105 ma in full sunlight and less under low light conditions. Parallel connection results in higher current. Each cell measures 0.8" x 0.8" (2 x 2 cm) and weighs 0.02 oz. (0.57 g).

Fourteen solar cells are combined in four separate arrays that are designed for internal wing mounting. Two right-wing arrays are designated RA-3/RA-4. Left wing arrays are LA-3/LA-4. Each array is a sandwich of plexiglass, solar cells, flat lead connectors, cardboard and epoxy. Individual arrays measure 1.8" x 2" x 3/16" (4.6 x 5.1 x 0.5 cm) and weighs about 0.4 oz. (11.3 g).

FIG. 1. Pair of Solar arrays mounted in wing of Midwest Hobie Hawk. Covering is clear Super MonoKote.

FIG. 2. Regulator-charger behind two Kraft KPS-18A servos on component deck of Hawk. Trigger line on nearest servo pushrod activates microswitch. Charging jack is used to "jump charge" other aircraft or charge transmitter batteries four at a time.

In-line arrays can also be constructed. These measure 1" x 3.6" x 3/16" (2.5 x 9.1 x 0.5 cm) and have the same weight. Construction of very lightweight arrays that weigh 0.15 oz. (4.3 g) is also possible.

Useful power from PS-1, under load, is about 5.9v at 100 ma in full sunlight, i.e., 590 mw. No-load output is 7.1v at 100 ma (710 mw). A 50% power loss occurs within an hour of sunset and at low sun angles relative to array position. Under low light conditions, a 4-cell battery pack (BP-4) assumes its normal function. Although designed as a battery charger, it became clear, as testing proceeded, that under conditions of full sunlight, PS-1 could (by itself) power a receiver and single servo system without batteries.

Flashing LED indicator: Operation of PS-1 is indicated by a flashing LED. This module has four components, encapsulated in epoxy. The unit measures 1/2" x 1/2" x 1" (1.3 x 1.3 x 2.5 cm) and weighs 0.1 oz. (3 g). LED indicator draws a maximum of 0.8 ma and can be mounted inside a wing or in fuselage, at any convenient location between PS-1 and regulator-charger. Voltage drop across flasher is negligible.

Regulator-charger: Nine components of regulator-charger are mounted on a 1⅛" x 2" (2.9 x 5.1 cm) perforated circuit board. The unit occupies 1" (2.5 cm) of vertical space and weighs 0.7 oz. (20 g). No adjustments are necessary once the circuit is in operation. Regulator-charger is designed for mounting

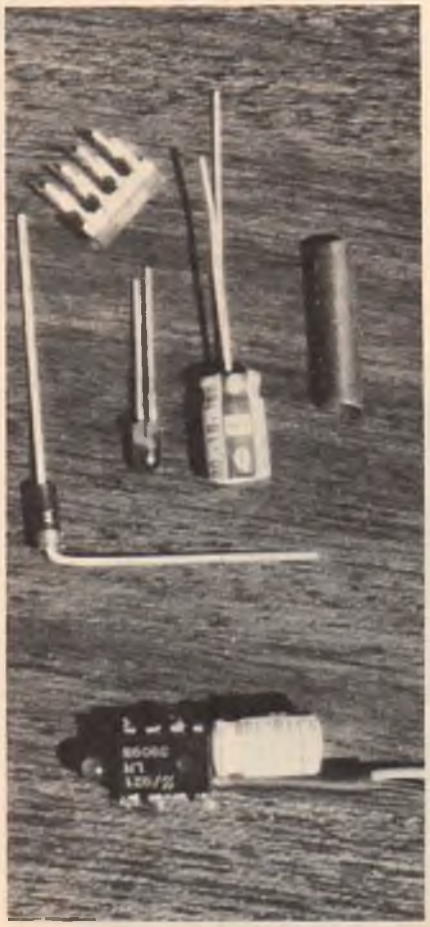

FIG. 3. Components of flashing LED indicator and top view of finished module before encapsulation in black epoxy. LED shows operation of Solar array but draws only micropower.

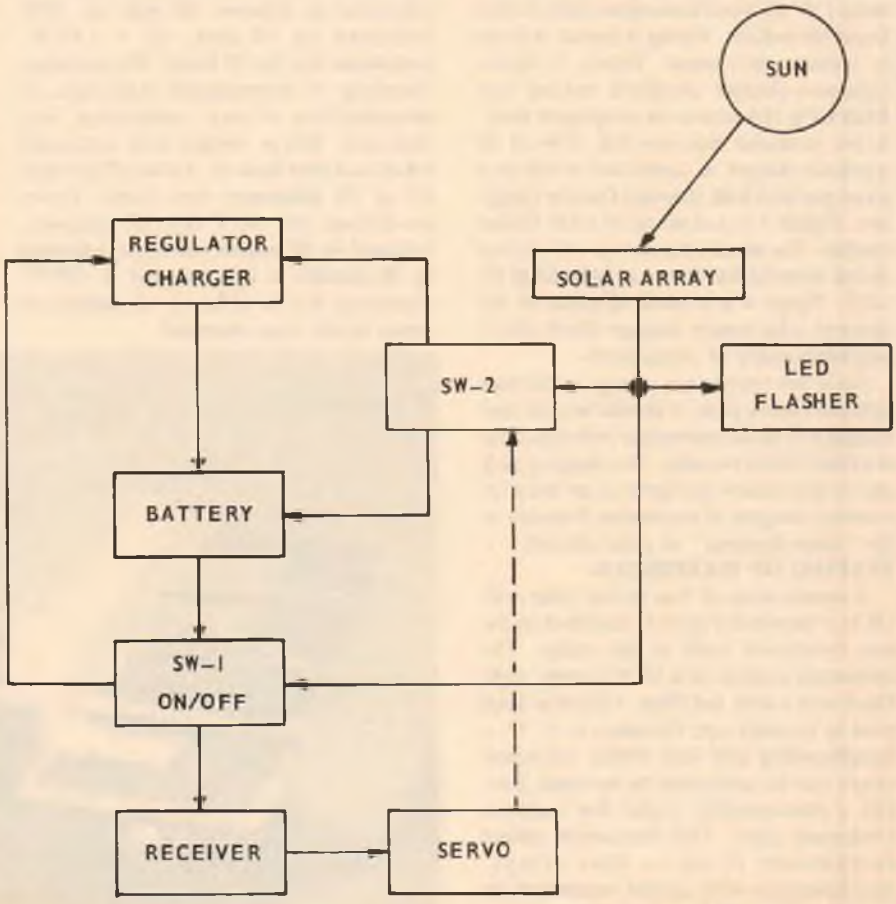

FIG. 4. Block diagram of airborne Solar battery charger. Slide switch SW-1 turns Load On or Off and simultaneously sets regulator-charger to deliver Low or Trickle charge to battery. Dashes indicate trigger line from servo to microswitch SW-2. Microswitch sets Low or Power Boost modes by selecting regulated charging or direct connection of Solar array to battery and Load. LED flasher indicates operational status of Solar array.

close to existing servos. Various switching arrangements allow charging at **trickle, low** or **power boost** rates in the field. **Low** and **power boost** modes are available while airborne. **Trickle** charging occurs in the **load-off** condition. Normal movement of one servo (rudder or elevator) is used for microswitch actuation by means of a trigger line. Adjustable, constant current circuitry is used to condition power from PS-1 to BP-4 and receiver/servos **(load).** Off board wires, terminated in Deans connectors intercept existing plugs between battery and receiver. Power from PS-1 is delivered to regulator-charger by shielded cable. Plugs at wing roots allow easy disassembly.

System interface: Batteries from several manufacturers were tested during the course of this study. 450 mah Cadnica, 225 mah Eveready and 110 mah Panasonic battery packs were used. Kraft systems provided a KP-3AS receiver and KPS-18A servos plus transmitter, on a "loaner" basis for testing and evaluation. Radios, batteries and charging system were installed in a Midwest Products' Hobie Hawk for flight testing. This particular glider has wing cells that are ideal for mounting solar arrays.

Widely spaced wing ribs and an absence of overlying spars are distinct advantages for solar applications. Figure 1 shows array mounting in the Hawk wing. Plex faces are about 1/8" (0.3 cm) from upper skin of clear Super MonoKote. Wiring is buried in foam to prevent movement. Figure 2 shows regulator-charger mounted behind two Kraft KPS-18A servos on component deck. Servo actuated microswitch (SW-2) of regulator-charger is connected to elevator servo pushrod with stranded Dacron trigger line. Figure 3 is a close-up of LED flasher module. The tubular black extension is heat shrink material that serves as lightshield for LED. Figure 4 is a block diagram of the airborne solar battery charger which shows interrelationship of components.

Since this system can charge a 450 mah airborne battery pack, it should be clear that charging of nicad transmitter batteries (four at a time) is also possible. The charging jack and switch (shown in Figure 2) are used for external charging of transmitter batteries or for "jump charging" of other aircraft.

TESTING OF MATERIALS:

A control array of four in-line solar cells (SCs) is shown in Figure 5, mounted on the test instrument used in this study. The instrument consists of a 1X telescopic sight fitted with a dark red filter, a circular level used to measure sun elevation to ± 1°, a breadboarding unit into which individual arrays can be connected by terminal pins, and a photographic tripod that supports component parts. This instrument allows comparison of up to four arrays, simultaneously with control measurements taken from the in-line device. Volts and ma were measured with a Data Precision digital multimeter, factory calibrated to National Bureau of Standards specifications. Temperature was measured with a probe, similarly calibrated.

As part of this study, both clear and colored, transparent Super MonoKote were tested as covering materials. As expected, clear material blocks less light than colored covering. A single layer of clear MonoKote reduced power output by 6.3%. Comparable reduction from other coverings was as follows: Super MonoKote yellow, -24.6%; orange, -29.8%; red, -37.9%; blue, -58.4%. Mounting solar cells to plexiglass with epoxy increases power by approximately 6%. Losses from mounting under MonoKote (clear) are essentially offset by the plexiglass mounting technique. The small, net loss more than compensates for reduced drag and increased protection afforded by internal wing mounting.

In a separate series of tests, solar arrays were mounted horizontally and power output was measured as a function of sun elevation angle to the array. In general, as long as the sun is higher than 30° above array surface, adequate power is developed. Best results were obtained between 10:00 a.m. and 3:00 p.m. on bright, sunny, cloudless days.

Some estimate of the durability of SC array materials was obtained from a series of environmental and impact tests. Arrays with 1/16" (0.2 cm) plex faces were tested in a Thermotron environmental chamber, scheduled as follows: 30 min. at -50°F followed by 30 min. at + 145°F, continuous test for 10 hours. No cracking, clouding of transparent materials or delamination of any component was observed. Power output was measured before and after burn-in. Values of less than 1/2 of 1% difference were found. Under conditions of -50°F for 30 minutes, followed by 30 minute recovery, followed by 30 minutes in live steam at + 125°F, continuous test for 5 hours, no damage or power losses were observed.

Impact testing was accomplished by allowing individual arrays to free-fall from a height of 4' (122 cm) to an asphalt-tile covered concrete floor. After repeated tests, no damage other than dented corners or bent terminal pins was observed. One array was hammered, cornerwise, 1/2" (1.3 cm) into a block of hard balsa. No cracking or delamination occurred. This same array was taped to an asphalt roadbed and driven over repeatedly with a 2500 lb. (1134 kg) automobile. No cracking or delamination was observed but this treatment did produce minor surface scratching. In separate tests, a 3/16" (0.5 cm) diameter ball bearing was dropped on array face from a height of 3' (91 cm). After four trials, no cracking or delamination was observed. This same test routinely breaks the bottom of a mayonnaise or pickle jar on the first trial and leaves obvious dents in the bottom of a tin can.

Results of all tests lead to the conclusion that weight of packaging materials is well worth protection afforded to internal components. These arrays are suitable for use in model aircraft, boats or other appropriate applications.

CONSTRUCTION:

Solar arrays: A 1/16" (0.2 cm) plexiglass face on each array increases power output and provides structural rigidity/protection for SCs. A thin cardboard support layer secures SCs during construction and insulates soldered connections. Cardboard backing protects soldered connections from external damage and seals the unit. Wire wrap terminals provide external connection. The entire package is bonded with Devcon 5-Minute Epoxy. Blocking diode (D-1) is encapsulated in three cell, right wing array, RA-3. These arrays are rugged and durable. If weight is the single, most important factor, construct arrays with 1/32" (0.1 cm) plex faces and use 1/32" (0.1 cm) balsa

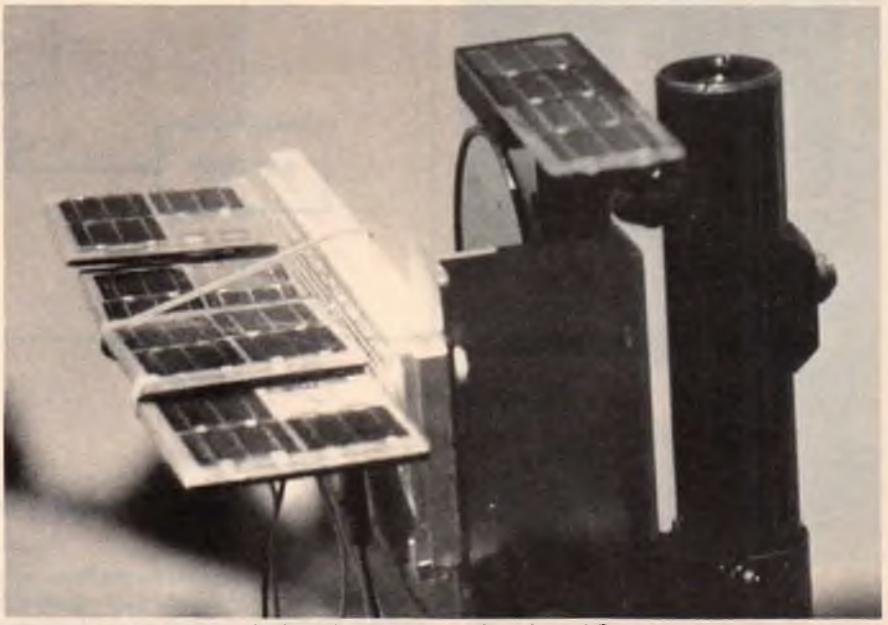

FIG. 5. Test instrument designed to measure elevation of Sun and compare output of Solar arrays to in-line unit mounted at front. Instrument attaches to photographic tripod.

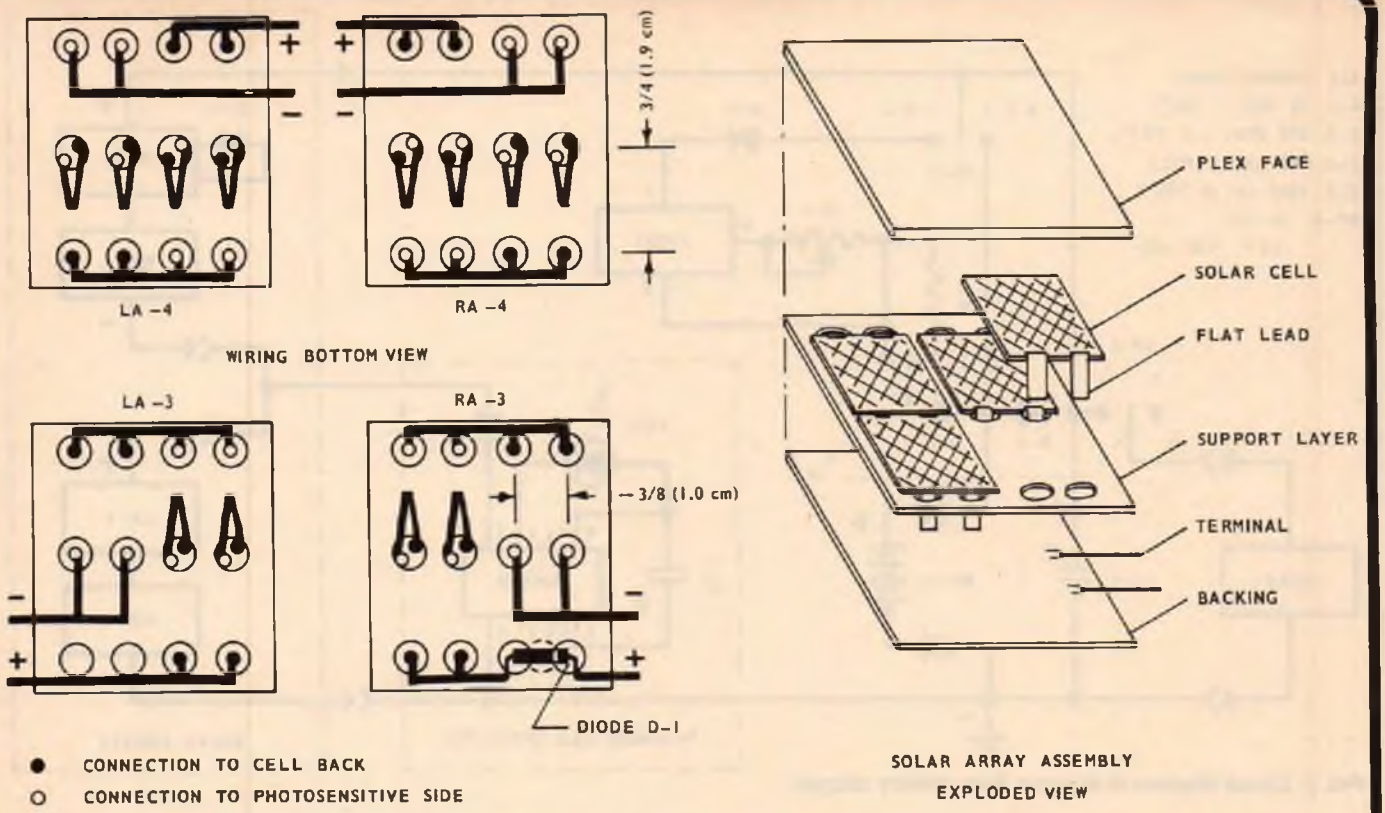

FIG. 6. Wiring and assembly of Solar arrays. Flat leads from photosensitive surface should not contact edge of cell back. All SC's are series connected.

support layers with no backing. With flat lead material for terminals, such arrays should weigh about 0.15 oz. (4.3 g) each. These units have the same electrical characteristics as more rugged units but cannot meet the same standards for environmental and impact resistance. Some trade-off is necessary between weight and ruggedness. Final decision in this, is left to individual discretion.

Solar cells are made from glass wafers and are fragile. Handle carefully to avoid breakage. Avoid flexing leads any more than necessary. The light sensitive surface of each SC is negative (−), the back is positive (+). It is easiest to cut, stack and block sand components for all four arrays at once. Proceed as follows:

(1) Measure free space between wing ribs. If more than 1¾" (4.4 cm) use square arrays; if less, use in-line configuration. Arrays can be mounted by ends, edges or on backs with epoxy. Select dimensions that are easy to mount. Read entire instruction set before beginning. Refer to Figure 6 and to photographs showing various construction details. Work carefully.

(2) Cut slightly oversize, four plex faces and eight pieces of thin cardboard. E-Z Erase typewriter paper is packed with stiffeners 0.025" (0.06 cm) thick. This or an equivalent material should be used.

(3) Peel protective paper from one side of each plex face. Use #100 sandpaper to roughen surface. No shiny spots should remain. Stack and block sand edges of plex and cardboard.

(4) Mark one piece of cardboard for hole punching. A hand-held punch is used to perforate stock as indicated. One additional hole, shown by dotted lines in Figure 6, is required for diode D-1 in RA-3. Four protective backings are unpunched.

(5) Unpack all SCs and bend flat leads perpendicular to cell backs. Use multimeter to test each cell. Read 0.5v at 100 ma in full sunlight. Use scissors to cut leads to 1/2" (1.3 cm). Avoid sharp bends at lead connectors. Save all pieces of flat lead material.

(6) Align four SCs in holes of one support layer. Be certain correct connections can be made. Double check orientation of SCs in support layer. Bend end leads outboard and center leads as shown in illustration. Use Hot Stuff, Eastman 910 or an equivalent fast setting adhesive to tack cell corners to support layer. Keep adhesive off photosensitive surfaces.

(7) Mix sufficient epoxy to cover photosensitive surfaces and cardboard to a depth of 1/32" (0.1 cm). Position sanded plex face in epoxy coating and turn assembly onto waxed paper on smooth work surface. Use fingers to press out air bubbles while keeping edges of assembly aligned. Cover surface with waxed paper also, to prevent sticking to fingers.

(8) Flat leads are typically soldered as follows: Bend one lead to form "Vee." Insert other lead into "Vee" and press together to assure good mechanical connection. Solder quickly with 30 watt soldering iron. Do not use acid core solder. Do not overheat. Complete all SC to SC connections as illustrated.

(9) Use Figure 6 as a guide to positioning of terminals. Actual location may vary depending on wing structure. Positive (+) terminal should be outboard to negative (−) on all arrays. Position wire wrap terminals and solder to flat leads. Soldering for this array is complete.

(10) Be careful to avoid loosening leads during testing. Peel protective paper from plex face. Use multimeter to test array. Read 1.9 to 2.1v at 95 to 110 ma in full sunlight. If these values are not obtained, recheck all connections and orientation of cells in support layer. Correct as necessary. Replace protective paper on plex face.

(11) Mix sufficient epoxy to cover all flat lead connectors and support layer to a depth of 1/32" (0.1 cm). Position backing in epoxy and turn assembly onto waxed paper on smooth work surface. Cover backing with waxed paper also and use fingers to press out air bubbles, while keeping edges aligned. Fill gaps at edges with additional epoxy as required. After epoxy cures, sand edges with #100 sandpaper. Do not attempt to sand between terminals. Set aside one finished array.

(12) Fabricate a second four-cell array in mirror image to the first. Refer to steps 6 through 12 and Figure 6. Arrays RA-4 and LA-4 are now complete.

