1959-61 MODEL AERONAUTIC YEAR BOOK

by Frank Zaic

1959-61

MODEL AERONAUTIC

YEAR BOOK

Edited by

Frank Zaic

MODEL AERONAUTIC PUBLICATIONS

New York, N.Y.

MODEL AERONAUTIC PUBLICATIONS
Box 333 • Cooper Sta. • New York 3, N.Y.

Printed in U.S.A.

Carmen R. Zaic

By now many of us have realized that Model Aeronautics is an enjoyable and satisfying lifetime hobby. - - Therefore, let us treat it as we would a lifetime companion.

Frank Zaic

May, 1961
Lansdowne, Pa.

ELECTRIC FREE FLIGHT STORY

Fred Militky —————————————— Germany

The idea to fly with electric power goes back to the year of 1940. The reasons were: First, the difficulty in starting the internal combustion motors used at the time, and secondly, the gas and oil mess when handling them.

I made my first experiments with two DAIMONZ motors. The power was not sufficient, even if the very heavy batteries used at the time could have been omitted.

I thought of securing a precision motor of some other type. Being a pilot myself, I knew that in a highly developed airplane, there were also installed high-quality electromotors for various auxiliary drives. After a few unsuccessful tries, I was able to get a SERVO motor of FW 190. Its performance was excellent, but it required 24 volts. However, it was impossible to carry in the model such a large and heavy power source. I experimented with tow flights, hoping to gain something by distributing the weight into two models. The first model carried the motor, the second, the battery. Naturally, unsuccessfully. An interesting point of this experiment was that, as far as I know, I had used for the first time a rigid connection between the models instead of the string tow commonly used at that time.

Several years passed, during which I kept trying to find new motors and new current sources, but there was just nothing suitable.

Then I looked into electric-powered control line flight. First without controlled stabilizer. Pretty soon I found out that the problem depended very much on the voltage selected.

In the control line flight, the battery was outside the model; consequently, the whole picture was more favorable due to the considerable decrease in weight. I strapped a small wooden box to my waist containing the batteries. Furthermore, by means of an electric resistance, I could regulate the volaget fed to the motor. With voltage from the distributing system of 24 volts, it was possible to fly. But because of the high voltage required, the practical value of this system was very small. The high voltage storage batteries are expensive, and with current source from an outside distributing system, one is restricted to one spot and also subject to a certain danger. However, with lower voltages, the losses in the conducting wire were so large, that flights were almost impossible. But about this, more another time—now to the free flight.

Many, many thrust measurements followed, and I realized that the answer was the same as in the control line flight, something could be achieved in the free flight if higher voltage was used.

Much later, in 1955, I found suitable storage batteries. These were the silver-zinc storage batteries. I paid for just one experiment several hundred marks for them (DM—25¢). Since I considered this type of experiments (high voltages, strong motors) of no practical value, I decided to discontinue them completely. It was clear to me that an electric-powered flight through use of small, relatively inexpensive motors and common, cheap batteries, would be much more difficult to achieve. But it was in this field that the practical solution should be found.

Since 1951, I tried systematically to obtain and examine every motor that might be suitable for my purpose. The same was done with current sources. It was extremely difficult, because the basis for success could not be looked for in one element alone, but in the exact balance between motor, battery, propeller and installation of the motor. The suitable model would then be easy to build.

Particularly difficult and tedious was, of course, the procurement of the motors. As can be easily understood, manufacturers were not too keen to make investments and developments for an apparently hopeless project. Quite a few stories could be told in this connection!

Things would not be quite as bad if the power/weight ratio of an electric drive aggregate (motor, battery, propeller) would not be so poor. On the other hand, the power/weight ratio of the diesel and glow-plug motors is truly phantastic. Furthermore, the efficiencies of the smaller commercial electric motors is simply miserable, 30% was the best. With reduction gears, the value dropped down to 5%.

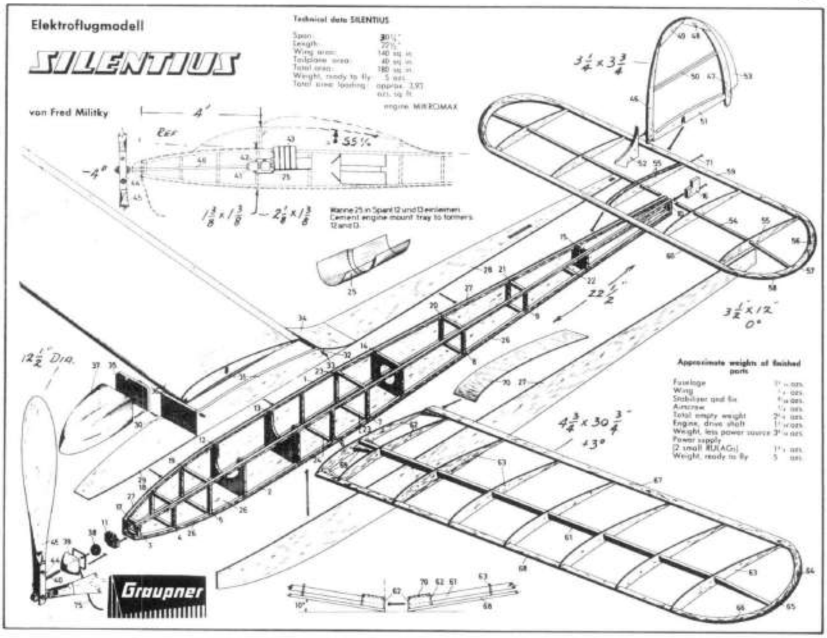
I recognize the direction of development, which would achieve a practical value, with my FM 198 model. It was a rebuilt Wakefield model. It was finished on March 4, 1951, and weighed, ready to fly, 350 gramm (12½ oz.) However, I could not obtain enough power to make it fly.

As already mentioned, the following years were dedicated to additional measurements, procurement of motors and the study of them. In the meantime, I had gathered a complete collection—whole cartons of electric motors. I always endeavored to improve these units to fit the desired purpose by modifying them. A special motor type was crystallized through all this research work from which I expected favorable results. Its weight should be 25 to 70 gramms (.9 to 2½ oz.). The weight of the suitable battery should be about 50 to 70 gramms.

On March 23, 1956, I finished the model FM 219 which was to be used in tests with various motors in free as well as control-line flights.

It should be pointed out here that practically all tests, models, etc. were always carefully recorded. Therefore, it is possible to give today exact details concerning the past work in this field.

That my selected plan of construction was right, was proven on March 18, 1959, when I was finally able to make the first truly satisfactory climbing flight with an electric-powered model. For this, I had used my new model FM 241 which was actually my previous model FM 219 with small modifications. Prior to that, however, I had made innumerable experiments with various models and with the available motors, but there had never been enough power to make them airborne.



Let us skip these years of labor from 1956 to 1959. Through Mr. Heck, of MODEL magazine, I learned of a new type of motor, and I immediately got a sample. Motor and battery were temporarily attached to my model FM 241. Right after work, on March 18, 1959, I hurried to the flying field. Due to the many failures suffered through the years, I did not believe that I would succeed this time either, and I did not connect the motor cut-off before launching it. The motor was switched on at 18:45 o'clock. I could not believe my own eyes: The model was not only airborned but climbing steadily. I tried to recover it in time because I realized that I had not limited the running time of the motor, but in vain. It climbed steadily and five minutes later, it had disappeared in a lightly overcast sky, while the evening shadows began to fall.

This was the most exciting moment in the 25 years I have been active in model airplane building!

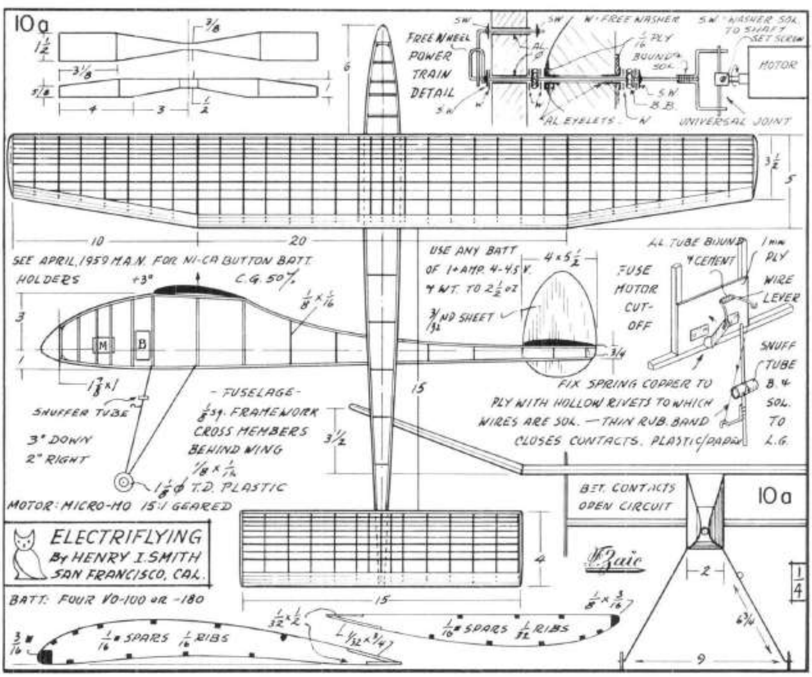
Thus, the problem was apparently solved. Alas, only apparently solved, because a new hurriedly built model, of the same type and with a new motor, did not want to climb at all. I looked for the trouble in the model itself and made lengthy tests with various propellers and model adjustments. All in vain. After long discussions with Dr. Faulhaber, the builder of MIKROMAX motors, we came to the conclusion that the first motor, an unregistered hand sample, had been equipped with a magnet system. Several weeks elapsed before I was able to get another motor with the new magnet. I went out on the field with a heart full of hope, to return fully disappointed. There was no sign of a climbing flight!

In time I began to think that the successful climbing flight had been only an hallucination. After continued study and research, we thought that the first sample motor might have had a special winding. Again many weeks passed before a new motor was built. It worked! And I could again experience the excitement of an electric-powered free flight.

Work continued: A motor with a more favorable winding was built, new battery combinations and new types of batteries were tested, and the model was subjected to a whole series of tests. A propeller was developed with the correct P/D ratio and blade area.

Since December 1959 we have had a really useful mechanism in the MIKROMAX T 03/15 (gear reduction 15:1) electro-powered flying motor and a specific battery combination, and a flying model kit SILENTIUS (from Latin "the noiseless").

It should be mentioned here that although I worked many years on this project practically alone, my close friend, George Benedek, knew all along about my work, and I want to express at this time my thanks for his valuable advice and theoretical observation. Furthermore, I want to thank Dr. Ing. Faulhaber, who, as scientist, was always ready to help in the solution of electro-powered free flight, despite of large financial investments (one arrangement for the change of the winding alone, came to several thousand marks).

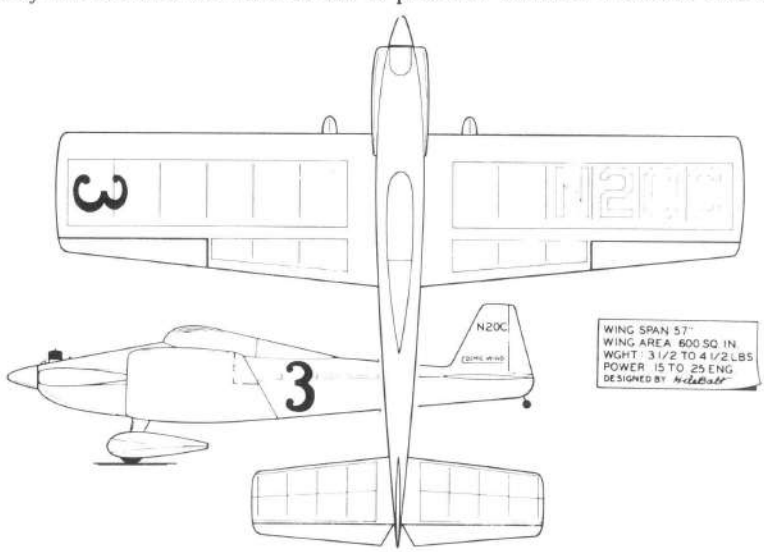


R/C OBSERVATIONS 1959/60 ——— Harold DeBolt

It has been a long struggle but it now appears to me that we have finally reached that high plateau in R/C. I was going to say that we have reached the ultimate but quickly realized that you never do get there. . . . However things have looked real good during this past year and it seems wonderful to have been in on so much really fine flying! Heard Bob Dunham say at the Nats that this was the second year for his model and that he hoped and expected to get a 3rd year out of the same job, surely this must point out the progress which has been made. It takes extreme reliability and an excellent flying airplane to stay on top for 2 years and possibly a third!

The flying at the '59 Nats surely must have taught us something. It was my feeling that any one of the 20 people who qualified could have won the event if the ball had bounced in their direction, then too, the relatively small point spread between 1st and 10th place indicated that some excellent flying was being done by all concerned. Which raises the question: have our models and our flying finally outstripped our competition rules? It seems to me that they have and that it is time to do something about the rules so that we can determine our champions more easily and better.

It would be easy to simply add tougher maneuvers and then sit back to watch the boys try to accomplish them along with all the rest. However, it seems to me that the problems are more complicated than that. For one thing I don't believe that everybody gets an opportunity to do his best at the Nats. Right now it seems to me that a great portion of what it takes to win is riding on "lady luck" and that luck is not necessarily the element we want to use to pick our winners. I believe that one

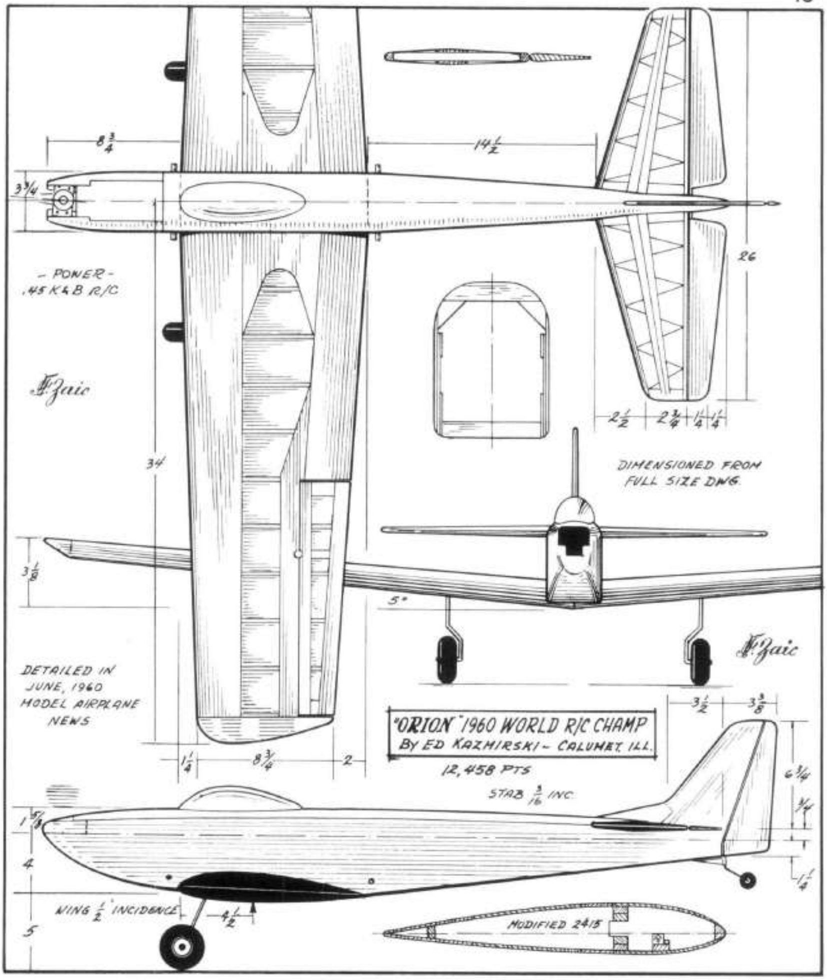


way to overcome this element is to bring about more flights, in other words, arrange it so that everyone will get more than one or two flights per day. This can be done by reducing the total time allowed for each flight. I think that this time can be reduced without detracting from the quality of the performance by simply combining many of the maneuvers and cutting out others which are either repetitious or relatively simple. Seems as though we could pick up perhaps one flight in four this way which would be a big step forward.

As far as model design is concerned it seems to me that under the surface two trends have developed. Some of us are continuing with the inherently stable types and that others are leaning towards full scale and allowing their models to be on the unstable side while depending upon control to accomplish the flying. The latter of course seems to be a logical development until you take all points into consideration. It would seem that there are certain obstacles which must be considered when following this trend. We have an established "delay" in our controls which is the time it takes to see that the model requires some sort of correction and the interval which represents the time required for the pilot to make the movement at the xmitter and for the actual control response to happen in the model. This time delay will become increasingy important as model speeds increase, of course; secondly it is unfortunate that we cannot know that the control is required until the model has done something which shows that it is needed. There appears to be no immediate answer to this problem. Another consideration is perspective: often the model is at a deceptive angle at a great distance, so to speak. Only vast experience can tell exactly what is going on at that point. From this view point it would seem that there would be an advantage to have a model which has the automatic recovery features of a inherently stable design.

I have been following the "stable" line of thought for a number of reasons, one being that I believe this sort of design is more suited to the average flyer and that I depend on this average flyer for my bread and butter. There not being enough time available to do what I might like personally, and at the same time keep kit designs flowing, I have to be sure that my personal work is of such a nature that it will also make favorable kits. Being more or less forced into the "stable" design school I have been able to explore it rather thoroughly and have found it most interesting. Frankly, I believe that just as good flying can be gotten from the stable types and a lot easier on the "ulcers" too. One distinct advantage seems to be much smoother flying because of the fewer corrections which are required to keep the model on course.

One of the obstacles encountered when trying to obtain "Nats caliber" stunting from a stable model is to get the model to perform some of the "unstable" maneuvers such as a tail spin. The other design types seem to want to spin at the drop of a hat so that maneuver is easy for them, not so with the stable ship as it resists the spin all the way. There is an obvious answer, of course, and that is to disturb the stability of the

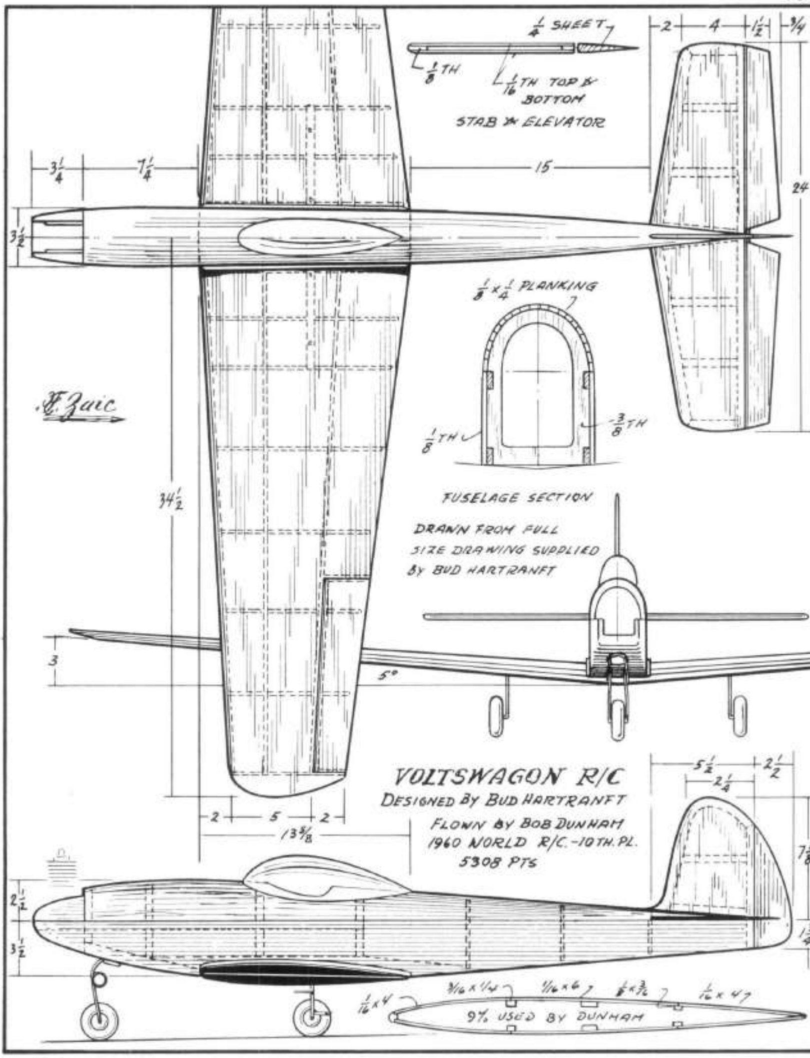


model when such a maneuver is desired. The simple way to do such a thing seems to be to use excessive control movement, obviously a model can be forced to do most anything if enough control action is applied. So it would seem that if we can develop a control system with a broader range than we now have, it should throw the advantage towards the stable design.

At present I am using a modified system that does just about what is needed and seems to bear out this thought. Ordinarily the system provides just the right control movement to do good looking maneuvers and as such it operates in the normal manner. The fundamental required to spin is an absolute stall; naturally, enough up elevator movement will produce a stall in any model. The catch is to have the right amount of movement for a pretty loop under normal conditions and then have the ability to add more movement when a stall is desired. We only require the stall for the spin, and we also need rudder action for the spin, thus simultaneous control. Therefore, my servos are arranged so that when you use simultaneous rudder, and "up" elevator in one direction, you get more up elevator (about double) than you would when the elevator is used separately. This produces the full stall and, of course, the spin. When the opposite rudder is used simultaneouly with the 'up' elevator you do not get the additional elevator travel and a true spiral dive results. This is, of course, a very elementary improvement or addition to our present control system, but I do think that it points the way, and indicates that we can probably develop our systems to the point where the system will do most of the work for us.

During the past year we took a good look at a low wing R/C designs and flying. One thing that was accomplished was to work out a model design that comes pretty close to being as stable as other types, close enough, in fact, to be easy to handle with rudder only control. Not being too familiar with other low wing designs, it is hard to say whether this is an improvement over them or not, but I can say that a low wing can be designed which is inherently stable. Having flown several of this nature I find them to be extremely maneuverable and relatively easy to handle. The two drawbacks which I found was that they seem to lack directional stability to the extent that it is necessary to use control to get them headed in the direction which you want. That is to say that they always tend to follow the last heading which they had, once in a turn they like to stay in it, once on a straight line they stay fairly well but do require a bit of correction now and then. The other drawback is that they must have flying speed (relatively fast) at all times. This can be a problem when landing; you must fly in all the way, and the safe landing is a wheel landing. Actually if you did a 3 point with one it would be luck 9 times out of 10. Under good conditions this seems to be no problem, witness the winning done with low wings at the Nats. However, if your field is cramped and hard to make a long approach into, it takes a skilled pilot to get one in neatly. Perhaps the answer is to add wing flaps or some other means of slowing down without loosing stability, it could bear some looking into, that is for sure.

With all this low wing flying I have had a good opportunity to compare them with the biplane types. To make a long story short I feel that the Bipe has a bit of an advantage, in as much as it will fly fast or slow. The Bipe seems capable of anything in the air which the low wings can do, some things perhaps a shade better, such as rolls, and at the same time it can be slowed way down when desired. This is an advantage in small fields; you can actually stall in if necessary and come out with a fairly neat landing. Normally you land a bit faster than stall speed but nowhere near as fast as with the low wing. So, it appears to me that both types have some advantages, depending upon what sort of conditions your flying is done under.



I believe that I have said just about enough for this time, yet looking back on what has been written I am pleased with one thing above all else. Apparently we have gotten to the point where we now are worrying about details,and the difference between only two model types; gone are the major problems and frustration of a couple of years ago! To me that is progress and a healthy situation for R/C!

January 20, 1961

I have your note this morning and am pleased to hear that the "book" is coming along well. I believe that you are right in thinking that we should have something in it regarding the USA International Teams reaction to the World Meet. I believe that I can voice an opinion which will parallel very closely the whole teams thinking about the trip and competition.

Predominate after thoughts by the team:

1. The Europeans make wonderful Hosts and know how to make foreigners feel right at home!
2. European model competitions are organized on a much higher level than most of ours, and actually rival major sporting events in magnitude and in spectator appeal.
3. The Sportsmanship shown by the R/C teams of all nations is most outstanding and is to be commended.
4. The caliber of the flying shown by most of the teams was better than we had expected and could hold its own in most or all of our competitions.
5. The German Nationals with their "elimination system" showed a lot of merit and would be worth our consideration if we want to bring out the finest R/C flying possible at our NATS.
6. It appears that the American models as flown by our team are the equal of any in the World, even though the approach seems to be quite different than that taken by the Europeans.
7. We feel that consistency is most important, the English used it to the fullest extent and of course, wound up with a well deserved team championship. Had the Germans had a bit more luck with their team, the whole picture would have been different.

As for the details of the meet and things of that sort, it seems to me that this had been well covered in the various periodicals which came out just after the competition. I can say that I thought that they did an excellent and accurate job of reporting which is all to their credit.

This is probably my chance to make my excuses and perhaps drop a word for Bob Dunham plus the Kazmirski story, so I will give it a try.

Ed proved once again what I have often said: That is, that he is about the most consistent flyer which I have ever seen. I don't know whether you can say that "luck" is with him, or what, but it does seem that whenever the ball bounces it always winds up in Ed's hands. I know for a fact that he really works hard at his modeling, and this probably accounts for more of it than anything else. However, how do you explain the fact that his engine failed badly late in both of his flights, yet it did not quit and actually came back as strong as ever? In general, though, his flying is tops and his score was earned all the way, they gave him nothing he did not earn. It is my opinion that he will be the man to beat for some years to come, and if someone does do it, the flying will have to be perfection itself.

I don't know how to explain Dunham's problem. Frankly, on the 1st flight his usual engine setting turned out to be the rich and what can you do without sufficient power? I sort of tied the engine failure on the second flight in with his first flight, being too rich I suspect that he unconsciously leaned out too much for the second, thus the engine stoppage. Nothing could be found wrong and later flights went off OK. . . The weather could have been the cause. We had test flown in dry weather the day before and Bob did well in it. The day of the meet was much colder and awfully damp, this could have created problems. Of course we will always debate what the outcome would have been had Bob gotten his best flights in, I would be the last one to bet on it for I think the score would have been so close that luck would have been the deciding factor. You must remember though, that this Dunham is not so bad either when it comes to that "bouncing ball stuff"!

As for myself I don't really have an excuse because I don't think that you can count negligence as an excuse. As you know, I use removable R/C units in my models. The airplane I was using (Stits Playboy) was quite new and yet thoroughly test flown. Actually, it had just really "come in" during the test flying in Zurich. Walt had given me a suggestion for trim which really put it into the proverbial groove so the airplane was hot, that is for sure. However, I was using a R/C unit in it which was several years old and, of course, as things age, they deteriorate. The older a unit gets, the more often you should check it. Frankly, being rushed I had not given this one the usual attention which it should have gotten. Truthfully, I did check it the night before the meet but lacking a real small screwdriver I did not check a single hidden wire, naturally it was this wire which broke during my flight. Apparently I was doing OK on the flight. I thought that the maneuvers were excellent, although perhaps just a bit out of position. I really had a lot of confidence right up to that last moment. Later on the score proved me right, we did very well as far as the flight went. I just wish for the teams sake that I could have finished the flight, for in the end so few points meant so much. . .

I don't think I need to make any excuses for the second flight with the Bipe. The Score was right up there with the best, and when you consider that I was no longer flying for the "Championship", that should make a difference. What I did do on this 2nd flight was to insert into it many of the things and ways which we fly over here. I felt that as long as I did not have a chance, it would be a good idea to show them some of the differences between our methods of flying and theirs. I hope that I accomplished my point, we shall see as they write new rules and build new models.