(13) Fabricate RA-3. Use support layer with extra hole (see step 4). Mount diode D-1 in this recess with banded end soldered to positive (+) terminal. Use multimeter to

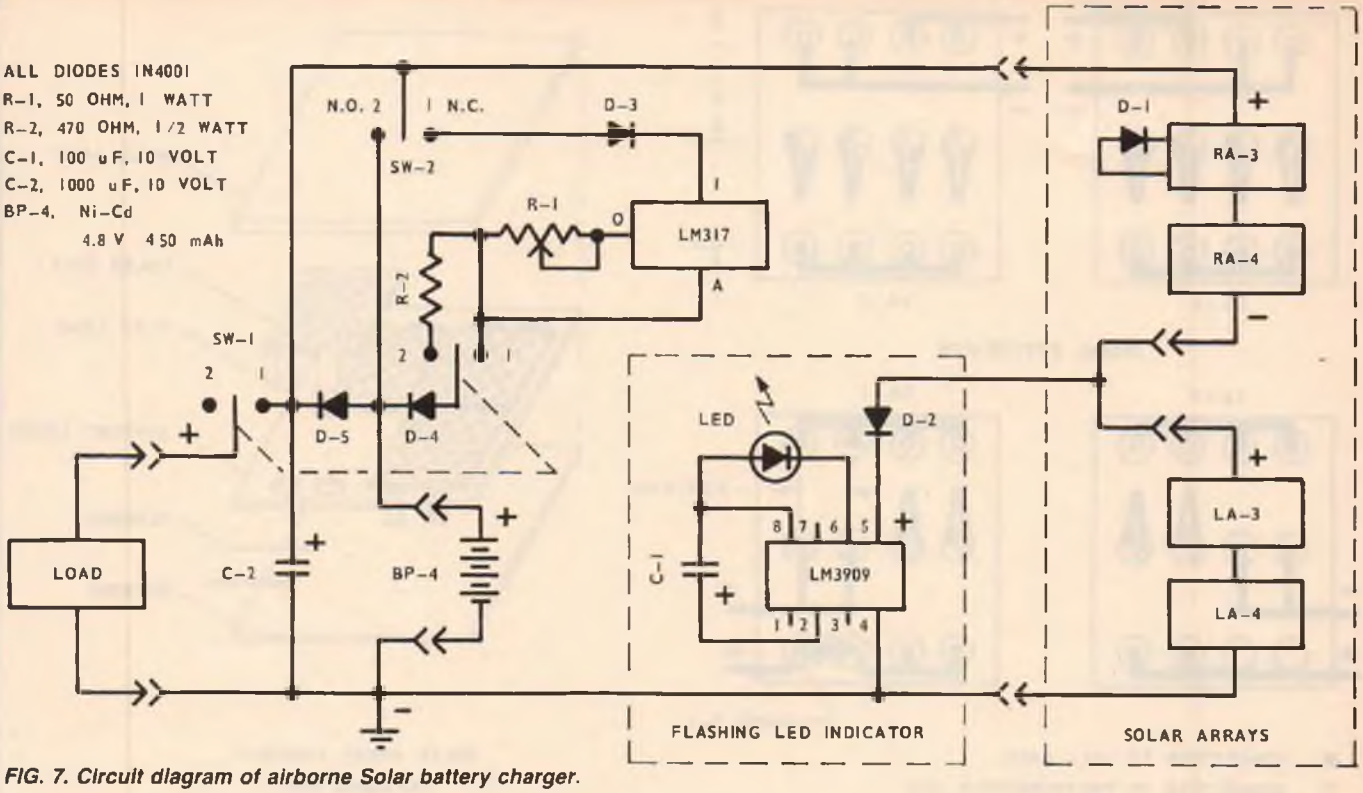

FIG. 7. Circuit diagram of airborne Solar battery charger.

test array in full sun. Read 0.9 to 1.1v at 95 to 110 ma.

(14) Fabricate mirror image LA-3 for left wing. This array contains no diode. In full sun, array should generate 1.4 to 1.6v at 95 to 110 ma.

(15) Connect all four arrays in series with RA-3 at positive (+) end of series connection. Test in full sunlight. Multimeter reading should be 6.5 to 7.1v at 95 to 110 ma. If these values are not obtained, recheck for loose connections or non-series connection. Arrays are now ready for installation.

(16) Route shielded phono arm lead in wire to position of array mounting in each wing. In right wing, connect RA-3 positive (+) to both internal wires (red/black) inside shield. Connect shield to RA-4 negative (−) terminal. Solder connections. Connect single jumper between RA-3 negative (−)

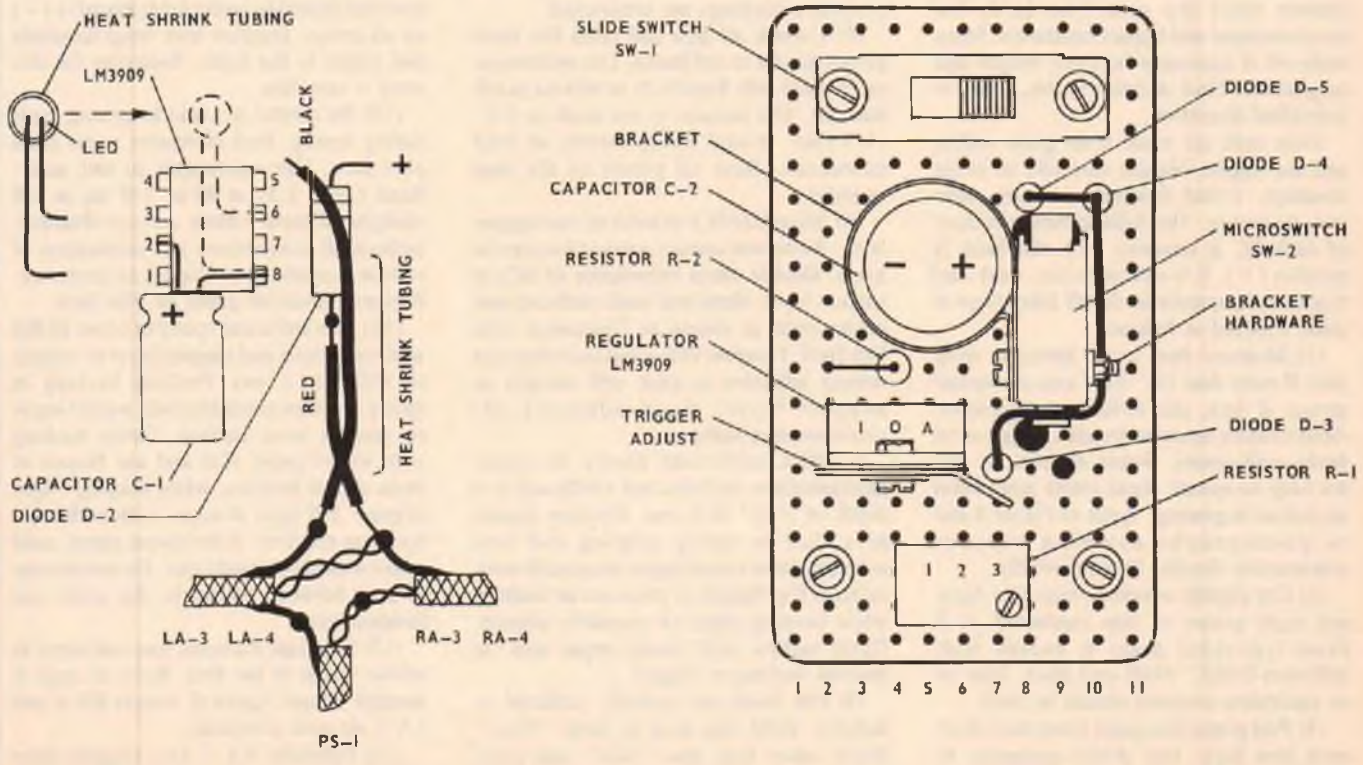

FIG. 8. Assembly drawings: (A) Flashing LED indicator with wiring of shielded cable connections also shown. (B) Regulator-charger component placement with top-board wiring of diodes indicated.

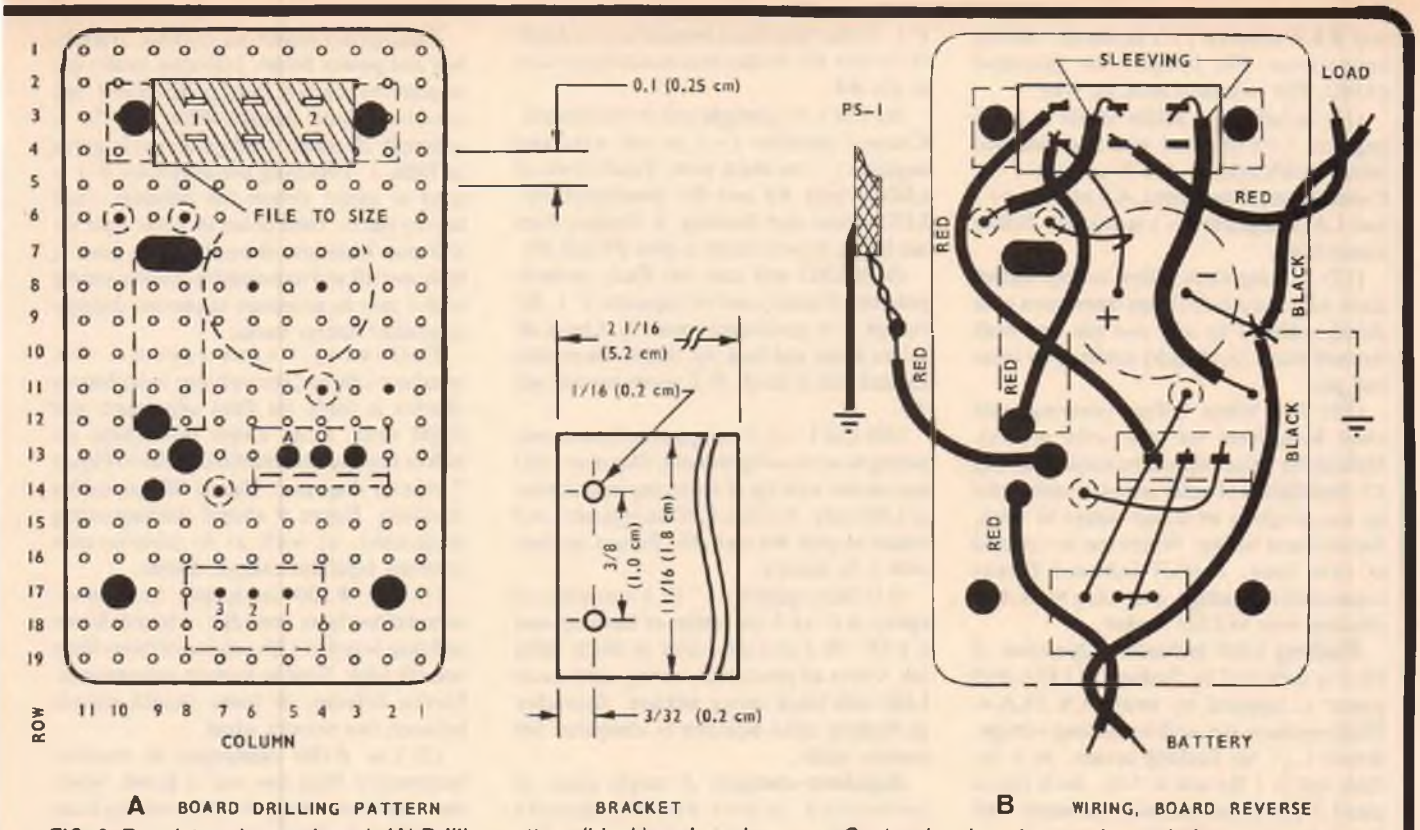

FIG. 9. Regulator-charger board: (A) Drilling pattern (black) on board reverse. Center drawing shows microswitch-capacitor bracket dimensions. Both ends are alike. (B) Board reverse wiring and off board connections.

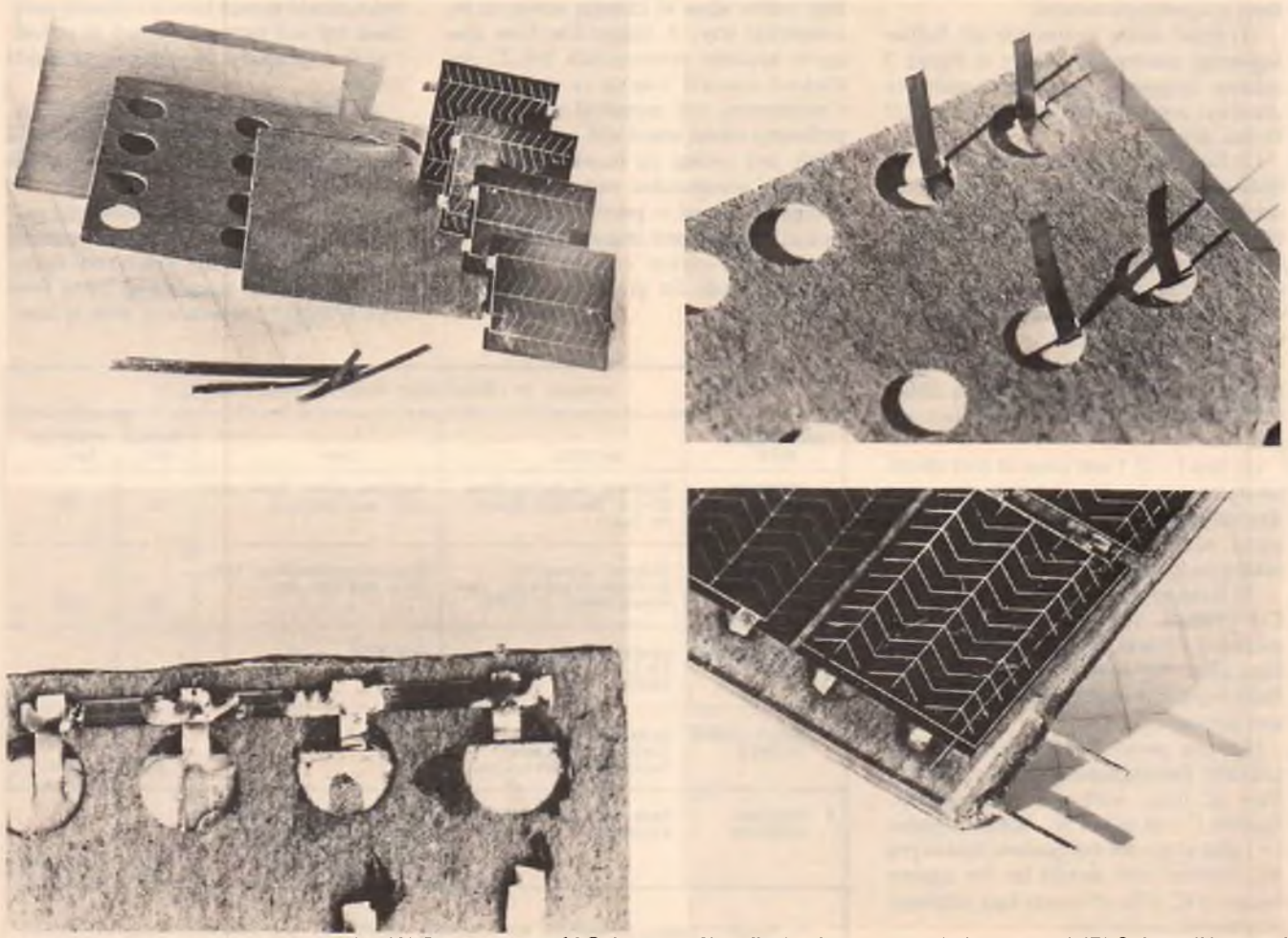

FIG. 10. Solar array construction details: (A) Components of 1 Solar array. Note flat lead connectors in foreground. (B) Solar cell inserted in support layer, bottom view. (C) Solder connections on bottom of support layer. (D) Photosensitive side of 1 array showing terminals.

and RA-4 positive (+) terminals. Solder connections. For jumper, use insulated (AWG #24 stranded) hook-up wire.

(17) In left wing, solder shield to LA-4 negative (−) terminal and both internal wires (red/black) to LA-3 positive (+). Connect jumper between LA-4 positive (+) and LA-3 negative (−) terminals. Solder connections.

(18) At wing roots, allow several inches slack wire and attach Deans connectors with shield soldered to one end pin and both internal wires (red/black) soldered to other end pin.

(19) Test wings before covering with clear MonoKote (at least over arrays). Multimeter values should be same as in step 15. Installation of solar arrays is completed by use of epoxy to secure arrays to wing. Secure loose wiring. Wings can be covered at this time. Install inboard Deans connectors in fuselage, near wing roots. Use shielded wire to LED flasher.

Flashing LED indicator: Operation of PS-1 is indicated by flashing of LED. Full power is supplied by arrays LA-3/LA-4. Flash rate increases with increasing voltage. Below 1.2v, no flashing occurs. At 1.5v, flash rate is 1 Hz and at 3.0v, flash rate is about 3 Hz. Flash intensity increases with increasing current. The four components are wired together, without circuit board, to form a lightweight module.

(1) Read entire instruction set before beginning construction. Refer to Figure 7 (circuit diagram), Figure 8A (assembly drawing), and to photographs showing LED flasher details.

(2) Bend lead on diode D-2, 90° to diode body at banded end. Cut straight lead from unbanded end to 5/16" (0.8 cm). Cut 4" (10 cm) piece of red, insulated (AWG #24 stranded) hook-up wire. Strip 1/8" (0.3 cm) insulation from both ends and tin ends with solder. Solder one end of red wire to straight lead from D-2.

(3) Cut 5" (13 cm) piece of black hook-up wire. Strip and tin wire ends. Make a 90° bend, starting 1/4" (0.6 cm) from one end.

(4) Slip 1" (2.5 cm) piece of heat shrink tubing over both red and black wires, and also unbanded end of D-2. Shrink tubing in place with tip of soldering iron. Set subassembly aside.

(5) Bend negative (−) lead on capacitor C-1 (100µf, 10v), 90° to case. Bend positive (+) lead, starting 1/8" (0.3 cm) from case, 90° in the opposite direction. Refer to polarity markings on capacitor. Be sure polarity is correct.

(6) Note position dot on face of IC LM3909. Dot indicates position of pin #1. Turn IC over, with pins pointing up. Position C-1 at end of IC. Solder negative (−) lead to pin #8 and positive lead to pin #2. Postive lead should lie flat against bottom of IC. Clip off excess lead, outboard to soldered connections.

(7) Position subassembly from step (4) with red/black wire pair next to capacitor C-1. Solder lead from banded end of diode D-2 to Pin #5. Solder bent end of black wire to pin #4.

(8) Use 1.5v penlight cell to test module. Connect positive (+) to red wire and negative (−) to black wire. Touch leads of LED to pins #6 and #8 simultaneously. LED should start flashing. If flashing does not begin, reverse leads to pins #6 and #8.

(9) If LED still does not flash, recheck polarity of battery and of capacitor C-1. Be certain IC is positioned correctly. Check all solder joints and look for shorts. Be certain banded end of diode D-2 points toward pin #5.

(10) Cut 1" (2.5 cm) piece of heat shrink tubing to serve as lightshield. Slip over LED and shrink with tip of soldering iron at base of LED only. Position LED as indicated and solder to pins #6 and #8. Re-test module with 1.5v battery.

(11) Mix together a 1" (2.5 cm) stripe of epoxy, a 1" (2.5 cm) stripe of hardener and a 1/16" (0.2 cm) dia. drop of black India ink. Cover all pins on IC, wiring and base of LED with black epoxy mixture. Assembly of flashing LED indicator is complete. Set module aside.

Regulator-charger: A single piece of perforated circuit board supports components of regulator-charger, switches and associated wiring. Unit mounts with four screws close to existing servos or on component tray. A trigger line from one servo actuates microswitch SW-2. An etched circuit board is not used. Components are mounted directly on perforated circuit board with epoxy. Solder joints and wiring on board reverse are sparingly encapsulated with G.E. silicon sealing compound to provide insulation as well as moisture and impact protection. A lightweight cover can be added to component side for protection in marine environments.

Three power modes are possible: **trickle, low** and **power boost.** Different modes are selected by manual slide switch SW-1 and servo-actuated microswitch SW-2. A summary of power configurations is given in Table I. Trimming potentiometer R-1 is used to adjust output for different sized battery packs. Data given in Table I are for 450 mah batteries, since these are used in both aircraft and transmitters. Lower setting of R-1 may be necessary to prevent damage to smaller battery packs.

Following construction of regulator-charger, the airborne solar battery charger is ready for final adjustment and flight tests. Read entire instruction set before starting construction. Refer to Figure 7 (circuit diagram), Figure 8B (assembly drawing), Figure 9 (board drilling/wiring diagrams), as well as to photographs showing regulator-charger details.

(1) Use #100 sandpaper to remove indentations from one edge of board. Score and snap board at 12th column of holes from smooth edge. Sand to remove indentations. Eleven columns of holes should remain between two smooth edges.

(2) Use #100 sandpaper to remove indentations from one end of board. Score and snap board along row 20, counting from smooth end. Sand out indentations and round corners of board. Nineteen rows of holes should remain between smooth ends. Sand top and bottom of board to provide "tooth" for epoxy. No shiny spots should remain.

(3) Refer to board layout in Figure 9A. Drill/file openings as indicated. Do not drill mounting holes for slide switch SW-1 at this time.

(4) Use #100 sandpaper on exterior case of SW-1. File rough edges around mounting holes so plate lies flush with board. Epoxy case in position. Keep epoxy away from switch toggle, contacts and ends of case.

TABLE I SUMMARY OF OPERATIONAL MODES IN FULL SUNLIGHT *

OPERATIONAL MODE	BATTERY	LOAD	SWITCH SW-1	POSITION SW-2
1. AIRBORNE POWER BOOST	Maximum charging from PS-1. Maximum drain to load.	Maximum power from both PS-1 and battery.	ON	ON
2. AIRBORNE LOW CHARGE	Reduced charging through regulator. Reduced drain to LOAD.	Reduced power from both PS-1 and battery.	ON	OFF
3. FIELD CHARGE POWER BOOST	Maximum charging from PS-1. No drain to LOAD.	Disabled	OFF	ON
4. FIELD CHARGE TRICKLE	Reduced charging through regulator. Continuous operation.	Disabled	OFF	OFF
5. SPECIAL AIRBORNE	Battery removed from aircraft.	100 mA, 6.5 V maximum power from PS-1 for single servo system. Full Solar flight.	ON	ON or OFF

* Bright, Sunny, cloudless days between 10:00 A.M. and 3:00 P.M. Sun elevation angle greater than 30° to array.

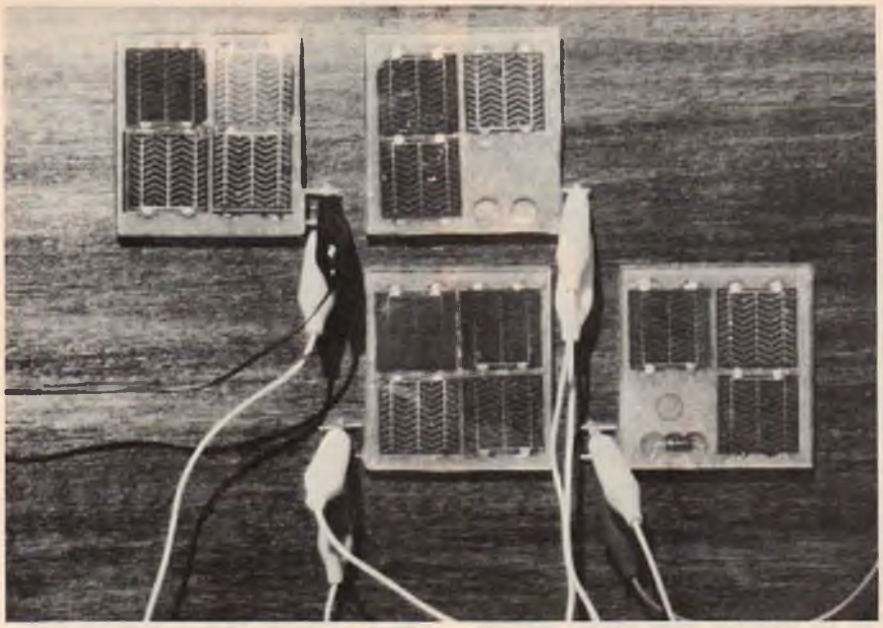

FIG. 11. Solar arrays under test. Left wing arrays at top, right wing arrays at bottom.

Fig. 12. Regulator-charger in nose of Hobie Hawk. LED flasher is mounted between control rods, aft of circular decal.

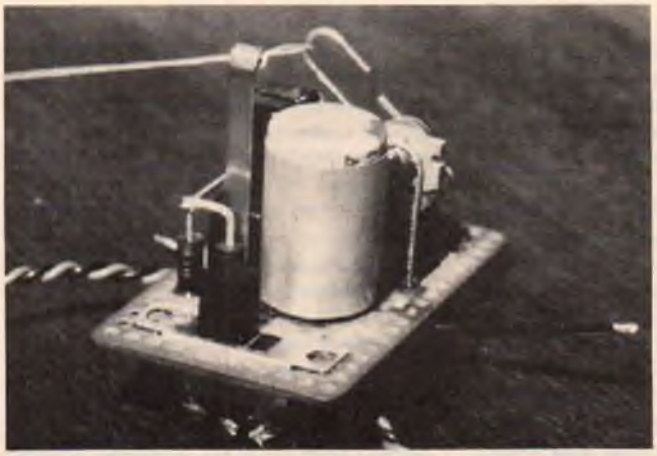

FIG. 13. Regulator-charger details: Trimming potentiometer; trigger adjustment and hardware mounted on heatsink of regulator; connections at microswitch terminals. Trigger line is stranded white Dacron.

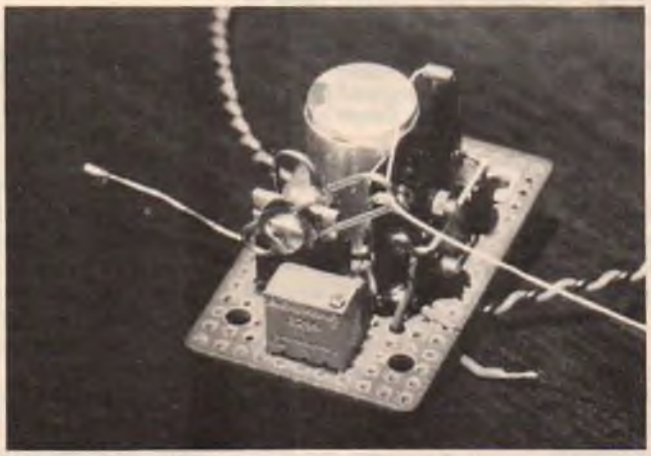

FIG. 14. Regulator-charger details: Slide switch; diodes forward of microswitch; microswitch-capacitor bracket. Outboard lead of resistor R-2 shows behind bracket.

Epoxy case sides and end tabs only. After epoxy has cured, drill mounting holes through switch plate. Note that these holes do not necessarily line up with holes in board or with other mounting holes.

(5) Cut from aluminum sheet, mounting bracket for capacitor - microswitch subassembly. Punch holes with nailset against hardwood. Note polarity markings on case of capacitor C-2 (1000µf, 10v). Negative (−) faces away from microswitch SW-2. Wrap bracket around capacitor and use small screws, washers and locknuts to mount microswitch. Adjust assembly. Microswitch SW-2 should be square to board with capacitor leads in row 8, column 4 and 6 holes. Fill crescent between mounting bracket and C-2 with epoxy. Epoxy subassembly to board.

(6) Bend one lead on resistor R-2 so both leads point in same direction, spaced two holes apart. Epoxy end of R-2 at row 11, column 4. A single drop of epoxy at row 11, column 2 secures bent lead. Epoxy regulator LM317 and trimming potentiometer R-1 in position. Regulator mounts in row 13 with heatsink facing aft. R-1 mounts in row 17 with adjustment screw aft. Clip regulator leads to 3/8" (1.0 cm).

(7) Use pencil to mark letters "I", "O", "A", on case of regulator as illustrated in Figure 8B. Grip actuator arm of microswitch SW-2 with pliers and bend back and forth several times to break arm 1/2" (1.3 cm) above microswitch body. Bend loop at tip of actuator arm. Use pencil to mark numbers "1", "2", "3", on case of trimming potentiometer R-1 as illustrated.

(8) Epoxy diode D-3 at row 14, column 7 with banded end against board. When epoxy has set, bend lead from unbanded end to topmost terminal of microswitch SW-2. Note clearance required for trigger line adjustment that mounts on heatsink of LM317. Solder connection at SW-2 and clip off excess lead.

(9) On board reverse with slide switch forward, bend lead from banded end of diode D-3 flat against board, then to LM317 terminal "I." Solder connection and clip off excess lead.

(10) At trimming potentiometer R-1, bend pins "1" and "2" together. Solder solid jumper (a piece of scrap lead material), between bent pins and LM317 terminal "O." Clip off excess lead.

(11) Route outboard lead from resistor R-2 in-between (+) and (−) terminals of capacitor, to slide switch SW-1, outboard terminal 2. Slip a 1" (2.5 cm) piece of insulated sleeving over lead and solder connection at SW-1. Clip off excess lead and slide insulated sleeving to switch terminal.

(12) Bend inboard lead from resistor R-2 to LM317 terminal "A." Solder connection at "A." Route excess lead to trimming potentiometer R-1, pin "3." Solder

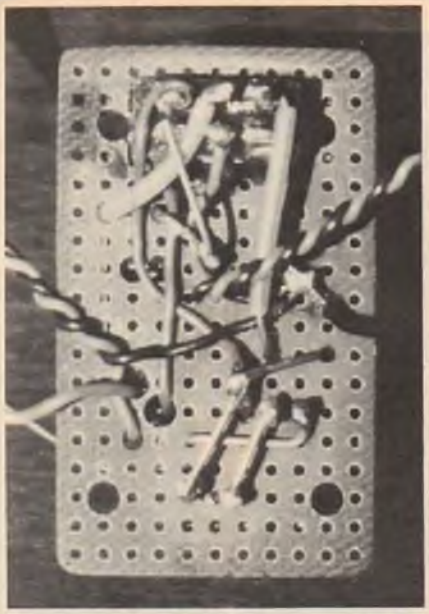

FIG. 15. Regulator-charger details: Board reverse before encapsulation. Twisted red/black pair (LEFT) goes to battery. Twisted red/black pair (RIGHT) goes to receiver. Single red wire (LEFT) is positive (+) Solar array connection. Black wire (RIGHT) was temporary common ground test lead. Wiring is compressed to board center to clear mounting flange at edge.

FIG. 16. Airborne Solar battery charger mounted in Midwest Hobie Hawk.

FIG. 17. Another view of airborne Solar battery mounted in plane.

connection at R-1 and clip off excess lead.

(13) Cut 1½" (3.8 cm) piece of red, insulated (AWG #24 stranded) hook-up wire. Strip and tin wire ends with solder. Route wire between slide switch SW-1, outboard terminal 1 and LM317, terminal "A." Solder both connections.

(14) Route negative (−) lead from capacitor C-2 through hole at row 9, column 2. Bend lead to board top and clip off excess lead. This line is the common ground connection.

(15) Cut 1½" (3.8 cm) piece of red, insulated (AWG #24 stranded) hook-up wire. Strip and tin wire ends with solder. Route wire through 1/8" (0.3 cm) hole at row 12, column 9. Solder to lowest terminal (wiper) of microswitch SW-2. Solder other end of wire to slide switch SW-1, inboard terminal 1.

(16) Epoxy diodes D-4 and D-5 in place, forward of microswitch SW-2 on board top. Note that banded end of outboard diode D-4 faces away from board. Banded end of inboard diode D-5 faces board. Double check band positions before epoxy cures.

(17) On board top, bend banded lead on outboard diode D-4 around outside of microswitch and solder to SW-2 center terminal. This terminal (2 on circuit diagram) is normally open (N.O.). Bend unbanded lead on inboard diode D-5 to banded end of diode D-4 and solder connection. Clip off excess lead.

(18) On board reverse, bend lead from banded end of outboard diode D-4 to outboard center terminal (wiper) on slide switch SW-1. Slip a 1" (2.5 cm) piece of insulated sleeving over lead and solder connection at SW-1. Slide insulated sleeving between switch contacts to prevent shorting. Clip off excess lead. Two insulated red wires lie under sleeving.

(19) Bend lead from banded end of inboard diode D-5 to positive (+) lead on capacitor C-2. Solder connection 1/4" (0.6 cm) from board. Clip off excess lead from diode and bend remaining lead from capacitor (+) to slide switch SW-1, inboard terminal 1. Solder connection at SW-1 and clip off excess lead. Route all wiring to SW-1 free of mounting holes and switch ends.

(20) Cut a 1¼" (3.2 cm) piece of red, insulated (AWG #24 stranded) hook-up wire. Strip and tin wire ends with solder. Route one end of wire through 1/8" (0.3 cm) hole at row 13, column 8. Solder wire to wiper (bottom connection) on microswitch SW-2. Free end of wire is PS-1 positive (+) input.

(21) Twist tightly together two 12" (31 cm) lengths of red and black insulated (AWG #24 stranded) hook-up wire. Clip ends to equal length after twisting. Strip and tin wire ends with solder at four places. At one end of twisted pair, install Deans connector (or other appropriate plug) to mate with existing battery connector. At other end of twisted pair, install plug to mate with existing receiver (**load**) connector. Mate connectors and test twisted pair jumper to be certain it works.

(22) Cut twisted pair in half. Tag ends: "B" for battery and "L" for load. Strip and tin wire ends with solder. Route both black wires on twisted pairs to common ground connection and solder.

(23) Route red "B" wire through 1/16" (0.2 cm) hole at row 14, column 9 and solder to center terminal of microswitch SW-2. Route red "L" wire to inboard wiper (center terminal) of slide switch SW-1 and solder this connection.

(24) Cut a 12" (31 cm) piece of shielded phono arm lead in wire. Separate shield and internal wires. Solder shield to common ground connection. Solder both internal wires (red/black) to PS-1 input (refer to step 20). Use a 1" (2.5 cm) piece of heat shrink tubing at this solder joint for strength. Shrink tubing with soldering iron tip. Use caution to prevent melting of insulation on thin red/black wires.

(25) All electrical connections to regulator-charger are now complete. Check all solder joints and check for shorts. Reverse of board will be encapsulated after testing. Determine that all diodes have banded ends correctly installed. Check polarity of capacitor C-1. Be certain switch connections are correct.

TESTING AND ADJUSTMENT:

Refer to circuit diagram (Figure 7), assembly/wiring diagrams (Figures 8B/9B) and photographs to be certain construction is correct. The first test series are bench checks for regulator-charger.

(1) Use 100K ohms setting on multimeter. Connect test probe (+) to PS-1 (+) and test probe (−) to BP-4 (+). Read 22K ohms with SW-1 **off.** Read 470 ohms less, with SW-1 **on.** Activate SW-2 (**power boost on**), read zero.

(2) Use 10v scale on multimeter. Connect test probe (−) to ground and test probe (+) to **load** (+). Use 4.8v battery pack for simulating power from PS-1 to regulator-charger. Connect battery (+) to PS-1 (+) and battery (−) to ground. With SW-1 **on,** read battery voltage. With SW-1 **off,** read zero. Disconnect battery (+). With SW-1 **on**, read battery voltage stored in capacitor C-2. With SW-1 **off**, read zero.

(3) Use 10v scale on multimeter. Connect test probe (−) to ground and test probe (+) to **load** (+). Connect battery

AIRBORNE SOLAR BATTERY CHARGER PARTS AND MATERIALS

Designation	Number Required	Nomenclature	Source Code
SC	14	Photovoltaic Silicon Solar cell, 0.8" x 0.8" (2.0 x 2.0 cm), 0.45v, 90 to 100 ma. SOLAREX — see text.	B
Plex Face	4	Acrylic Safety Glazing (G) ANSI Z97.1-1966/72, .079U, 0.062" (0.158 cm) thick. Cut from sheet PLEXIGLAS.	E
LM317T	1	Three Terminal Adjustable Regulator, 1.5 Amp, TO-220 case.	A
LM3909N	1	Micropower LED Flasher	A
SW-1	1	Miniature Slide Switch (Double Pole Double Throw)	E
SW-2	1	Subminiature Microswitch HONEYWELL 311SM703-T	D
R-1	1	Trimming Potentiometer 3/8" (1.0 cm) Sq., 50 Ohm 1 Watt, BOURNE 3299W-1-500	C
D-1,2,3,4,5	5	Silicon Rectifier Diode 1N4001, 50 PIV, 1 Amp.	A
C-1	1	Capacitor, 100µF, 10V Radial Lead Electrolytic PANASONIC 100/10R	A
C-2	1	Capacitor, 1000µF, 10V Radial Lead Electrolytic PANASONIC 1000/10R	A
R-2	1	Resistor, Carbon Film 5% 470 Ohm, 1/2 Watt	A
LED	1	Light Emitting Diode	A
Board	1	Perforated Circuit Board 0.100" (0.3 cm) centers	A
Miscellaneous		Rosin core solder. 30 Watt soldering iron. Multimeter for testing. Cardboard. Insulated red/black AWG #24 stranded hook-up wire. G.E. silicon sealing compound. Mounting hardware. DEANS connectors. Wire wrap terminals. HOT STUFF and DEVCON 5 min. epoxy. Heat shrink tubing, 1/8" (0.3 cm). Shielded phono arm lead in wire. Battery pack BP-4, EVEREADY.	E

Source Code	Distributor
A	Digi-Key Corporation P.O. Box 677, Hiway 32 South Thief River Falls, MN 56701
B	Edmund Scientific Company 7082 Edscorp Building Barrington, N.J. 08007
C	Hamilton Electro-Sales, Inc. 10950 W. Washington Blvd. Culver City, CA 92030
D	Steven Engineering Company 967 Airport Blvd. S. San Francisco, CA 94080
E	Local hardware store, Hobby shop or Electronics supply house.

Note: Distributors have been selected for availability of high quality components. Other options are possible. Check phone book or for bargains in electronics magazines. In general, you get what you pay for. Items with brand names in CAPITALS are highly recommended.

pack to normal connection (Deans connector on twisted pair "B"). With SW-1 **on**, read 0.3 to 0.6v less than battery voltage. Activate SW-2 (**power boost on**), read battery voltage.

(4) Use Max. ma scale on multimeter. Connect test probe (−) to ground and test probe (+) to BP-4 (+). Simulate power to regulator-charger from PS-1 by battery (+) to PS-1 (+) and battery (−) to ground. Turn SW-1 **on**. Adjust trimming potentiometer R-1 to read 50 ma. Activate SW-2 (**power boost on**), read battery amperage. With SW-1 **off**, read 3.0 to 7.0 ma **trickle** charge. With **power boost on**, read battery amperage.

(5) Use 10v scale on multimeter. Same test probe and battery connections as previous step (4). With SW-1 **on**, read 1.0v less than battery voltage. With SW-1 **off**, same reading. With **power boost on**, read battery voltage.

Bench testing is now complete and regulator-charger will operate properly if test values noted have been obtained. Final adjustment of trimming potentiometer R-1 will be necessary with **load** and battery pack installed in aircraft. Before installing regulator-charger in aircraft, encapsulate board reverse with G.E. silicon sealing compound. Use a small amount of sealer to cover wiring, connections and secure off board leads. Keep sealer away from toggle on slide switch SW-1 and from ends of switch on board reverse. Avoid sealer at the bottom (board end) of actuator arm on microswitch SW-2. Mounting edge of perforated circuit board should also be free of sealer.

Determine mounting position of flashing LED indicator and route all shielded cables to this location. Connect flasher as indicated in Figure 8A. Secure flasher in aircraft with

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FIG. 18. Airborne Solar battery charger mounted in Midwest Hobie Hawk. Pretty lady is Patty James.

Completed gauges and components in various stages of construction.

Two gauges in use showing aileron differential.

CONTROL THROW GAUGE

One of the most useful gadgets that we have discovered in quite awhile is this gauge to measure control surface travel.

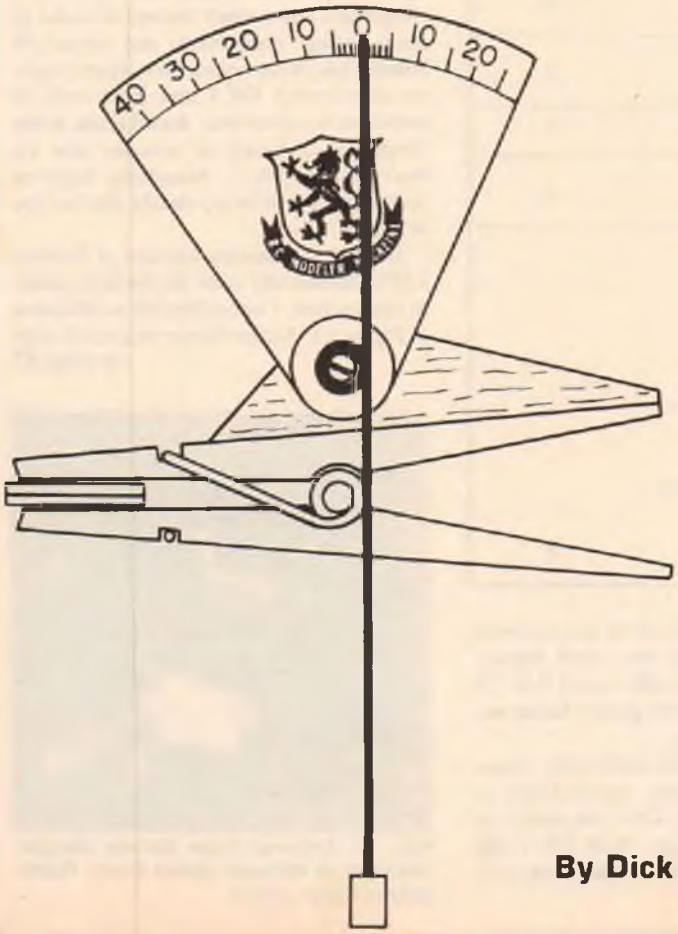
Its primary value is providing a reference reading to assist in adjusting the aileron and elevator travel to achieve the desired flight performance. Elevator sensitivity and aileron differential are only a couple of the many adjustments that may be checked with this handy gauge.

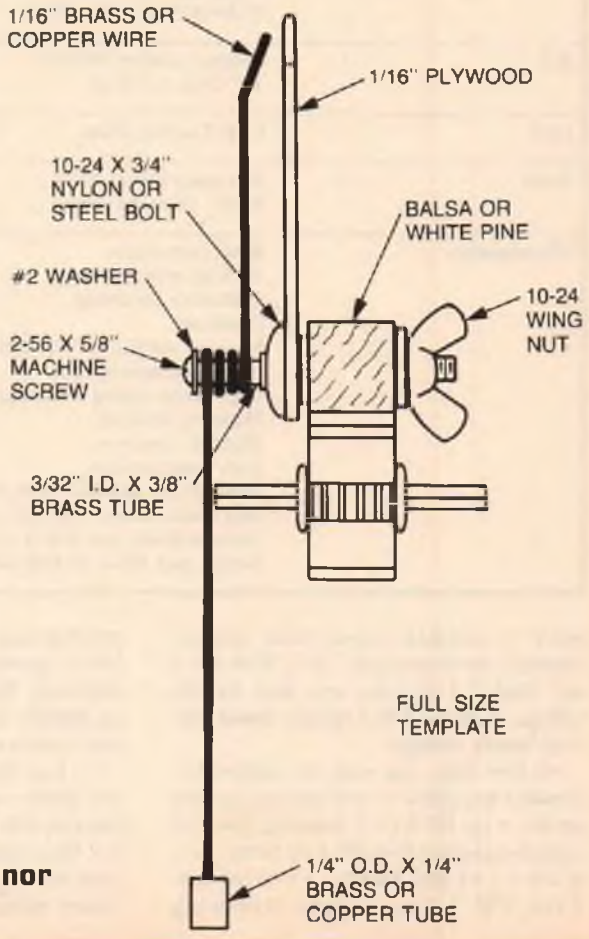
Using the gauge is almost effortless. Simply clip it onto the surface, rotate the dial to a zero degree reading, and note the indication while operating the radio. The model does not have to be in a level position nor does the gauge have to be attached at any particular location on the control surface.

Fabricating the gauge is quick and easy, we made up four in one evening from odds and ends in our shop and enjoyed every minute of the project. Also, the price is right.

A few construction hints might be helpful. Make Xerox copies of the dial face, cut it out oversize, glue it to 1/16" plywood, drill the 3/16" diameter hole, and then cut the outside to final size.

Disassemble the clothespin and trim the clamping end as shown. The clamping pads are 1/16" x 3/4" x 1½" plywood and are epoxied to the clothespin. The pivot block is also attached with epoxy.





FULL SIZE TEMPLATE

By Dick Tichenor

FULL SIZE TEMPLATE

We used a 10-24 x 3/4" nylon bolt and drilled and tapped a 2-56 hole for the pendulum pivot screw. We also used a 10-24 x 3/4" steel bolt with equal success but the nylon bolt was easier to work. If you can think of an easier or more convenient way, have at it. As long as it works, nothing is really sacred about how you do it.

We used 1/16" dia. brass wire for the pendulum and suggest that either brass or copper wire be used as it is easier than music wire to wind around a nail to make the pivot surface. The piece of 1/4" dia. tubing on the bottom of the wire was filled with solder to provide a pendulum weight. The wire must swing freely around the pivot.

It would be nice if we could say that we originated this gauge but we didn't. We modified a design by Roger Varvin that was presented in Modele Magazine, published in France, Philippe Loeillot, Editor. Incidentally, Mr. Loeillot presented the most spectacular coverage that we have ever seen on a modeling event in his report of the 1980 QSAA Las Vegas Fly-In.

We hope you will make up a few of these gauges; you will find them to be a very worthwhile addition to your field box. □

Gauge dial is calibrated in degrees.

WHATSERNAME

By R. Carol Sweeney

You know how it used to be when you brought someone home to meet your folks. There were the standard questions:

Does he drink? — No.

Does he smoke? — No.

Does he cuss? — No. (Frankly, I knew more words than he did.)

Well, what they didn't know to ask --- and, frankly, neither did I --- was, "Does he have any hobbies?" Actually, the question should really be: "Does he fly R/C?"

Given the fact that I didn't know to ask — and keeping in mind that we've survived 29 years of marriage — that suggests that:

(A) I'm a martyr.

(B) I'm a survivor.

(C) All of the above.

Therefore, I've decided to form a club. Membership is restricted to wives of RC'ers --- and I recognize that it might be viewed as sexist. Further, I've decided to call the club "Whatsernames."