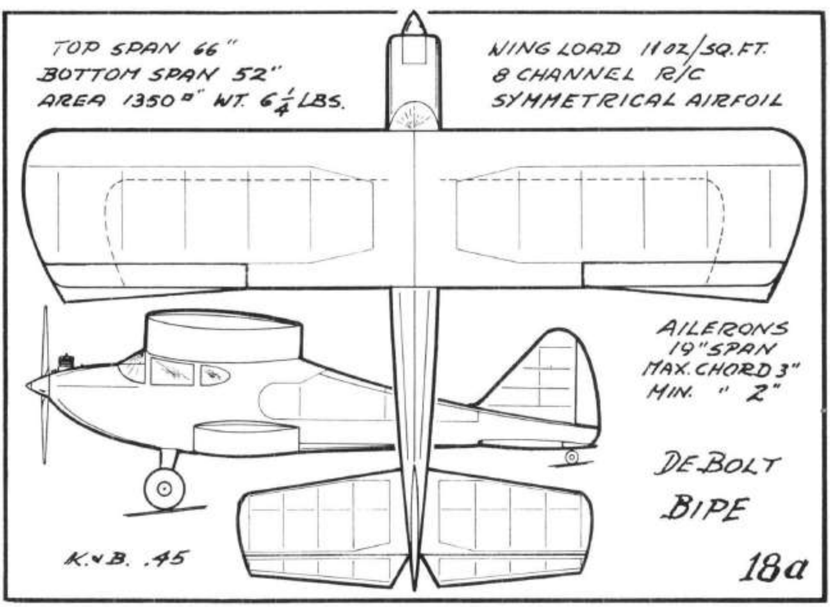
We thought that the English models paralleled ours the closest of any that we saw. Their models are small by European standards and are quite fast and maneuverable. They say that they do not have the radio reliability which we seem to have, so you could easily excuse the "lesser" paint job which they used. As the results show however, they flew them well and really know what they are doing.

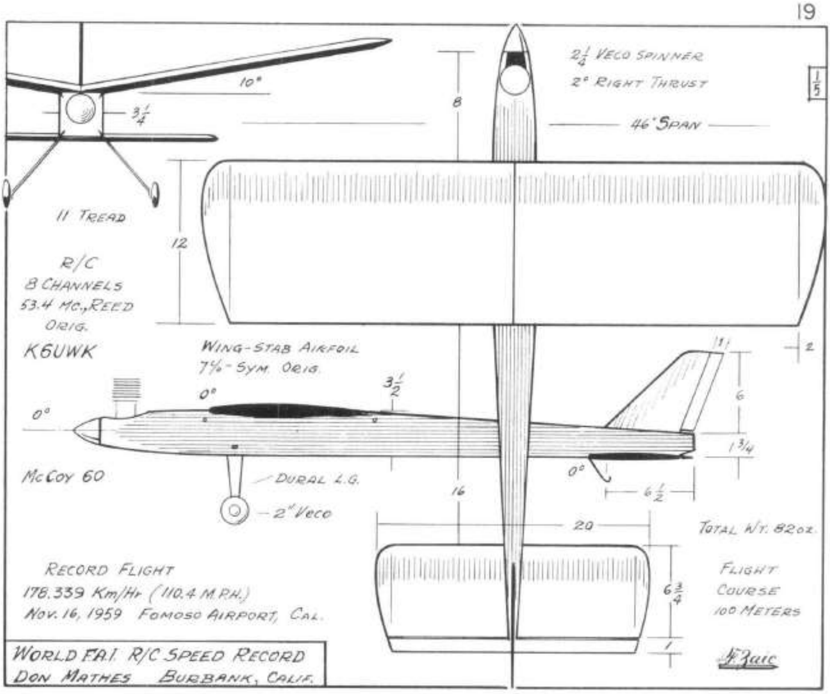
I would say that the Belgians must get to work. Our observation was that they have a wonderful reliable machine but it is outdated by the models of today. It is both too slow and too erratic between maneuvers, to meet today's competition.

The Germans have an entirely different approach. They fly a fairly large model at a reasonable speed and, while no spectacular, it does get the job done. They will do all the maneuvers well, but somehow it seems that it is a struggle for them to do it. It appeared that they were operating very near the limit of their capability. They very definitely could improve their landing gears, and this would help them considerably. We were amazed by the reliability of the Ruppert Twin diesel engine which they used. They seemed a most admirable power plant in spite of the size and weight.

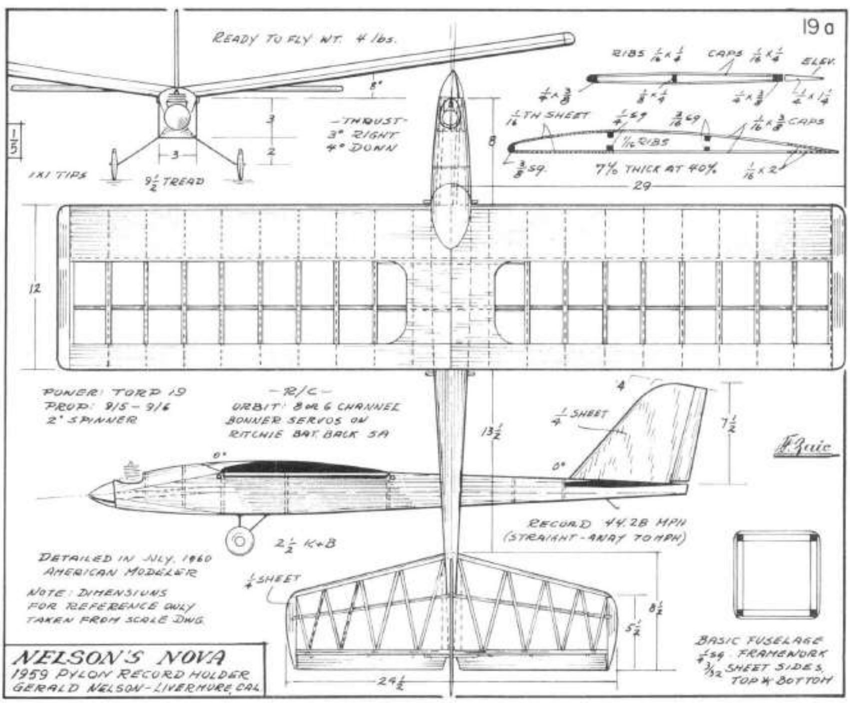
We felt that the competition proved most enlightening, and that as a result, the next one will show a marked change in both model design and flying. We picked up many usable ideas and feel that the Europeans did the same. If we all went home and used the good things which were apparent the next event should prove most interesting.

A great big "thank you" must be given to the Swiss Aero Club and the Swiss people by all the competitors for a tough job well done! I can not recall ever seeing a meet so well arranged and so well conducted. They just did not overlook a single small detail!





$2\frac{1}{4}$ VECO SPINNER
2° RIGHT THRUST
46" SPAN
1/5
10°
$3\frac{1}{4}$
8
11 TREAD
12
R/C
8 CHANNELS
53.4 MC., REED
ORIG.
K6UWK
WING-STAB AIRFOIL
7% - SYM. ORIG.
$3\frac{1}{2}$
0°
0°
McCOY 60
DURAL L.G.
2" Veco
16
0°
$1\frac{3}{4}$
6
2
$6\frac{1}{2}$
20
TOTAL WT. 82 oz.
RECORD FLIGHT
178.339 Km/Hr (110.4 M.P.H.)
NOV. 16, 1959 FOMOSO AIRPORT, CAL.
$6\frac{3}{4}$
1
FLIGHT
COURSE
100 METERS
WORLD F.A.I. R/C SPEED RECORD
DON MATHES BURBANK, CALIF.
W. Zaic



19 a
READY TO FLY WT. 4 lbs.
RIBS $\frac{1}{16}\times\frac{1}{4}$
CAPS $\frac{1}{16}\times\frac{1}{4}$
ELEV.
8°
1/5
3
2
3
-THRUST-
3° RIGHT
4° DOWN
1X1 TIPS
$9\frac{1}{2}$ TREAD
$\frac{1}{16}$ TH SHEET
$\frac{3}{8}$ SQ.
$\frac{1}{16}$ RIBS
7% THICK AT 40%
$\frac{1}{16}\times\frac{3}{8}$ CAPS
$\frac{1}{16}\times 2$
29
8
12
POWER: TORP 19
PROP: 9/5 - 9/6
2" SPINNER
- R/C -
ORBIT: 8 or 6 CHANNEL
BONNER SERVOS ON
RITCHIE BAT. BACK SA
$13\frac{1}{2}$
4
$\frac{1}{4}$ SHEET
$7\frac{1}{2}$
0°
0°
W. Zaic
$2\frac{1}{2}$ K+B
RECORD 44.28 MPH
(STRAIGHT-AWAY 70 MPH)
DETAILED IN JLY. 1960
AMERICAN MODELER
NOTE: DIMENSIONS
FOR REFERENCE ONLY
TAKEN FROM SCALE DWG.
$\frac{1}{4}$ SHEET
$8\frac{1}{2}$
$5\frac{1}{2}$
BASIC FUSELAGE
$\frac{1}{4}$ SQ. FRAMEWORK
$\frac{3}{32}$ SHEET SIDES,
TOP & BOTTOM
NELSON'S NOVA
1959 PYLON RECORD HOLDER
GERALD NELSON - LIVERMORE, CAL.
$24\frac{1}{2}$

PREPARING FOR WORLD R/C RECORDS

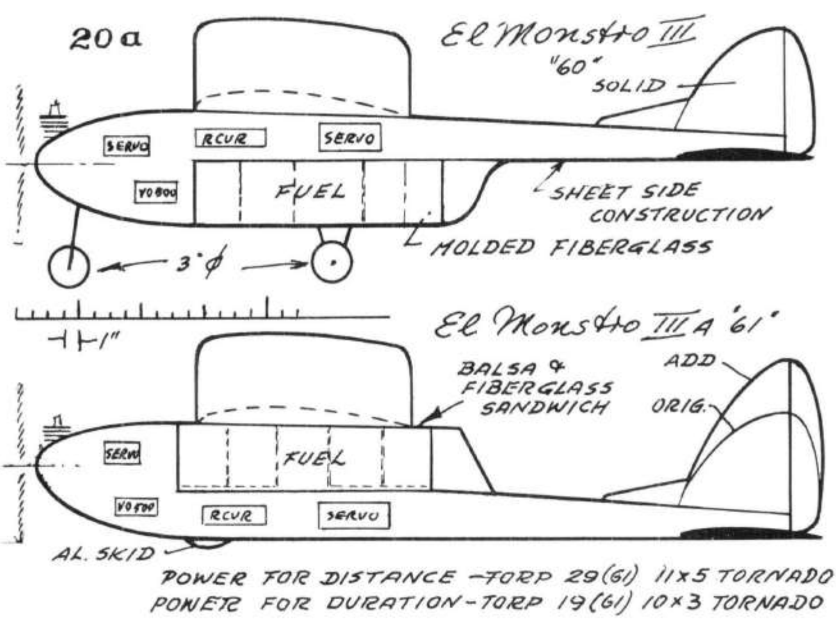
Dick Everett —————————————————— Chino, Cal.

Background of Dick's R/C distance record of 37.1 miles flight was printed in the Sept. 1959 American Modeller. Rather than discuss the record fight, Dick decided to give some details on his latest undertaking.

This fourth version was much different. Off and on ever since the first record flight, I've been thinking of improvements. We have had two basic problems, (1) maximum weight, (2 kilos, and (2) model must R.O.G., (launch has since been changed to optional) but weight has not changed. At first thought single channel equipment is the lightest, so shall we use it? No! It is best for disance attempt to be able to trim (longitudinally) during flight for maximum speed for a given engine. The difference between take-off attitude and flight attitude when up on the step is 12 to 15 mph or 50 to 60 miles per flight. All up weight of the radio gear we are using for 10 to 12 hours flight time is 21 ounces, including the VO 500 six pack.

We started this time with a fuselage reminiscent of your old "Thermics". The 110 ounce fiberglass fuel tank was strapped on the bottom wih rubber bands. The main gear was then fastened to the tank with more rubber bands. Many test hops were made—all terminating due to lack of proper fuel flow. We were using the same system as on the previous distance flight. Pressure from the crankcase was fed through a check valve, to a metering valve, then into the tank. Out of the tank to the needle valve through a filter. We used the Torp 45 for all these tests.

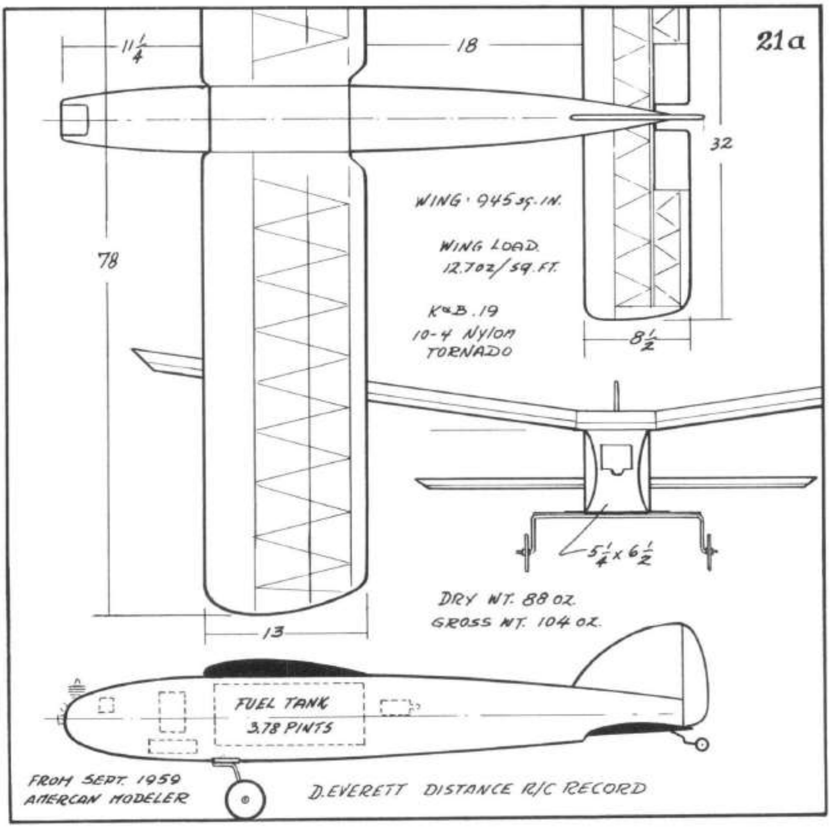
After two weeks of trying and changing, I gave up and modified the fuselage by putting the tank on top and changing the entire front end. Test flights then indicated a lack of vertical tail area (dutch roll), so we added 25%. On the first attempt a flight of over an hour was made, (the



first flight of more than 35 minutes). We landed, took the bird home and made some minor changes. The next day a test flight of two hours plus was terminated when it was noticed that the model was losing altitude, (it should have been gaining) we discovered that the tank and wing slipped aft almost ¾ in. We then keyed everything and subsequent test flights were good.

At the present time we intend to fly the closed course distance first, then the duration, the straigh line distance and altitude. We are using super het relayless receivers (Orbit and F & M), Bonner transmiters and Torp engines, 29 for distance, 15 for duration.

The present design (?) does not have any patch cables to the servos, eliminating four plugs and the associated wires. Fuel capacity was nearly doubled without any appreciable increase in fuselage area by making a fuselage to house the R/C gear and mount the tail and engine. The tank then supports the wing. This design change ended with a lighter airframe and a consequent increase in fuel carrying capacity. I expect to hand launch the bird on its record attempts with just a skid for landing. Removing the landing gear, allowed an additional ¾ pint of fuel.



TWIN ENGINED R/C Robert D. Heise, Alameda, California

At last, I have finished the three-view drawings of the "Heisen-doppel." That is the name I have given to my brain child.

The first thing I decided to do was to build a rather large model so that the extra weight and proposed future changes would not affect it's flight—result: the 6½'—1,014 square inch plane as drawn. I chose a 2415 airfoil for it's forgiving stalls on large model planes.

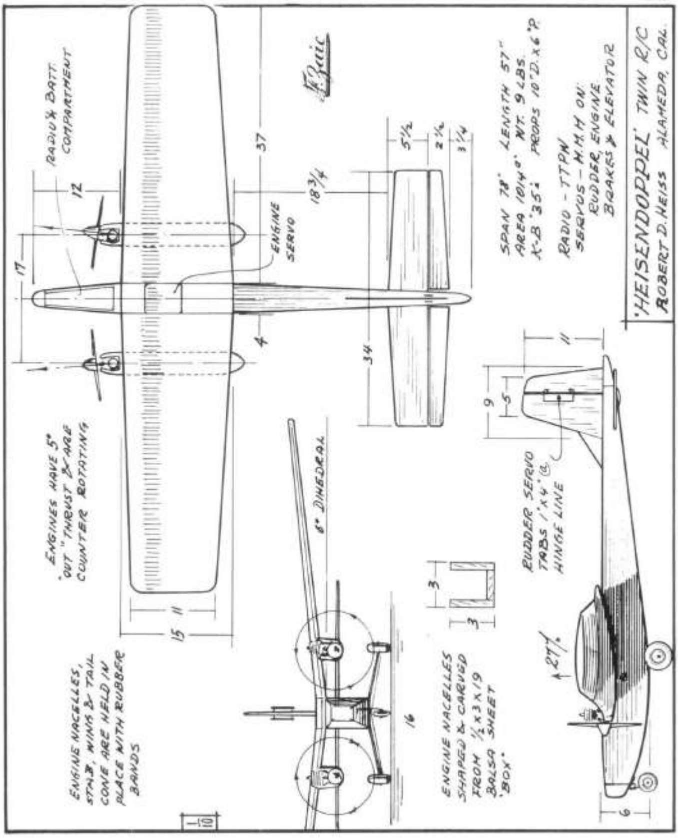
As you will note, the construction and layout of the aircraft is very straightforward, only the simplest methods of construction were used; square fuselage, simple empenage, shoulder wing mount, bottom stab mount, etc. The plane uses rudder, elevator, engine and brakes. I feel that I have a very unique servo system worked out to obtain the above controls with T.T.P.W. The radio transmitter and receiver are not modified in any way from the original conception by Walt Good. I have proportional rudder, elevator, brakes (either right or left wheel) trimmable throttle and I am now installing a steerable nose wheel. This gives excellent control for this type model.

It will perform all of the pattern maneuvers except spin and outside loops. I haven't actually tried outside loops, but I doubt if it will do them because of twin engine take-off troubles. When one engine stops, it leaves you with marginal power and air speed. I have had an engine stop on take-off about four times in one day and that was too much. I didn't spin and didn't crash, but it was very close, especially that first time when I didn't know exactly what to do.

To obtain good single engine directional control, I added small servo tabs to the rudder to assist my rudder servo under adverse attitudes as mentioned previously.

One of the greatest reasons for my success in twin engine operation is the offset in the engines on each nacelle. As noted, you will see about 5 degrees offset to the outside. Another factor is the closeness of the engine to the fuselage in relation to wing span. Therefore, the greater the wing span for the distance between engines, the more likely you will have good single engine performance. Yet another design feature will be noted. The length of the tail moment arm. It is quite long and the fuselage side area is rather small which helps the rudder overcome the terrific thrust of one engine. At the present time when one engine stops during normal flight, I can hardly notice it on the control action. I can only detect the change by sound. Speaking of sound, you have to hear the engines to really appreciate twin or multi ships.

The take-offs and landings are very realistic and something to see. The steerable brake method, along with tricycle gear, makes ground handling a breeze. It is really a pleasure to fly a plane that is not under powered, yet not so fast that you can't handle it. Most "35" power planes weigh from 5 to 7 pounds. Mine is always on the heavy side. Imagine



flying a "35" plane that only weighs 4.5 pounds and has a 20 inch prop to swing, at 10,000 R.P.M.; that is the end result of the twin. It will climb up right from take-off at about 50 to 60 degree angle and keep on going up without any sign of stopping. I have climbed out to 1,000 feet like this and noticed no change in air speed. The finished plane weighs in at 9 pounds, but I feel that it could be reduced to about 7 to 8 pounds with no effort.

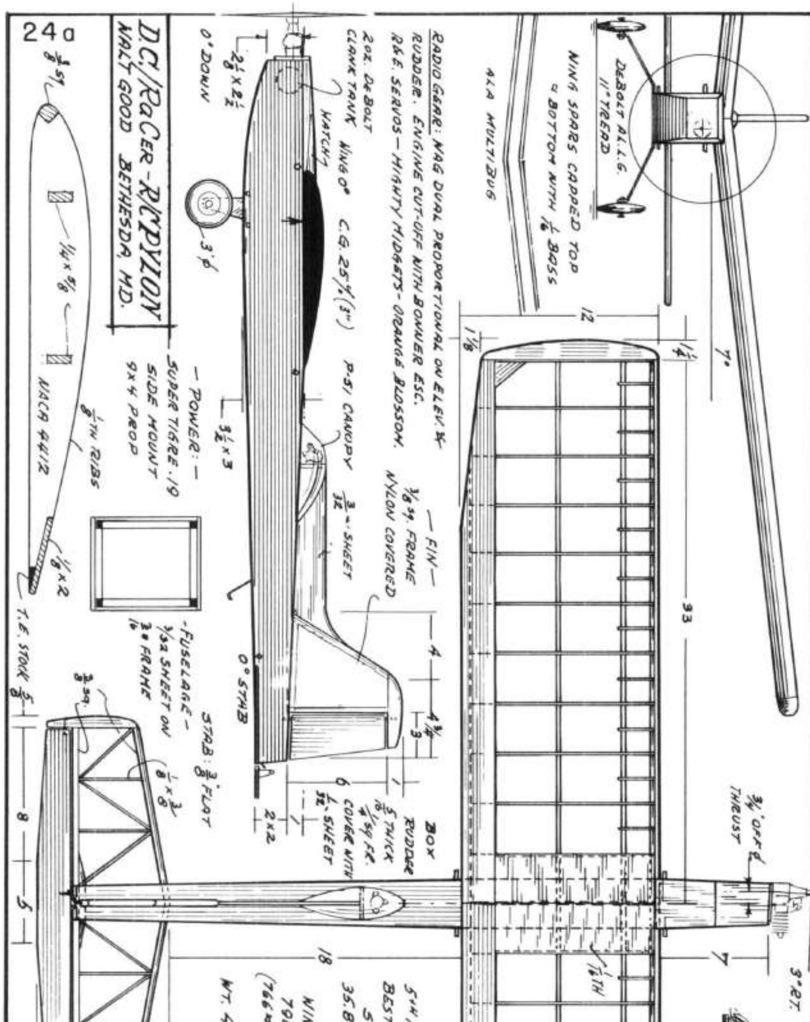
The engine nacelle and wing structure are really heavier than necessary. I used plywood in many places where it would not be required. Flight tests and hard landings have shown many structural and design changes that could be made to improve on the weight, looks, and performance of the plane. I am trying to draw up the changes and have some plans available for the few who might want to try the biggest thrill in radio control.

It was a lot of work and I sure have taken more than my share of ribbing about the plane, but all I can say is, it was worth it; if only to hear the people remark: "I know it can't be done, but there it goes."

R/C PYLON RACING ——— Walt Good, Bethesda, Md.

The Pylon racer was built and flown during 1959 and represents a design which may now be slightly outmoded. The basic requirement was an AMA Pylon ship for a .19 engine and over 766 sq. in. wing area. An attempt was made for low weight and low drag. The latter was gained mostly from reduced frontal area which had far more effect than I thought it would.

The controls were the WAG dual proportional on Rudder and Elevator with the fail safe being used for engine cutoff. The proportional



elevator was very effective for holding flat trim during the straight sections of the course, and the simultaneous, and proportional, rudder and elevator was very natural for snappy pylon turns. The proportion of 7 degrees dihedral and the fin area of 5% to 6% gave very nice turn characteristics. The wing which was actually flown was from my old Multibug and used a 4412 section which was 12% flat bottom section but it did not get built due to lack of time. In fact six inches were cut off the Multibug wing to bring it down to 790 sq. in. which was close to the required 766 sq. in.

The best speed from the ship in an official race was 35.8 mph. I am sure it would be much better with a thinner wing and a better prop match. I was never able to get the 9 x 6 prop to rev on the Super Tigre .19 so I was confined to a 9 x 4 at about 14,000 rpm. Never did play much with special fuels except to borrow some Wizniewski mixture at the 59 Nats! I would be in favor of some simple standard fuel mix as adopted by the FAI for control speed. That is, just Methanol and Castor.

Probably the most impressive thing about the Pylon Racer, from the pilot's viewpoint, is the difference in flying feel with and without engine. Under power you feel like you've got ahold of a slippery eel, but when the engine stops, she becomes a gracious lady and floats to a landing like an A-2 glider.

Thanks for the opportunity to slip a ship into the famous Year Book, the true archive of Model Aviation. Best of luck with your continuing efforts in producing this most worthwhile publication.

P.S. The pylon ship met a complete demise when it came out on the short end of a dogfight. The midair collision resulted in a sprinkle of parts, so sudden and complete that I thought the ship had evaporated. The wing was the only recognizable piece floating down among the debris!

R/C DELTA NOTES ——— Weldon Smith, Lansing, Ill.

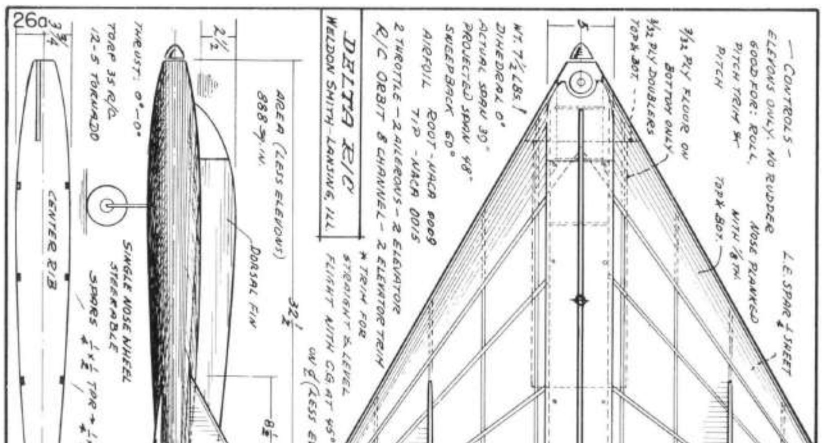
This folly was started about three years ago when Fred Stout advanced the idea that a Delta was the natural answer to the R/C pylon race. He, Bob Baldwin, Cliff and myself built some. Out of the original bunch, Bob's was the only one which flew successfully. That was for the 1958 Nats, and after our rather poor showing, we re-grouped that winter and the enclosed plan was my attempt in 1959. After our experiences in '58, my thought most foremost was to make a "sturdy" airplane. It was sturdy alright! Came out at 7½ lbs, and I was trying to fly it with a .19. Did manage to get off the ground a few times, but finally gave up on the pylon race and installed a Veco .31. A few flights with the engine, then, finally put in a K & B 35 RC. This proved to be more than adequate power and about a dozen flights were made. Finally, the airplane was retired. It was either that or retire the pilot. All flights were extremely exciting and, to say the least, nerve-wracking on me.

We found out a few things about Deltas from this one. No doubt, anyone who has played with them has already found these truths, but we, of course, were groping in the dark, since not much information is available on the beasts.