Please note that the name was selected with careful deliberation. As you may have guessed, it stems from the many times Neil — my R/C husband — has referred to me as, "Whatsername." This usually occurs as he speaks to his R/C buddies over the phone or in person. Usually his references to me go like this:

"I'll tell Whatsername when the dinner will be."

"Whatsername won't be home — I'll meet you at the field."

"Whatsername's having the kids over. Can't make the fun fly."

But I'm getting ahead of my story — the reason that prompted me to form the Whatsername Club.

As I stated, in innocence I married a model plane affecionado. My first inkling of the ramifications of the symptoms occurred soon after we returned from our honeymoon. I entered the apartment after a full day at work and two hours of commuting and called to Neil. No answer.

I walked into the living room and found him on the floor. Spread out between him and his friend were plans for a plane. They were both oblivious to my presence. Finally Neil looked up, nodded to me (his bride of three weeks) and said, "Oh, Bob, this is Whatsername-Carol." that scene was to be repeated many times over a period of 29 years.

Flying took somewhat of a backseat for several years as he worked on becoming a ham radio operator. Then my name Whatsername became a household word around the world as he spoke of his XYL (that's ham talk for ex-young lady, grounds for divorce if I ever heard it), and called me Whatsername-Carol.

What I didn't realize that studying ham radio was really part of the master plan and that model planes were not a thing of the past, they were part of the future.

The awakening came the day I walked into the house (we were living in California by then) and came face to face with the biggest model plan I had ever seen. Neil sat on the floor with a sheepish grin on his face and said, "I've bought a glider," and then turned to his friend and made the inevitable introduction, "John, this is whatsername-Carol."

Gliders, bungees, servos, and wave length became the life blood of our existence. Our sons knew the language and smirked in utter male chauvenism when I

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"IN-SITU TECHNIQUE"

For Producing Fiberglass Components

By Dario Brisighella, Sr.

Over the years there have been scores of articles published on the various method of working with and producing fiberglass components for use in our hobby of model building. Some, of course, have been very technical or complex while others are more simple or basic. Still it amazes me to be asked many times a year by fellow modelers, just how to go about producing fiberglass components.

Most avid modelers have some of the basic knowledge required to produce fiberglass parts in the conventional method of: master or plug, female mold, and ultimately laminating or laying-up of the glass cloth with resins. Though this may well be the best time-proven method for producing any sort of fiberglass component with any sort of accuracy, it is too time consuming for many of the single or one-of components we may need for our models.

There are no doubts that components layed-up in a female mold, more often than not, produce the best finished products. Let's consider an engine cowl for an example. Basically it is the outer shape or dimensions that we are interested in obtaining. Working with a female type mold to produce an engine cowl insures these outer dimensions, providing the original plug is properly sized and shaped. The interior of the cowl, so far as smoothness is concerned, is of little or no importance in most cases. That is, until the need arises to have the interior size or shape correspond to the fuselage so it may fit over or slide onto the fuselage. It then becomes very important that both the interior and exterior dimensions be held to a close tolerance and this then becomes another "bag of worms," which sends most modelers back to the hobby shops in search of another kitted model rather than trying his/her hand at scratch building.

Lately, it seems that most every model subject I select to do requires the engine cowl to overlap the fuselage by several inches, if I want the cowl separation line to be in a scale-like location at the firewall of the full-sized subject. Nothing, I feel, can be more distractive on a model, than having a non-scale, additional panel line or seam running around an engine cowl, anywhere but where it belongs. Our engines, be it a small glow-engine or even a large chain-saw conversion engine, are nowhere near the scale length of any real aircraft engine and mount. So, it is a really rare occasion, on most models, to have our engines mounted on the scale-location firewall. Aside from being able to utilize some of the excess space forward of the scale-location firewall for radio equipment and fuel tank, etc., it is much easier and stronger to just extend the model's fuselage to a point more convenient, under the cowl to secure our engine. So, as not to add any additional seams in the engine-cowl, it is best to just have the cowl overlap this lengthened fuselage.

Now, **don't** turn to the next article or run for cover, as I hope to demonstrate just how simple and quickly the methods I use, produce all sorts of form-fitting fiberglass components, I aptly named it the "in-situ technique." In-situ is a very old term, meaning some form of work being done in place. The term itself describes the method or fits the technique like a glove (very small pun). To simply describe my technique is to say that basically it's a method whereby some sort of expendable material is affixed in place, then shaped as required and, over this expendable material, resin impregnated glass-cloth is laminated to produce a removable fiberglass component. A release agent is employed to prevent the resin from adhering to the subject, over which the fiberglass part(s) are being fabricated. There is no guesswork involved as to how well the component will fit upon completion, since being made directly in-place (in-situ), insures an exacting fit.

The expendable material, in this case, the mold over which the laminating is accomplished can be, for example; wood, paper, clay, wax, or most of the foam products like polystyrene (normally white and beaded) or polyurethane foam. Basically, there are two types of resins mainly associated with the R/C hobby industry. Most of the commercially produced R/C items today employ the epoxy type resin as it is a more stable product for the most part. The other resin, and one more generally available to the modeler, is polyester resin. Of the two resins, polyester, offers the lowest cost and the widest range of working latitudes as it applies to working temperatures and mixing ration with its catalyst, etc. The polyester-type resin is available in most hobby shops, packaged under many popular brand names. Most hobby dealers stock two types of this resin. One is labeled finishing resin, and the other is laminating resin. It is this laminating resin which is used for laying-up the fiberglass components. In a pinch, I have used the finishing type with complete success.

Before actually delving into the "How to . . . " of "in-situ fiberglass techniques . . . ," I would like to just touch a few bases on the materials themselves. First, as many of you know, polyester resins do not work well with polystyrene foam. This is the white, beaded foam material most often employed for foam wing cores. The polyester resin will attack and literally melt this foam away unless it is somehow protected from contact by the resin. I have used this beaded foam to make all sorts of fiberglass components over, but after shaping the foam, and to protect it from the resin attack, I protect all the exposed foam with a thin coating of 5-minute epoxy adhesive. Epoxy resins or adhesives have no effect on the polystyrene foam.

The other foam product I use is polyurethane. This is a light tan colored foam and has a sandy, gritty feel to it. This material is immune to attack by either polyester or epoxy resins. Though polyurethane foam is somewhat easier to shape and sand, it must be cut or chipped away for removal. Polystyrene foam, on the other hand, can be almost melted away with a small amount of dope thinner, acetone, etc.

Either type of foam boards or blocks are available at most local insulation distributors. Fall-offs, damaged or broken pieces, can be purchased very economically. On my last shopping trip, they were free for the taking, only to help clean up the warehouse. Modeling clay, or even common window putty, makes a very fine expendable material over which fiberglass components can be laminated. The side benefit here is that it is easy to remove after the required component is completed, plus being very easy to mold or shape. Stiff paper or card stock may also be used in conjunction with other expendables, as you will learn later on.

In working with any method of fiberglass lay-up, a most important item has to be the release agent. The resins employed in fiberglass work are, in themselves, a very fine adhesive, and it is this quality which most modelers find objective in creating fiberglass components! I, like many, have ruined my share of female type molds because the release agent failed. I have tried all sorts of products and have used at least 5 or 6 brands of wax trying to protect my molds with little, if any, success. That is, until I learned about P.V.A. (Polyvinyl Alcohol). For those not familar with P.V.A., about the best description I can render is the product is like liquid Saran Wrap. The liquid is either brushed or sprayed over whatever area is to be protected from contact by the resin. When it dries, the P.V.A. produces a very thin protective coating. P.V.A. dries reasonably fast and generally one or two coats are sufficient. The P.V.A. is water soluble and, therefore, is easy to clean up or remove. It

can be applied over the best of finishes without worry. Though not a hobby shop item, it can be purchased from chemical supply houses. The smallest quanity I know of is in gallon lots, which would last a lifetime, or you may choose to split it up between a few fellow modelers and share the cost.

Now let's get into the actual process itself, and follow the procedures used to produce an overlapping engine cowl for my Grande-scale "Starduster Too."

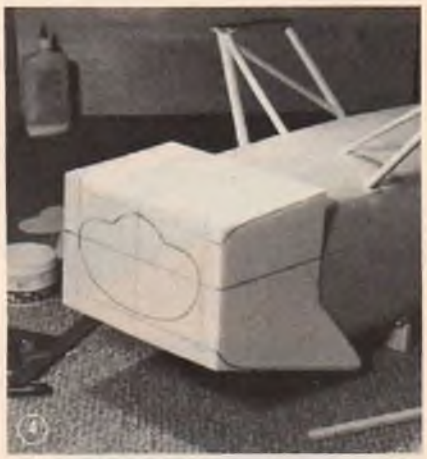
Photo 1: The fuselage is completed and sanded to its final contours. The working centerlines are well defined and that portion of the extended fuselage, onto which the finished fiberglass cowl will actually overlap (back almost to the cabane struts), is protected with strips of masking tape. The strips of masking tape are butted together, rather than overlapped, on installing. The masking tape used here became almost totally transparent due to its color match with the balsa wood, and does not show up too well in this photo.

Photo 2: Polyurethane foam blocks are tack cemented to the firewall. Working centerlines are extended onto the foam blocks with a felt tip pen.

Photo 3: Paper templates (part of the actual plans) are used to mark out the general outlines of the cowl.

Photos 4, 5, & 6: The foam blocks are worked and shaped toward the ultimate contours. The foam is easily sawn, cut with a sharp knife, or sanded to shape. The Stanley brand Sure-form Files work well also. If an area is undercut, dented, or nicked, etc., a bit of spackling compound can be applied to correct the condition.

Photo 7: As this cowl requires a returned lip at the front air intake opening, the foam block is carved to produce a recess, so as to



receive the laminating material. The final sanding of the foam is done with fine grit sandpaper to bring the foam flush with the masking tape which is protecting the wood fuselage. With the the sanding completed and all the particles of foam removed with a

vacuum cleaner, the masking tape is given two coats of P.V.A. No P.V.A. is applied to the foam.

Photos 8 & 9: The glass cloth is then resined into place. For this cowl, three layers of 1¼ ounce cloth will be applied. The number of overlapped joints is kept to a minimum. After the second layer of cloth was applied and cured, the entire cowl was rough sanded to reduce the bulge of the overlapped fabric and any other lumps and bumps which may have developed. In the actual application of the glass cloth, **avoid any excess use of resin.** The fabric need only be thoroughly wetted. Excess resin only adds weight, not strength. The strips of butted masking tape applied to the fuselage are now quite visible.

Photo 10: The laminating is completed and allowed to cure for an hour or so. It is then sanded again to a smooth finish. When sanding (wet sanding works best) the completed component, do not worry about

sanding through a layer of cloth. I do recommend that before removal, the entire component be given a coating of resin only to seal any fabric which may have been exposed by sanding. I have found that if any areas are left where the glass cloth has been exposed, in time, these areas will actually show right through the primer paint and finished paint job as well. The cowl is now ready for removal. To make removal of the polyurethane foam easy, I use a stiff piece of music wire with a small ninety degree hook bent onto one end. Used in an electric drill, the revolving wire hook digs out the foam with ease. Had this foam been of the polystyrene type, a bit of acetone would make its removal even quicker.

Photo 11: The completed cowl. To remove the cowl from over the masking tape on the fuselage, a thin section of a hack saw blade, **with the teeth ground off,** is slipped between the fiberglass and the masking tape to break the bond of the resin and the P.V.A. applied over the masking tape. The excess fiberglass is trimmed away after removal.

Photo 12: A few embellishments, panel lines, screws, rivets, etc., and some paint finish the project.

Now you may well ask how long did this

process take? Well, believe it or not, other than the embellishments and paint, this giant cowl was started and completed, from scratch, in one spare time evening . . . including the photo taking! It took a little over four hours in total time. One yard of glass cloth was used along with six ounces of polyester resin.

The cowl, as you can understand, is a perfect fit onto the fuselage. It has to be, of course, it was produced "in-situ." The thickness of the masking tape used to protect the wood fuselage was the same thickness as the ultimate covering and finish applied to it a few days later. If a thicker finish material was planned, then another layer or two of masking tape could have been applied before shaping the expendable foam block.

Removal of this foam core block was very easy on this particular cowl design because of its generous intake opening. But, bear in mind, that it does not take a very large aperture to insert the music wire hook to chew-up the foam into small particles. The interior of the fiberglass cowl is a bit rough on completion, but a bit of sanding on that portion, where the foam was, and a coat of paint hides all manner of sins . . .

This technique, with variations, can be used on all sorts of model items. The very large wing fillets (Photo 13) for my Quarter Scale PT-19A were produced "in-situ," over modeling clay and card stock on already finished surfaces. The P.V.A. release agent protected the finish from adhesion with the resin.

Photo 14: The complex stabilizer fairing made of fiberglass is from the same model and same method, only in this case, regular window putty was the expendable media over which the fiberglass was laminated.

Photo 15: Illustrates the cowl for the PT-19A. This cowl is the product of two techniques. The front nose bowl was layed-up in the more conventional manner of: wood plug, finished, female plaster mold, etc. A small recessed flange was left at the rear edge of the nose bowl, which later became homogenous with the "in-situ technique" that produced the very large rearward section of the cowl. This cowl is over 15" deep and it was made right over seven separate sections of foam fitted and shaped over a rather complex engine mount. This cowl also overlaps the basic fuselage by several inches.

Photo 16: Still another "in-situ" cowl. This one is from my Quarter size Stinson Voyager.

The nice part of having these cowls overlap the fuselage is that they are so very well supported, due to the closeness of fit, that only a small screw or two is needed to keep them in place. I have only shown here the rather large cowls that I have produced lately. This does not indicate nor mean that this method only works on big models. What it does indicate though is that I am totally dedicated to the larger birds.

Photos 17 & 18: Illustrates the fiberglass fairing made for my Starduster Too, to secure the windscreen. The expendable materials for the mold are a section of thin aluminum sheet only taped in place right on the fuselage and a piece of styrene sheet taped onto the aluminum at the proper angle. Again, P.V.A. is the release agent used to allow easy removal. A bit of trimming, some sanding, and paint complete the project. This neat little fairing

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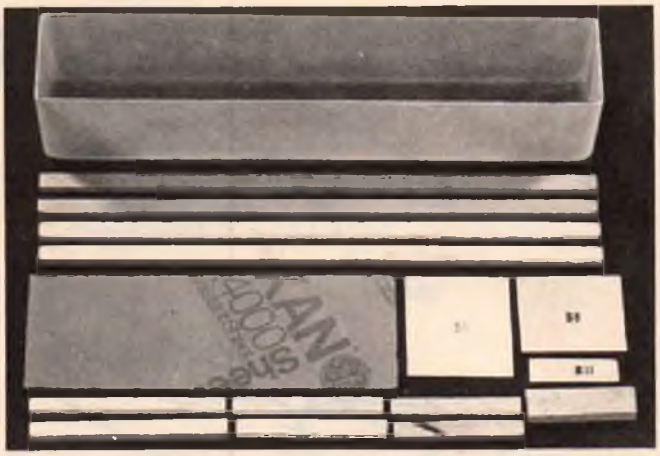
RCM PRODUCT REVIEW

Prather Products TUNNEL HULL



SPECIFICATIONS

Name	PRATHER 29" TUNNEL HULL
Boat Type	Sport & Competition
Manufactured By	Prather Products 1660 Ravenna Ave. Wilmington, California, 90744
Mfg. Suggested Retail Price	$129.95
Available From	Both Mfg. and Retail Outlets
Hull Length	29 Inches
Beam	13½ Inches
Mfg. Rec. Engine Range	21 c.i., 3.5cc Outboard
Recommended Fuel Tank Size	8 Oz.
Recommended No. of Channels	2
Rec. Control Functions	Rud., Throt.
Basic Materials Used In Construction:	
Hull	Fiberglass and Ply
Building Instructions on Plan Sheets	NA
Instruction Manual	Yes (19 pages)
Construction Photos	Yes

RCM PROTOTYPE

Radio Used	Airtronics XL Model 9121
Engine Make & Displacement	K & B 3.5 Outboard
Tank Size Used	8 Ounces
Weight, Ready to Float	98 Oz.

SUMMARY

WE LIKED THE:

Excellent glass work, installed transom plate and turn fin plate, very complete construction manual and photos, ease of handling, competitive performance.

WE DIDN'T LIKE THE:

Nothing here not to like. Just don't try to run it fast without the dummy pilot secured in the cockpit.

The latest boat kit from Prather Products, 1660 Ravena Ave., Wilmington, California 90744, is the Prather 29" Tunnel Hull designed for the K & B 3.5 outboard engine. The Tunnel Hull is a continuation of Prather's reputation for superb quality and high performance R/C boat kits.

The Tunnel Hull was designed by George Campbell, probably the world's most experienced model tunnel hull designer, and utilizes the latest state of the art concepts.

Opening the box and reviewing the contents will probably cause you do to a double-take as you search for more parts. There are not many pieces because most of the assembly work has already been accomplished for you. Upon examining the hull you will quickly discover that the quality of Prather's glass work is second to none.

The kit box measures 33" x 15" x 7"; this information is of particular interest to anyone ordering from outside the U.S.A.

Construction:

In constructing this boat we went strictly by the book, and can find nothing to add that would help in the building of this project. Prather's instruction books have established new high standards for the boat business. Incidentally, for this product review, 3 boats were built simultaneously.

Finishing:

Like all fiberglass (epoxy with no gel coat), there were pin holes to be filled. K & B Super Poxy was sprayed on and sanded, then the entire boat was painted and trimmed with Super Poxy paints.

Engine:

The K & B 2.5cc (.21) engines were used for good reasons: they are high performance little dudes and are the only ones available.

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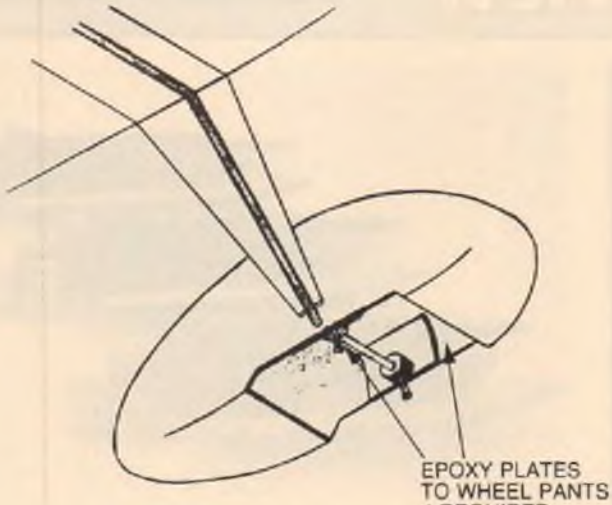
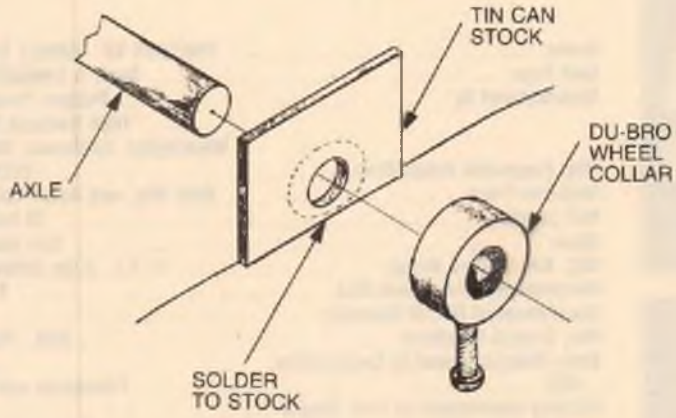
FOR WHAT IT'S WORTH





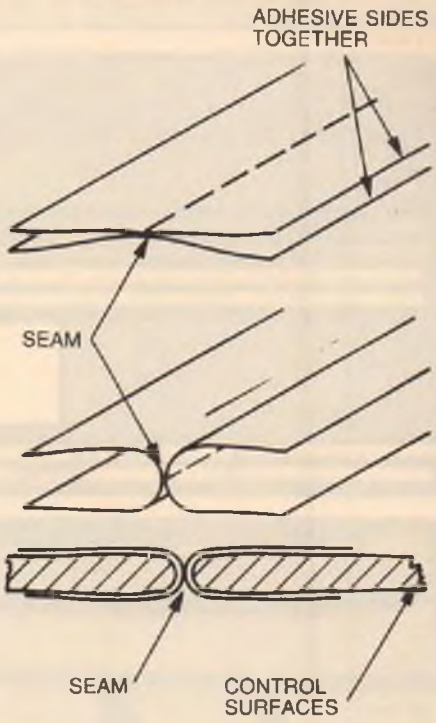
John Bodde of Jackson, Michigan, has come up with a quick reliable way to mount fiberglass wheel pants. Silver solder Du-Bro wheel collars to plates, cut from tin can stock, then epoxy the plates to each side of the wheel pant (a layer of glass cloth makes this much stronger). Be sure the set screw is pointing toward the bottom of the pants. File a flat on the bottom surface of the axle. Now slide pant and wheel on the axle and tighten set screws for a solidly mounted, yet quickly removable, wheel pant.

A covering color problem was solved by Alfred Trapanese of Eatontown, New Jersey, who submitted the following. While constructing a Fokker D VII Al found he needed a particular shade of covering material that was not commercially available. He solved the problem by obtaining some Super Coverite and soaking it in Rit fabric dye until the proper shade (green in this case) was established. The Super Coverite was then dried and ironed on. No adverse effects were noted.

Here is a detailing trick for scale enthusiasts from Ray Moyer, of Levittown, Pennsylvania. In scaling a 2" = 1' J-3 Piper Cub. Ray wanted to upholster the seats as near to "real" as possible. His wife suggested he use the vinyl (black leather look and feel) from one of her discarded pocket books. From the years of use, the vinyl had a very rich and weathered look and feel.

It was easy to work with and, with the aid of Titebond glue, you can cut and tuck corners and round edges to near perfection. Ray used straight pins to give the button and tufted look, and then painted the pin heads with black. He covered 1/8" balsa with 1/2" foam (used to wrap his batteries and radio) glued with Titebond glue and cut the outline of the seats needed. Pull your fabric just a little to the seat form and you get plush and full looking cushions.

Our first For What It's Worth submittal for iron-on fabric hinges was received from Edward Dziombak of Iselin, New Jersey.



This method uses any of the iron-on fabric covering materials that are coated with a heat sensitive adhesive.

Cut two strips of the fabric 1½" to 2" wide (depending on the size of the model), position evenly with the adhesive sides together, and sew a seam lengthwise along the center with a sewing machine.

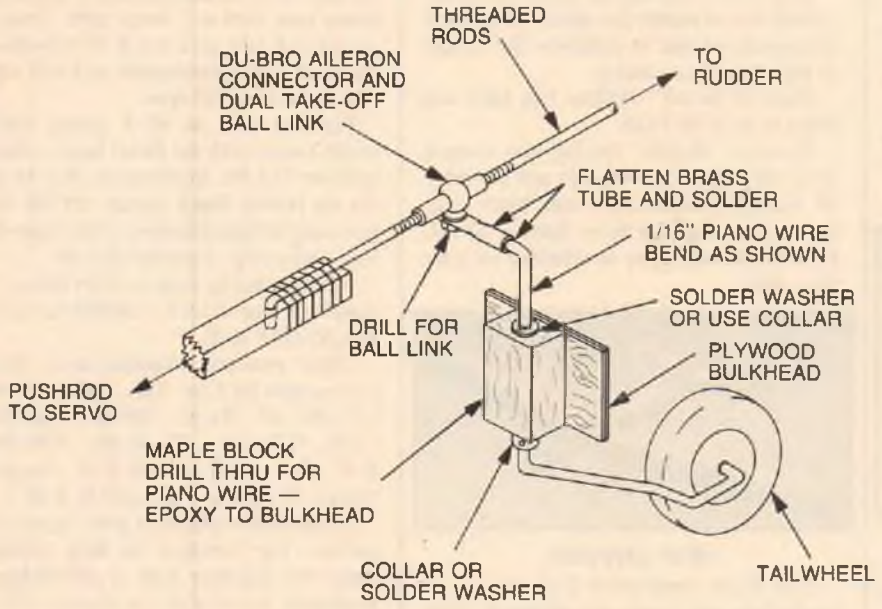
Carefully position the hinge material on the parts to be joined, as shown in the drawing, and then iron on securely. This method not only gives a strong, serviceable hinge, but makes the control more effective by sealing the gap between the surfaces.

Karl Bluemberg of Elmont, New York, describes his solution to a tailwheel problem in the following:

Karl recently designed and constructed a 44" wingspan P-51B Mustang. One of the problems he encountered and resolved was control of the steerable tailwheel. As you know, the P-51B tailwheel is located quite a bit forward of the rudder hinge line.

Karl was concerned about introducing any excess play in the linkage between the servo and the rudder. This, of course, meant that the pushrod could not have any breaks between those two points. This was accomplished as shown in the sketch. Use of the Du-Bro aileron dual take-off ball link allowed a direct connection between the servo and the rudder, while also providing a

FOR WHAT IT'S WORTH

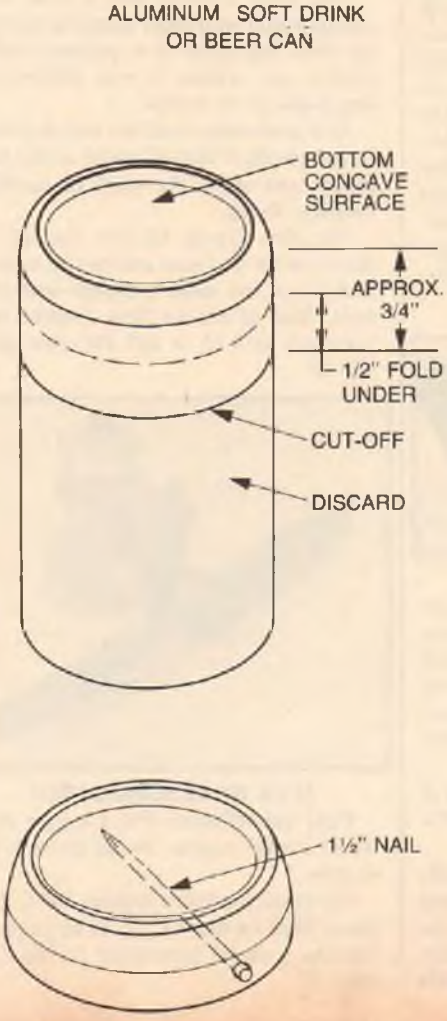


low friction connection to the tailwheel steering arm.

To improve ground handling, the steering arm of the tailwheel should be as long as possible. This reduces the angular motion of the wheel. The small size of Karl's plane dictated that he mount the tailwheel shaft axis off the centerline of the fuselage to provide a longer control arm. To compensate for the off-center condition, the wire to the wheel was bent where it left the fuselage, so that the wheel itself was aligned with centerline. The off-center shaft is not noticeable except under close inspection and does not detract from the plane's appearance.

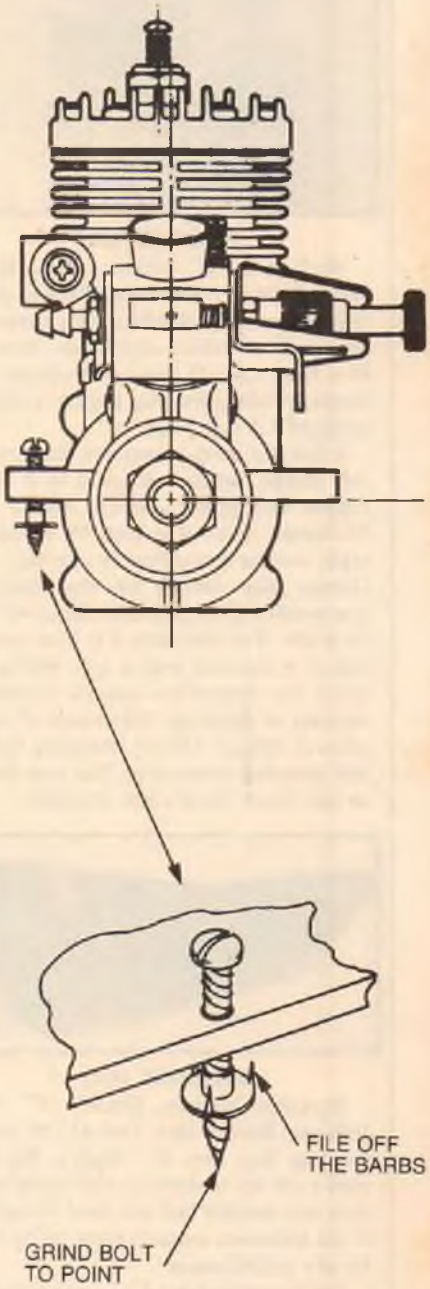
An idea for filler material is shared with us by Richard Jackson of Charleston Hgts., South Carolina. While "micro-balloons" are popular for filling, Dick does not like them; he feels they add no strength. Instead, he uses "Durham's Water Putty" of wood color and non-shrink, and he mixes it with Hobbypoxy I, II, III, white glue, Titebond, other epoxies, glass, and the old stand-by Ambroid. It doesn't hurt the glue but sure fills cracks, dings, and holes. After applying, smooth to shape with a finger wet with water or polysol depending on the glue base. Also water putty mixed with water is good. Price — .84¢ for a 16 oz. can in the hardware store that lasts quite awhile.

Another use for aluminum soft drink or beer cans comes from D.P. Tiffany Indialantic, Florida. He calls it his epoxy mixing bowl and equips it with a small nail to be used as a stirring rod. It is quick and easy to make and is disposable so, make up a bunch, after emptying the cans of course.



A method of locating engine mounting holes has been devised by Bob Dopita of Plainsville, Kansas.

Bob files the barbs off 2-56 blind nuts, grinds a point on 2-56 screws and assembles the screws and nuts in each engine mounting hole as shown. A light tap on each screw will then mark the hole centers accurately for drilling. Try it, it is a good way to do it.



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.

PRATHER 29" TUNNEL HULL

from page 79

. . . . . The engine was mounted on Prather's adjustable outboard engine mount for fine thrust line trim. This option costs $24.95.

Radio:

Another extra cost option is the radio box that is also well worth the money. It is epoxy-glass and is designed specifically for this boat. The radio box kit lists for $19.95. Into this we installed the Airtronics XL series, Model 9121, 2 channel radio. The servo reversing switch feature in the transmitter makes control installation a pleasure.

Running:

Now we get to the best part. If you followed the instructions you will come as close to running "straight from the shop" as possible. We used a J.G. E-20T prop for maximum performance. We also opted for another additional cost item, the #8270 boat stand kit. Made of birch plywood, it has a hinged safety cover for the prop and is NAMBA legal. The stand kit lists for $19.95.

Conclusion:

The cost of this boat and all of its options may seem a little expensive but, as they say, "you get what you pay for." Whether it be all out competition or run for fun, this smooth running, easy to handle and very fast boat should be just what you've been searching for. Beginner or expert — it will be hard to beat. □

IN-SITU TECHNIQUE

from page 78/76

takes less time to produce than it does to describe. You will have to admit that it adds that touch of class to the model, aside from being very functional in holding the windscreen in place. The screws are decorative only.

I may also inform you that the cowl demonstrated here in this rather lengthy article, later became the actual master plug to produce the production molds for T & D Fiberglass who now offer this cowl along with many other components in their fine line of fiberglass products.

The "in-situ technique" not only works for our models. I used this same technique to produce a goodly number of fiberglass components on the full-sized Starduster Too, that I constructed several years ago.

I can think of all sorts of fiberglass parts such as framing over a clear canopy, hatch covers, gear-leg fairings, nacelles, wheel doors and covers, antenna fairings, hinge covers, and on and on. The list is only limited by one's imagination. These are only ideas for our models. These can be carried further into full-sized aircraft. How many more items might there be for boats, cars, and all sorts of prototype work in general?

In describing/demonstrating my "in-situ technique" for fiberglass, it is my hope that the next time you ponder a new model subject, the thought of having to produce an item or two in fiberglass no longer will be viewed as: too troublesome or difficult.

I close with a word of caution: When working with the materials described here, **please** read, heed, and follow **all** the manufacturer's instructions and recommendations. □

WHATSERNAME

from page 75

asked for interpretations. That was not the worst of it, though. That occurred when their friends came over and introduced me as "Whatsername-my mom."

Despite living the world of model planes, life became quite stable — if that is ever an appropriate descriptor for marriage to an R/C modeler. However, the stability disappeared when Neil came home with a new revelation — powered R/C.

As I reflect on that day, he said "powered R/C" with such calm and tranquility that little did I know what this conversion would unleash.

The first transformation began with the car — it no longer fit in the garage. Instead the garage became a shop and a hangar. Now, make no mistake, I had already adjusted to the fact that two car garages were meant to house one car and shop equipment, i.e., work bench, tools, grinder, etc. Etc. always took up half the space. However, with the advent of powered R/C planes, it became a no-car garage — space for models only.

The second transformation was the frenzied activity that emanated out of the garage. Heretofore, time was taken somewhat with building models, but the process seemed rather relaxed. With the introduction of power, I'm sure that I had the same experience that the wives (if there were any) of the Wright Brothers must have experienced every time they experimented with a new plane. Neil worked, Neil labored, and I prayed. My prayers fluctuated between fear of burning down the garage to fear that he'd hurt himself.

In addition, the man I married who knew no cuss words had developed the expertise to turn the air blue with innovativeness.

Our phone bill skyrocketed. Phone calls were made and phone calls were received. His friends came over and counseled, caucaused and cussed.

Finally, the momentous day. It was beautiful — an R/C flyer's dream — no wind. The plane flew beautifully.

After the flight, there was a celebration. They crowded into the garage to toast the plane. I brought in beers and cokes and was formally introduced, "This is my wife, Whatsername-Carol."

And finally, Transformation #3. Years passed and Neil's expertise progressed. The planes became larger, more sophisticated, and faster. Finally the 'piece de resistance' --- a Gere Sport --- the most beautiful model I had ever seen.

Sitting in the cockpit was a model of a man who raised his right arm in salute. My mother-in-law created a uniform — he looked like a dashing aviator of the 30's in his blue and yellow biplane. Surely a magnificent sight to behold.

Our sons got caught up with the excitement and, for Neil's birthday, bought him a lightweight movie camera to mount on the plane. Coupled with the adapted marine four horsepower outboard motor, our spectacular blue and yellow biplane was ready to assault the sky.

The day was made to order. Neil's brother flew in from Fresno to take pictures of the event. The timing was perfect and, yet, too good to be true.

I can still remember that evening as I walked into the house. There was an uneasy silence.

"Hi," I said, "how did it go?"

"It crashed," he said. "Pilot error," he explained.

I could hear the pain.

I responded, "It must hurt."

He nodded.

Days later one of his friends came over to commiserate and see the film. At least we had a lasting memory. The camera, although smashed beyond repair and recognition, had produced an outstanding film of the Gere Sport doing what it was designed to do, and what Neil guided it to do, four minutes of breathtaking aerobatics, including the first flight where Neil executed a perfect three point landing. "It bounced three times," he said. At least he retained his sense of humor.

As the men entered the house, they nodded to me. Neil nodded in my direction and said, "This is Whatsername-Carol."

Only this time, instead of feeling indignant, or angry, or neglected, I felt differently. I still can't say why. I don't think I'm really sure.

It's not that things have changed. Neil

still spends endless hours in the garage. When I speak to him when he's working on his plane, he still mumbles at me. And he still introduces me as Whatsername.

Only now it's okay. Perhaps I'm the one who has made the breakthrough. Perhaps I'm the one who's entering the new frontier. Perhaps I'm finally beginning to understand the committment, the pride, the hard work, and, yes, the pain, that goes into being a power RC'er. And with that understanding comes respect and compassion.

So, Neil, you can continue to call me Whatsername. It's a name I'll bear with pride.

And that's what prompted my starting the Whatsername Club. Perhaps it will never have a charter, or by-laws, or dues. And probably the members will never meet or know each other. Yet each member will share a common bond: enthusiasm, dedication, and pride in the world of R/C. □

AIRBORNE SOLAR BATTERY CHARGER

from page 73/64

epoxy. Use Silicone sealing compound to secure shielded cables. Be certain shields do not contact each other outboard from flasher.

Charging jack and switch are connected between regulator-charger and load. Instead of charging into this system, the jack is used as charging source. Battery pack should be disconnected during external charging. Use **power boost on** and **jack switch off** (to load).

The following test sequence is used with airborne solar battery charger installed in aircraft. System testing should be done on a bright, sunny day between 10:00 a.m. and 3:00 p.m. in order to assure steady state conditions.

(1) Connect both wing arrays. Observe flashing LED indicator at about 3 Hz. If wing connection is not correct, LED will not flash. Unplug battery pack BP-4 at twisted pair "B" Deans Connector. Unplug all but 1 servo from receiver. Turn SW-1 **on**. Turn transmitter **on** and activate stick. Observe single servo response with power from PS-1 only.

(2) Install temporary jumper between twisted pair "B" terminals to simulate dead or shorted battery pack. Repeat test step (1) above and observe single servo response with simulated dead battery. Activate SW-2 (**power boost on**), observe zero servo response. Remove jumper at twisted pair "B" terminals. With **power boost on,** observe faster servo response than with **power boost off.** This test shows that limited flight is possible with dead battery in circuit. Extreme movement of servos is not possible, but some control is better than no control at all. Without batteries installed, single servo system flight is possible and **power boost** is available at extremes of control surface movement.

(3) Connect additional servos and 450 mah battery pack to system. Turn transmitter **on** and activate stick. Observe fully functional servos with **power boost on** or **off.** Connect multimeter in series with BP-4 positive (+) lead, read about 35 to 45 ma charging current to BP-4 with **power boost on** and SW-1 **on** or **off.**

(4) Connect 110 mah or 225 mah battery pack in place of 450 mah unit. Adjust trimming potentiometer R-1 to provide required charging current. Do not exceed manufacturer's recommendation for charging rate. If batteries heat up, reduce power output by adjusting R-1 to lower setting. A high charge rate in **power boost on** configuration is acceptable under airborne conditions because batteries are being continually discharged by **load.**

(5) Connect trigger line of stranded Dacron or equivalent material, between microswitch actuator arm and one servo linkage. Install half a paper clip with screw, washers and locknut to hole in heatsink on regulator LM317. Adjust trigger line tension and routing by moving paper clip. Microswitch should trip at about 50% movement of control surface in one (or both) directions. Final adjustment is made by flight testing to determine correct proportioning of **power boost on/off** for maximum flight time. Tighten screw to lock trigger line adjustment.

(6) Ground test entire system before flight testing to be certain everything works properly. Use a 110 mah battery pack during flight testing since minor adjustments can be realized sooner than with larger battery packs. Adjust trigger line for longest possible controlled flight time. Adjust trimming potentiometer R-1 to correct charging rate for battery pack in use. Some experimentation is necessary to fine-tune the system. Once tuned, no further adjustments are necessary. Charging of transmitter batteries or "jump charging" to other aircraft is possible without readjustment since in **power boost on,** both tension adjustment and R-1 are bypassed. Use of a timer is recommended under external charging conditions, as described, to prevent overcharging.

(7) For **trickle** charging, be certain **power boost** is in **off** position and SW-1 is also **off.** Position aircraft near a sunny window (much like a houseplant) to retain fully charged batteries.

Acknowledgements

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SCORPION IV

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If you find the front landing gear causing the plane to stand too tall up front, put the main gear in a vise and bend it in a little. The stance is wide enough anyhow and it gives you more prop clearance above the grass.

Engine:

We really appreciated the method of constructing the engine cowl. It was simply done with three pieces of balsa, two were ready sanded to shape. The compartment was more than large enough for our K & B .40. Removal is easy, the engine doesn't have to be compressed as in some planes; we used a Kraft engine mount as recommended.

A Sullivan 8 oz. slant tank was used, but checking the dimensions of the tank compartment lead us to discover a 10 oz. or 12 oz. tank will fit with room to spare.

Radio:

The RCM prototype contained a Kraft radio with KPS 12 servos. The receiver and battery were placed alongside each other forward of the wheels and the three fuselage servos aft of the wheel line. The plane is designed so the aileron servo is located just above the wheel line where there is more than enough room.

Flying:

We were quite impressed by the in-air handling qualities of Scorpion IV. We tried all of our limited number of maneuvers and she performed them quite flawlessly. The biggest surprise was how well she handled at low speed, no tendency at all to tip stall, she just seemed to float down to the field to a

perfect landing. We tried a series of low speed passes across the field, not on purpose but accidentally because of a heat expanded throttle pushrod. The Scorpion IV was throttled down as far as we could go and all she would do was to slowly fly the full length of the field. we would apply throttle and go around again trying to get lower. It took three times around the field to get low enough to get the wheels onto the grassy landing strip. After a minor adjustment to the throttle linkage we had no trouble greasing her in for a perfect landing.

Conclusion:

It indicates on the box label that the plane is for beginner builders and flyers. It is not appropriate for the rank beginner but fits perfectly as an aileron trainer for one who is taking that next upward step from, say, a 3 channel high wing trainer. The Scorpion IV also is high wing which keeps the Center of Gravity low and makes flying easier, but you should have both a little building and flying experience before trying this fine plane.

It is a fine plane, one you will enjoy building and flying and it **is strong.** □

CHALLENGER

from page 61/56

the front contour touches the lower capstrip properly. At the same time I use a cyanoacrylate glue to hold everything in place as I go along. Cut and glue the center section ribs (W-1A) to clear the 1/16" birch ply dihedral braces (WB-1). Glue the right side dihedral brace in place while the right wing panel is pinned to the bench.

Cut the outer (W-1A) for the dihedral brace to slip into the tip panel. Glue the 1/8" shear webs in place, gluing only the bottom and ends at this time. The upper 1/8" x 1/4" spruce spars are now glued in place, the pins are removed from the trailing edge and the top trailing edge is installed.

The 1/16" leading edge sheeting is next. Bevel the front edge slightly so it makes a good fit with the leading edge. Cut the front wing sheeting so there is about 1/16" of the top spar exposed; this helps to hold the front edge of the top capstrips. At this point, only sheet the center panel which is pinned flat on the board. Now, remove all pins holding down the outboard panel and raise the panel 2½" measured under the last rib (W-7). Glue the outer polyhedral braces and complete the wing sheeting on the right panel. After glue has set, remove the right panel from the building board. The left wing is built in the same manner except that no sheeting or capstripping is to be installed on the top until after the two halves are joined at the center with a 2½" dihedral measured at the polyhedral break (see detail on plans). After completing the joining of the two wing halves, the 1/16" ply plate can be installed. Trial fit the wing onto the fuselage, then glue the fuselage wing mount (F-8) into the fuselage. Drill and tap for a 1/4-20 nylon bolt. Use a 1" long nylon bolt to hold the wing in place.

The wing fairing blocks are now rough cut and shaped then glued on the wing while it is attached. Finish contouring the blocks to fair into F-2A and the fuselage at the trailing edge of the wing.

The wing tip blocks are installed and the entire wing assembly is sanded smooth. Pay extra attention to the area where the capstrips meet the leading edge sheeting. These must be flush and smooth or they will show up after covering. One final note: When covering the wing, be sure to put in 1/8" washout at each tip on the outer panels.

Finish And Covering:

After installing the radio gear and checking all controls to see that they work freely, remove the servos and battery pack leaving only the Nyrods® in place. Carefully sand the entire airframe with 320 sandpaper. The several prototypes were primed on the fuselage only with three coats of automotive primer with lots of sanding between coats, using 400 grade paper.

Use your favorite paint for the fuselage and fin and one of the plastic films for the wing, rudder and flying stab.

The towhook can be installed at this time. The placement should be 1/8" ahead of the C.G. The hook used on the prototype was purchased at a local hardware store for a nominal cost. It is a regular "L" hook used for various things in the household. Drill a small hole in the 3/8" square spruce and screw the hook in. It's a good idea to put a few drops of cyanoacrylate glue on the hook to keep it from working loose.

Flying:

In setting up your control surface throws, they can be set for maximum throw. Make sure that the stab does not reach the end of the slot in the fin and cause your servo to stall. Start with a middle hole on your servo output wheel or arm and set up the throw to give you the full movement at the stab without touching the ends of the slot. The rudder can have the full throw of about 30 degrees each way.

After carefully checking your complete installation to see that all control surfaces are moving in the right direction, and are free from any binding, go through a range check with your radio.

Check the C.G. adding ballast as necessary. If you are using mini-servos, it may be necessary to add a little weight. The Challenger was designed to accept even the larger type standard servos.

Test glide your Challenger from a slight rise, if possible. This will give you a little altitude so you can observe the flight characteristics of your new creation. Do the necessary trimming and adjusting of the control surfaces to obtain a straight and gentle glide.

Now comes the time for the high start or a trip to your favorite hill. Your first launch

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CHALLENGER

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will certainly be a great thrill as will the many to follow.

Carefully watch your first flight and do your final trim adjustments. Add nose ballast as required. I hope you have as much enjoyment from your Challenger as we have — happy landings. □

PIT STOP

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that to be Top Qualifier you were going to have to beat Bill Jianas or Hank Smith. It could be done. Rick Davis, Chuck Phelps, Arturo Carbonell, Curtis Husting and Dana Smeltzer had the potential, but everything would have to be right. Jianas turned 20-0 laps and Hank Smith matched it with 20-0 laps! The racing couldn't have been closer — or could it? The only thing I didn't like about the race was the starts. It was a rolling start which was impossible to figure out. It looked more like as soon as the first car punched full throttle, the green flag was raised. Hardly fair. Hopefully next year they'll use the ROAR starts.

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Into the 2nd day of qualifying I was able to increase my time every time out and had taken over 1st place after the 6th round with 18-13, placing Roger Curtis 2nd with 17-63, Gary Kyes 3rd at 17-61 and Mike Reedy 4th with 17-39. It was surprising how well these cars ran and I'm sure if we had Can Am bodies, the Super Stock cars would have been able to qualify for the Open "B" Main. But I must admit the G.T. coupe bodies do look more racy on the track. There were 147 total entries with 40 for Super Stock.