Firstly, keep the C.G. forward. I moved mine from 45% to about 48% (on center section) in an attempt to get a faster pitching tendency to speed up turns. This made the ship completely unstable in pitch, and led to only one of the "hair-raising" flights. This gave us the clue that too much sweep increases longitudinal stability to the point that the airplane will not pitch fast enough to loop or turn, and any attempt to increase the pitch by moving C.G. aft, makes the elevator so sensitive that the plane becomes uncontrollable.

We also have decided that to use a symmetrical section requires a super light airplane to the point that you have lost any speed advantage gained from the airfoil, because you just can't build them that light.

My new airplane has a Clark YH and weighs 4¾ lbs. on four-channel Orbit. Incidentally, it flies well on a Torp. 19. I used Bob's ribs and spread them out a bit so that it has 45 degree sweep and 54 inch span. Extremely fast, and the fellows hate to launch it, because it makes such a fearsome noise. (We have no place to take off and so it has not as yet made a take-off—and here I am entering it in the Lakeland R/C contest next weekend).

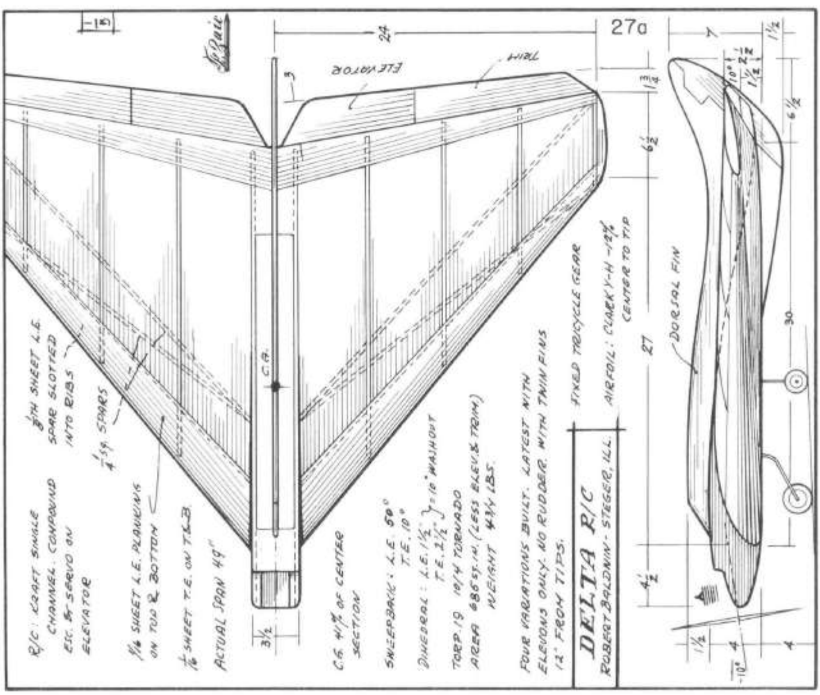


R/C DELTA NOTES CONTINUED —— Robert Baldwin

Since Weldon had the opportunity to write first, I have been saved the task of explaining the start of all this nonsense.

The Delta on sheet no. 2 is actually the second attempt on my part. This one was designed to be flown on single channel and, after several changes in lateral area on the fin (taking off the top in the rear and putting the same area forward), it is quite docile. There is about 10 degree downthrust in the engine to keep it from climbing too rapidly with power on. The glide is quite flat, for a Delta, and about all that happens when you use up elevator in the glide is for the nose to come up slightly and the ship settles more rapidly.

Number 3 Delta is with symmetrical airfoil NACA 0009 at the root and tapering to 0015 at the tips. Radio is 8-channel Bramco: Two on elevator function, two on aileron, two on throttle, and two on elevator trim. This one shows promise of being a good one. Wing loading is fairly light. It has about 1400 sq. in. of area and has a Fox 35 R.C. engine. It has been temporarily shelved to allow more concentration on No. 4 which is designed to fit AMA pylon event rules. Basically, has the same plan form as the one on sheet no. 2. Uses an Olympia 15, Orbit 4-channel radio, no rudder, just elevons for turning. Right now it is "Dutch Rolling" at slower speeds. Going to try more fin area in the center, cutting down somewhat on the two twin fins which are located about 18 inches apart on either side. This job is pretty fast with the Olympia 15, and looks as if the bugs will work out O.K.



WORLD R/C GLIDER DURATION RECORD ——
—— from Upper Hutt Aeromodellers, Nov. 1960, New Zealand

As most of you will already know, Ian Barber of the Wellington M.A.C. recently broke the world record for Radio Control Glider duration. At the moment the time is unofficial but is being forwarded to the F.A.I. for ratification. Ian's time of 9 hours, 4 minutes, broke the record of Dr. R. Chase of U. S. A. by about 30 minutes. New Zealand, or rather Frank Bethwaite, had a pretty fair hold on his record for some years and it is great to see it back here again. Congratulations Ian.

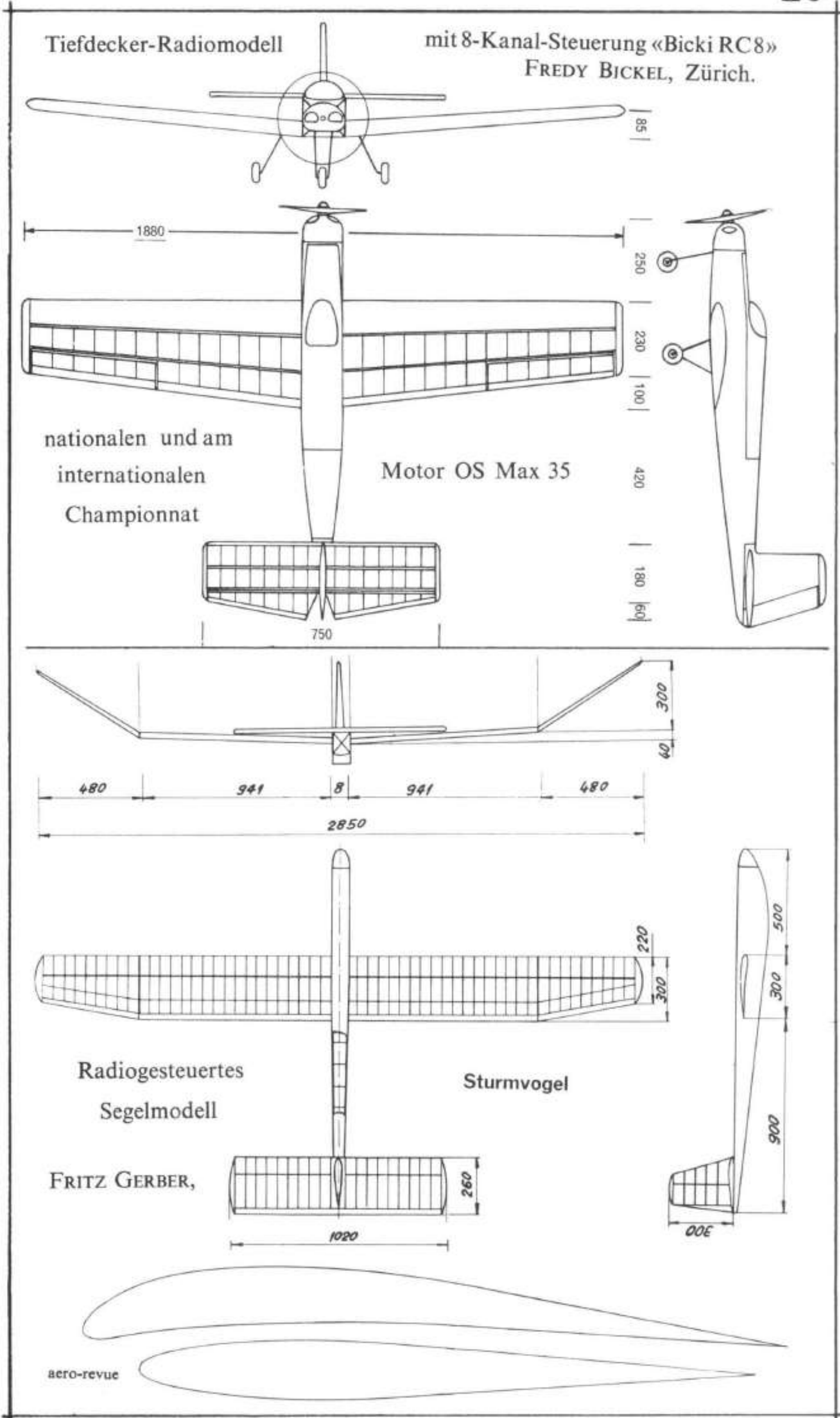
From what I can gather, the conditions were far from ideal for people like you and me. How would you like to stand on the top of a hill in a strong, cold wind for over 9 hours, starting at about 6 a.m. Here is some of the story that I've been able to get through devious channels: On the Saturday night the weather forecast sounded reasonable, so Ian decided to have everything ready for an early start the next morning. Actually, this mainly meant getting the official timekeepers here, as the model has been ready to go at a moment's notice for nearly two years. The wind has to be from true west for conditions to be favorable at Ian's hill at Paraparaumu. On Sunday morning the wind was favorable enough but the cloud was only about 200 ft. above the hill. In spite of the low cloud level, Ian decided that the chance was too good to miss, so he launched at 6:31 a.m.

The air was fairly turbulent near the hill most of the time, and the model kept getting up into the cloud. Elevators were used to get it back down again. Eventually, after almost 9 hours of flying, the model got too far into the cloud. Down elevator was applied. When the model reappeared, it was going downwind and almost vertical. There just wasn't room or time to pull it out. Fortunately, it landed within the allowable distance from the takeoff point.

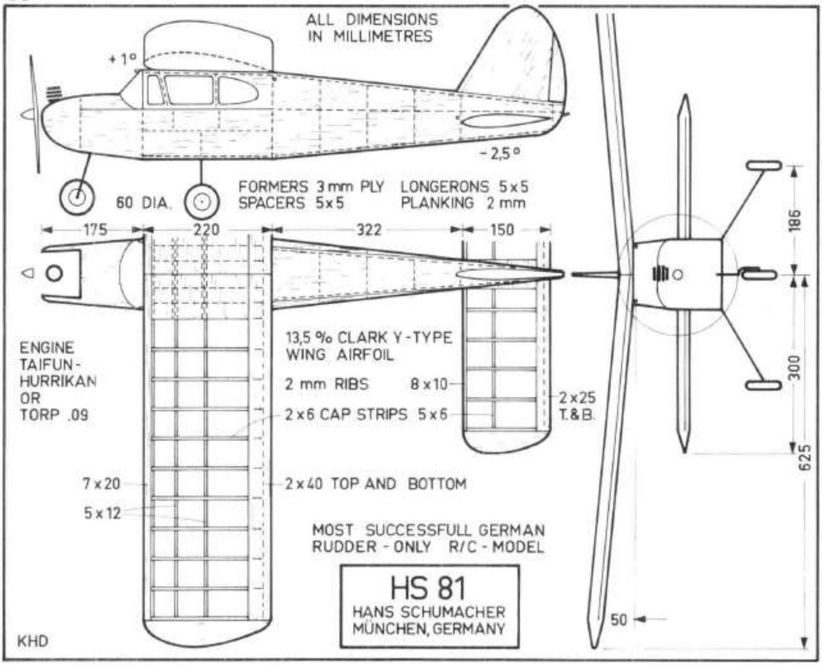
The model was a standard Bethwaite Mark V design with a wingspan of 72 in. Drawings of this model have appeared in several overseas magazines. During the flight only ¼ of the available turns were used. The 1½ volt Kalim cells (four in parallel) were actually showing a higher voltage at landing than at takeoff, while the 45 volt battery had only dropped about 2 volts.

The radio equipment was Wright (well made New Zealand) operating rudder and a trim elevator. The elevator has a chord of ⅜ in. and is the full span of the tailplane. There is only 1/32 in. up and 1/32 in. down movement on it. However, this is enough to change trim from floating glide to a very fast shallow dive. The dive is so fast that the model will shed its wings if turned.

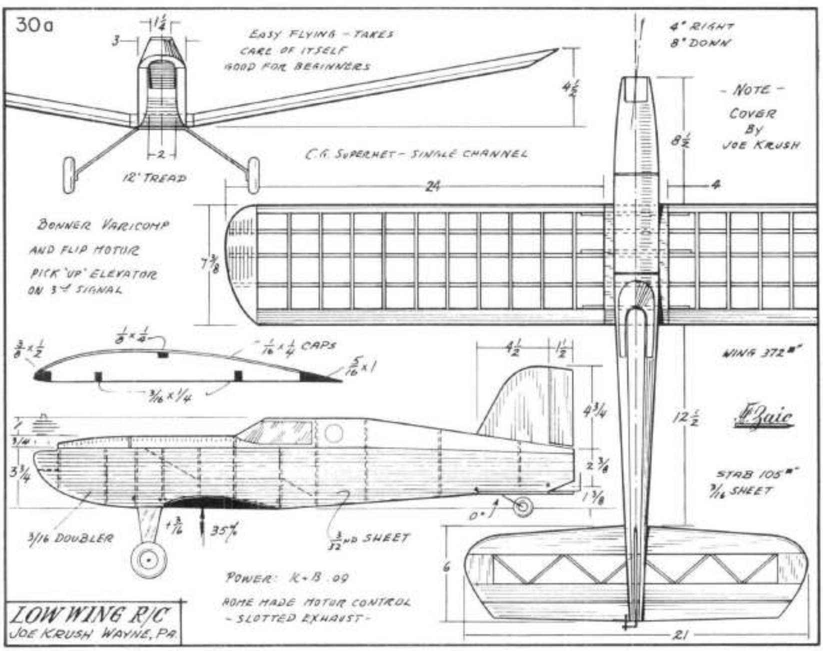
Ian was originally shooting for 12 hours and we think given the conditions he'll do it. We hope you keep going, Ian.


Tiefdecker-Radiomodell
mit 8-Kanal-Steuerung «Bicki RC8»
FREDY BICKEL, Zürich.
85
1880
250
230
100
420
180
60
750
nationalen und am
internationalen
Championnat
Motor OS Max 35
300
40
480
941
8
941
480
2850
220
300
500
300
900
Radiogesteuertes
Segelmodell
Sturmvogel
FRITZ GERBER,
260
1020
300
aero-revue

30


ALL DIMENSIONS
IN MILLIMETRES
+1°
-2,5°
60 DIA.
FORMERS 3 mm PLY
SPACERS 5x5
LONGERONS 5x5
PLANKING 2 mm
175
220
322
150
186
300
625
ENGINE
TAIFUN-
HURRIKAN
OR
TORP .09
13,5 % CLARK Y-TYPE
WING AIRFOIL
2 mm RIBS
8x10
2x6 CAP STRIPS
5x6
2x25
T.&B.
7x20
5x12
2x40 TOP AND BOTTOM
MOST SUCCESSFULL GERMAN
RUDDER - ONLY R/C - MODEL
HS 81
HANS SCHUMACHER
MÜNCHEN, GERMANY
50
KHD

30a


EASY FLYING - TAKES
CARE OF ITSELF
GOOD FOR BEGINNERS
4° RIGHT
8° DOWN
- NOTE -
COVER
BY
JOE KRUSH
12" TREAD
C.G. SUPERHET - SINGLE CHANNEL
24
BONNER VARICOMP
AND FLIP MOTOR
PICK "UP" ELEVATOR
ON 3rd SIGNAL
3/16 x 1/4
1/16 x 1/4 CAPS
5/16 x 1
WING 372□"
3/16 DOUBLER
35%
3/32 SHEET
STAB 105□"
3/16 SHEET
POWER: K+B .09
HOME MADE MOTOR CONTROL
- SLOTTED EXHAUST -
21
LOW WING R/C
JOE KRUSH WAYNE, PA.

R/C SLOPE SOARING IN CALIFORNIA

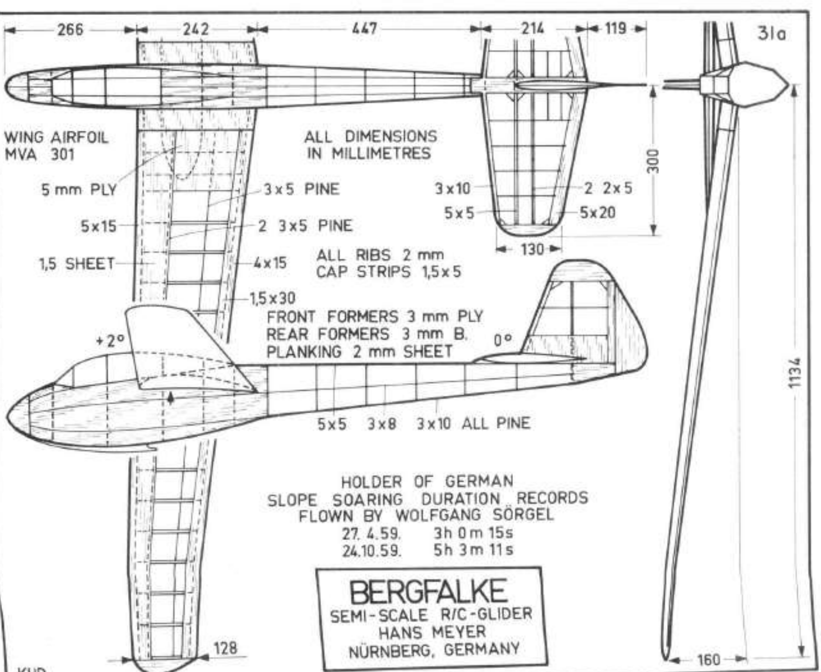
F. D. Rose ——— Dec. 1960, ——— Los Angeles, Cal.

You asked about our slope soaring operation here in L.A.

The history of it, as far as I know, dates back to around 1953. Some fellows, mostly unknown to me, started out on the cliffs of Palos Verdes, just over the ocean on the peninsula of L.A. Progress eventually caught up with them and the area was built up. Later four fellows started it up again on a cliff a couple of miles inland from the Playa del Rey beach area in southwest L.A. Of the four, three are still active and the number has swelled to about 25 in all that have tried their hand at this strange and exciting phase of modelling. There are 10 or so of us that are hard core enthusiasts that are out almost every week.

The first thing I want to get clear is that this article is strictly a rough guide to the interested modeler. Everything in this article can at some time be violated and still have a good flying ship. I'm just putting on paper the things that I have seen work but none of what I write is a hard and fast rule.

The requirements for slope soaring are simple but take some hunting to find. You need a slope facing, or near so, into the prevailing winds. The angle of the slope will be relative to the velocity of the wind. The steeper the slope the less the velocity has to be and vice versa. This

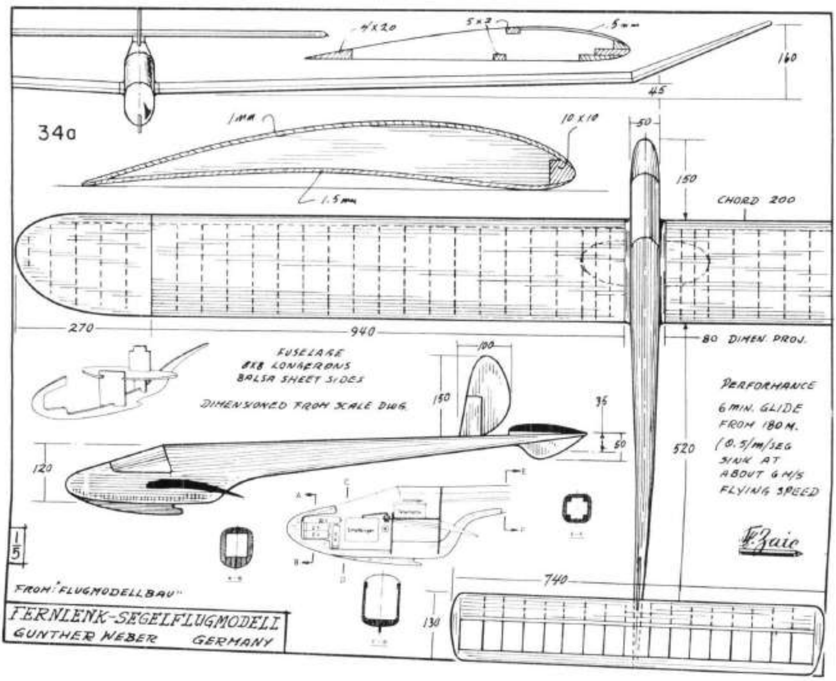


General building procedure should be like that of a power R/C ship, strong and rugged all the way through. There will be times your ship will be landing at speeds in the excess of 25 M.P.H.

Hard as it is to believe, when watching them, gliders are doing up to 35 M.P.H. A stab placed on the fin is not a bad idea because of the beating it can take on landing. The wing should have hardwood spars, be reinforced at the dihedral breaks and be planked at least on the top side of the leading edge. The glider should be completely covered with silk unless fiber glassed. There is no need for a wheel in the keel because you will want it to stop as soon as possible after landing, unless you get fancy and try touch-and-go landings on the edge of the cliff (which can be done with luck, nerve and skill). Either servos or escapements can be used with success, just be sure the servo is fairly fast.

One of the critical items in the trimming of the slope soarer is the position of the C.G. It should not be farther back than 33% of the chord from the leading edge, nearer is alright.

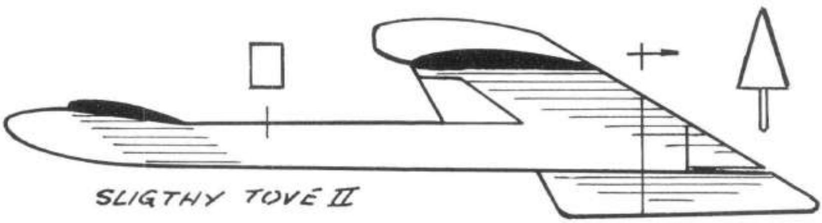
A few more comments about the slope. The amount of lift from the slope depends on two factors. The angle of the slope and the velocity of the wind. The steeper the slope the less wind velocity is needed and vice versa. The best way to judge a slope is to watch the birds with soaring characteristics.



DESIGNING R/C CANARD Wm. Hempstead, Clifton, N. J.

Canard plans published in a magazine started the search for a stable configuration. (The one in the magazine would only fly upside down). Experiments with chuck gliders led to the following conclusions: Elevator area to be 1/3 wing area; sweep back for both wing and elevator, about 3 to 4 degrees decalage; a large fin behind the wing; and the distance from the center of lift of the elevator to C.G. should be 1/3 to 1/2 of wing span.

The first model had 36 in. span and was built to the above specifications. The wing was mounted on a cabin and the motor on a pod. The reason for this was to put the prop close to the C.G. and minimize torque and thrust variations. An engineer friend claims that the distance from the prop to the C.G. means nothing, and this may be true, but the greater this distance is, the more sensitive the plane is to thrust variations.



This plane was called "Slithy Tove I" (see Lewis Carrol) and flew off the board with the only trimming required being the addition of 15 degrees downthrust to prevent the model from diving. This sounds off, but remember, the prop is above and little behind the C.G. and, therefore, vertical thrust adjustments are reversed. Since power was provided by a tired McCoy .049, the climb was gentle—very gentle. It would turn the same in either direction with rudder only and had no tendency to drop its nose. Eventually the plane was lost in the tall grass.

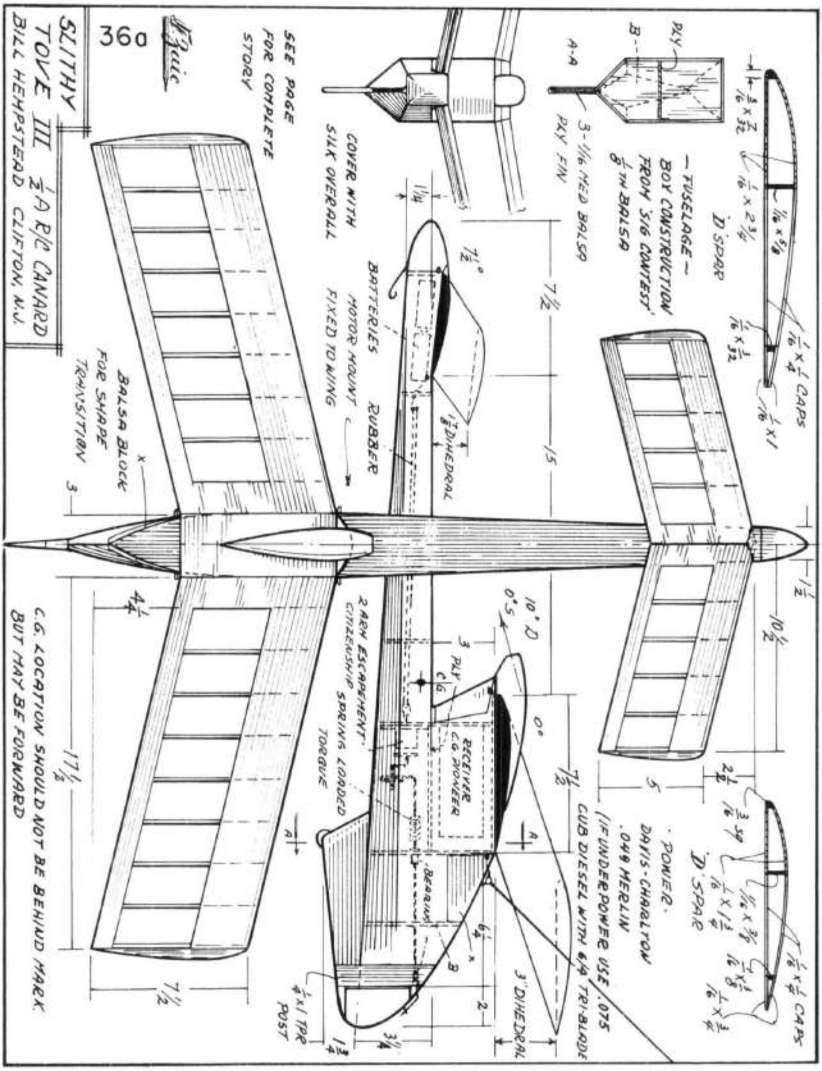
A second model was built a year later with slightly different lines, but the same configuration. This developed an oscillation on the glide which could only be cured by increasing the fin area. When this was done, the trouble disappeared. Power was from a Thimble Drone Jr., and the climb was straight up under full power. Again the design was completely stable. Unfortunately, this one was lost out of sight after an overrun of 30 seconds. Both models had a peculiarity: No matter how much power was applied and how hard the launch, they dropped to about a foot from the ground and then slowly started to climb. This is hard on nerves, but there was never a mishap.

A few other comments might be of interest. All wings and stabilizers have been identical, using a Clark Y and "D" tubing. The Clark Y; simply because it makes construction easy and has performed well. The "D" tubing is the only construction for free flight or radio because it is the only one which is warp free, and I use it on everything.

(By the way, this whole thing started as a research project for a course taken during my quest for a Masters degree. It was an excellent topic since no one had even heard of a Canard and most of the report was on the experiments involved. The first one flew so well that Canards got under my skin.)

Weight in the rear is critical, and some radio equipment might not be light enough. I used pencells in III, but have to add 1½ oz. lead ballast. Should have made the fuselage wider and used C or D cells.