There were a lot of surprises in the Open Class, but the most incredible was the performance of 13 year old Ralph Burch, Jr. — or Ralphie, from Texas. You'll remember I told you Ralphie's 4th ever 1/8 race was at the Miami 24 hour race, where his team was in 2nd place the 1st 2 hours, with Ralphie's driving help. Well, this was now his first race, with a brand new kit car that he had never before driven. Bill Jianas had spent the previous night helping Ralphie's father Ralph Burch, set up the car. Adjusting linkages, setting tweak, etc. I'm still amazed at Ralphie's driving ability and racing knowledge. He just simply doesn't make any mistakes, which is why he was able to qualify for the "A" Main Event. And he can only get better!

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Another surprise was the AMPS cars were getting slower and slower with every qualifying heat. Their first heat was their best. As the traction came up their times were getting worse and worse. Whereas everyone else's times normally get better and better.

And Arturo Carbonell just didn't look like the Art the we're all used to. Normally Art and Jianas put on the best racing, but this time it was Jianas and Smith. Art never really quite had that extra something that he normally has. He qualified third, which is great, but it wasn't Art.

Well, a couple more rounds of qualifying went by and they were all heart stoppers. Jianas now had two 20-0 qualifiers — but so did Smith! Did I say the qualifying couldn't be closer? Wow! The Associated Team were all running K & B's or K & B McCoys built by Rich Lee, which were all super fast. The Delta Team was relying on Picco motors, which were almost as fast. But they had a reliability problem. Hank Smith said he had to change his rod after every 5 minute qualifying heat. I said, "What are you going to do about the Main?" and he said he was going to run an OPS, because it was more reliable. I was running a prototype of K & B's new 21, which should be released now, and which was as fast or faster than anything in my class. And it ran all week long. That's what you want.

Going into the final qualifying round, I still had top time, so I wasn't going to run, if I didn't have to. I was in the last heat, and Roger, Kyes and Reedy were in the heat before, so I'd just see where they finished to see whether or not I'd run my last heat. I was watching their heat, with Kyes leading Roger in 2nd. Just then Jianas came over and needed some safety wire for his header pipe. By the time I found the wire, the heat had finished and my heat had started. Kyes had turned 18-19, taking over 1st place, with my time of 18-13 2nd, Roger in 3rd at 17-63 and Reedy 4th at 17-39. But we were all in the "A" Main tomorrow.

Chuck Phelps was in one of the middle rounds and definitely had the capabilities to beat Jianas or Smith, but there wasn't quite enough traction to use all the power he had. So he had to settle for 5th spot.

Down to the final qualifying heat or what we referred to as the 7th running of the "A" Main. The cars were brought to the pre grid, fueled, driven or raced to the starting line, it didn't seem to matter which, and somewhere in that confusion the flag was raised. Curtis got off in the lead with Dana close behind, but at the end of the straight Dana hit Curtis, sending Curtis into the dust. This let Hank, with Jianas on his bumper, past. Now Hank had to do two

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things to become Top Qualifier. He had to beat Jianas and 20-0 laps. If Hank didn't do both, Jianas would be Top Qualifier because Jianas already had the better back up time. They both knew what they had to do and they were really trying to do it.

Hank certainly has improved as a driver in the last year, because he was looking as good as Art. Hank had the lead with Jianas not 2 feet behind. It was like this for 3 minutes. Both cars within 2 feet of each other, but neither car touching each other. Then Jianas found the opening he was looking for and took the lead. But 2 laps later Hank took the lead back. With 2 laps to go, Jianas got the lead back and 10 feet to spare. It looked like his race. Then, just as he was about to start the sweeper, the AMPS car and Tassilio were engaged in their own private race right in front of Jianas. They were on the inside, so Jianas decided to pass on the outside. Just as he went to pass, Tassilio and the AMPS car collided, sending the AMPS car into Jianas. Hank went by on the inside to take the lead, with Jianas finishing 2nd. But Hank's time wasn't quite fast enough to beat Bill. If the race would have been about 1 more minute it probably would have had a different finish.

Rick Davis had gotten a bad start and had to start from the back, but he was actually the fastest car on the track and was closing on the leaders. Rick was definitely ready for the Main tomorrow.

After qualifying was over the track was opened for practice. Roger and I practiced together for comparison. Trying different wings and tires and we were both running quite a bit faster. Art was also practicing, but it didn't look like he had found what he was looking for yet. An absolutely incredible thing about this track was that I was able to run the same set of front molded tires **all week**. I finally tried a different compound Saturday night.

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Sunday — Main Event day. **Rain**! I guess it finally had to happen! The Florida club decided to determine finish positions by taking each racers best 3 times, and combining them to make the equivalent of a 60 lap Main. After announcing this decision, with Jianas winning Open and Hank Smith 2nd, and myself winning Super Stock, a loud protest was heard from those racers who only got in one good heat. All that time I thought it was thunder accompanying the rain, but it was actully protesting! I guess it was loud enough that the club had second thoughts and decided to revert to custom and decided the Main Event on single best qualifying. I think the 3 heat total would have been okay, if it had been announced prior to qualifying, so everyone would have been aware of the procedure. As it wasn't announced ahead of time, the single heat method must be used. Everybody naturally wanted to run the Mains, but everybody had 7 shots to do their thing, and everyone there certainly knew after 7 heats who was who.

Rain not withstanding, you still put on a fantastic race, members of the Central Florida R/C Auto Racers and when it comes to banquets, you're in a class by yourselves. How about a Hawaiian Luau complete with hula dancers? Incidentally, I've got some beautiful blackmail pictures of Tony Stephenson, from England, learning to do the hula with the native dancers! Tony really put his heart, or something else, into his dancing. Lookin' good, Tony! As was Pete Fusco and Gary Kyes. I don't know how they can get all that stuff moving in so many different directions at the same time. Amazing! And then Ray Hepner and Kim Davis presented some of the most beautiful trophies you'll ever hope to win. See you guys next year. □

SOARING

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more of us than there are hot rocks. We're the guys that pay the freight. I wouldn't mind trying Skip's format in some of our club contests. We might find that we want to improve our speed capability — I might just put my Paragon wing on backwards — and GO!

*
**

Got another letter on the interest in, and cost of, soaring. This one was from Mr. Legion Air, Cecil Haga from Arlington, Texas. Cecil proposes that a National Soaring League be set up, structured similar to that in Pro Football. There would be an American Soaring Conference, and a

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National Soaring Conference. Also, there could be an Eastern Division, and a Western Division, with the split about the Eastern border of Texas, Oklahoma, Kansas, etc. This would make a total of 48 teams; 12 in the NSC West, 12 ASC West, 12 NSC East, and 12 ASC East. These team locations would be scattered around to best serve the locations of the flyers. Each team would consist of 4 flyers.

To get on a team, a flyer tries out for an NSC or ASC team in his area. He pays a try-out fee of $10. If he doesn't make one team, the fee also gives him a shot at the other. Each team then plays 12 games per year. These games are played by "fly by mail." Schedules are made by a "Commissioner," who also tabulates scores and keeps rankings. Each game cost the flyer $5. Each team flys identical tasks using a hi-start with a taut line, tied to the stake, and the opposite end of the rubber, to limit the stretch.

At the end of the season, the Eastern Division Champs play the Western Division Champs for the respective NSC and ASC Championship. These two teams then, would meet somewhere in the U.S. in a "Thermal Bowl." Each team member would receive $1000 travel money. Individual trophies would be awarded the winner, with a Thermal Bowl trophy to be held and maintained by the A.M.A.

Cece has the finances worked out and it looks feasible. Cece thinks the tryouts could be held in Sept./Oct., 1981, with play starting in 1982.

Mr. Haga proposes that interested soaring societies and clubs could be the media for talking up this idea, and soliciting their members. I would suggest that anyone wanting more information, or with implementation ideas, contact Mr. Cecil Haga, 3017 Norwood, Arlington, Texas 76013; phone (817) 261-6118.

Howzat! □

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transmitted to the camera. By all means use a fast shutter speed. When using the Canon "Sure Shot" you have very little control over the shutter except, using a faster film will speed it up.

Calm air will give you best results when photographing a particular subject. Fly as smooth as possible and when the time arrives for that special moment, cut the throttle, set the aircraft down and snap the picture. By throttling down the engine, the vibration level will be reduced, hopefully, allowing for a sharper picture. Make sure of a perfectly balanced propeller.

When using the Canon "Sure Shot," I

acheived best results with ASA 400 film and do not suggest using anything slower. If you are interested in slides try Ektachrome 400 or Fujichrome R-400. Or with color negative films I recommend Kodacolor 400, Fujicolor F-11400 or 3M Color Print film ASA 400.

The Camera

I did considerable looking before choosing a camera. The camera requirements had to be a 35mm with a moderate wide angle lens, auto exposure, with a wide coupling range and, most important, it had to have a self-winding film transport. It also had to be reasonably light in weight and cost. After looking over those available, I finally settled on the Canon "Sure Shot" AF 35M. This camera is one of the new electronic generation on the market and had all the features I needed, including some I didn't need. For example, the camera has an auto focus feature which is not necessary on aerial shots. However, I use the camera for other work and find it relaxing not to focus. The AF 35M is not a single lens reflex (SLR) by any means but does take good pictures. The lens are Canon's own 38mm f2.8 and are constructed of 4 elements in 3 groups. It has an auto exposure meter coupling range from EV6 (f2.8 at 1/8 sec.) to EV17 (f16 at 1/500 sec.). Film speed scale is from ASA 25 to 400. Power source is two size AA alkaline manganese batteries. Nicad batteries cannot be used. Total weight, including batteries is 14¼ oz. Although the lens are not removable there are provisions for using a screw-on filter with a thread size of 48mm. The cost of this camera is approximately $150.00 depending on where you buy. It is an absolute electronic marvel and I highly recommend it for one who lacks confidence in his/her ability to take good pictures.

The Airplane

Just about any large, slow flying airplane will serve as a good air platform. Of course, it must have room inside the fuselage to mount the camera module. The Telemaster is an ideal airplane for this purpose because of its slow flying characteristics. It will lift 8 pounds (besides itself) with ease and has plenty of room in the fuselage and then some. It's no raving beauty, but it is a terrific utility aircraft with very stable flight characteristics. And, it can do many things for you besides fly. My particular TM has been in service since 1974 and has hauled up quite a number of interesting projects.

The TM with camera aboard has a fairly light wing loading. Considering the possibility of flying from small areas, I installed a .90 engine which enabled short take-off and quick climb-out. Using a 16/6 prop on the .90 enabled me to idle at a slower rpm when taking a picture. The lower rpm seems to agree with the camera module with regard to vibration. I tried shooting pictures at all rpm levels and got the best results with the above mentioned engine combination with a very low idle.

The Camera Module

The best way to mount the camera in the aircraft is in its own module. There are a

number of reasons why this makes good sense. First and foremost the camera needs protection in the event of a crash. Because of the initial cost, you certainly would like to have it around for future photography. Secondly, it was necessary to isolate engine vibration, as much as possible, from the camera. And, finally, it makes good sense to have the camera completely mounted and ready for operation. The module enables you to check out the camera triggering function on the workbench. It adds very little weight (8 oz.) and, in general, provides a way to have everything in good working order before taking to the air. The module must be removed from the aircraft for film loading and unloading.

The module is quite simple to build and is made of 1/8" lite ply and pine. It can be assembled in one evening. The entire module is lined inside with 5/16" soft rubber foam. It is important **not** to fit the camera tight in the foam rubber. Install it just so that it fits — not too loose and not too tight. Spend some time and make sure because this will affect picture quality.

The triggering plunger, as shown on the drawing, is made of aluminum. An alternate method of making this part would be to make it from wood. Possibly a dowel glued to a piece of 1/8" ply. Be certain that the dowel is square to the plywood disc. Chuck it up in a drill and square it up. Or, maybe a friend with a metal lathe will help you.

The dimensions on the drawing should get you in the ball park with regard to plunger travel. The shutter button on the camera has little to no over-travel and is quite critical about reaching the bottom of the stroke. For this reason it is necessary to shim between the plunger and the shutter button. Using pieces of disc shaped masking tape applied to the shutter button seemed to work quite well. They can be easily removed if necessary. Keep shimming with tape until the shutter releases **every** time. **Make sure it is reliable**. Remember —my first roll of film was blank. What a disappointment!

Taking The Picture

The day finally arrives when you have it all together and you are ready to try your skill with aerial photography. What better place than your own flying field. Pick a reasonably easy target and start practicing. Make dry runs from different altitudes. Study the lighting on your chosen subject and try for a sidelighted picture.

With the Canon "Sure Shot" auto winder it is possible to take a picture every few seconds, therefore a roll of film, say 36 exposures, could be exposed in a very short time. A roll of film can easily be exposed during a 15 min. flight although you may want to spend more time getting the aircraft in position between shots.

As stated before, practice, practice aiming. This is one of the most difficult skills to acquire. Using the left or right wing (depending on which side the camera is located) to aim the camera at the subject and remember the camera is angled down

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slightly. Try to visualize an imaginary line from the aircraft to the subject. This is especially difficult to do when you are some distance away. However, a sixth sense seems to take over and, with practice and many shots, you are bound to win out. Admittedly a certain amount of luck is involved. If I were asked to take certain pictures over again, I might find it extremely difficult. Shoot many shots of the subject while you are up there. You may never get back there again, therefore, consider your film cheap and bang away.

Summary

On your first aerial photo mission here are some things to remember: Check to make sure your radio is functioning properly; check out the aircraft for good flight-worthy conditions. Balance the propeller for smooth engine running. Before loading the camera with film, dry run camera shutter operation by operating servo. **Make certain it is reliable.** Use a fast film to speed up camera shutter. This is important for optimum picture quality. Pick a bright day with calm wind conditions. Plan the first flight at your regular flying field where you are familiar with the surroundings. Check light conditions and determine desirable lighting — side lighting, front lighting or back lighting. Incidentally, back lighted shots are easy because the camera lens are well shaded by the wing when shooting directly toward the sun. When airborne, pick out an interesting subject and practice a good shooting procedure. Be consistent. As you approach the subject, come back on the throttle, settle the aircraft down, aim, and then shoot. Do not try to capture the subject

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in one shot. Instead, take many and pick out the best ones. You will not print every picture. Remember, it does take practice to acquire the skill.

Obviously your first time up on a photo mission will be experimental. It would be prudent on your part to start with black and white film such as: Kodak Tri-X Pan or Ilford HP5 (both ASA 400). These films are much cheaper to work with and can be processed by you at very little cost per shot. I found it more expedient to buy a bulk film loader and load my own 35mm cartridges. Film can be purchased in 50 to 100 ft. rolls. This brings down the cost per shot even more. I find it simpler and less time consuming to send all color film to commercial processing labs. It is very easy to process black and white film allowing you more control and flexibility. There are many good books available that explain the step-by-step procedure of black and white film processing. Whatever you do keep it simple and by all means have fun. That's what it's all about.

Perhaps I may have been too technical with this article for some of you, however, if you are interested in aerial photography, and like to fly R/C, it is possible to do both at the same time. It is a challenging and fascinating part of our hobby that will bring many hours of pleasure to those who pursue it — it has me. You see, I am still looking for that one and all encompassing aerial photo that says it all. And, when you show your photos around and say they were taken from an R/C model airplane, you are bound to have a few disbelievers. It's great fun! Put your airplane to work and make it do something for you. Happy flying and good luck! □

SO YOU REALLY WANT TO FLY R/C

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the truth were known, we all clutch a little every time we do something unfamiliar. It's a tough problem to overcome.

Here are a couple of suggestions. Arrange with your instructor ahead of time what will happen if you get in trouble while flying. You could agree on a simple word cue to let him know you're in trouble and that he should take control of the plane. Something simple like, "Take it," will do. Also practice (before flying) the way you will deliver the transmitter to his waiting expert hands. By setting up and practicing these protective actions, you'll handle the real situation with efficiency and dispatch. One of our presidents put it very succinctly, "The only thing we have to fear is fear itself."

Usually a summary is inserted at this point in the dialogue and this article is no exception. Seriously, folks, good reliable flying skills are largely the result of your own determination. If you decide you **really** want to fly R/C, you will fly R/C. If you allow yourself to waste time, you can literally spend years getting to be just a "Sunday Flyer."

So remember these practical suggestions. Build yourself a nice slow trainer as your first plane. As soon as you get done, start building a back-up airplane. Avoid making your aircraft perfectly gorgeous; make it aerodynamically perfect but sort of a plain plane. Pick yourself an instructor **and** back-up instructor. Get yourself out there and fly a lot. (If possible every day. You can really learn fast that way.) And don't leave your flying education to chance. Use the phone, set up appointments and keep them. Don't let fear get in the way of learning to fly. Remember to set up anti-crash procedures between yourself and your instructors. Just knowing exactly what you're going to do if everything goes wrong can be a very comforting thought.

And that's it. Hopefully there's an idea or two you'll find useful. Good luck!

(Ed Note: RCM suggests that after any kind of crash, it is advisable to have your radio checked over by the manufacturer or authorized service center for possible damage. The radio may work fine, however, there could be some damaged components that won't show up until you're airborne again, then it's too late.) □

ELECTRA LITE

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. . . . . spacing and the instructions say 22". We followed the plans and it worked well.

Some places in the construction will tempt you to add just a bit more structure — **don't do it**. It is strong enough as designed, weight is the key. In fact, if you don't mind a bit of difficulty in transport and storage, the wing can be built in one piece saving about 3 oz. We opted for convenience and built the two piece version; 93" is a big wing.

Covering:

The bare wings are quite flexible and gain most of their rigidity from the covering material. We used Super MonoKote and suggest that the entire wing be covered before any section is shrunk. Use a sealing iron to attach the edges but not the ribs. We used a Top Flite heat gun for shrinking the MonoKote, alternating top and bottom in stages to reduce warping. Once everything is tight, check for twists and make any necessary adjustments. When you are satisfied, tack the covering to the ribs. This step adds quite a bit of strength.

Motor:

An Astro Flite 05 was used and the motor fits nicely in the pre-drilled nose block.

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from page 123/46

Strips of masking tape on the rear of the motor work well to keep it in position. A Goldberg 1½" spinner was modified by drilling a 3/8" hole in the nose cone and several angled 1/8" holes were drilled in the back plate. The modification is necessary since it allows the spinner to act as a fan for motor cooling. The batteries are installed in the wing saddle area with the case removed to reduce weight and improve cooling. A third servo with a micro switch was used to provide motor control.

Radio:

Installation of the radio should be done at the same time as the motor so that both may be used to achieve proper balance. We used three channels of a Futaba 6 with the motor adjusted to start at the full throttle position. A sliding tray is used as the mixer system and works very well. Although standard servos can be used, micro servos such as the Futaba S-20 are recommended. They have plenty of power and make the installation a lot easier. After everything is in place, double check that there are no potential shorts in either system. One pilot we know forgot to check and while the smoke trail made it easier to track the airplane, it is hard on equipment.

Flying:

Each time we set up a V-tail, there is a moment of doubt --- how can you twist one way while pushing the other way and expect something predictable to happen? We didn't want to try and outguess the designer so we set the throws as recommended and the C.G. at the aft edge of the spar. With this done, we tried a few test glides into the proverbial tall grass, primarily to make sure that V-tails still work.

The first powered flights were with a 6/3 prop and were a great disappointment. Four minute motor runs yielded only 50 to 60 feet of altitude and this only by very careful flying. We decided to give it one more chance before packing up and put on a 6/4 prop. What a difference! This time a three minute run had the Electra Lite at well above high start altitude. This was more like it. With the motor shut down the drag from the prop is there but the rest of the plane is clean enough to more than offset. Penetration is very good and even light lift can be worked for altitude. The Electra Lite will turn very quickly and invites you to chase around the sky after that thermal you just missed.

Conclusion:

The Electra Lite is a very pleasing airplane to look at especially in the air. The V-tail takes it out of the ordinary and also contributes to its agility. One of the nicest things about electrics is the new places that are available for flying. We've flown out of the local school yards on several occasions and the availability of power helps to avoid

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ELECTRA LITE

from page 126/46

the goal posts and buildings. We don't recommend the Electra Lite for the complete novice but anyone with a bit of building experience should have no trouble — just keep it light. The kit is well worth the $49.95 price so if you have been considering silent power, the Electra Lite would be a good choice. □

RADIO SPECTRUM

from page 45/44

operate on different frequencies, in fact, in different bands. Francis' latest letter was sparked by our recent review of the Chromatronics fail safe black box in the February, 1981 issue. He agrees that fail safe "in the old way" doesn't do you much good because transmitters don't fail very often and few models will land safely with neutralized controls.

His solution looks good. He uses a 27 MHz receiver, a Chromatronics and the engine, rudder, one aileron and one elevator on one chain (with a 1.2A-hr pack), and a 72 MHz receiver, a Chromatronics, the other aileron servo and the other elevator servo on another chain (with a 500 ma-hr pack). See Figure 2.

The improvements are obvious. If you get interference on one band, the servos on that receiver neutralize and you can land using the other band. Francis has landed the plane on either chain.

Now you need to add a circuit that neutralizes the servos if a battery dies. I still don't know what you do if you break a wire in a servo and it drives hard over, but I suspect you have some chance. For instance, if an aileron went hard over, you should be able to counter the rolling moment with the other aileron and the pitching moment with the elevator. What do you think?

P.S. Don't ask me if it is legal.

Home Built Transmitter

Dear Jim:

I read in your column that you built a new transmitter over winter. I, too, built a transmitter following your suggestions a few months back.

I used the Ace Silver Seven Encoder coupled to the Kraft FM Module in a single stick configuration. I haven't connected the Ace option features, but there's comfort in knowing they are there if ever needed.

The interface between encoder and module was not quite as simple as it appears. Ace provides a 5 volt output, whereas the module needs 9 volts so a switching stage was added and Ace's pulse shape was modified.

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RADIO SPECTRUM

from page 132/44

Alignment was straightforward, except that the RF module got quite warm after a few minutes. It turned out that the module by itself drew about 200 mils, though the output was clean and on frequency. I reduced the gain of the buffer stage to where the RF drain was about 100 ma and the 2N4427 no longer burned my finger.

I have just completed the first flight tests with "flying" colors. Air range is out of sight with the antenna half collapsed and, best of all, the low-down, close-in glitches which occurred with the old Heathkit, are gone! I suspect these were a combination of antenna null and reflection since air-range was out of sight.

I'm having trouble finding a name for my transmitter, since it is part Ace and part Kraft. Maybe I should call it a "Half Ace" transmitter?

Your column is great! Keep the info flowing.

Ed Gerhardt
Basking Ridge, New Jersey

Now that is the kind of letter I like to get: somebody doing as I say, not as I do. Actually I'm pretty happy with my new transmitter, but it was a lot more work starting from scratch. My main reason for not using the Ace encoder was strictly one of packaging. It didn't fit.