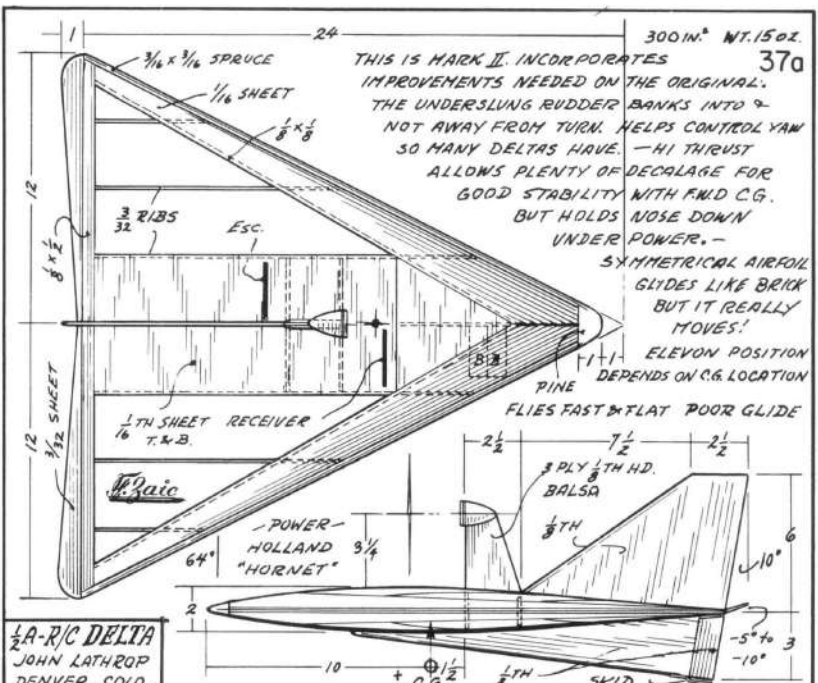
If the model shows any Dutch Roll or oscillation, add fin area at the bottom. This should not occur, but since fin area is minimum required (due to looks mainly), it might happen in a few cases, but the added fin

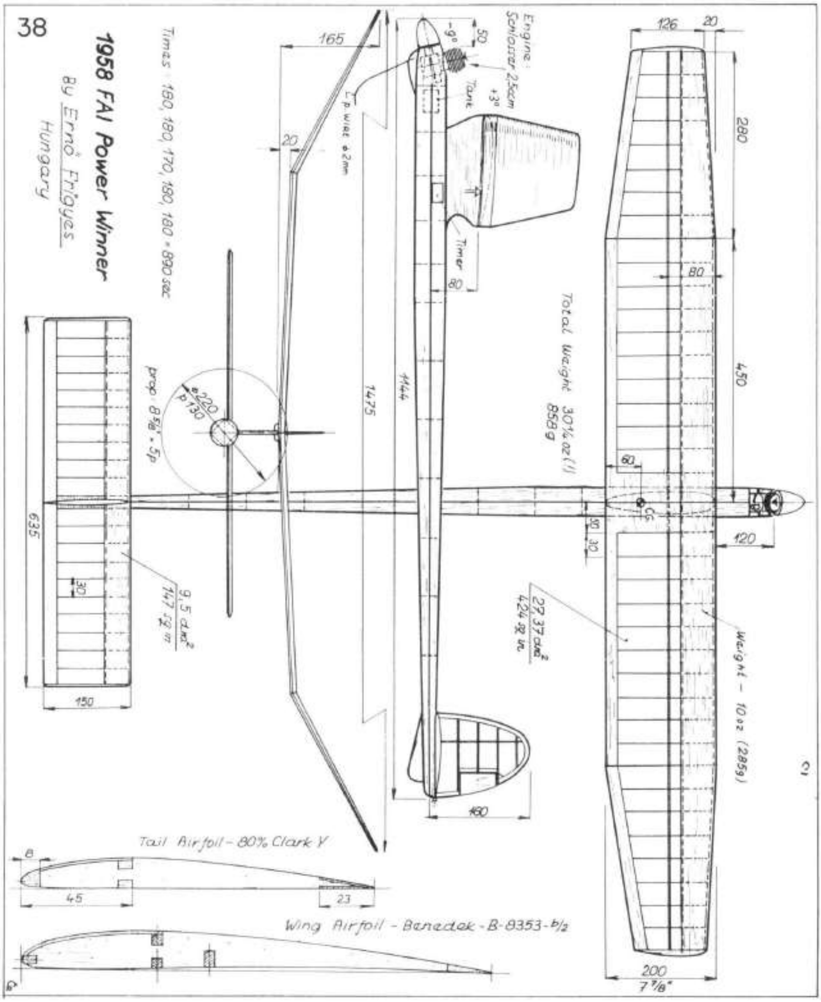


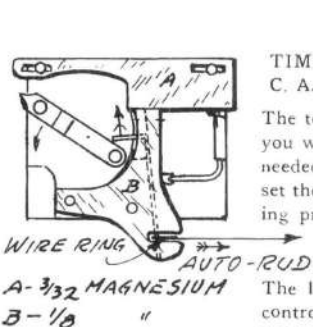
will cure it. "Slithy Tove" has no other stability problems, even under high power. If a warp gives a turn, use a trim tab to correct on the rear of fuselage, not on wing or stabilizer. Thrust is very ineffective and torque has no noticeable effect. Remember, up and down thrust adjustments are reversed. For a model which does not climb, add down thrust. "Slithy Tove" will not loop under any conditions, so that it is no problem.

The C.G. can be as much as two inches forward of the position shown with no effect, but not to the rear. If it glides well, don't worry about the C.G. Chances are the model will turn out tail heavy, if anything, and in this case, on the glide it will simply flop to the ground. It will not stall violently as will a conventional layout. Moving the C.G. forward of the optimum point simply increases forward speed and sharpness of glide angle. Since the C.G. is not critical, moving it forward thus affords a good method of increasing wind penetration on the glide. Under power, wind penetration is superb under any conditions, and as good as planes with elevator control. This is, I believe, due to high thrust.

Any one who wants a sport free flight will find "Slithy Tove" an ideal choice. Just cut rudder area in half. It will turn either way safely with only rudder adjustment. No spins or spiral dives. I once knocked the rudder on II and it stayed in a 60 degree bank about 6 feet from the ground until the engine quit.





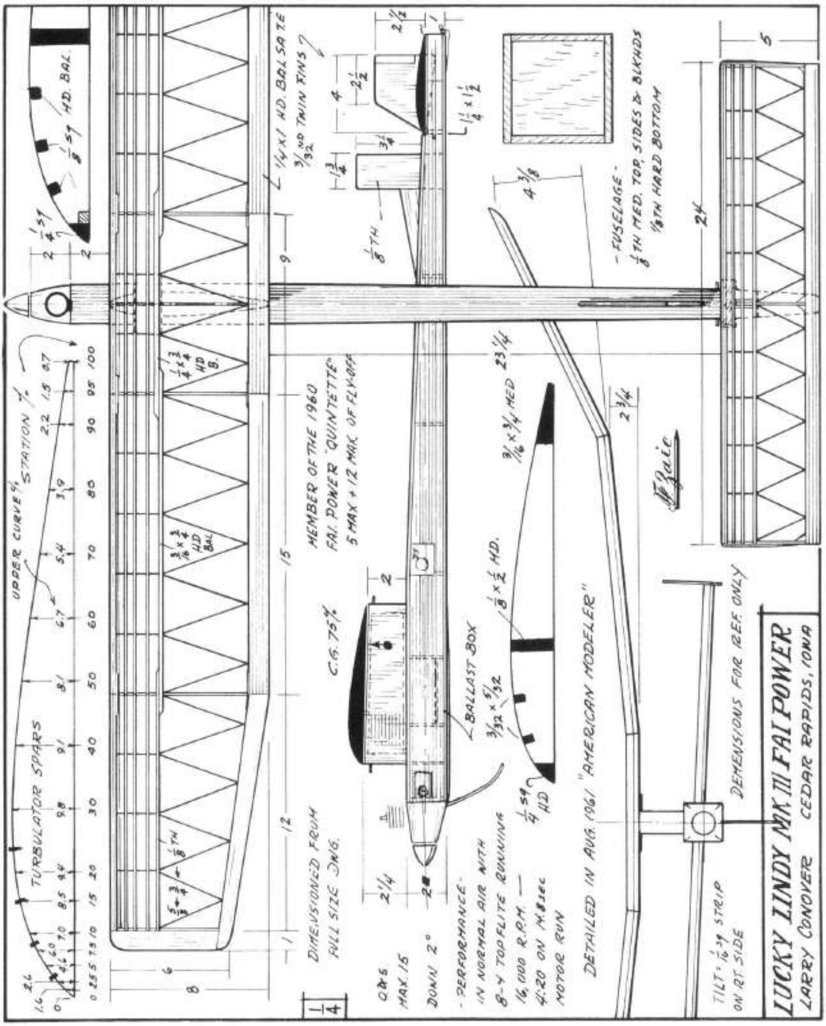


TIMER SET STOP AND AUTO-RUDDER RELEASE

C. A. SCHUCHMAN, Belleville, Ill.

The top item is a sure fire timer set. How many times, when you were just about ready to launch a gas model, the engine needed a little better needle valve setting, and you had to reset the timer quickly? No need to take your eyes off the whirling prop when using this simple item. Just crank the timer arm until it hits the stop, and then let it go!

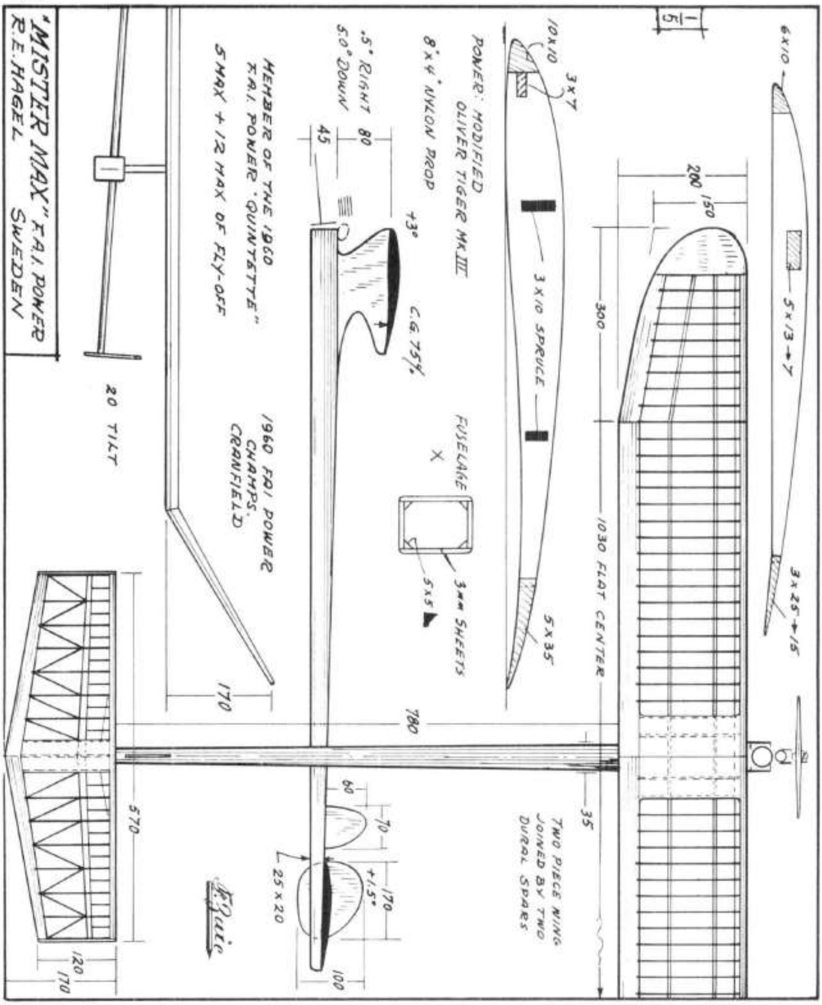
The lower item is for those who want to use auto-rudder control for power and glide transition. It can, of course, be used for other timed releases.



1960 POWER FLY-OFFS — Peter Sotich

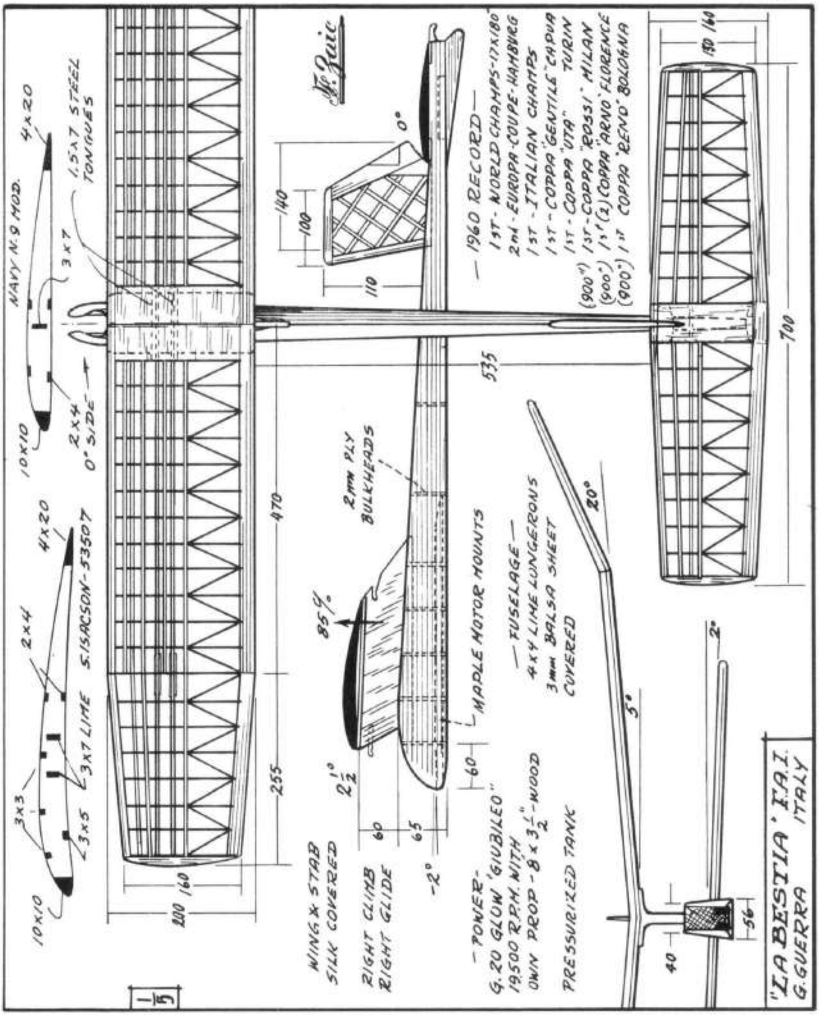
Unfortunately, weather took a turn for the worse with rain falling just about starting time and a change in the direction of ground wind. A test flight was made by Great Britain's Tony Young from another launching area and his flight indicated that the original site would be satisfactory.

It had been previously decided at a Team Managers meeting by Contest Officials to fly until 6 p.m. and then stop flying regardless of the number of contestants tied with all maxes.



Ed Miller had the misfortune to drop out in the first flyoff round when his engine quit running with the model pointed straight up. The model stalled all the way down with an 86 second flight being recorded. Ed claims that the motor was running better than ever. It is possible that the silk on the underside of the wing may have loosened up because of the rain and damp weather. J. Winn's model (proxy flown by V. Jays) recorded a zero second flight. Thus, two of the 13 flyoff contestants were eliminated.

The next flyoff round saw J. Fontaine of France being eliminated by only 3 seconds with a flight of 177 seconds. T. Johannessen of Norway was also out of the running after recording a zero flight.



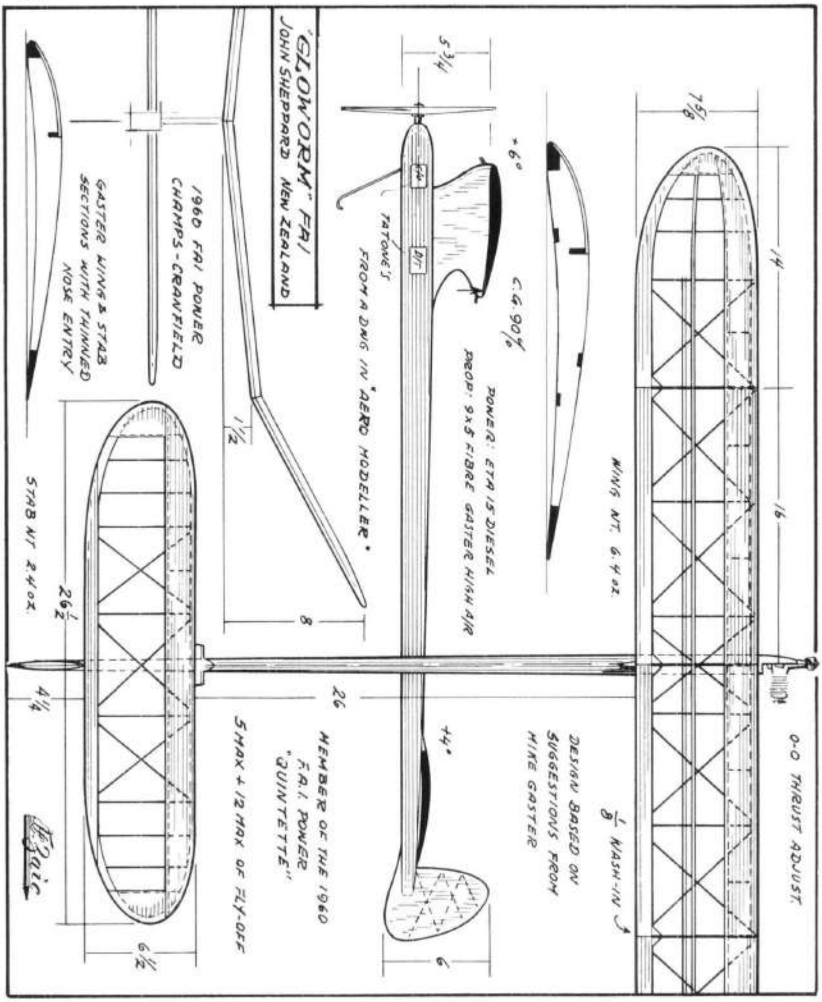
3rd FLYOFF ROUND

B. W. Bulukin of Norway was the only contestant to drop out in this round after a 1:47 second flight. Only 8 contestants remained.

4th FLYOFF ROUND

E. Frigyes of Hungary, 1958 F.A.I. Power Individual World Champion dropped out after a flight of only 129 seconds. There were now 7 contestants left.

5th FLYOFF ROUND



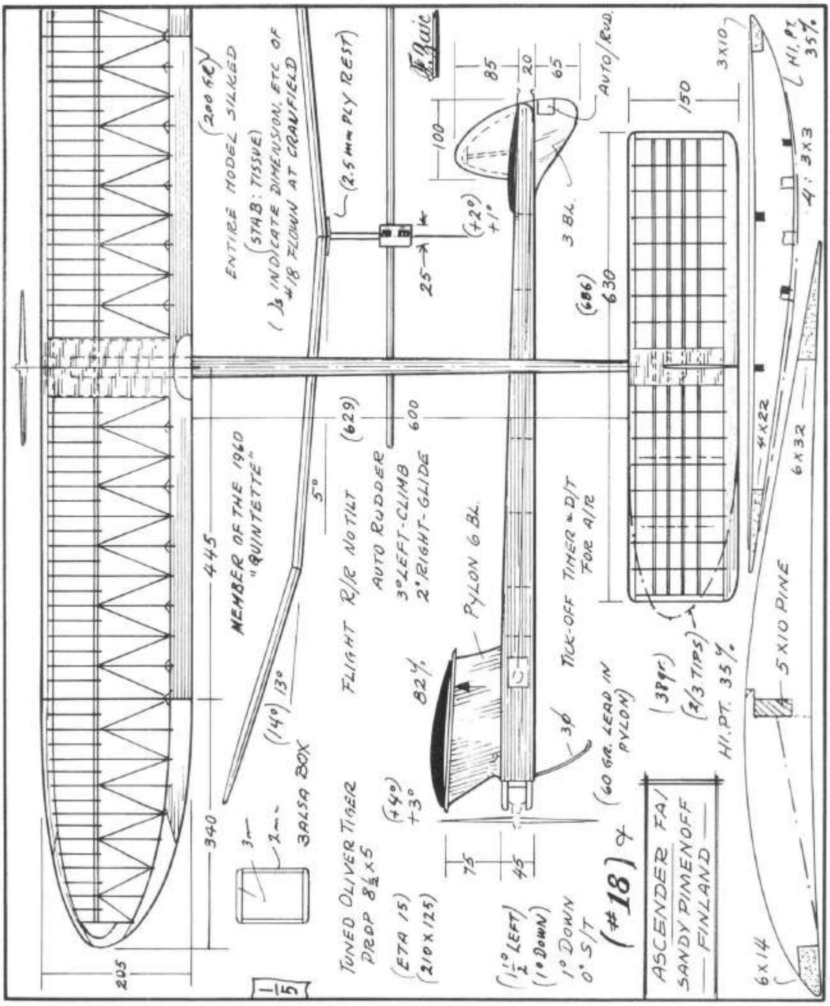
Dave Posner of Great Britain dropped out after a flight of 156 seconds which left 6 contestants.

6th FLYOFF ROUND

No change as all contestants obtained maxes. There was a meeting of the Jury during this round and their decision was to continue flying 3 minutes maxes during a 15 minute round. Reaction to this decision was not too enthusiastically received by the remaining 6 flyoff contestants.

7th and 8th FLYOFF ROUNDS

No change as all contestants obtained maxes despite shorter rounds.



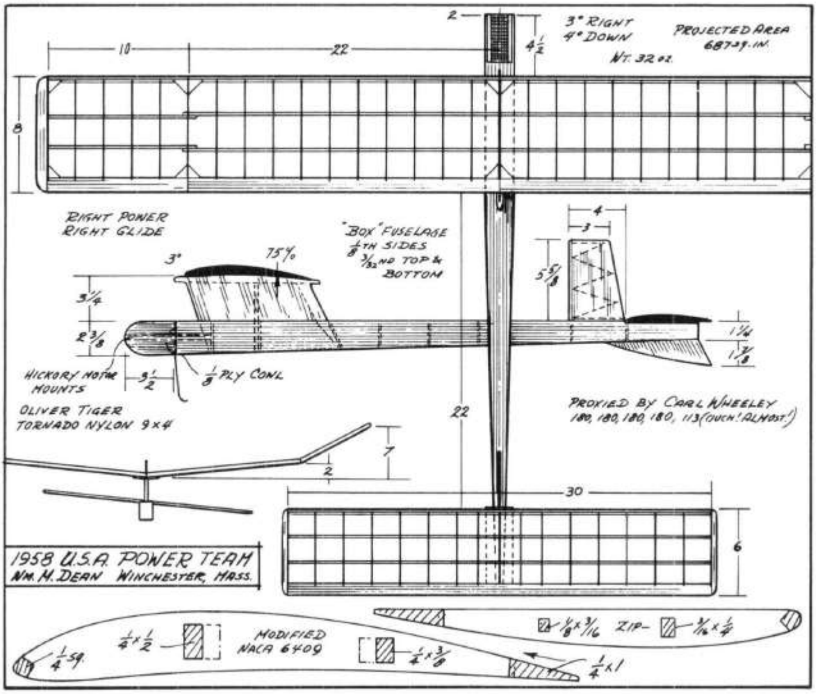
9th FLYOFF ROUND

Z. Sulisz of Poland was eliminated when the engine of his model had an overrun thus leaving only 5 contestants with all maxes.

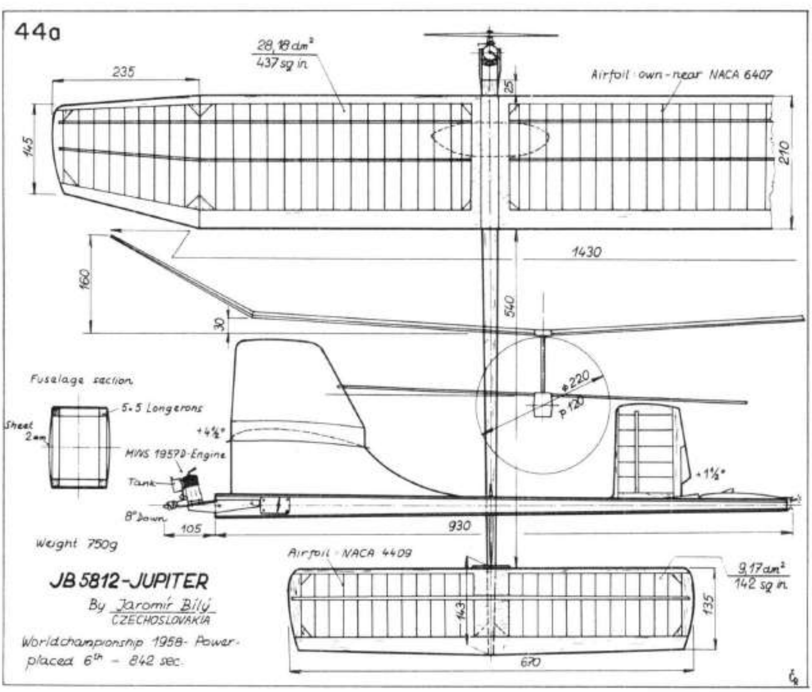
10th, 11th and 12th FLYOFF ROUNDS

No change since all contestants obtained maxes. It has been mutually agreed that all contestants remaining after the 12th flyoff round would be declared Joint Champions. Each of the 5 joint champions had made a total of 17 consecutive 3-minute maxes. *MODEL AVIATION OCTOBER 1960*

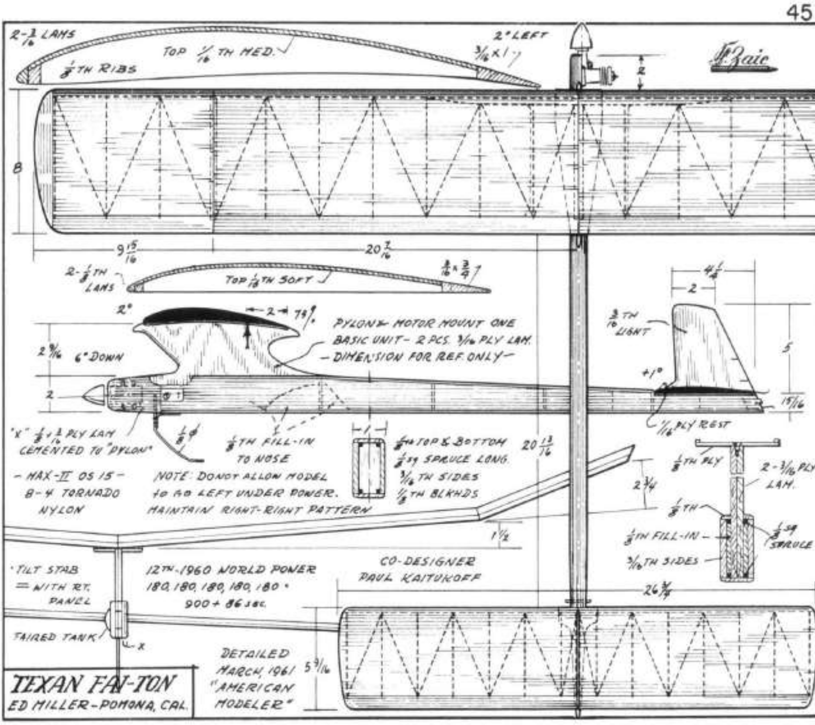
44

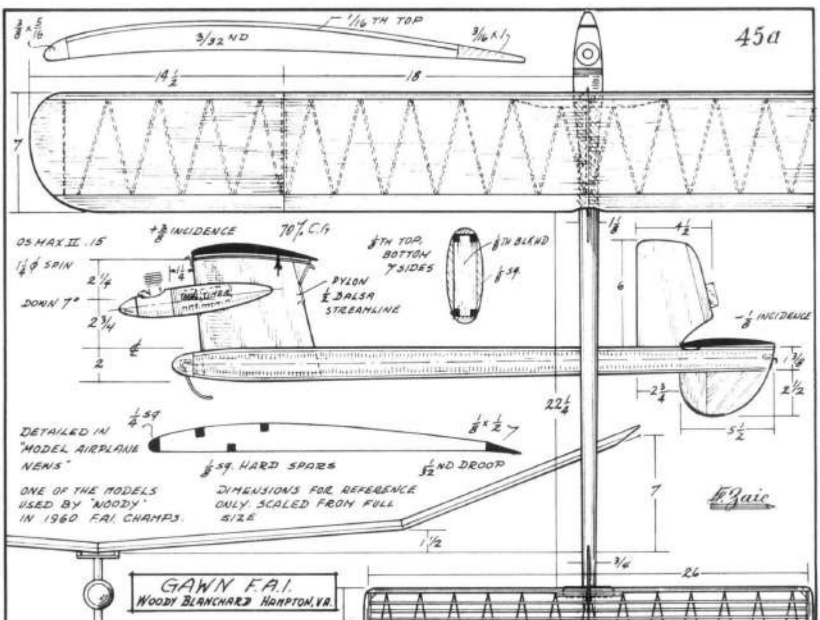


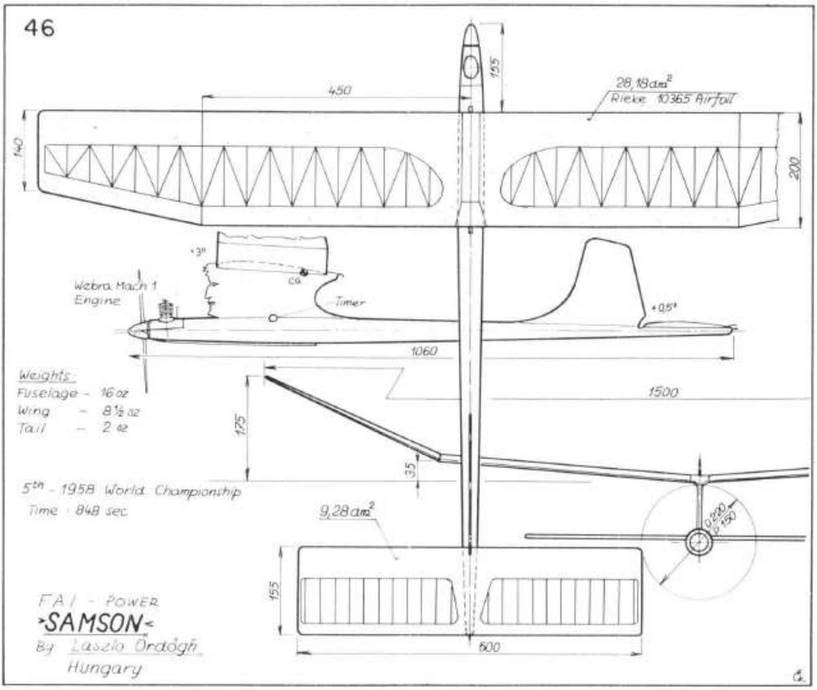
3° RIGHT
4° DOWN
PROJECTED AREA
687 SQ. IN.
WT. 32 OZ.
RIGHT POWER
RIGHT GLIDE
"BOX" FUSELAGE
1/8 TH SIDES
3/32 ND TOP & BOTTOM
75%
HICKORY MOTOR MOUNTS
1/8 PLY CONE
OLIVER TIGER
TORNADO NYLON 9×4
PROXIED BY CARL WHEELEY
180, 180, 180, 180, 113 (OUCH! ALMOST!)
1958 U.S.A. POWER TEAM
WM. H. DEAN WINCHESTER, MASS.
MODIFIED
NACA 6409
1/4 SQ.
1/4 × 1/2
1/4 × 3/8
1/8 × 3/16 ZIP-
3/16 × 1/4
1/4 × 1



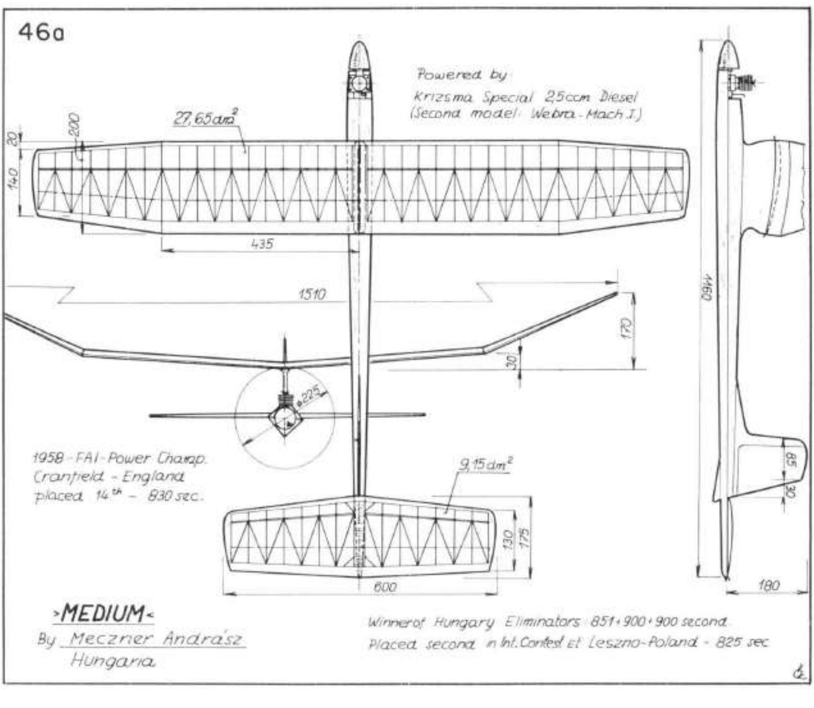
44a
28,18 dm²
437 sq in.
Airfoil own - near NACA 6407
1430
540
Fusealge section
5.5 Longerons
Sheet 2 mm
MVVS 1957D-Engine
Tank
8° Down
+4½°
+1½°
⌀220
p120
105
930
Weight 750g
Airfoil NACA 4409
9,17 dm²
142 sq in.
670
JB 5812-JUPITER
By Jaromír Bílý
CZECHOSLOVAKIA
Worldchampionship 1958- Power-
placed 6th - 842 sec.


2-3/16 LAMS
TOP 1/16 TH MED.
1/8 TH RIBS
2° LEFT
3/16 x 1
Zaic
8
9 15/16
20 7/16
2-1/8 TH LAMS
TOP 1/16 TH SOFT
3/16 x 3/4
2°
2 9/16 6° DOWN
PYLON & MOTOR MOUNT ONE BASIC UNIT - 2 PCS. 3/16 PLY LAM. - DIMENSION FOR REF. ONLY -
3/16 TH LIGHT
+1°
"X" 1/8 + 1/16 PLY LAM CEMENTED TO "PYLON"
1/8 TH FILL-IN TO NOSE
1/16 TH TOP & BOTTOM
1/8 SQ SPRUCE LONG.
3/16 TH SIDES
1/8 TH BLKHDS
1/16 PLY REST
20 13/16
- MAX-II OS 15 -
8-4 TORNADO NYLON
NOTE: DONOT ALLOW MODEL TO GO LEFT UNDER POWER. MAINTAIN RIGHT-RIGHT PATTERN
1/8 TH PLY
2-3/16 PLY LAM.
2 3/4
1/8 TH FILL-IN
1/8 SQ SPRUCE
3/16 TH SIDES
1 1/2
TILT STAB = WITH RT. PANEL
12TH - 1960 WORLD POWER 180, 180, 180, 180, 180 = 900 + 86 SEC.
CO-DESIGNER PAUL KAITUKOFF
26 3/4
FAIRED TANK
DETAILED MARCH, 1961 "AMERICAN MODELER"
5 9/16
TEXAN FAI-TON
ED MILLER - POMONA, CAL.

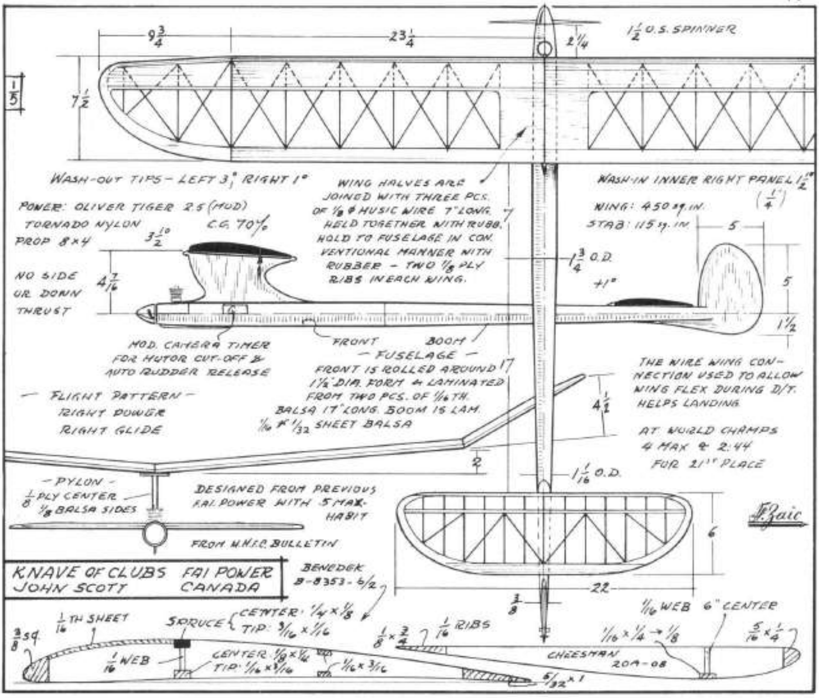

45a
3/8 x 5/16
3/32 ND
1/16 TH TOP
3/16 x 1
14 1/2
18
7
+1/8 INCIDENCE
70% C.G.
OS MAX II .15
1 1/4 Ø SPIN
DOWN 7°
2 1/4
2 3/4
2
PYLON 1/2 BALSA STREAMLINE
1/8 TH TOP, BOTTOM & SIDES
1/8 TH BLKHD.
1/8 SQ.
1 1/8
4 1/2
6
-1/8 INCIDENCE
1 3/8
2 1/2
2 3/4
5 1/2
22 1/4
DETAILED IN "MODEL AIRPLANE NEWS"
1/4 SQ
1/8 x 1/2
1/8 SQ. HARD SPARS
1/32 ND DROOP
ONE OF THE MODELS USED BY "WOODY" IN 1960 F.A.I. CHAMPS.
DIMENSIONS FOR REFERENCE ONLY. SCALED FROM FULL SIZE
Zaic
1 1/2
3/4
26
GAWN F.A.I.
WOODY BLANCHARD HAMPTON, VA.
5 1/2



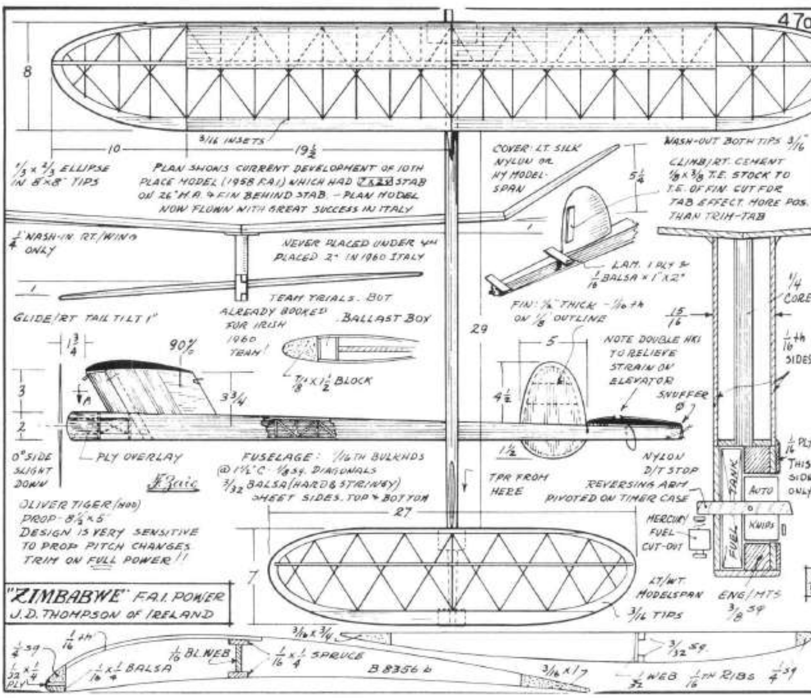
46
450
155
28,18 dm²
Rieke 10365 Airfoil
140
200
+3°
Webra Mach 1
Engine
CG
Timer
+0,5°
1060
Weights:
Fuselage - 16 oz
Wing - 8½ oz
Tail - 2 oz
175
1500
35
5th - 1958 World Championship
Time : 848 sec
9,28 dm²
155
600
FAI - POWER
›SAMSON‹
By Laszlo Ordögh
Hungary



46a
Powered by:
Krizsma Special 2,5ccm Diesel
(Second model: Webra-Mach I.)
27,65 dm²
200
20
140
435
1510
170
30
1460
1958 - FAI - Power Champ.
Cranfield - England
placed 14th - 830 sec.
9,15 dm²
85
30
130
175
600
180
›MEDIUM‹
By Meczner András
Hungaria
Winner of Hungary Eliminators 851+900+900 second
Placed second in Int. Contest et Leszno-Poland - 825 sec

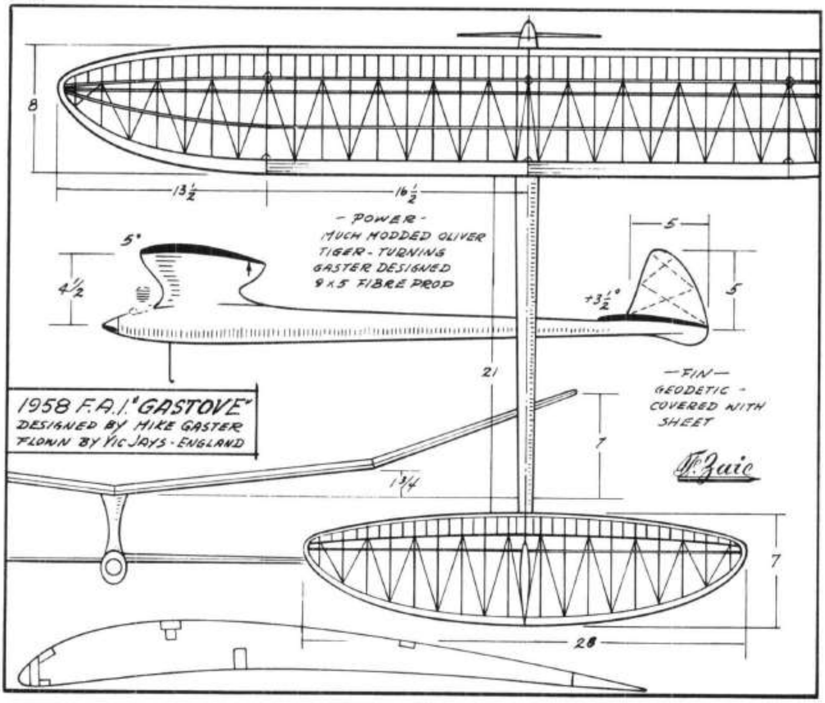


1/5
9 3/4
23 1/4
2 1/4
1 1/2 U.S. SPINNER
7 1/2
WASH-OUT TIPS – LEFT 3° RIGHT 1°
WING HALVES ARE JOINED WITH THREE PCS. OF 1/8 Ø MUSIC WIRE 7" LONG, HELD TOGETHER WITH RUBB. HOLD TO FUSELAGE IN CONVENTIONAL MANNER WITH RUBBER – TWO 1/8 PLY RIBS IN EACH WING.
WASH-IN INNER RIGHT PANEL 1/2° (1/4°)
POWER: OLIVER TIGER 2.5 (MOD) TORNADO NYLON PROP 8×4
C.G. 70%
3 1/2°
WING: 450 sq. in.
STAB: 115 sq. in.
NO SIDE OR DOWN THRUST
4 7/16
1 3/4 O.D.
+1°
MOD. CAMERA TIMER FOR MOTOR CUT-OFF & AUTO RUDDER RELEASE
FRONT
BOOM
– FUSELAGE –
FRONT IS ROLLED AROUND 1 1/2" DIA. FORM & LAMINATED FROM TWO PCS. OF 1/16 TH. BALSA 17" LONG. BOOM IS LAM. 1/16 & 1/32 SHEET BALSA
17
THE WIRE WING CONNECTION USED TO ALLOW WING FLEX DURING D/T. HELPS LANDING.
– FLIGHT PATTERN – RIGHT POWER RIGHT GLIDE
4 1/2
AT WORLD CHAMPS 4 MAX & 2:44 FOR 21ST PLACE
2
1 1/16 O.D.
– PYLON – 1/8 PLY CENTER 1/8 BALSA SIDES
DESIGNED FROM PREVIOUS F.A.I. POWER WITH 5 MAX-HABIT
FROM N.H.F.C. BULLETIN
6
KNAVE OF CLUBS FAI POWER
JOHN SCOTT CANADA
BENEDEK B-8353-6/2
22
3/8
1/16 TH SHEET
SPRUCE { CENTER: 1/4 × 1/8 TIP: 3/16 × 1/16
1/8 × 3/4
1/16 RIBS
1/16 WEB 6" CENTER
3/8 sq.
1/16 WEB
CENTER 1/8 × 1/16 TIP 1/16 × 1/16
1/16 × 3/16
1/16 × 1/4 → 1/8
5/16 × 1/4
CHEESMAN 20A-08
5/32 × 1

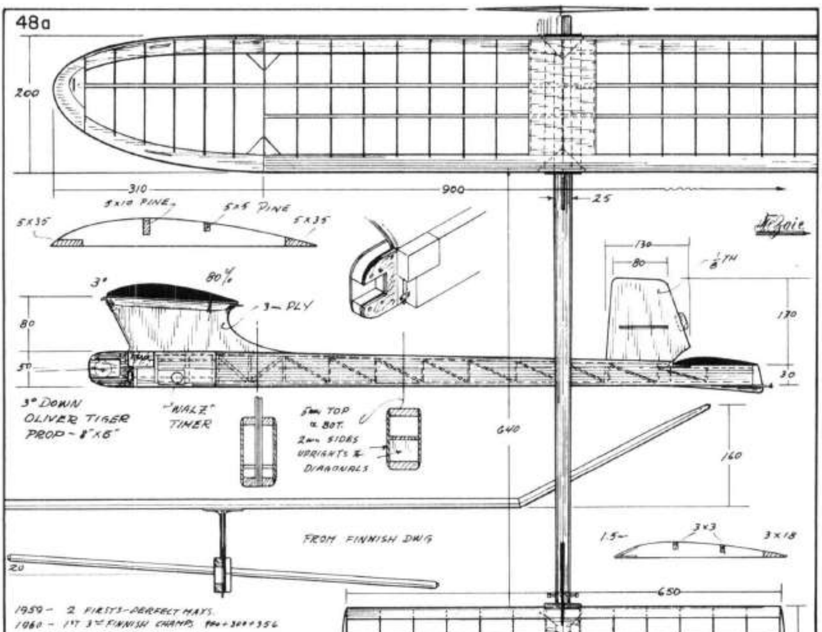


47a
8
3/16 INSETS
10
19 1/2
1/3 × 2/3 ELLIPSE IN 8×8" TIPS
PLAN SHOWS CURRENT DEVELOPMENT OF 10TH PLACE MODEL (1958 F.A.I.) WHICH HAD 7×23 STAB ON 26" H.A. & FIN BEHIND STAB. – PLAN MODEL NOW FLOWN WITH GREAT SUCCESS IN ITALY
COVER: LT. SILK NYLON OR HY MODELSPAN
5 1/4
WASH-OUT BOTH TIPS 3/16
CLIMB/RT. CEMENT 1/8 × 3/8 T.E. STOCK TO T.E. OF FIN. CUT FOR TAB EFFECT. MORE POS. THAN TRIM-TAB
1/4" WASH-IN RT./WING ONLY
NEVER PLACED UNDER 4th PLACED 2nd IN 1960 ITALY
LAM. 1 PLY & 1/16 BALSA × 1" × 2"
1/4 CORE
TEAM TRIALS. BUT ALREADY BOOKED FOR IRISH 1960 TEAM!
BALLAST BOX
GLIDE/RT TAIL TILT 1°
FIN: 1/4" THICK – 1/16 th ON 1/8 OUTLINE
15/16
29
1 3/4
90%
5
NOTE DOUBLE HKS TO RELIEVE STRAIN ON ELEVATOR
1/16 th SIDES
7/8 × 1 1/2 BLOCK
3
3 3/4
4 1/2
SNUFFER
2
1 1/2
1/16 PLY THIS SIDE ONLY
0° SIDE SLIGHT DOWN
PLY OVERLAY
FUSELAGE: 1/16TH BULKHDS @ 1 1/2" C. 1/8 SQ. DIAGONALS 3/32 BALSA (HARD & STRINGY) SHEET SIDES, TOP & BOTTOM
NYLON D/T STOP
TPR FROM HERE
REVERSING ARM PIVOTED ON TIMER CASE
TANK
AUTO
KNIPS
FUEL
OLIVER TIGER (MOD) PROP – 8 1/2 × 5 DESIGN IS VERY SENSITIVE TO PROP PITCH CHANGES TRIM ON FULL POWER!!
27
MERCURY FUEL CUT-OUT
7
1/5
"ZIMBABWE" F.A.I. POWER
J.D. THOMPSON OF IRELAND
LT/WT. MODELSPAN
3/16 TIPS
ENG/MTS 3/8 sq.
1/16 th
3/16 × 3/4
3/32 sq.
1/4 sq.
1/16 BL.WEB
1/16 × 1/4 SPRUCE
1/32 × 1/4 PLY
1/16 × 1/4 BALSA
B 8356 b
3/16 × 1/7
1/32 WEB
1/16 th RIBS
1/4 sq.

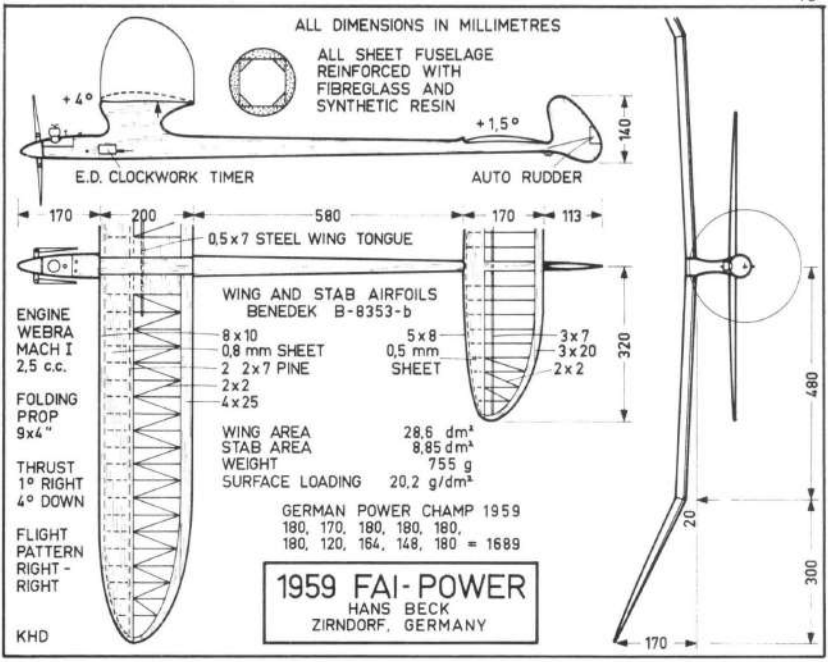
48

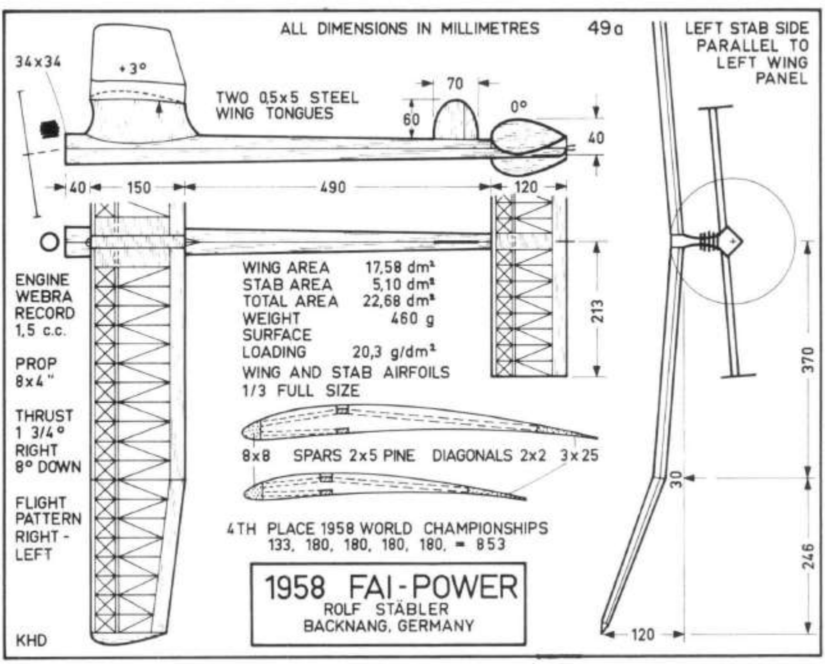


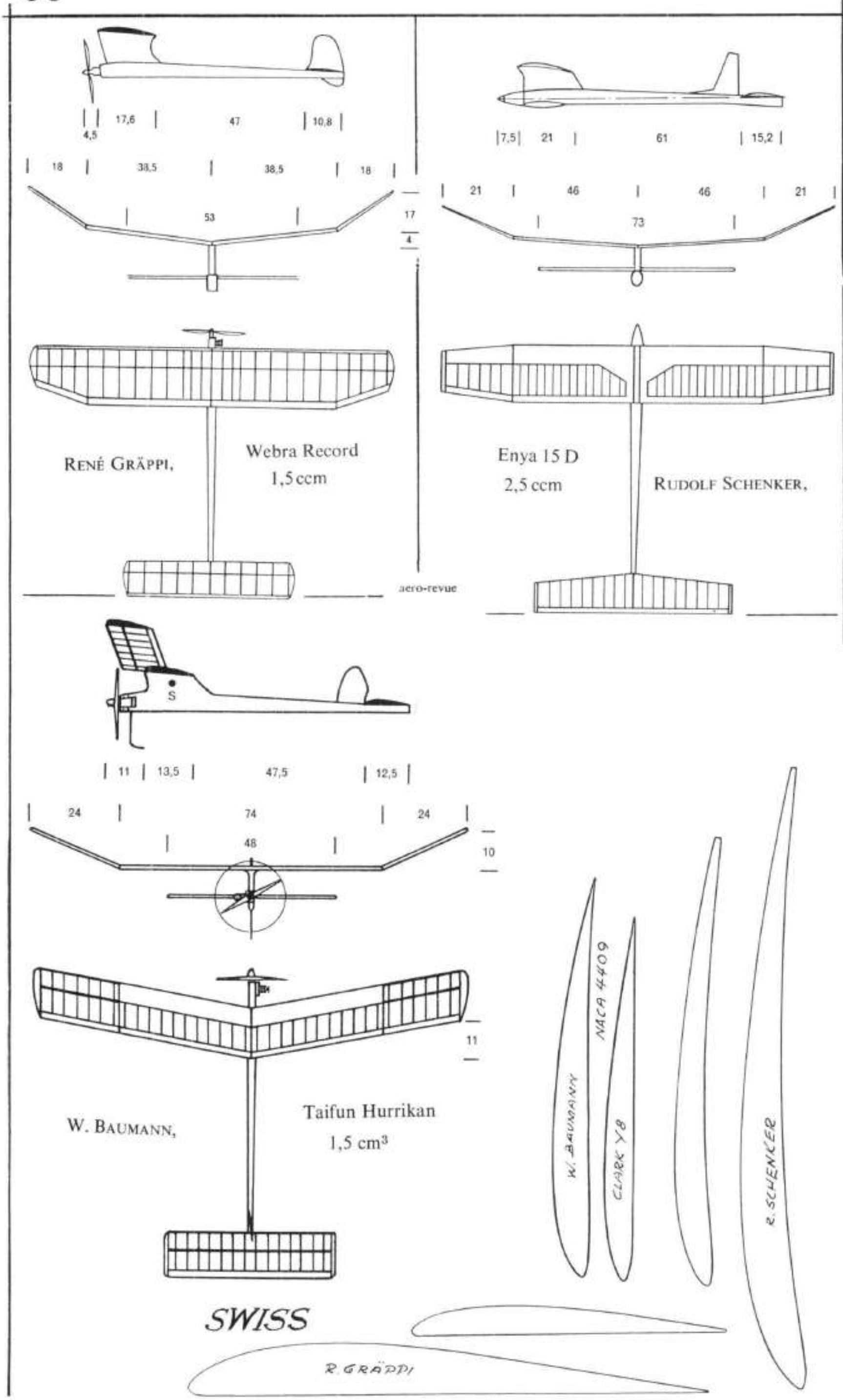
1958 F.A.I. "GASTOVE"
DESIGNED BY MIKE GASTER
FLOWN BY VIC JAYS - ENGLAND
- POWER -
MUCH MODDED OLIVER
TIGER - TURNING
GASTER DESIGNED
9 X 5 FIBRE PROP
- FIN -
GEODETIC -
COVERED WITH
SHEET
8
13 1/2
16 1/2
5°
4 1/2
5
5
+3 1/2°
21
7
1 3/4
7
28