One comment on the high current problem in the RF Module: I'm not sure of the cause, but I'm sure it wasn't the interface. So if anyone else is considering such a project, you don't have to worry. If Ed had used the module in a Kraft transmitter, he would have had the same problem.

Next Month

Some of you may think I work for Kraft because I talk about Kraft equipment so much. The reason I talk about their equipment is because they provide me with information to talk about, either in form of schematics, data, or hardware. Bob Novak has done the same. I can't tell you guys how to add dual rates to systems I've never seen up close. A few months ago a reader asked me to comment on the JR system. I mentioned that Don Wietz had been flying them, but that I hadn't really seen enough to recommend them. Well before that was printed, Circus Hobbies sent me a system. I can tell you one thing, it sure looks and sounds great (especially the coreless motor servos).

We'll try to give you more dope next month. □

BIG IS BEAUTIFUL

from page 43/42

either. They have an extensive stable of both large and conventional sized models, and a

SASE to the above address will get you additional details.

★

Bill Effinger (remember Berkeley Models, all you old timers?) is back in the model business and he has come out with some great stuff. If Old Timers are your passion, Bill has some good things for you, and if you are into Quarter Scale WW I, has he got something nice for you!

Bill's idea is to supply to the modeler a complete service. Much as an architect supplies to a client, Bill will undertake to supply those items not readily available to the modeler in his own workshop and will be available to the builder as a consultant where necessary. This concept will establish a designer/builder service which should assure successful completion of a plan-built model. Bill's experience and background in modeling will be available to his clients and should provide a unique service to them. Send Bill a dollar and you will be on the mailing list for his current and future announcements. (WE Technical Services, P.O. Box 76884, Atlanta, Georgia 30328). You can deduct the 1.00 from your first order, if you like.

I have just ordered Bill's newest creation, a Quarter Scale SE-5A. The model weighs 10¼ pounds, less radio, so it is quite light. It can be flown without the flying wires as all surfaces are self supporting. Wingspan is 80½" and it will take anything from a 1.9 to a 2.4 c.i. engine. The prototype uses the Mag Aero 21 cc engine and the landing gear is spring loaded, rubber shock mounted, and adjustable for both camber and toe-in with a simple screw adjustment.

The plan set is laid out in sub-assemblies for convenience, and complete prefabrication of a kit from which to build is made simple. I'll have more to say about the plan when I have had a chance to have a good look at it but, in the meantime, if some of those Golden Oldies or the SE-5A turn your crank, drop Bill a SASE and a buck and he'll keep you up to date.

★

Those of you who are using the Cosmocon Tuned Exhaust System for the Quadra engine will be pleased to know that Cosmocon has announced a rebate system. In exchange for pictures and details of your Cosmocon installation in your boat or plane, describing the performance characteristics you experienced, they will send you $15.00 in cash and a colored jacket patch. Naturally, Klaus and the people at Cosmocon are interested in accurate information from which to form a data bank in order to assist other modelers and to give them some idea as to future product development. So . . . there's a chance for some input into the data bank, a new (and unique) jacket patch plus 15 bucks. Not a bad deal. The rebate offer is a limited time thing, but it applies to present users of the Quadra-Charger and to future purchasers as well. The limitation was not spelled out in my information, so get on the bandwagon before it fills up! (Cosmocon, RR #2, Uxbridge, Ontario, Canada, L0C 1K0.) □

from page 40

This 90 pound model is equipped with operating gun turrets, searchlights, and even a fully functional aircraft catapult which actually launches a tiny replica of a German seaplane. After the little plane lands in the water, the Scharnhorst swings one of its two working cranes over the side and then moves in to complete the recovery of the aircraft. As if all this isn't enough, the ship is also equipped with an 8-track tape player which delivers a medley of authentic German beer drinking music and marches.

Trained as a jet aircraft mechanic at the start of his Navy career, Perry didn't really think about connecting his hobby with his job until 1976 when he became a recruiter for the Orlando area. Once he realized the potential for Navy publicity that his hobby presented him, Perry embarked on a building program that would have made military planners green with envy. His next project was a 7' long, 70 pound model of the ill-fated ocean liner "Titanic." Why the Titanic? "The story of the real Titanic has always fascinated me since I first read about it in high school, so naturally I wanted to reproduce it in miniature," Perry said. His scale model is nearly as lavish as the original. When he moves a switch on his remote control transmitter, the model's interior is bathed in the glow of 60 tiny light bulbs which reveal the fully equipped gymnasium on the boat deck, a carpeted and paneled first-class entrance and foyer, and several other rooms, all reproduced to the last detail. Another switch controls the ship's horn (salvaged from a Honda motorcycle) and, like the Scharnhorst, the Titanic is fitted with a tape player, but in this case the music emitted is from the turn of the century, with ragtime and Strauss waltzes predominating.

Standing by to assist the larger vessels as they enter and leave port is the "Dixie Moran," a 12" long radio controlled tugboat which can move ahead, astern, change speed, turn left or right, and stop dead in the water on command from the operator standing on shore. Like its full sized counterpart, the tiny tug is able to maneuver the larger ships in and around the "harbor." Perry built the tug from a commercial plastic kit and modified it to operate via radio control after approximately a week's work on it. His other models, however, are entirely scratch-built without benefit of kits of any kind.

The newest ship in Perry's flotilla is a 7'6" model of the U.S.S. Long Beach, America's largest nuclear powered guided

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MINI-FLEET

from page 144/40

missle cruiser. Fabricated from fiberglass and acrylic plastics, this latest addition represents nearly two years effort including six months spent on research and drawing the blueprints. "The Navy is understandably reluctant to release official plans of their nuclear ships," Perry explained, "so I was forced to draw the blueprints by taking measurements off photographs and by referring to various books and publications to obtain information on small details such as weapons and the ship's boats."

Perry's demand for authenticity reflects clearly in the amount of detail present on this, his latest model. Observers will see such items as a number of miniscule windshield wipers on the bridge windows, crosshairs on the gunsights, and fire hoses on the bulkheads. There are even several uniformed Navy personnel visible through the bridge windows and working on the deck. Perry's "Long Beach" joined the rest of his fleet on the high seas last July.

What's next on his "shipyard's" building schedule? "A working model of a nuclear submarine followed by a new type of cruiser," Perry reveals, "later on, I intend to add an aircraft carrier and possibly a U.S. Navy battleship. But first, I'll have to move to larger quarters." □

FLYING LOWE

from page 29

9's with an occasional 10 in order to win. Taxi downwind to a point that will permit lift-off in front or slightly past you: never start a take-off roll in front of you! Start from dead still unattended and advance power smoothly at a fairly quick rate — but never jam it. If you have any cross wind you should bring it up more quickly to get the slipstream over the rudder quickly. Apply rudder if necessary to keep it straight and don't be timid about it. You may need lots of it in a strong cross wind, but be prepared to let it out as the ship gains speed. Accelerate to a good speed and apply a bit of back pressure to lift it off. Careful, don't jump off, since this is where judges really zing you! Climb out in a shallow but steady climb keeping it absolutely straight and level. Don't be timid! If it's slightly banked at lift off, get it level and give the judges a good finish. When you're up to required altitude, call complete. Oh, I forgot, be sure and call out maneuver start and complete as described in the "book."

In the climb-out you will probably have to hold a bit of rudder to keep it straight, at least until you're up to full flying speed. Pick up the retracts after calling maneuver complete unless you're sure you can hit that switch without disturbing something. If you have difficulty lifting the ship off smoothly

without jumping, the C.G. may be too far forward or the ship may be sitting slightly nose down. You will also find it more difficult to lift off smoothly from grass due to wheel drag.

A couple of suggestions: if you have a cross wind (which is the usual situation), be prepared for the ship to weathervane into the wind — just be ready with a little rudder to counter this. Be sure that the rudder and nosewheel steering track together. If they don't, then you might lift-off with unwanted rudder and pull it off heading. If you lift-off at slow speed, torque may grab it, and yaw it left, so keep the rudder in after lift-off and slowly reduce it as you gain speed. You probably are getting the picture already that the rudder is as important as any other control; you must learn to use it effectively if you ever want to be a proficient flier.

After take-off, you should proceed to perform maneuvers in a fixed track upwind and downwind at a fixed distance out. Essentially the maneuvers are flown as close as possible without exceeding the bounds prescribed in the "book." Especially, do not exceed the vertical limits since judges do not like to stretch their necks excessively looking up and if you stray overhead or behind — forget it.

Okay, after take-off, turn downwind for a turn around into the wind to perform our next maneuver, the wingover. A turn around can be anything, but get into the practice of doing a precision maneuver since it gives the judges the impression that you know what you are doing. Most fliers use a split "S" and maintain the "track" at a constant distance. I usually make a fairly tight horizontal turn around. I turn in toward the deadline or "zero score" line and turn out to establish the line. If you split "S," throttle back so that it doesn't come screaming back at 200 mph! Whatever you do --- do it with precision.

Okay, head upwind at a modest altitude, say 50 feet. Let the ship fly past a couple hundred feet and begin a smooth pull-up until vertical. Next throttle back allowing the ship to slow until its almost dead in the air. Keep it straight with the rudder. If there is a cross wind, the ship will try to weathervane into the wind so be prepared with rudder corrections. Don't be timid — use that rudder — you may need lots as it slows. It will be best to pivot into the wind at the top. In fact, you should always go that way if possible, so space the maneuver accordingly. You may find it best to leave the engine at high idle trim to help the pivot. In any event, if the ship completely stops, the only thing that will make it pivot is prop wash over the rudder. I usually give it a little blast with the throttle at the same time that I hit the rudder to make sure of a quick pivot — but don't prolong it, as it will try to fly out of the pivot. The greatest skill is required in judging just how slow the ship can get coupled with minimum throttle to make it go around. Only practice will make this perfect.

After the pivot, dive straight down

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FLYING LOWE

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parallel with the up track and exit using the same radius of pull-out as entry and the same altitude as entry. Don't be afraid to use the rudder to straighten out the dive. Properly done, the up and down lines should be identical and parallel and the pivot very tight with the ship almost dead in the air at pivot. You will see a number of fliers "fly around" with a fair amount of throttle. This is not a stall turn. Often the ship will yaw side to side a couple times after the pivot on the down line, especially if the pivot is done at very slow speed. This is okay, but if you don't like it, hang onto the rudder after the pivot for a short time and it won't do it — remarkable, eh? Just slowly release the rudder on the down line to keep it from yawing off heading.

You will find some ships stronger in this maneuver than others. Lots of rudder throw is required to be effective at very slow airspeed. Also, for a given design, a more forward C.G. will help it pivot. I have had ships absolutely refuse to pivot especially if you are trying to pivot downwind with a fairly strong cross wind. Also if you are slightly tipped into the wind and try to go downwind, some simply won't make it. So, plan this simple maneuver so that you always pivot into the wind. With sufficient cross wind you probably won't need any throttle.

In summary, you can see that the most skill is required in accomplishing a precise tight pivot — only practice will help here — try various techniques with your particular ship. One additional word: when you pull the power off on the upline, the ship may try to pitch up. If this happens apply a little down elevator to keep it straight. Better yet, check to see if you have down thrust in the ship. With power on, the nose is pulled down; power off, it pitches up. Whatever it does, correct it instantly! Don't let it wander all over the sky. Don't be hesitant about applying whatever is required to keep it

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FLYING LOWE

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straight. After doing a couple of dozen you will find a consistency in what your ship does and what your standard technique should be. If your ship tries to pitch up or down, or roll when you apply rudder at the pivot, you have a design or construction fault. If it pitches, go back to my previous disussion on yaw, pitch coupling. If it rolls, you have a dihedral problem. Of course, you can learn to correct these anomolies, however, it will always make the maneuver more difficult. Also, as you change the speed of the pivot, the magnitude of the effect will change.

Well folks, you can see that even a simple manuever like the wingover has a lot of complications. What you must do is gain an understanding of the aircraft and what influences its behavior. This is why I find it impossible to discuss trim and maneuvers without talking about design. Of course you can learn by hard work to fly mechanically, but woe unto you if you change ships, or the trim changes, or the weather conditions change. A "mechanical" flier always must practice more and can't easily adapt to changes.

That's about all the space this time. We'll continue to discuss some of the basic maneuvers next time. In the meantime — Practice — with purpose! □

SCALE VIEWS

from page 23/22

this spring in Birmingham, Alabama. Architect's drawings show it to be a large and impressive installation. A room will be set aside for display models, equipment and memorabilia which will be displayed under glass in a controlled environment. Bud Caddell, an RC'er of 30 years standing, is on the model exhibits committee. They are seeking donations of outstanding scale models of 2" scale or smaller as well as pieces of equipment of interest to the general public. Since the museum is a non-profit corporation, chartered as tax-exempt under Section 501 (c) (3) of the Internal Revenue code, donations are tax deductible and a receipt will be furnished for this purpose. If you have or know of a scale model that might qualify for this excellent promotion of the hobby by a major museum, send photos and descriptions to: Bud Caddell, Southern Museum of Flight, 1525 Badham Dr., Birmingham, Alabama 35216.

Back Issue Magazines

One of the best sources of plans and data for scale building are the thousands of old aviation and model magazines. In Scale Views for April 1979, we reported on places

where these could be found. As far as I know, all of those listed in that issue are still in operation. Since that time I have found some other dealers in back issues:

Jerry Derushie. Like many back issue people, Jerry is a long-time modeler who is as much interested in collecting, including drawings and old kits, as he is in selling magazines, which he has been doing for 4 years. At the present time he has 6000 issues in stock, mostly American titles such as RCM, RC Sportsman, Air Trails, American Aircraft Modeler, Flying Models, Model Airplane News, Air Progress, Wings, Airpower, Air Classics, etc. English publications include Radio Modeller, Radio Control Models and Electronics, Air Enthusiasts, Air Pictorial, Flying Review, Model Aircraft, Aeromodeller, Profile Publications, and others. He finds it difficult to keep a list that is up to date so prefers to operate by means of the "want list" method. Send him a self-addressed envelope along with the names and dates of the magazines you are looking for. He will reply as to availability and price. Since he is in Canada (932 King St. East, Apt. 6, Hamilton, L8M 1B8 Canada), do not put a U.S. stamp in your self-addressed envelope. Instead, send an International Reply Coupon (obtainable at any post office) or 17 cents in coin. He will search for magazines and drawings you need that he does not have in stock.

Bruce Thompson. Another Canadian collector, who got into the business when he found that he had to buy complete collections to get particular issues he wanted, began selling duplicates. He is particularly proud of his early pre-1932 issues of Model Airplane News and pre-1933 issues of Flying Aces when it was a 7" x 10" "pulp" before it went to 8½" x 11" and became a "slick" in size, if not paper quality. When I can find time to dig into my basement full of paper to find the dates of issue, I'm going to see if Bruce has copies of several of my kid efforts at articles in Flying Aces, which I either have only in a beat up scrap book or not at all. Another interesting series he has which brought back memories is a run of Popular Aviation from 1932 to 1941, with all of those great scale model plans by Paul Lindberg. As you can see, Bruce specializes in very old magazines, has many 1930's copies of MAN, Flying Aces, Air Trails (when it was Bill Barnes Air Adventurers), Aero Digest, Aviation, Popular Aviation and pulps like Sky Birds, Wings, Dare-devil Aces and War Birds. But he also has later issues of contemporary magazines. For his most recent list, send $1.00 to him at 328 St. Germain Ave., Toronto, Ontario M5M 1W3 Canada.

Tom Walsh. Interested in buying and selling Air Classics, Air Combat, Wings, Aeroplane Monthly, Air Enthusiast/Air International, Airpower, Aerophile as well as others, Tom operates by means of "want lists" as detailed above in the item about Jerry Derushie. It almost seems we have a Canadian conspiracy afoot to corner the

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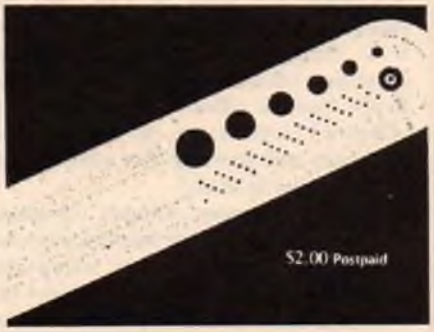

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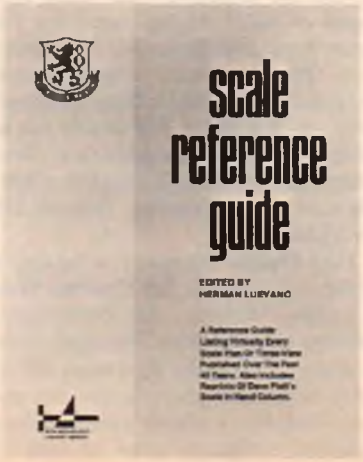
market on back issue magazines for he, too, is located up north at 57 Dunwich Drive, St. Thomas, Ontario N5R 4T7 Canada.

Period Aero. Richard Jenkins service specializes in magazines from the first 50 years of flight. He has specific lists covering Military, Commercial and Sport Aviation, Aeromodelling and Aviation Fiction. Send for the list covering your interest or state your specific needs. He will search for things he does not have or make facsimiles of items he doesn't wish to sell. If you have magazines to sell or trade, write to him at 49 Valley Rd., Ashland, Massachusetts 01721. Telephone calls can be made to (617) 881-3717 from 8 to 10 evenings, eastern time.



This is a good time to call attention to the unique RCM publication called "Scale Reference Guide." To make proper use of the back issue sources given above, the researcher needs to know what back issues are pertinent to his project. No better place

to find out than in the SRG, an index of 3-views and scale model plans published since the late thirties. Aircraft types are listed alphabetically with the magazine title, date of issue and page number. This is the most useful book for the price in the scale model field. Send $5.50 to RCM, Box 487, Sierra Madre, California 91024, for your copy. □

ENGINE CLINIC

from page 14/13

fellows are looking for in their overweight scale type models of the non-high performance type. However, in the case of a WW II type fighter, a higher air speed is required and this means an engine that develops its power at higher rpm. The O.S. .60 converts to diesel operation with the Davis diesel conversion very well. However, converting to diesel would not give the additional power that you are after. You did not say the wing area but a nine pound model with a six foot wingspan is bound to have a high wing loading and require high air speed to perform properly. The .60 would probably do it but performance would be marginal. A .90 would be the only way to go. I would rule out one of the reduction drive units as this would only add more weight to an already overweight model.

As for your other questions — converting to diesel operation means considerably higher compression ratios. This, in turn, does impose higher loads on the internal parts --- especially when larger propellers are also used. The only saving factor is that diesels do run cooler so not as much heat is being generated. But even so you are putting some pretty heavy loads on the engine.

The vibration bit is a bit hard to define. When operating the engine on glow ignition at higher rpm (13,000-15,000) you have a high speed vibration — the type that shakes servos apart, loosens screws, etc. With diesel operation you run the engine at lower

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ENGINE CLINIC

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rpm and there is more vibration than with glow operation, but of less frequency.

Diesel fuel is not easily obtainable commercially. I imagine there are small operations selling diesel fuel but Davis is the main source of diesel fuel for his conversion units. Check Davis' ads for prices. Pretty rough, but diesel operation does increase fuel economy considerably. In the long run, however, I do not believe the gain in economy off-sets the increased fuel cost so you do not save enough over the cost of glow fuel to really matter. This pertains to the .60 size engines. You will show a considerable savings with the 1/2A through .15 size engines. You can naturally mix your own diesel fuel as the basic ingredients are readily obtainable; Kerosene, ether (either motor or medicinal will work), and oil. Either castor oil or a synthetic such as Klotz can be used. However, for smooth combustion and overall better operation, the fuel should contain 2% Amyl nitrate. This is the hard ingredient to obtain as it is on the prescription drug list. Amyl nitrate is a heart stimulant and some years back idiot kids were using it for obtaining a "high," the same as sniffing airplane glue, etc. It was taken off the market and put on the prescription drug list. It can be prescribed by your family doctor if you explain what you intend using it for. But then finding a drug store that stocks Amyl nitrate is another problem. Amyl nitrate works even better but is almost impossible to obtain in less than drum quanitities. Also see the dangers of storing diesel fuel in the next letter.

Dear Clarence,

Would you please comment on the heat process used, materials added to, temperature and time, etc, for the aluminum silicon treated piston used in ABC engines. At what temperature are the piston, rods baked? How is the rod strengthening achieved in this baking process? What is meant by piston "growing?" What exactly happens to them — do they get slightly larger, is the aluminum any harder?

I have a muffle furnace which is good up to 1200°F and I would like to try baking the aluminum connecting rods, if this will toughen them up. (Yes, I realize something else will break if the rod doesn't.)

As a caution for anyone who mixes their own diesel fuel, or has occasion to use ethyl ether, please note that ether oxidizes readily on exposure to air. Explosive, unstable peroxides may be formed. As a precaution,

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use 2% ethanol in ether for a stabilizer; don't use old ether that has been opened previously; don't ever try to open a can of ether if the can is bulged, old, or, especially, gone "dry." The friction in opening the can may be enough to detonate the ether peroxides if the solution has evaporated and the peroxides may have crystallized around the cap and thread.

I thoroughly enjoy your column. Thank you very much for your time. If at all possible I would like to see some comments in your column on diesels.

Yours truly,
John Carron
Ontario, Canada

John, I think you have a little misunderstanding about why we bake the ABC piston and sleeve assemblies. It is not for heat treating or hardening, but just to stabilize the material. Often the pistons will keep growing (actually get larger in diameter) every time the engine gets hot. The piston can also go out of round as can the brass sleeve. By placing in a 600° oven for an hour and then plunging into cold water, this growth and distortion can be eliminated. When doing this you usually end up with the piston being a tighter fit in the sleeve and some lapping to fit is required. Once this is done the engine will hold its fit without changing except due to normal wear. However, this baking process is not generally required for pattern or sport type engines. It is of most advantage for the racing type engines used in Formula I and marine use. You would not want to bake the rod as this would only weaken it. Actually the rod has been heat treated to begin with and many manufacturers also heat treat the ABC piston/sleeves. So the baking process will not always work on all makes of engines. I think this whole business started with the Super Tigres that introduced the ABC piston/sleeve set-up. Evidently they did not heat treat the piston and fellows found they would continue to grow with use. An engine has a tighter fit after an hour or so of running than when new. Baking the piston and sleeve stopped this problem.

I know in the case of the K & B ABC engines that both the piston and sleeve are given a heat treat process. The piston is given what is called a T-4 heat treat. This involves heating at a high temperature for a long period of time and quenching in water. Then reheating at lower temperature stabilizes and eliminates brittleness. Although I do know the exact temperatures and times involved, K & B might not appreciate their methods being made public.