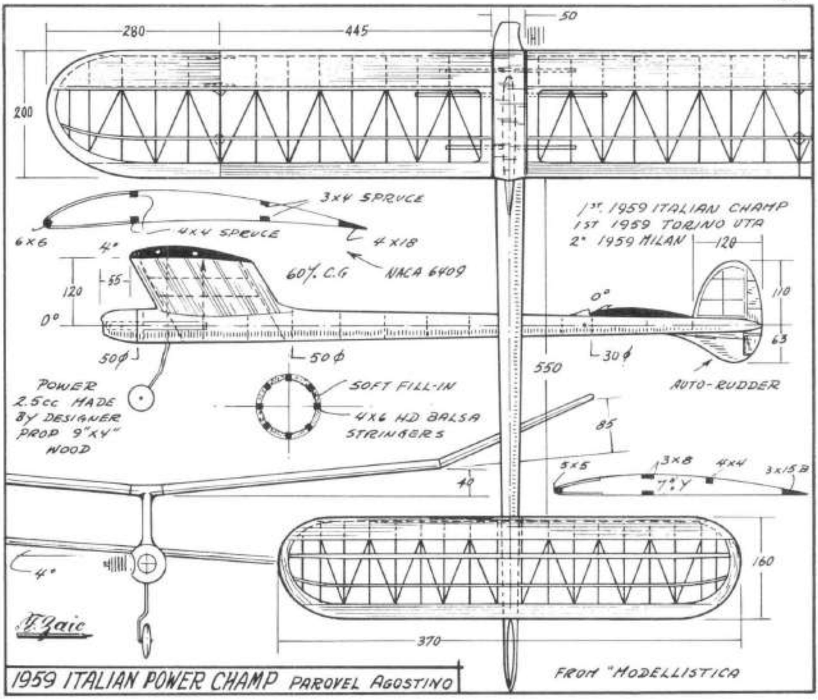


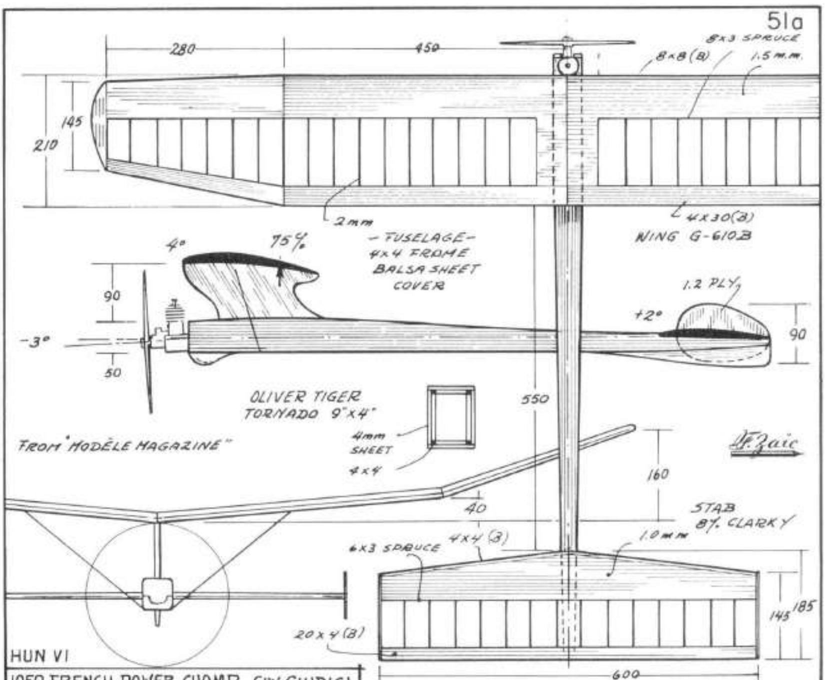
48a
D-1 "PULTERI" FAI
OSMO NIEMI ~ FINLAND
1959 - 2 FIRSTS - PERFECT MAXS
1960 - 1ST 3RD FINNISH CHAMPS
AND OTHER IMPRESSIVE TOTALS
FROM FINNISH DWG
3° DOWN
OLIVER TIGER
PROP - 8"X6"
"WALZ" TIMER
3 - PLY
5mm TOP & BOT.
2mm SIDES
UPRIGHTS & DIAGONALS
5X10 PINE
5X5 PINE
5X35
5X35
200
310
900
25
3°
80%
80
50
130
80
130
30
640
160
1.5
3X3
3X18
650
130
20


ALL DIMENSIONS IN MILLIMETRES
ALL SHEET FUSELAGE REINFORCED WITH FIBREGLASS AND SYNTHETIC RESIN
+4°
+1,5°
140
E.D. CLOCKWORK TIMER
AUTO RUDDER
170
200
580
170
113
0,5 x 7 STEEL WING TONGUE
WING AND STAB AIRFOILS BENEDEK B-8353-b
ENGINE WEBRA MACH I 2,5 c.c.
8 x 10
0,8 mm SHEET
2 2x7 PINE
2x2
4x25
5 x 8
0,5 mm SHEET
3x7
3x20
2x2
320
480
FOLDING PROP 9x4"
THRUST 1° RIGHT 4° DOWN
WING AREA 28,6 dm²
STAB AREA 8,85 dm²
WEIGHT 755 g
SURFACE LOADING 20,2 g/dm²
GERMAN POWER CHAMP 1959
180, 170, 180, 180, 180,
180, 120, 164, 148, 180 = 1689
FLIGHT PATTERN RIGHT - RIGHT
20
300
1959 FAI-POWER
HANS BECK
ZIRNDORF, GERMANY
KHD
170

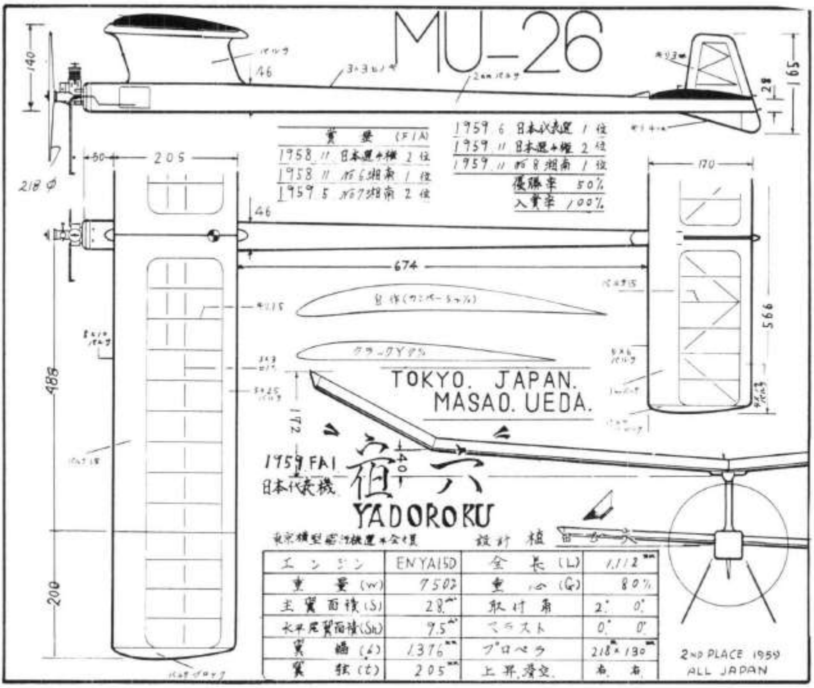

ALL DIMENSIONS IN MILLIMETRES
49a
LEFT STAB SIDE PARALLEL TO LEFT WING PANEL
34x34
+3°
TWO 0,5x5 STEEL WING TONGUES
70
60
0°
40
40
150
490
120
ENGINE WEBRA RECORD 1,5 c.c.
WING AREA 17,58 dm²
STAB AREA 5,10 dm²
TOTAL AREA 22,68 dm²
WEIGHT 460 g
SURFACE LOADING 20,3 g/dm²
WING AND STAB AIRFOILS 1/3 FULL SIZE
213
370
PROP 8x4"
THRUST 1 3/4° RIGHT 8° DOWN
8x8 SPARS 2x5 PINE DIAGONALS 2x2 3x25
30
FLIGHT PATTERN RIGHT - LEFT
4TH PLACE 1958 WORLD CHAMPIONSHIPS
133, 180, 180, 180, 180, = 853
246
1958 FAI-POWER
ROLF STÄBLER
BACKNANG, GERMANY
KHD
120


4,5
17,6
47
10,8
18
38,5
38,5
18
53
17
4
RENÉ GRÄPPI,
Webra Record
1,5 ccm
7,5
21
61
15,2
21
46
46
21
73
Enya 15 D
2,5 ccm
RUDOLF SCHENKER,
aero-revue
S
11
13,5
47,5
12,5
24
74
24
48
10
11
W. BAUMANN,
Taifun Hurrikan
1,5 cm³
W. BAUMANN
NACA 4409
CLARK Y8
R. SCHENKER
SWISS
R. GRÄPPI

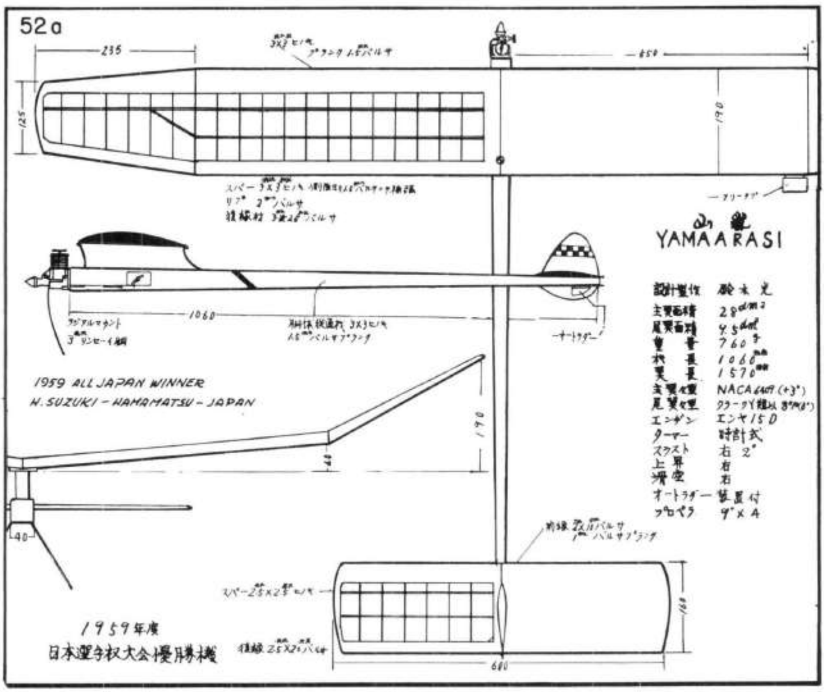

280
445
50
200
3x4 SPRUCE
4x4 SPRUCE
6x6
4x18
1st. 1959 ITALIAN CHAMP
1ST 1959 TORINO UTA
2° 1959 MILAN
120
4°
60% C.G
NACA 6409
120
55
0°
0°
110
63
50ϕ
50ϕ
30ϕ
550
AUTO-RUDDER
POWER
2.5cc MADE
BY DESIGNER
PROP 9"x4"
WOOD
SOFT FILL-IN
4x6 HD BALSA
STRINGERS
85
5x5
3x8
4x4
3x15 B
7% Y
40
4°
160
370
F. Zaic
1959 ITALIAN POWER CHAMP PAROVEL AGOSTINO
FROM "MODELLISTICA


51a
280
450
8x3 SPRUCE
8x8 (B)
1.5 mm.
145
210
2mm
4x30 (B)
WING G-610B
4°
75%
-FUSELAGE-
4x4 FRAME
BALSA SHEET
COVER
1.2 PLY
90
+2°
90
-3°
50
OLIVER TIGER
TORNADO 9"x4"
550
4mm
SHEET
4x4
FROM "MODÈLE MAGAZINE"
F. Zaic
160
40
STAB
8% CLARK Y
6x3 SPRUCE
4x4 (B)
1.0 mm
145
185
20x4 (B)
HUN VI
1959 FRENCH POWER CHAMP GUY GIUDICI
600

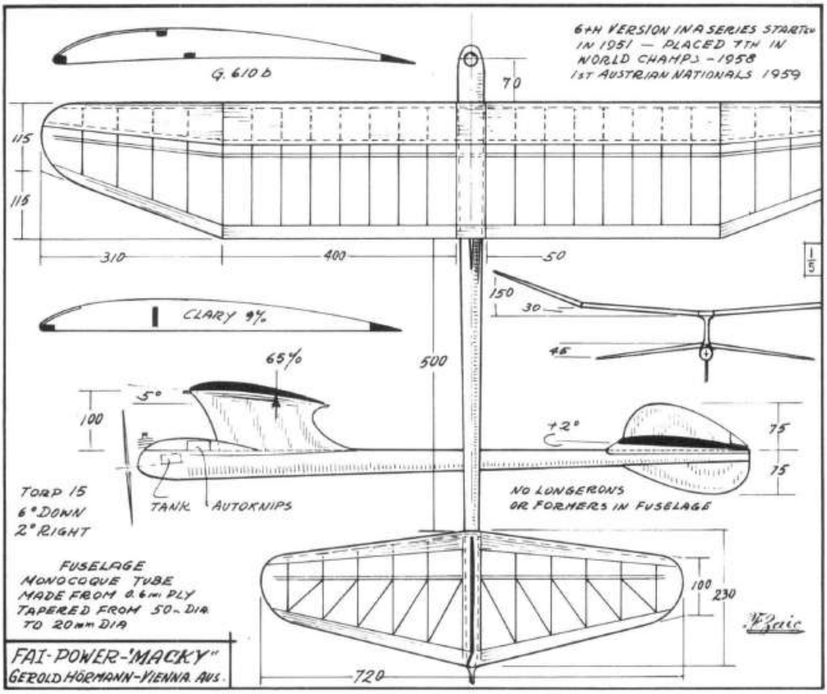
52

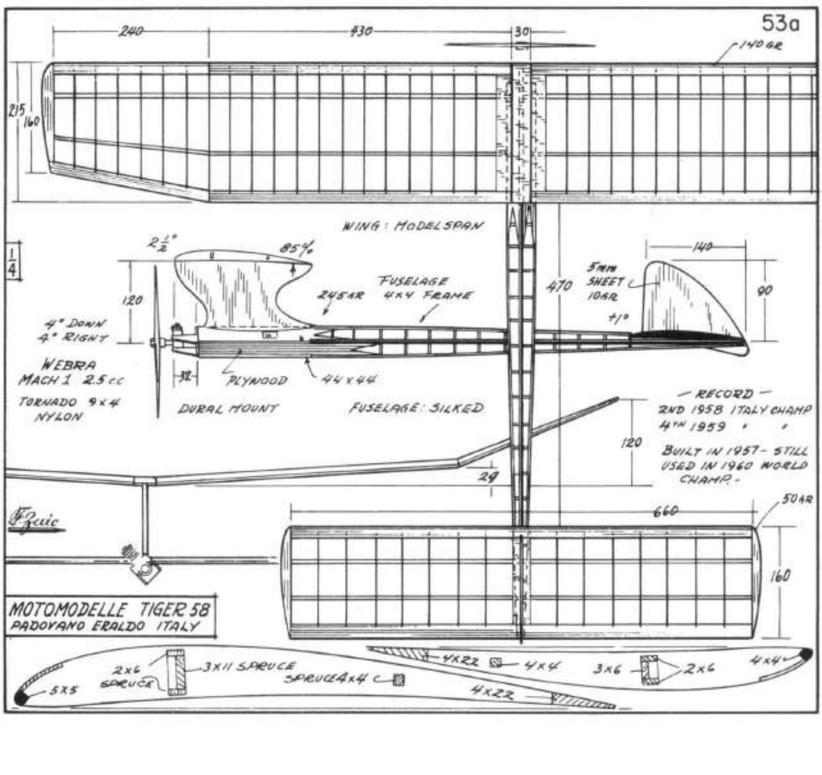


MU-26
1959.6 日本代表選 1位
1959.11 日本選手権 2位
1959.11 No.8 湘南 1位
優勝率 50%
入賞率 100%
1958.11 日本選手権 2位
1958.11 No.6 湘南 1位
1959.5 No.7 湘南 2位
TOKYO. JAPAN.
MASAO. UEDA.
1959 FAI
日本代表機
YADOROKU
ENYA 15D
2ND PLACE 1959
ALL JAPAN



52a
YAMAARASI
1959 ALL JAPAN WINNER
H. SUZUKI - HAMAMATSU - JAPAN
1959年度
日本選手権大会優勝機


6TH VERSION IN A SERIES STARTED
IN 1951 — PLACED 7TH IN
WORLD CHAMPS - 1958
1ST AUSTRIAN NATIONALS 1959
G. 610 b
70
115
115
310
400
50
1/5
150
30
CLARY 9%
45
65%
500
5°
100
+2°
75
75
TORP 15
6° DOWN
2° RIGHT
TANK
AUTOKNIPS
NO LONGERONS
OR FORMERS IN FUSELAGE
FUSELAGE
MONOCOQUE TUBE
MADE FROM 0.6mm PLY
TAPERED FROM 50mm DIA
TO 20mm DIA
100
230
720
FAI-POWER-"MACKY"
GEROLD HÖRMANN-VIENNA AUS.


53a
240
430
30
140 GR
215
160
WING: MODELSPAN
1/4
2 1/2°
85%
120
FUSELAGE
4x4 FRAME
245 GR
470
5mm
SHEET
10 GR
140
90
+1°
4° DOWN
4° RIGHT
WEBRA
MACH 1 2.5 cc
TORNADO 9x4
NYLON
32
PLYWOOD
44x44
DURAL MOUNT
FUSELAGE: SILKED
— RECORD —
2ND 1958 ITALY CHAMP
4TH 1959 " "
120
BUILT IN 1957 - STILL
USED IN 1960 WORLD
CHAMP.
29
660
50 GR
160
MOTOMODELLE TIGER 58
PADOVANO ERALDO ITALY
2x6
SPRUCE
3x11 SPRUCE
5x5
SPRUCE 4x4
4x22
4x4
3x6
2x6
4x4
4x22

VERY HIGH THRUST LINE DEVELOPMENTS

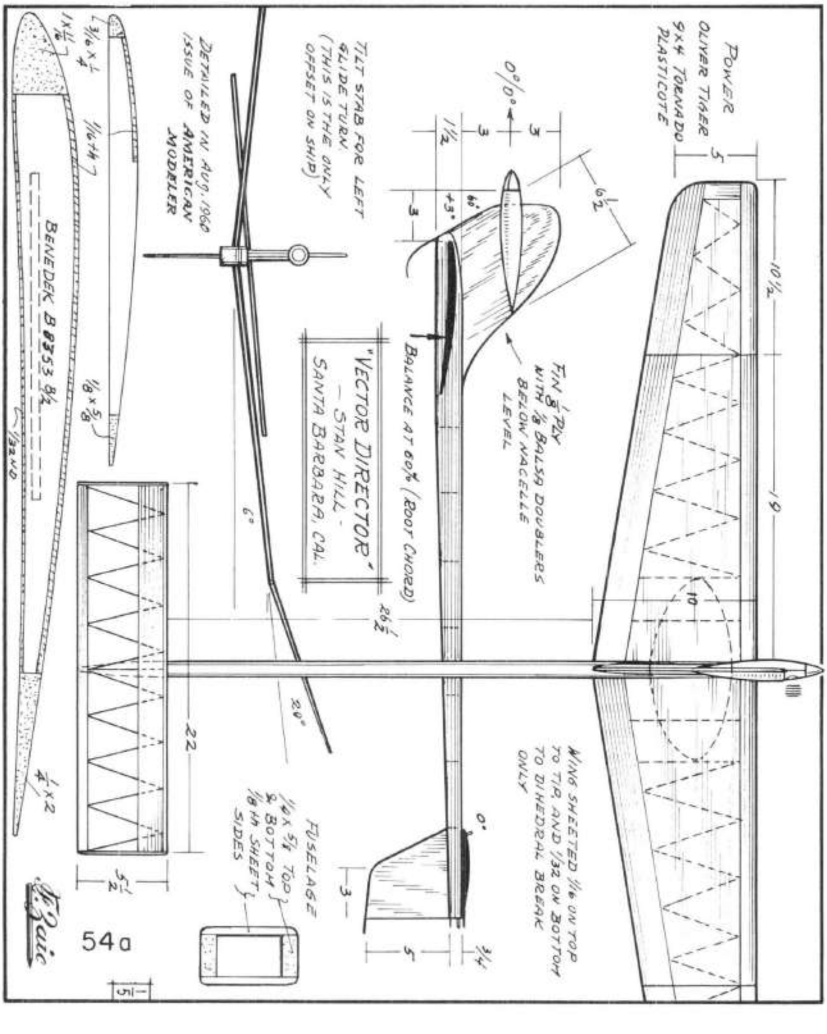
Stanley D. Hill ——————————— Santa Barbara, Cal.

Many thanks for your inquiry as to V.H.T.L. developments.

The design, as it now stands, may be considered fully developed. It was drawn in April 1957, and the only changes that have turned up are structural and minor.

The placement of some fin area above the thrust line and dropping the rudder back under the stab again give a complete balance of turn-inducing forces at all speeds under power.

Stability is such that it may be launched in either left or right vertical bank with perfect safety, immediately righting itself to normal climb attitude of 70 to 80 degrees. No thrust offsets or warps are necessary and stab tilt is used for glide turn.



Work done by Alan Brown, Keith Hoover, Oscar Czepa and Russ Hansen closely parallel mine to the level of incredibility—good evidence of the design's validity.

Summarizing, I think the configuration allows for less critical adjustment, safer power characteristics and somewhat better performance if the two former points are used to advantage in choosing model size and flight pattern.

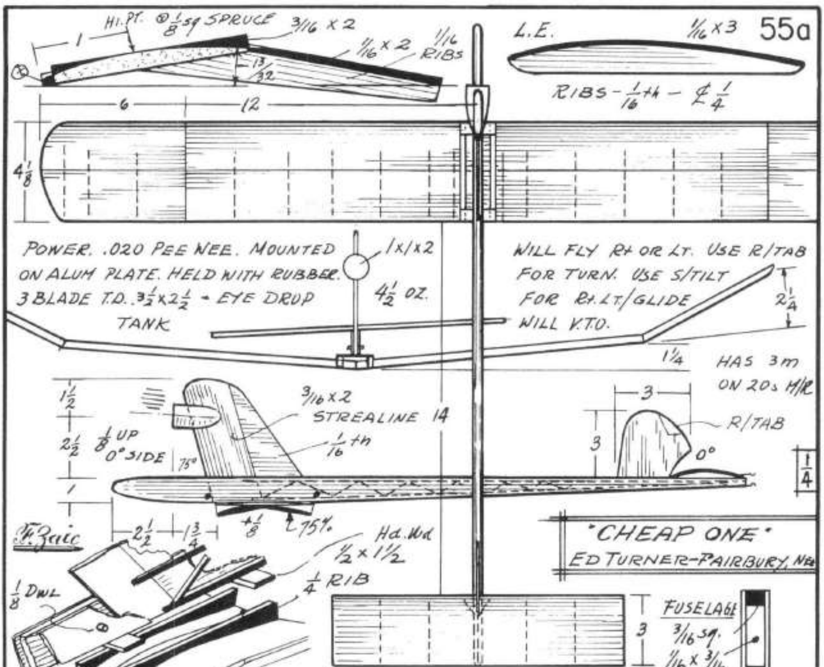
In any case, it is a joy to fly and consistant maxes are easy to obtain.

THE CHEAP ONE —————— Ed Turner, Fairbury, Nebr.

This is a design of my own, with the information you presented in your last Year Book by Czepa and Stan Hill.

It follows Czepa's FAI ship in number of ways. I am using an all sheet construction, and I built the first ship for about 70 cents minus the engine. The design was actually thought up while I was in New Hampshire with Air Force for the Jr. Club members of the Lawrence Airoscrats of Lawrence, Mass.

I did not have any problems with this plane in any way. I had to cock the stab up quite a bit, but outside of that there were no dangerous flight patterns.



V.H.T.L. WITH JEDELSKY WING —— Keith Hoover

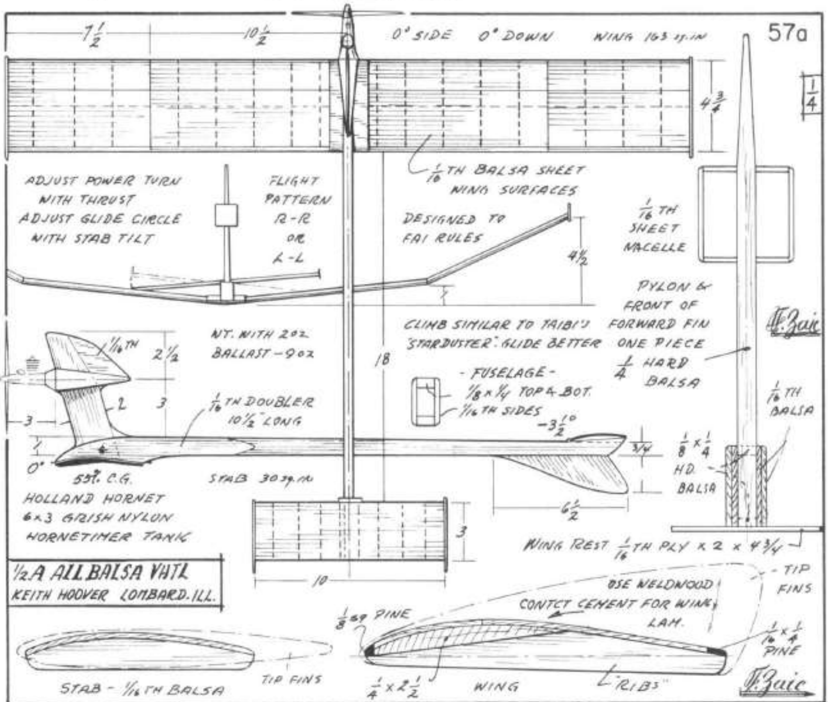
In 1956, during Oskar Czepa's visit to this country, a number of us in the Chicago area were introduced to the possibilities of Jedelsky's all-balsa construction. At about that time, the other train of thought represented in the enclosed plan came to me in a letter from Stan Hill, whose first Hammerhead represented the pioneer attempt with a Very High Thrust-Line. His basic concept was to mount the motor on a forward fin, with resulting longitudinal and spiral stability under power. Jedelsky's construction is the greatest advance in free-flight aeromodelling in two decades; Hill's insight is the greatest boon to free-flight power modelling since Goldberg's "Zipper". Czepa's first experimental model was presented in the '57-'58 Year Book; the model presented here represents the refinements and lessons I have developed in a series since that time. It is submitted because its radical features represent the possibilities in the layout. At a time when Holland Hornets are flying models with over 500 square inches of wing area, this force arrangement "handles" the power with only 163 square inches in the wing and an 18% stab. Glide is a bit fast with a weight of 9 ounces (almost twice contest ½ A's with similar area of two years ago) but still acceptable because of the efficient Jedelsky airfoil.