I have found, however, that if you have a loose piston/sleeve fit you can tighten it up by baking the piston only at 600° for an hour and plunging into cold water. The piston will increase in diameter two to three ten thousandths (.0002"-.0003"). □

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reliable running and good response to throttle opening, and your lift off setting with the main needle valve set so as to be just fully breaking into two cycle, you should have a good carburetion. Bear in mind, though, that the wrong mix of collective and throttle can throw all of this into confusion so that what I have described above applies only to a helicopter which has either the main blade pitch settings correct (in the case of fixed pitch) or the blade angles and mixing correct (in a collective pitch helicopter). More of this in later columns.

Well, it now seems that I won't be able to answer all of the question that were posed last month but I'll at least hit a couple of them for you. You may remember one of them was, "what happens if you have too much pitch in the main rotor blades, or not enough?" I think we have really covered this subject before but maybe not as a response to such a specific question. The correct pitch settings of rotor blades of a production R/C helicopter will have been specified for you in the building and/or flying instructions. It is important to stay very near to that setting. One of the reasons is that the blade section, diameter and pitch have all been chosen to most effectively use the available power from the engine in terms of its torque/speed characteristics. Increasing the main rotor pitch creates more drag and, hence, torque demand on the motor, at any given speed. This may result in the motor not being able to accelerate past a certain speed because it cannot provide the torque demanded of it. Also, when you fly with too much pitch in the main rotor blades, several other problems arise. The first is that the tail rotor blade pitch will have to be increased in order to counter the increased main rotor blade torque and, hence, you will have a less effective tail rotor system. Secondly, because of the increased load in the engine caused by the larger pitch and increased drag of the main rotor blades, acceleration of the engine will be more difficult and, hence, your vertical up and down performance will deteriorate. The result of this will be that if the helicopter starts to descend for any reason it will be much more difficult to stop it by adding throttle because the power won't go fast enough. And we all know the result of that, don't we? Third, if you have a lower than recommended blade speed then your stability and control will be less. If there is not enough pitch on the main rotor blades, then the engine will over 'rev' and, again, will not be running efficiently.

Running with too little pitch like this gives you an ineffective helicopter so far as lift is concerned since we are not using the engine torque effectively at the high end of the speed spectrum. So try and keep to the pitch that the manufacturer recommends. If you really want to experiment then remember that you will have all these other factors of blade section, diameter, chord, and tail rotor design to be changed. Take

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GIVE IT A WHIRL

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this into account when you make your changes.

Well, next month I'll cover more beginner's questions and we will also be able to report to you on the helicopter activity in some of the major national trade shows.

Reference

'The Helicopter' By H.F. Gregory. Published By A.S. Barnes & Co., Inc. Cranbury, New Jersey. □

CUNNINGHAM ON R/C

from page 8

edge of each sheet to overcome the bow that seems to be found in all balsa blocks and sheets. Use the metal straight-edge, or an even longer straight-edge to do this. Don't use a yardstick. You will find that most yardsticks look like a pretzel when viewed for straightness.

Once you have one good edge on each side piece, pin the two sides together and then draw the basic fuselage side on one side. Draw with the marking pen. Make sure that what you're drawing is what is shown on the plans. Measure everything carefully. If you think that you're never going to use the plans again, or if you are the type of builder who likes to mutilate plans, cut the side view out of the plans, and stick it to the two side pieces with the glue stick. When you have cut the fuselage sides you can then stick the plans back together with Scotch Tape to help you continue on with your building.

Next, pick out the inside of each side. The easiest way to do this is to put the top edge of each piece together and lay them flat on the building board. One should be the right side and the other the left side. Laying top edge to top edge, use the marking pen to draw all

the former locations and location of any other pieces that are to be glued to the sides. Again, make sure that you are drawing on the inside of each piece. Use the drafting triangles to make sure that the former lines are at right angles to the top edges, if the top edges are the long straight section of the fuselage.

Now, if you're building a simple box-type fuselage model, you can glue the formers to one fuselage side. At least glue the formers from the firewall back to the former just behind the wing saddle to one fuselage side. When these are dry, you can glue the other side assembly to the first and, if you have marked correctly, everything should be in its correct place. When you join the two sides at the tail, it is best to pin the assembled fuselage over the plan, then bring the two sides together at the rear, exactly over the centerline of the plan. This is the only way that you can be sure of building a correctly aligned fuselage. If you just stick the two sides together somewhere in the air, you're not going to have a correctly aligned model.

Okay, so now that we've got the fuselage pretty well along, how about the wings. Cutting out the wing ribs can be done in one of several ways. The easiest way to cut wing ribs if you have no power tools is the old razor blade method. First, make a master template by sticking the copy of the wing rib to a piece of balsa wood. Carefully cut out this master rib, and sand to the finished outline with fine sandpaper. If you have screwed up making the master template, make another at this time. Make one that is correct. Then, using the marking pen or a ball point pen, draw around this master template on sheets of balsa until you have made the outline for the required number of wing ribs. Again, select your balsa wood so that the density and grain structure is similar in all of the ribs. Never make a rib cross-grain; always lay out the ribs so that the grain runs the long way of the rib. Cut out all of the wing ribs with your trusty razor blade or knife. Cut on the outside of the outline, but do not cut any of the spar slots.

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When all of the ribs are cut to size, stack them in one large bundle, making sure that they are as carefully aligned as you can make them. Insert the master template rib into the center of the stack. Pin the stack together with pins running from each side of the stack. Use a sanding block and medium grit sandpaper to carefully shape the entire stack to the outline of the template rib. Don't hurry this procedure, just make sure that you have sanded a good stack of ribs. Blow off the sanding dust and then, leaving the stack still pinned together, draw in the location of the wing spars. You can do this easily using the drafting triangles or a carpenter's square and the master rib template and soft pointed pen that you have been using.

When you are sure that everything is okay, take the fine toothed razor saw blade and gently cut the slots for the spars. You can cut to the correct depth with the razor saw, and then use the razor point to cut across the bottom. When you have done this, clean out the spar slots and make a trial fit with a piece of spar material. If it doesn't fit, you can widen out the slot carefully with either an emory board or a fine toothed metal file. When you have completed the stack of ribs, keep them together until you're ready to use them. Use one half of the stack for the left wing panel and the other half of the stack for the right wing panel. Save the master template for a repair job, or for another wing at some future time.

To digress for just a moment, really good sanding blocks can be made from a piece of 2 x 4 about 6" long. You can staple one grit of sandpaper on one face, another grit on the other. If you make several sanding blocks with several grits of paper, then you can easily sand anything that you need.

Building a good wing is a matter of securing a good building surface to use for wing construction. Check around at the local lumber yards for a freight damaged wood door. Make sure that the one that you select is good and straight and you will have a building board that will last through many models.

If you own, or have access to, a band saw, then making wing ribs, or any parts is a snap. Use a fine toothed metal cutting or plywood blade, at least 1/4" wide for sawing. Make sure that the table is exactly 90 degrees to the saw blade. Again, assemble a stack of balsa wood, with pieces cut large enough to make the wing ribs. Glue a copy of the wing rib to the top of the stack, then cut on the outside line of the rib. Make sure that you always cut in the same direction. By that I mean that you should start at the leading edge of the rib to make the cut on the top side, then start from the leading edge of the rib to make the cut for the bottom side. If the table is not quite square you will compensate for the out of squareness and the stack will still be the same size. You can cut a small stack of ribs on a jig saw, but the accuracy generally is not as good as with a band saw.

Building R/C aircraft from scratch is a lot of fun. Naturally there are more subjects available from magazine plans than there are from kits, so if you once get hooked on building this way you are in for a lot of fun. Even more fun comes when you design your own aircraft, draw your own plans, build your own design, and then take it out to fly.

We didn't get into covering this time, but we will take a look at this in some future issue.

★

Time to remind all of you fliers of large aircraft who live somewhere in the Southwest, that the 4th Annual Southwestern Jumbo RC Fly-In will be held July 18 and 19 at Thunderbird Field just west of Fort Worth, Texas. Any large model is eligible to enter. Flying will begin at 8 a.m. on Saturday and Sunday, will run til 4 p.m. on Saturday, and to 1 p.m. on Sunday, in order to give the many people who come from a long distance a chance to start homeward. The turnout has been super for the past three Jumbos and I'm sure that this year will be even larger. If you're interested in coming to fly, or to be a spectator, drop me a line and I will send you further information on the Jumbo. Write to me at 2440 Colonial Parkway, Fort Worth, Texas 76109. See you there --- it's going to be a lot of fun one more time. □

SUNDAY FLIER

from page 6

and frustrating experiences! Isn't that Dumb!

Chief Dumb Dumb
Drew Allen
Santa Clara, California

As the saying goes, Drew, "Smile. It's only a hobby!"

Frank Pulte of Rockford Michigan, writes:

Dear Mr. Willard:

For your dum-dum contest I would like to submit the following:

As I was covering a wing with Solarfilm, I had the wing in my lap working from the center section out to the tip. As I was shrinking the covering, the iron slipped and came to rest on my chest. The resulting burn, blister, and scar left a perfect impression of the iron on my chest. It was rather embarassing to explain what happened to my chest every time I went swimming this summer.

Sincerely,
Frank A. Pulte
Rockford, Michigan

Embarassing, yes. But we've all done things like that. How many of you have stabbed yourself with a screwdriver when it slipped? Still, very few have gone to the beach with a localized "tan" spot on the chest. But carelessness is not necessarily dumb.

Jack George of Brandon, Florida, tells about his dumbest action:

Dear Ken:

Here is a contribution for your "Mr. Dum-dum" contest:

Some years ago I went to our field to fly a Sig Cub equipped with a Blue Max radio. There were four or five fliers there but none on 72.40 so I put a pin on the board denoting my use of that frequency.

Fueled up and ready to start the engine, I turned on, but other than some servo jitter there was no control response. I removed the wing to examine plugs and wiring while turning the set on and off at odd intervals. Absorbed in this work I became mildly aware of some commotion on the flight line. I looked up and saw the guys staring at an Ugly Stik which seemed to be flying in a normal manner. With better things to do I returned to trouble shooting and kept hearing sounds of agitation from the flight line. I shut my radio off and asked a nearby modeler about the ruckus while noting that the Ugly Stik was coming in for a routine landing. He told me that it apparently had interference on 72.08 and almost crashed several times. I could feel my face turning

red when I heard this because it dawned on me that I was using the wrong transmitter of the identical two I owned and was trying to operate a 72.40 flight pack with a 72.08 transmitter. After apology to the still agitated Ugly Stik pilot I sneaked back home to consider the error of my ways and how I could have pulled such a dumb trick. Also to put better identity marks on the transmitters.

Sincerely,
Jack George
Brandon, Florida

Yes, Jack, that was dumb. I know. I've done a similar thing myself --- fortunately not at the field, but in my workshop. I have two identical transmitters on different frequencies, and once tried to operate the receiver with the wrong transmitter. Cost me a fair piece of change, too. Took the system over to the post office and sent it in for a check over. Got a collect call from the service outfit --- "Did you know your transmitter and receiver are on different frequencies?" He didn't charge me --- but I had to pay the postage. Dumb.

This one gave me a good laugh, just picturing the scene. Richard Mongin of Milwaukee, Wisconsin, writes:

Dear Mr. Willard,

Here's my entry for the Mr. Dum-dum contest.

I started up the K & B .40 engine. As I stood up, my left leg touched the prop. Howling with pain, I moved the leg away and lost my balance. As a result, the right foot came down on the fuselage just behind the wing. Result: one crushed fuselage.

I didn't know whether to laugh or cry. A nearby modeler was nearly exploding trying to contain his laughter. So we both had a good laugh. He is an airline co-pilot, this may be the first time he wet his pants outside the line of duty.

It's too bad there wasn't a dancing teacher there. I might have been the inspiration for a new disco dance (the Falcon Stomp?).

Sincerely,
Richard J. Mongin
Milwaukee, Wisconsin

Funny, Richard, but not really dumb. Just another reminder to be careful around model engines.

Merle Hastings of Fairfax, Iowa, let the mosquitoes trap him into a situation that qualifies him as First Deputy Dum-Dum.

Dear Ken:

Forgetting the oars to your boat is not even in the same class with the dumb thing I did last Sunday.

Because of a picture in a Model Aviation Magazine a few months ago, many people are now familiar with our flying site at Seminole Valley park in Cedar Rapids, Iowa. What the picture did not show is that the mosquitoes out there approach the size of dragonflies and placed an important role in causing me to commit the biggest dum-dum of them all.

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SUNDAY FLIER

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Greg Frohreich was flying Wendell Maakestad's Taurus; I had followed Wendell up in the air with my Kavalier. After flying around a bit those pesky mosquitoes started getting to me and I asked Wendell to take my transmitter so that I could swat a couple of them. While swatting mosquitoes Greg yelled, "I got hit!" Being the considerate fellow that I am, I told Wendell to give me my transmitter so that he could take his own transmitter from Greg. Assuming that if he is having radio problems he would much rather be flying his plane himself. Once I had the transmitter in my hand it occurred to me that I had no idea where my plane was — and that was dumb.

By all rights I should be able to end the story here with the phrase, "you know the rest," fortunately, there is a happy ending. Once I realized the predicament I was in, I gave the elevator a little up and simultaneously heard an engine running to my left. Since there were only two planes in the air, I assumed it had to be mine. Because I had given it up elevator this presented the largest possible silhouette and I was lucky in spotting the plane immediately. Both Wendell and I landed safely.

This episode suggests a new contest for the suicide jockeys. After they get their plane up in the air, they should be required to hand their transmitter to another flier and turn their backs to the plane. After a suitable amount of time they would be handed their transmitter back and be required to find their plane and bring it under control and land before it crashes. This could be run as an elimination as the sole survivor being the winner.

Yours truly,
Merle Hastings
Fairfax, Iowa

Since there were "extenuating circumstances" he didn't quite win top honors.

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Finally, here's an episode with no carelessness, no reason other than distraction, so it qualifies for Top Dum-Dum. Way out there in New South Wales, Mike Minty tells all:

Dear Ken:

Okay Ken — here goes with many a blush as I remember, but this is my entry in the Mr. Dum-dum competition.

A few months ago I was flying my 72" Piper Cub at our field in Belrose near Sydney NSW. Our club is Warringah Radio Control Society (WRCS) and we have a beautiful (thanks to a lot of members' efforts) field in a depression in the bush. My Cub drops parachutes, in this case a Snoopy with plastic multi-colored chute and the drop was looking good — it should land right on the strip. Simon said to me, "A dollar if I catch it?" I agreed and watched as he ran out, laughed as he dodged around and actually did catch it and it was then my heart lept up in my throat and hit me under the chin. ***I'm still holding the TX in my hand — I'm flying!!*** *And I hadn't looked at the plane for at least 8 seconds (which you know is a long time for a plane to fly on its own — stand still and count them and imagine how far a .40 powered job goes in that time!).*

I looked around frantically — no plane — I shut throttle — neutralized everything else and looked again — Hells bells — there about 3/4 mile away and going down towards the trees on the horizon is a yellow dot — no idea of orientation.

Well — with some quick stick waggling and a lot of luck I got it back — my pulse was about 160 and my knees very wobbly. I shan't bother with "the moral of this story is . . . ," anybody who can't work that out deserves what I managed to avoid.

Now the least you can do is repay my blushes with For What It's Worth, Vol. IV.

Best wishes from a Sunday (Scale) Flyer now a temporary resident in Singapore for 2 years (in case the address caused confusion) and still flying the Cub!

Mike Minty
Singapore

No question about it, Mike, you won the prize going away. At least, your airplane was going away. But you never did tell us --- did you pay Simon the buck for catching Snoopy?

To all of you who sent in your entries, thanks very much. I'm sure you'll agree with me that Mike deserves the award. But don't lose hope. There's always another flying session, or building session, when you'll have another chance.

I know, it's the old saw --- "If it can happen, it will."

Your book is on the way, Mike. Have a Singapore Sling and celebrate for all of us lesser Dum-dums! □

from page 4

*Now, though I call this a pre-production announcement, the first engines **are** many, many months away, believe me, production is already in progress! Casting molds are in process, forging techniques are being finalized, etc. By golly, it's busy here in these Pennsylvania woods.*

In closing, to anyone waiting for present engines, they'll come. Should you order an Ohlsson Commemorative or two, I hope you will be as thrilled with them as I am with the honor to develop and construct them; and as appreciative as I am to Mr. Ohlsson, to his engines, and for his permission to do this for all of us

Best regards,
Herb Wahl

●

We would like to share the frustrations described by our long time friend Bob Dick in his recent letter.

Dear Don,

Why am I writing this left handed? You may well ask . . . and I'm going to tell you. The other morning I decided to do a little work in the shop (which is really our den), and I got out my favorite "working in the shop" denims. I imagine just about everybody has a pair of jeans that he or she uses (wears?) when work in the shop is imminent. These are usually old, worn, and paint spattered, with little chunks of dried epoxy glue scattered here and there. As an aside, if you don't have a pair of denims that fit this description, just wear a good pair when you work in the shop, and, voila! An instant pair of "working in the shop denims."

Anyway, as I prepared to put on these old pants, I noticed that a seam had opened up! This minor happening was due to (a) a slight increase in my body weight recently, and (b) the threads in these very old pants just plain gave up. Immediately a flash of pure inspiration struck me! Carl Goldberg! His glue, I mean! Carl Goldberg's Super Jet! Yes, by jehosaphat, I decided to use Super Jet on that open seam . . . and thanks to you, I had a bottle of it. (Incidentally, I never would have bothered with this seam except for the fact that it was the one that ran right down the center of the seat.) As I began to apply the Super Jet I noticed that, while the size of the drops were perfectly adequate for shop work, the stuff wasn't coming out in a large enough quantity to do good denim seam repairs. A little investigation revealed that the top dispenser tip could be pried off, and I did so. Now the glue was available in a larger amount, but I had to figure a way to momentarily clamp the seam while the stuff went through the curing process. Well, I thought, why not use the pliers I had just used to pry off the dispenser top? And, so I did. And in the process of pouring Super Jet onto the seam, too much came out of the bottle . . . so I quickly brushed the excess off of the denims, grabbed up the pliers and clamped down — hard. And waited for the stuff to cure. And it did. And now I have to

FROM THE SHOP

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write left handed because I have a pair of pliers in my right hand! Permanently. Did you ever try to put on your shoes left handed . . . with a pair of pliers in the right one? You think that's easy . . . try driving a car. And if you really want to find out about people, go shopping. It was instant hysteria in the checkout line at our neighborhood market when I tried to get money out of my wallet. I didn't know whether to hold the wallet with the pliers and get the money out of it with my left hand — or hold the wallet with my left and get the money out with the pliers. The biggest thrill of the day came when I went into the bank to cash a check. The cashier caught a glimpse of the pliers and screamed, "hold up"! An eighty year old security guard drew a blue steel thirty eight on me, and all I could think of was how am I ever going to explain this!

Anyhow, I figured that the idea of gluing seams in work pants with Super Jet is so great (provided you ***don't*** *glue the pliers to yourself) that I'd like to share with all your readers. So here it is "For What It's Worth." Now I don't expect you to print all of this . . . just say something like, "Bob Dick of West Covina, California, uses Super Jet to glue up seams in his 'working in the shop denims' . . . and if you decide to do the same — be careful."*

That's about it — the real reason for writing is to tell you that I'm all out of Super Jet . . . it was a big seam. Also, the pliers took a lot.

Your friend,
Bob
(just call me Lefty)

P.S.

The really big challenge came when I had to go to the bathroom! The next time you see Carl, tell him I said "thanks a whole lot."

●

From SIRS, newsletter of Sentral Illinois Radio Society, Ed Pike, Editor, we found this tongue-in-cheek parody of the engine columnists:

Engine Infirmary

The novice is not the only one to seek out Chinn Lee's sage advice. This month's problem comes from one of the biggies.

Dear Chinn Lee,

I am about to begin construction of a Quarter Scale model of the Gossamer Condor, whose 1977 exploit was the world's first controlled human-powered flight. The pilot propelled the aircraft by pedaling a bicycle type device that turned the propeller.

I would like to maintain scale fidelity and use a dwarf for power. Does this seem feasible?

General I.M. Daft
Research and Development Center
United States Air Force

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Dear Daft,

Yes, but you must exercise extreme caution. Your first problem will be in hiring an aviation minded dwarf. This will be no easy matter, as unemployed dwarfs are rare and not easy to find. However, you might check with Disney Studios, for I hear that they have six or seven of the little fellows who are presently drawing unemployment. I would recommend Dopey, as he is probably used to being high.

The short legs of a dwarf create the same results as a short stroke engine. He will turn up high rpm's but will be lacking in thrust and brake horsepower. To overcome this deficit you must use a Byro Drive or one of the other speed reduction type units.

You must break-in your dwarf very carefully. I would recommend that you bench run him on a excercise bike before installing him in the plane. Run several tanks of fuel through him, allowing him to operate at a moderate 2-cycle speed. Do not allow him to 4-cycle, as that will instill bad habits that will create future problems. During break-in your dwarf must build up his stamina. It is important for you to use 15% Go-Saki fuel (15% Saki — 85% Baker's AAA degummed castor oil). After three tanks of this mixture, he will feel like running forever.

The size of your dwarf will determine whether you build a Quarter Scale or a 1/3 Scale airplane. Remember to build light for maximum performance and a happy dwarf.

If the dwarf should chicken out at the last minute and refuse to fly, run a couple of tanks of 98% Go-Saki through him. He will not only fly, you will have a hard time keeping him out of the pylon races.

Caution — Before attempting any flights, check to see if your AMA insurance covers bodily injury to the flier of a model airplane, who has both feet off the ground, just prior to the crash.

Hi ho, hi ho.

Chin Lee
Wizard of the infernal
combustion engine.

Late Breaking News Bulletin

Reliable sources report that the Russian Dwarf-lator (put a dwarf in the Quarter Scale cockpit) Project has suffered a serious setback when the entire dwarf training class was committed to a detoxification center. The Russians, in an all out effort to be first to put a dwarf in the air, had pushed their dwarfs beyond their limits by running them on 100% Go-Vodka.

With the United States now in the lead, we can soon expect great results.

●

That should do it for now, see you next month. □

DID YOU KNOW...

that a simple way of extending a needle valve, and changing the direction of adjustment, is by the use of a short length of silicone fuel tube? Use a one to one and a half inch length of tube fitted over the needle valve knob at one end, and over a length of 1/16″ wire at the other to make a flexible "universal" joint. The wire will need a small loop bent in the end that's to fit into the tube, and both fittings should be secured in place with a silicone seal, such as the GE type, being sure that the metal parts are *clean*. Those building quarter scale might try this one to get needle valve adjustments away from that big nasty prop. And *please*, take a buddy along when going out to fly a ¼ scale. They are too big for any one man to hold safely.

And did you know that Devel-Hide is great for things other than covering foam wings? This chemically bonded wood fibre product has all the strength of 1/64″ ply, but is far easier to finish than either ply or balsa. Great for covering built-up surfaces such as the vertical or horizontal stab, turtle-decks, etc., and best of all, it costs less than ply or balsa. $4.00 for a 26″ x 32″ sheet, .010″ or .015″. (Min. order, 4 sheets). Postpaid in the U.S., or at your dealers. Idea Development, P.O. Box 7399, Newark, Delaware 19711