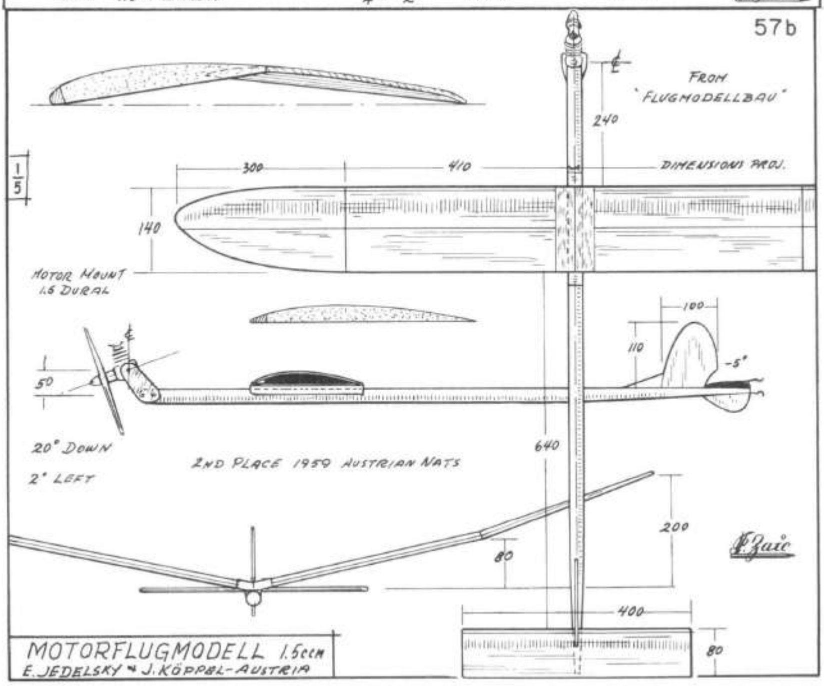
One of the most important advantages of the VHTL force layout is the vastly improved longitudinal and spiral stability over conventional pylon and high thrust line designs. The natural looping tendencies of any power model, because of increasing wing lift under high speeds, are couteracted by the high motor position. The forward fin greatly increases dihedral effect, resisting spiral dives. A small stab may be used in this arrangement, and it can be set at a negative angle without bad effects, making climb to glide transition good.

It is important to note that the entire model is out of the propeller slipstream, with the exception of the forward fin. This reduces drag to an absolute minimum. It also avoids the necessity of tricky adjustments or gadgets to control turn or loop in the climb (rudder, stab, and the low wing are in clear air.) The side area of the forward fin, incidentally, is balanced above and below the thrustline. My designs are the only ones I have seen which have this feature, and it permits one to choose any combination of power-glide pattern safely. I usually fly these models right (1 turn every 5 seconds of motor run) under power and right in the glide.

The wing used in this design has some unusual features. It's laminated construction, using a rubber-base cement, gives a strong, flexible, but flutter-free flying surface. The ribs on the underside act as wing "fences" seem to give added directional stability, so I have given up attempts to build such a wing without the ribs. The low wing position permits "pop-off" on a hard bump as easily as on the conventional model. Tip fins are used with a generously high aspect ratio for efficiency. The overall height of the usual Jedelsky section is from 7½ to 9 percent of chord, but on this very small model, a 10 percent section is used to help carry the FAI weight.

Though some Hammerhead versions have appeared, no one has heard whether Czepa is continuing this line of development. Nevertheless, my experiences of the past four years lead me to believe that the VHTL, combined with this new method for constructing flying surfaces, offer utmost promise for future development.





TRAJECTORY THEORY DESIGN —— V. H. Ure, Canada

This model was developed from an article in the last yearbook, called Trajectory Theory by Alan C. Brown; with a few variations of my own.

The first model that I tried was a small model for the Space Hopper .049, and was a real hot job, and very touchy to fly. This model used a Blazer wing and tail and looked similar to the sketch in the article. It was a very short nose design with the wings at zero and stab at -2½°. The forward fin and engine were attached to the wing. This job showed viscious tendencies and soon destroyed itself.

But the design showed possibilities and work was started on a new version. This model was modified to the outlines I use now, and the big feature to me was that the Forward fin and engine were fixed to the fuselage and not to the wing. The incidences were shuffled around a little and finally wound up with wing at 2½° degrees and stab at -1½°.

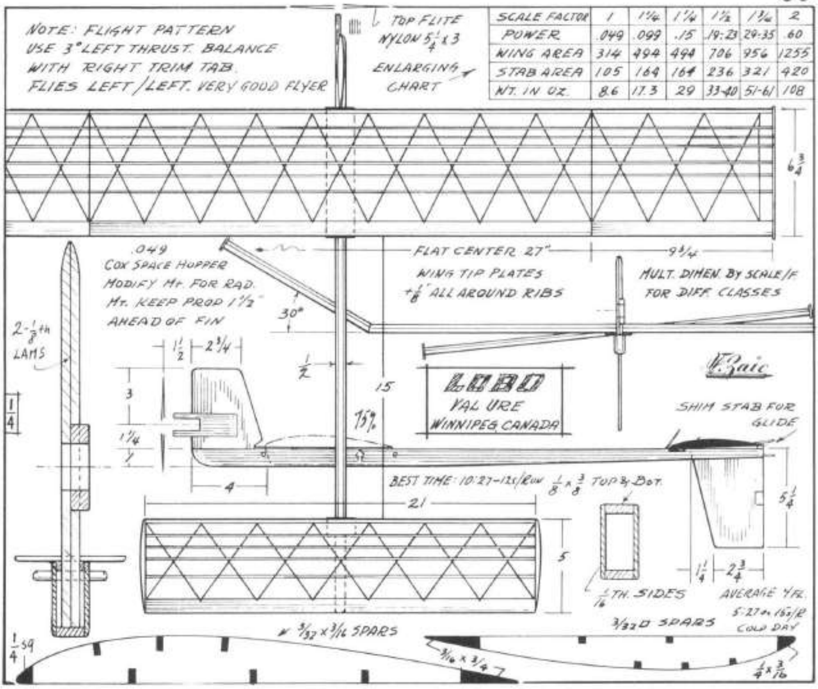
The first flight showed a straight out looping condition (about 100 yards in dia.) with a poor recovery. Left sidethrust was given to the engine, and model did a little better but needed still more sidethrust—finally winding up with 3 degrees left. With this sidethrust, model was turning left in a smooth pattern, but as motor run was extended, model appeared to be coming down in a wide circle instead of up, and was moving very fast. In an effort to raise the left wing a little right rudder tab was used, and after 3 or 4 more flights, had it doing a real nice pattern —left-left. Model was climbing in a loose spiral at a 70 degree angle with about 1 turn in ten seconds. Recovery was excellent with the model flying fast enough to slide right into the glide.

In an effort to check on other patterns a right-right was tried using reverse adjustments. Model would climb to right alright, but required an awful lot of stab tilt to make it turn right. This was attributed to the offset c.g. on account of side mounted engine.

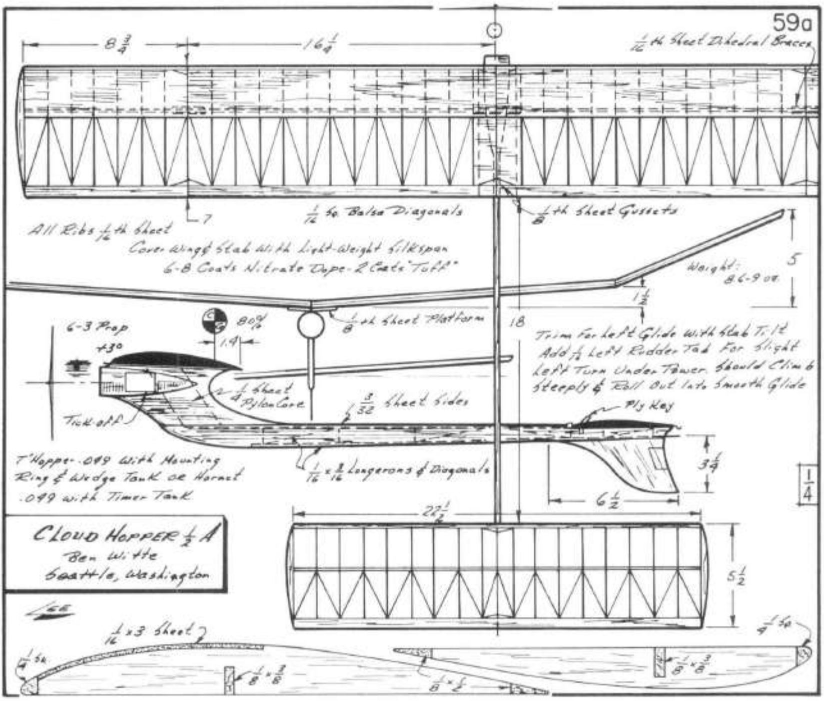
This model averaged over 5 minutes on 20 seconds on the morning that I was testing the design, a cool day, solid overcast and no wind with a high humidity.

At present have finished and am testing a new ½A, an .099 and 2 FAI .15's. The FAI's are coming along real nice and appear as though they will be real good. At present am experimenting with a O° setting on the wing, and enough negative in the stab to make the required decalage in an effort to speed up the climb. Models appeared to be hanging back under power with the wing at 3 degrees. This new trim worked real well and speeded the climb about 50%. I attribute this to the reduction in frontal drag from the wing. This was tried on the .099 and .15 FAI jobs and has worked out so well that it has been shown on the drawings.

At the moment I am trying to find a way to reduce the mass moments to give a little better stall recovery on the FAI's. As this design is now, it is a very good model and is easy to fly and trim. I have enjoyed flying them and shall use them this summer in competition, and maybe continue modifying until I get it as near foolproof as I can. As it is, it will give anyone a run for his money.



SCALE FACTOR	1	1 1/4	1 1/4	1 1/2	1 3/4	2
POWER	.049	.099	.15	.19-.23	.29-.35	.60
WING AREA	314	494	494	706	956	1255
STAB AREA	105	164	164	236	321	420
WT. IN OZ.	8.6	17.3	29	33-40	51-61	108



HIGH THRUST EXPERIENCE

Bill Langenberg —— San Jose, Cal.

Based on my experience over the past three years with this series of high thrust line models, some general comments regarding the species, might be appropriate. Four ships were involved: (1) ½A, (2) FAI, (3) AB combination, and (4) ½A shown in plan. All four models utilized relatively high aspect ratios around 9-11, stabilizer areas of about 33-35 percent, and the swayback fuselage design, as drawn. Minor modifications involved tapered outer wing panels, tip plates on the elevator, and a 9 percent MVA 301 airfoil in the wing. Some variations in the shape and size of the fin were also employed, but none of these varied the basic flight pattern of the design. Summarizing considerable test and contest results, the following can be made:

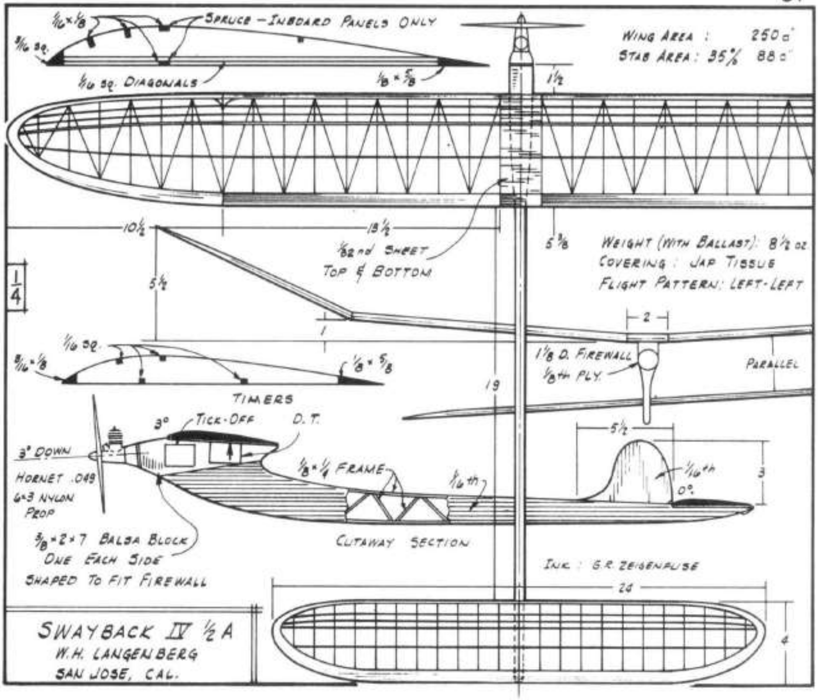
1) High thrust line models of this type will climb safely only to the left. This is probably due to slipstream action upon the rudder, a condition which could be eliminated by converting to a very high thrust line arrangement.

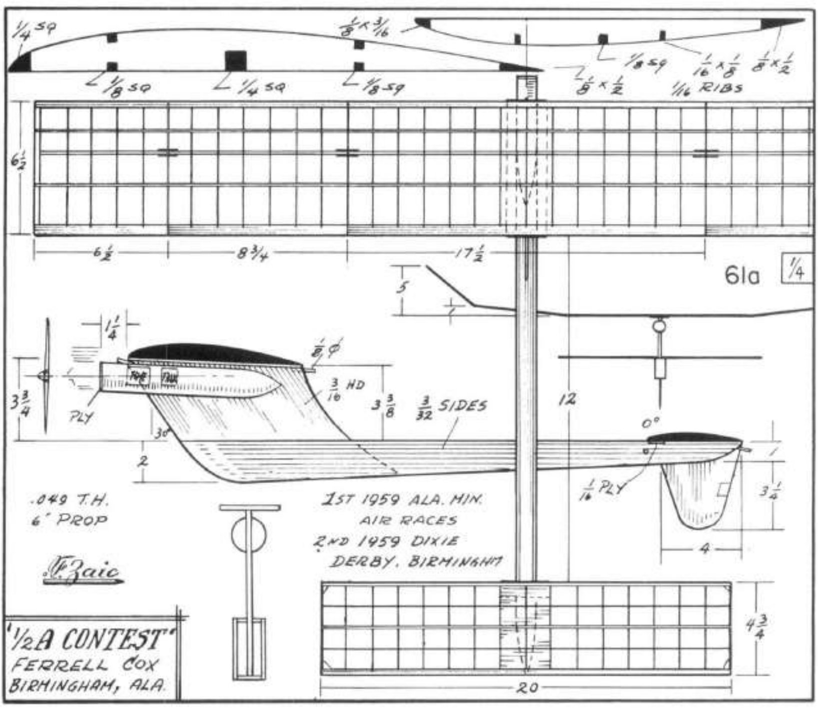
2) Climb appears to be maximized by locating the center of gravity relatively far forward, at approximately 60 percent of wing chord. This results in an excellent climb/glide transition and provides a good "bounce" set-up for turbulent air. But during calm weather, as is sometimes experienced, even during contests in this area, the glide leaves something to be desired.

3) Vertical take offs in windy weather are not good. To avoid flipping the models on their back, particularly the lighter ½A versions, they must be launched downwind. This results in substantial sacrifice in altitude gained from the climb.

4) The swayback design requires special reinforcement structure in the fuselage to prevent chronic breakage aft of the wing on D-T landings. This is particularly important under the current heavier weight rules.

At the risk of being classified as an iconoclast, I must admit that my experience with high thrust line design over the past three years has not convinced me of their inherent superiority over the more prosaic pylon models. With the advent of the 1959-60 AMA rules, it seems to me that much of the former advantage ascribed to high thrust ships, i.e. their ability to handle full engine power, has been negated. The heavier minimum weights now prescribed for all models, will tend to tame some of the jobs previously difficult to adjust. And in regard to use of "excessive" down thrust, it is my opinion that down thrust's ability to lean a hot model into the wind on a VTO more than offsets the relatively minor loss of engine efficiency.


SPRUCE – INBOARD PANELS ONLY
WING AREA : 250 □"
STAB AREA : 35% 88 □"
1/16 SQ. DIAGONALS
1/8 × 5/8
1/32nd SHEET TOP & BOTTOM
WEIGHT (WITH BALLAST): 8 1/2 oz
COVERING : JAP TISSUE
FLIGHT PATTERN: LEFT-LEFT
1 1/8 D. FIREWALL 1/8th PLY
PARALLEL
TIMERS
TICK-OFF
D.T.
3° DOWN
HORNET .049
6×3 NYLON PROP
1/8 × 1/4 FRAME
3/8 × 2 × 7 BALSA BLOCK ONE EACH SIDE SHAPED TO FIT FIREWALL
CUTAWAY SECTION
INK : G.R. ZEIGENFUSE
SWAYBACK IV 1/2 A
W.H. LANGENBERG
SAN JOSE, CAL.


1/4 SQ
1/8 × 3/16
1/8 SQ
1/4 SQ
1/8 × 1/2
1/16 × 1/8
1/8 × 1/2
1/16 RIBS
61a
3/16 HD
3/32 SIDES
PLY
1/16 PLY
.049 T.H.
6" PROP
1ST 1959 ALA. MIN. AIR RACES
2ND 1959 DIXIE DERBY, BIRMINGHM
"1/2A CONTEST"
FERRELL COX
BIRMINGHAM, ALA.

LOW ASPECT DESIGN ——— Harry Ryks, Muncie, Ind.

To understand the why and how of my low Aspect Ratio designs many factors must first be explained.

When the 173.4 oz. power loading rule went into effect it was clear that the old designs would not be entirely suitable for the almost 75% increase in weight they would have to carry. Therefore, I sat down to "think" a new design.

Firstly, I considered the normal weather and thermal conditions that would be encountered at most contests. Winds of 5 to 15 mph and as high as 25 mph would prevail. Air would be gusty and turbulent with numerous thermals, also turbulent and just as many "holes" or downdrafts. Thermals would have a narrow base,with a widening cone of smoother thermal air at the higher altitudes covering more of the sky area,and thus downdrafts would not be as violent,and would be fewer in number and smaller in area at the higher altitudes. Clockwise rotation would be expected.

A contest ship, to meet these conditions must be stable in the wind and turbulance. A high climb would be essential to get the ship up to broader part of the thermals where it would be easier to pick up the thermal and avoid the "holes". Counter clockwise pattern would aid in tightening the ship in the thermal thus a left glide necessary.

Attacking these problems in reverse I went to a thrust lay out to secure a safe left-left pattern to get the best of the power/glide transition.

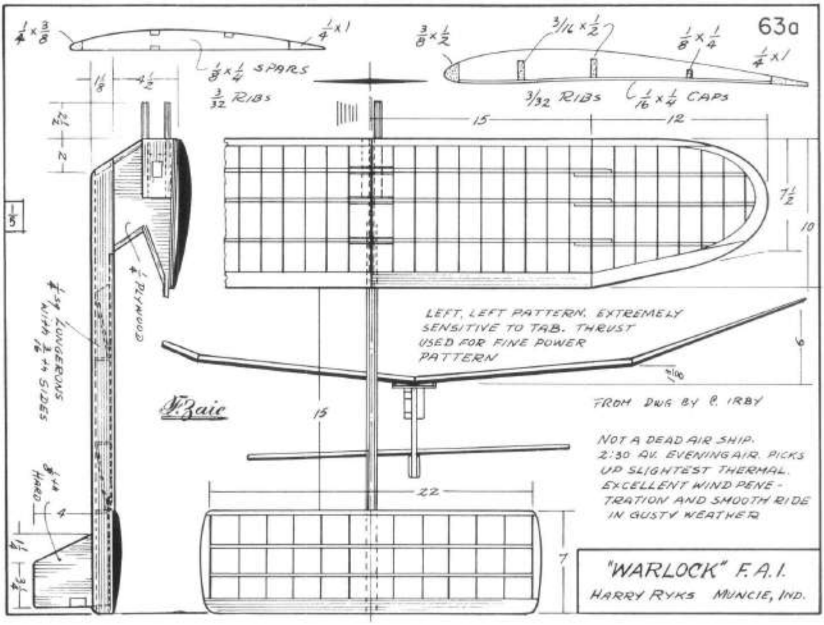
Next was the climb design. Climb depends upon power/weight/drag of a plane. As the weight and power are rather fixed by displacement the only reduction of the formula could be in the drag. Not much could be done in the parasitic or skin friction line, however, it was thought that by keeping the frontal area to a minimum overall drag could be reduced. As I consider the wing and stab span, multiplied by the airfoil depth, as part of the frontal area I felt it best to keep the span small. Together, with a short coupled airplane for good recovery in turbulent air, everything pointed towards a small, overpowered plane. However, with the weight fixed by the displacement, a small ship would come up with a very high wing loading. To reduce the loading it was necessary to cram the area on without increasing the span. This was done by lowering the Aspect Ratio.

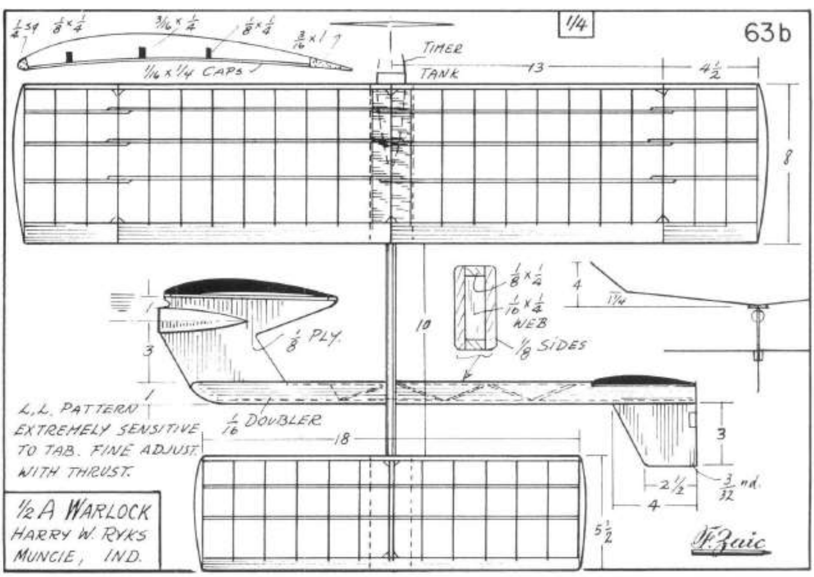
As theoretically proven, a high aspect wing is more efficient than a low aspect ratio. It was my belief that by choosing a correct airfoil a low aspect wing could surpass or at least approach a high aspect wing without a proper airfoil or with a zip-zip airfoil. After studying a great many airfoils I came up with a thinned down (actually stretched out) Benedek B-8353/b-2. With elliptical tips to cut tip loss, I believe it very efficient.

In practice this design has done everything I had hoped for. It is rather a disappointment in dead evening air averaging only 2:30 or 2:45. However, with a little breeze or any type of thermal activity the time jumps rapidly.

Flying against other ships under the new weight rules I have outclimbed anything in the same class. The ship rolls out at the top nicely due to the left/left pattern, does not seem susceptible to "holes" and rides any thermal like it bought a ticket.

One season does not prove a design but this design in three classes, and thru seven ships, has shown no deviation from the planned performance.



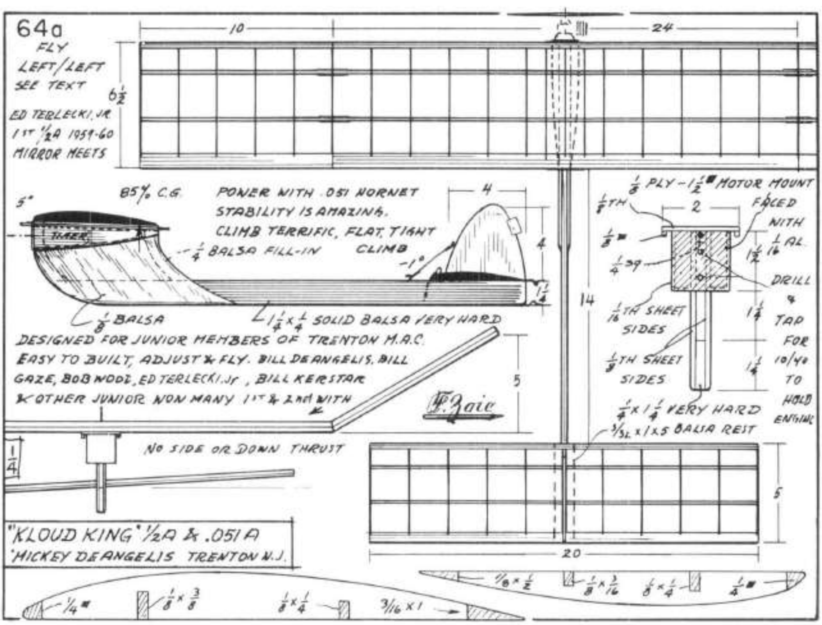


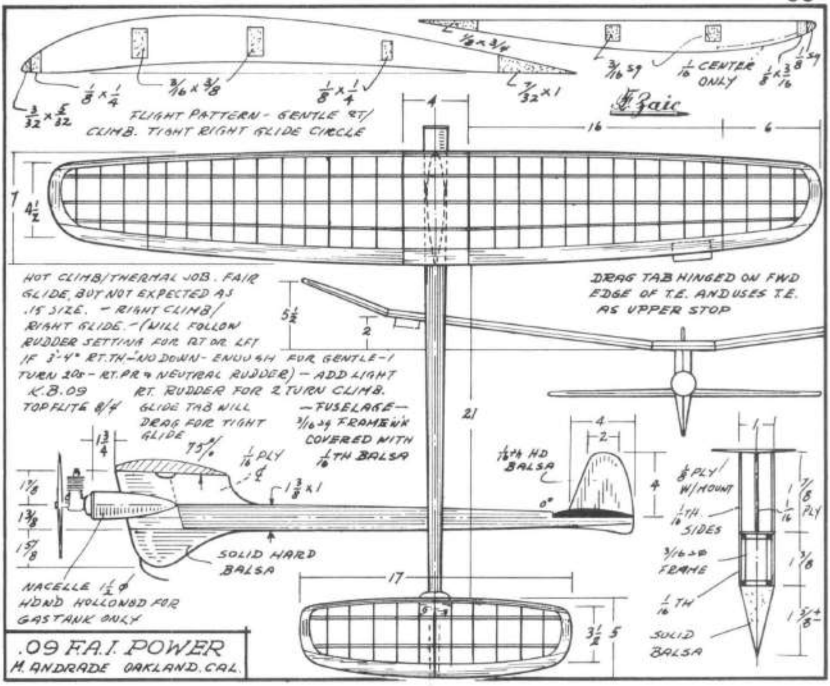
KLOUD KING NOTES — M. DeAngelis, Trenton, N. J.

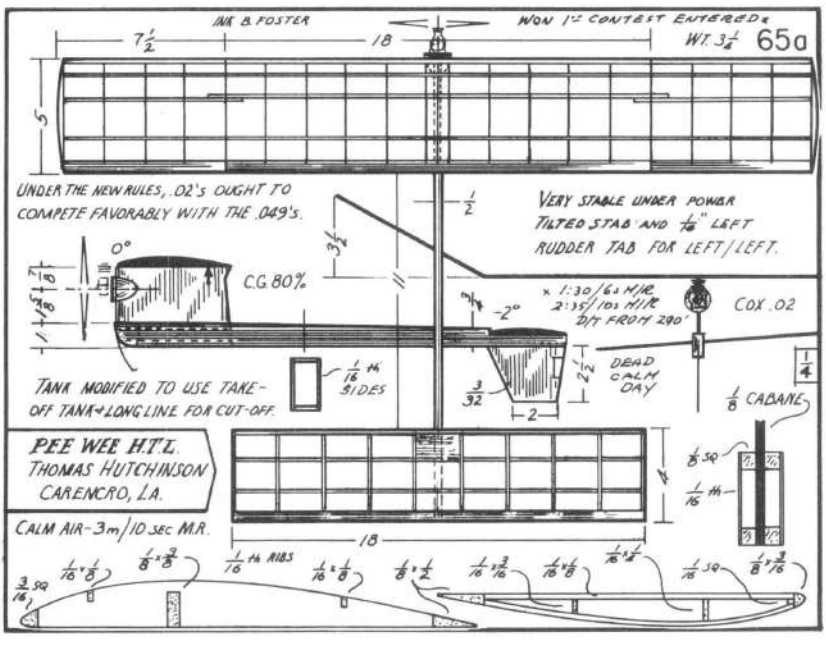
Basic adjustments are made with rudder tab (used sparingly) for left power turn, and stab tilt for left glider turn. Hand glide the model. Adjust for flat glide, and use tilt for slight left glide. (This will or should develop into tight left turn glide after power.)

Power test with rich engine for 5 to 7 sec. flights. (Do not use backward prop.) Test and adjust until model has no tendency for tight left climb, looping and/or diving and does have good climb angle. Now try full power. The climb should be almost straight up with one or two left circles. Glide should be tight left circle.

Flat center and large tip dihedral cause the model to have "slide around" turns like towline glider, and it picks up thermals like them. If built-in warps demand right turn, after excessive use of left tab, "give-in" and fly Right/Right. This ship, like most other high thrust models, is good for juniors as it will fly almost as well Right/Right. But for hopped Hornets, Space Hoppers in hands of experienced flyers, Left/Left gets up highest. No side or down thrust recommended. VTO's beautifully.



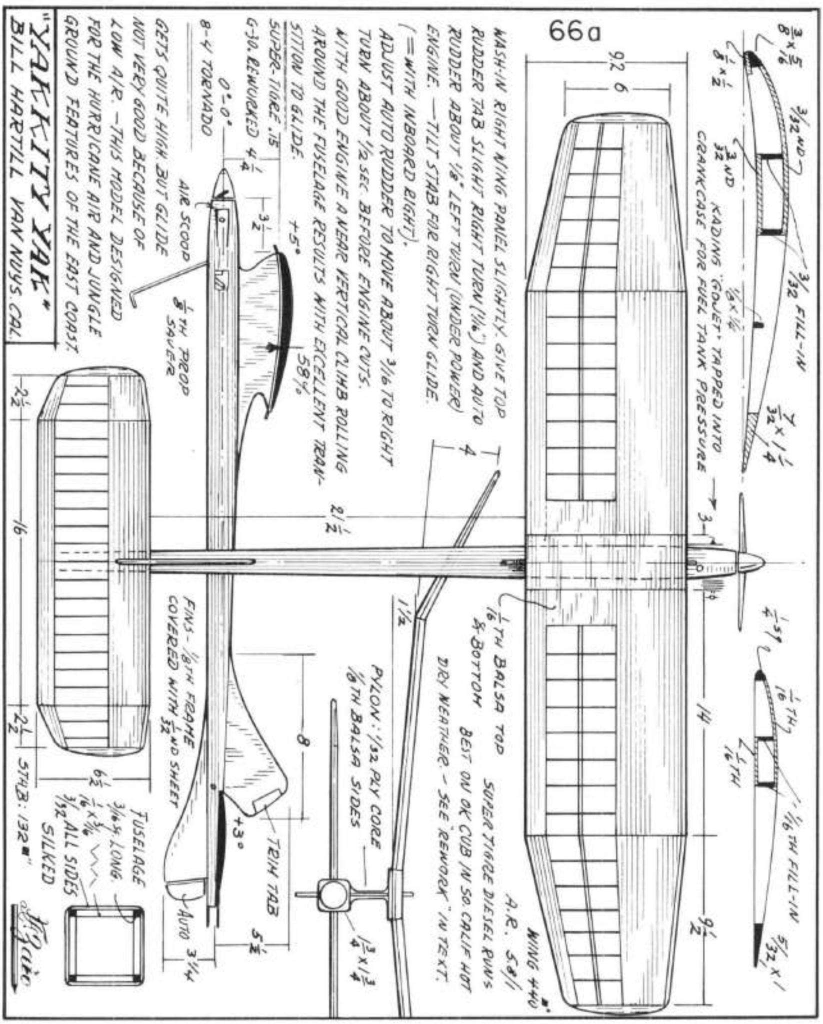

FLIGHT PATTERN - GENTLE RT/ CLIMB. TIGHT RIGHT GLIDE CIRCLE
HOT CLIMB/THERMAL JOB. FAIR GLIDE, BUT NOT EXPECTED AS .15 SIZE. - RIGHT CLIMB/ RIGHT GLIDE. - (WILL FOLLOW RUDDER SETTING FOR RT OR LFT IF 3°-4° RT.TH.-NO DOWN- ENOUGH FOR GENTLE-1 TURN 20s - RT.PR & NEUTRAL RUDDER) - ADD LIGHT RT. RUDDER FOR 2 TURN CLIMB.
K.B.09
TOP FLITE 8/4
GLIDE TAB WILL DRAG FOR TIGHT GLIDE
75%
-FUSELAGE- 3/16 sq FRAMEWK COVERED WITH 1/16 TH BALSA
DRAG TAB HINGED ON FWD EDGE OF T.E. AND USES T.E. AS UPPER STOP
SOLID HARD BALSA
NACELLE 1 1/2 φ HDWD HOLLOWED FOR GASTANK ONLY
1/16th HD BALSA
1/8 PLY W/MOUNT
1/16 TH SIDES
3/16 sq FRAME
1/16 TH
SOLID BALSA
1/16 CENTER ONLY
F. Zaic
.09 F.A.I. POWER
M. ANDRADE OAKLAND, CAL.


INK B. FOSTER
WON 1st CONTEST ENTERED
WT. 3 1/4
65a
UNDER THE NEW RULES, .02's OUGHT TO COMPETE FAVORABLY WITH THE .049's.
VERY STABLE UNDER POWER
TILTED STAB AND 1/16" LEFT RUDDER TAB FOR LEFT/LEFT.
C.G. 80%
× 1:30/6s H/R
2:35/10s H/R
D/T FROM 290'
COX .02
DEAD CALM DAY
TANK MODIFIED TO USE TAKE-OFF TANK & LONG LINE FOR CUT-OFF.
1/16 th SIDES
1/8 CABANE
PEE WEE H.T.L.
THOMAS HUTCHINSON
CARENCRO, LA.
CALM AIR-3m/10 sec M.R.
1/16 th RIBS

HIGH A/R & POWER FLIGHT Bill Hartill, Van Nuys, Cal.

The discussion on high aspect ratio dealt mainly with Nordic performance. However, the basic concept holds for other models as well. The same sort of optimization study could be made for Wakefield and FAI power models too if the airfoil characteristics are known and reasonable estimates of fuselage, drag, etc. can be made.

With power models though, stability and control during powered portion of flight becomes at least as important as the glide. (It is futile to argue which is most important). By observing the climb patterns of quite a few power jobs, it has become quite obvious that the lower the aspect

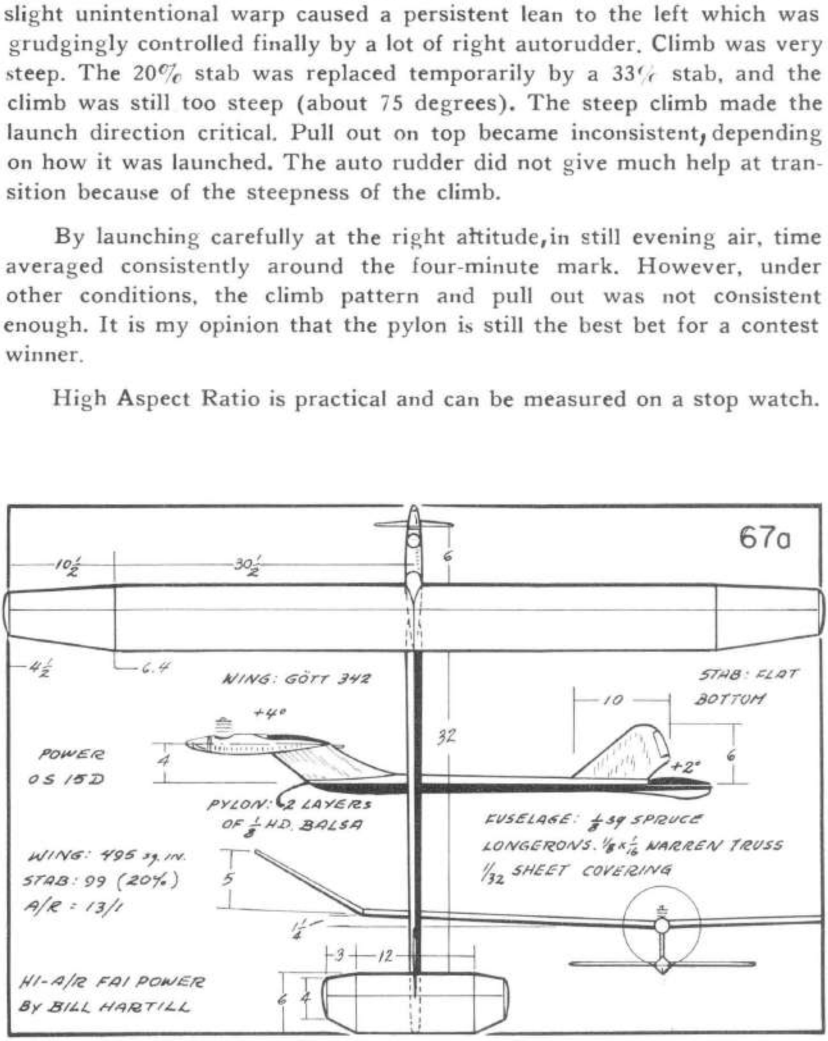


ratio the tighter the roll and the better control is obtained. The high Aspect Ratio wing (high Aspect Ratio I define as 11 or higher) requires a much more open climb pattern. Attempts to close up the spiral usually result in a half loop followed by a flat circle. Lenthening the tail moment seems to add little correction. The most effective control was to use auto-stab and auto rudder. This worked out quite well and is the technique I will stick to for now.

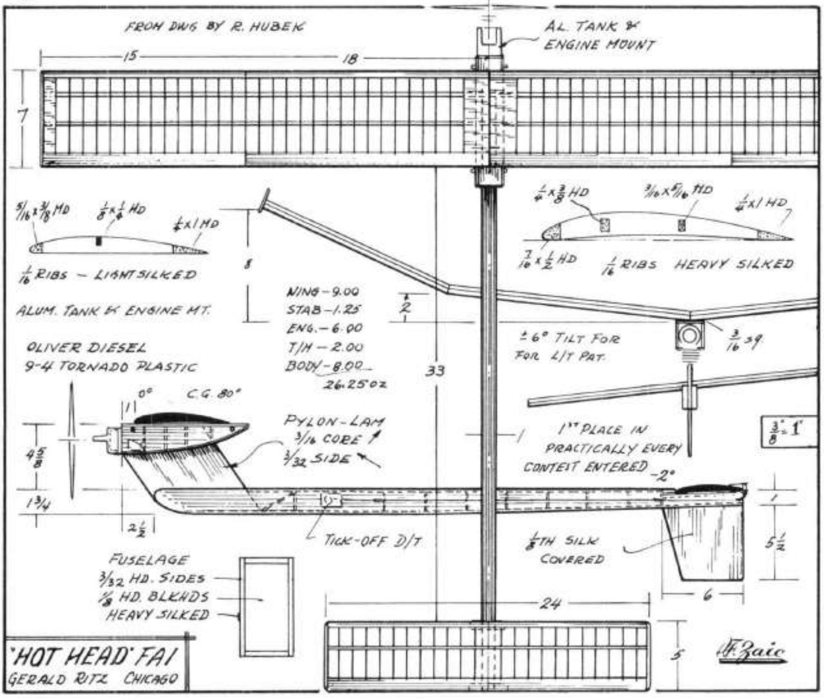
All of the above refers to Pylon type power jobs. Another approach is Hi-thrust line. It was reasoned that Hi Aspect Ratio and Hi-Thrust might go together quite well since roll in the climb was not needed. The ship shown was the result. The glide turned out to be quite good. A slight unintentional warp caused a persistent lean to the left which was grudgingly controlled finally by a lot of right autorudder. Climb was very steep. The 20% stab was replaced temporarily by a 33% stab, and the climb was still too steep (about 75 degrees). The steep climb made the launch direction critical. Pull out on top became inconsistent, depending on how it was launched. The auto rudder did not give much help at transition because of the steepness of the climb.

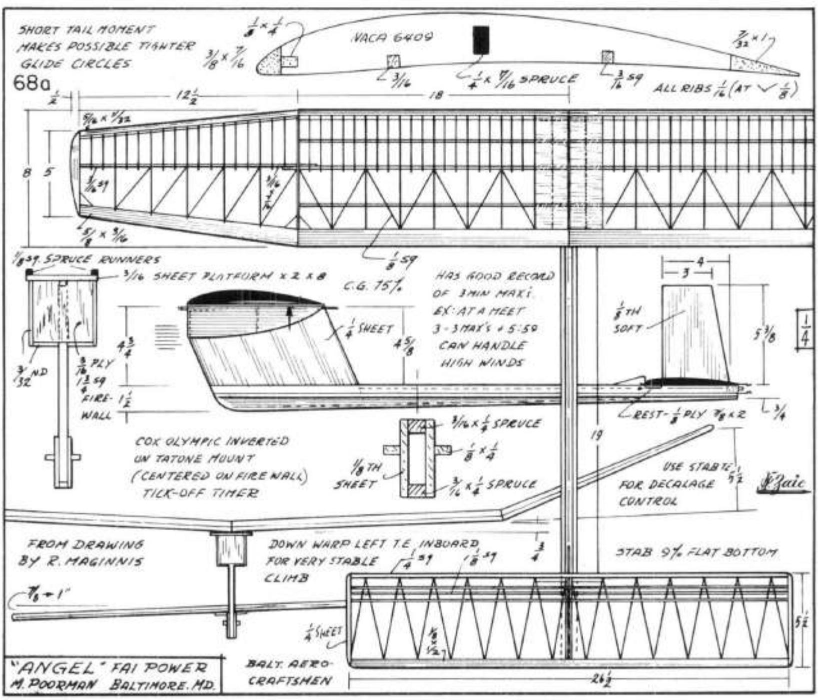
By launching carefully at the right altitude, in still evening air, time averaged consistently around the four-minute mark. However, under other conditions, the climb pattern and pull out was not consistent enough. It is my opinion that the pylon is still the best bet for a contest winner.

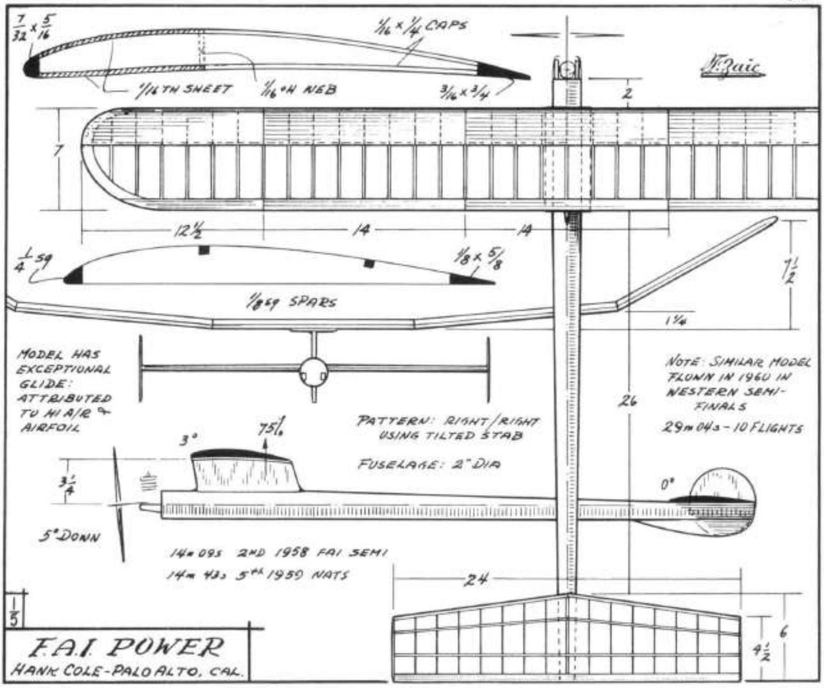
High Aspect Ratio is practical and can be measured on a stop watch.



68

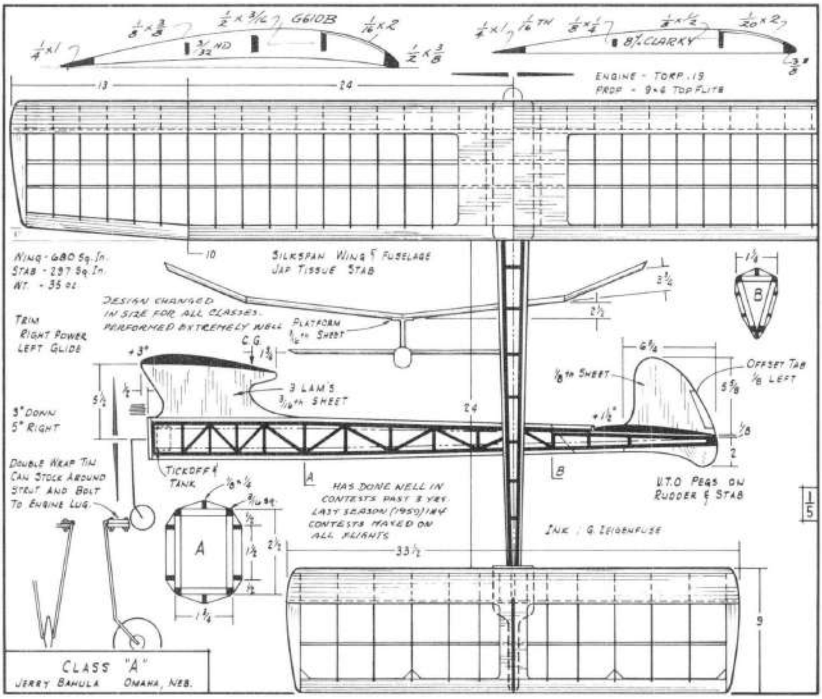

FROM DWG BY R. HUBEK
AL. TANK & ENGINE MOUNT
15
18
7
5/16 x 3/8 HD
1/8 x 1/4 HD
1/4 x 1 HD
1/16 RIBS – LIGHT SILKED
1/4 x 3/8 HD
3/16 x 5/16 HD
1/4 x 1 HD
7/16 x 1/2 HD
1/16 RIBS HEAVY SILKED
8
WING – 9.00
STAB – 1.25
ENG. – 6.00
T/H – 2.00
BODY – 8.00
26.25 OZ
2
ALUM. TANK & ENGINE MT.
OLIVER DIESEL
9-4 TORNADO PLASTIC
3/16 SQ.
± 6° TILT FOR
FOR L/T PAT.
33
0°
C.G. 80%
PYLON – LAM
3/16 CORE
3/32 SIDE
1st PLACE IN
PRACTICALLY EVERY
CONTEST ENTERED
-2°
3/8" = 1'
4 5/8
1 3/4
2 1/2
TICK-OFF D/T
1/8 TH SILK
COVERED
1
5 1/2
6
FUSELAGE
3/32 HD. SIDES
1/8 HD. BLKHDS
HEAVY SILKED
24
5
"HOT HEAD" FAI
GERALD RITZ CHICAGO
F. Zaic


68a
SHORT TAIL MOMENT
MAKES POSSIBLE TIGHTER
GLIDE CIRCLES
1/8 x 1/4
3/8 x 7/16
NACA 6409
7/32 x 1
3/16
1/4 x 7/16 SPRUCE
3/16 SQ
ALL RIBS 1/16 (AT ✓ 1/8)
1/2
12 1/2
18
5/16 x 3/32
8
5
3/16 SQ
3/16
5/8 x 3/16
1/8 SQ
1/8 SQ. SPRUCE RUNNERS
3/16 SHEET PLATFORM x 2 x 8
C.G. 75%
HAS GOOD RECORD
OF 3 MIN MAX'S
EX: AT A MEET
3 - 3 MAX'S + 5:59
CAN HANDLE
HIGH WINDS
4
3
1/8 TH
SOFT
5 3/8
1/4
1/4 SHEET
4 3/4
4 5/8
3/32 HD
3/16 PLY
1 3/4 SQ
FIRE-WALL
1 1/2
REST - 1/8 PLY 7/8 x 2
3/4
3/16 x 1/4 SPRUCE
1/8 x 1/4
1/8 TH SHEET
3/16 x 1/4 SPRUCE
COX OLYMPIC INVERTED
ON TATONE MOUNT
(CENTERED ON FIRE WALL)
TICK-OFF TIMER
19
USE STAB T.E.
FOR DECALAGE
CONTROL
F. Zaic
FROM DRAWING
BY R. MAGINNIS
DOWN WARP LEFT T.E. INBOARD
FOR VERY STABLE
CLIMB
1/4 SQ
1/8 SQ
3/4
STAB 9% FLAT BOTTOM
7/8 = 1"
1/4 SHEET
5 1/2
"ANGEL" FAI POWER
M. POORMAN BALTIMORE, MD.
BALT. AERO-
CRAFTSMEN
26 1/2

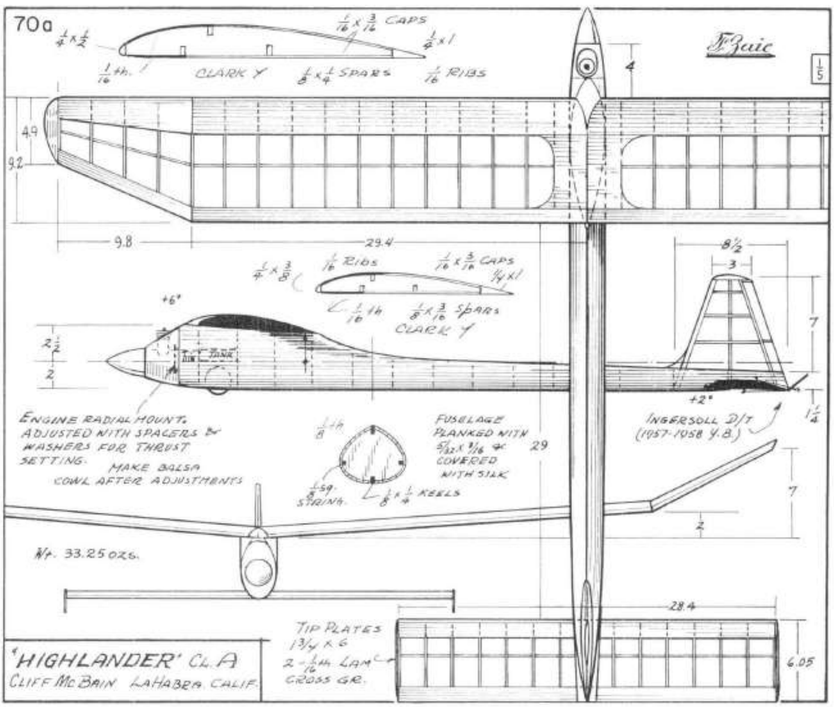


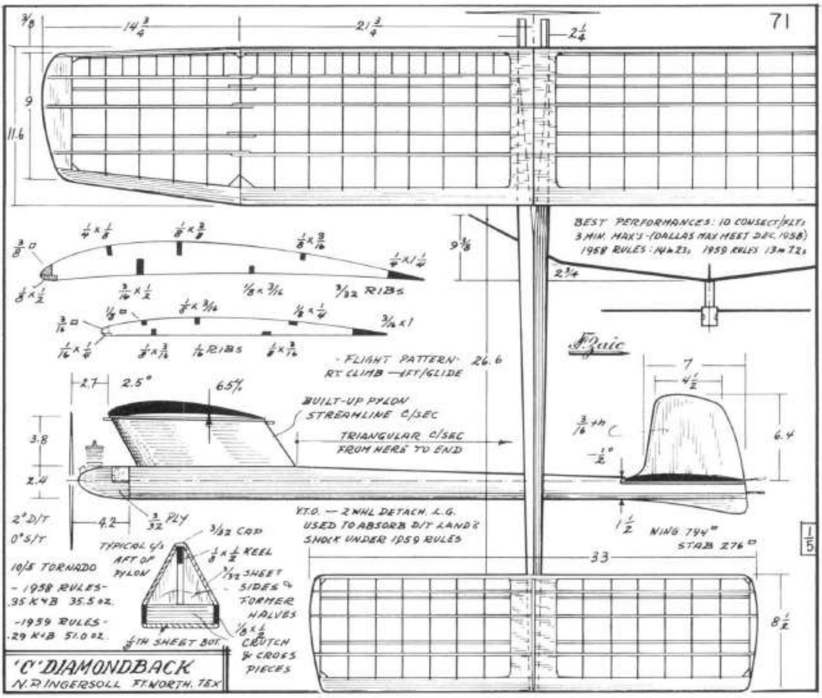
The power model has a very exceptional glide which may be attributed to the wing airfoil and aspect ratio. In my 1960 model, which I flew at Fresno and lost out to Ed Miller by 22 sec., I made the following modifications. Fuselage lengthened 4 inches. Stab was made rectangular and equipped with undercambered airfoil. Twin rudders were reduced to endplate size and area combined in subrudder. Pattern is right-right, using tilted stab.

My building time was limited this year and I got a late start on the new model. It was completed only the week before the semifinals at Fresno. It proved easy to adjust and put up a good showing at Fresno. My undoing was in the 7th round when Ed Miller, Bill Atwood, F. L. Swaney and I all had 6 maxs. I held off 'cause the air didn't look good, and sure enough, the best flight of the other 3 was 2:35 by Ed Miller. All I needed was a max to ice it. I waited for a breath of wind, and launched, but the drift on top was different, and I crossed the thermal at right angles into the downdraft on the side. Ended up second to Ed; Miller 29 min. 24 sec., me 29 min. .04 sec. Nothing for second place as you know. We both had 8 maxs out of 10 flights, but he fared a little better in the two downdrafts. Such is life.

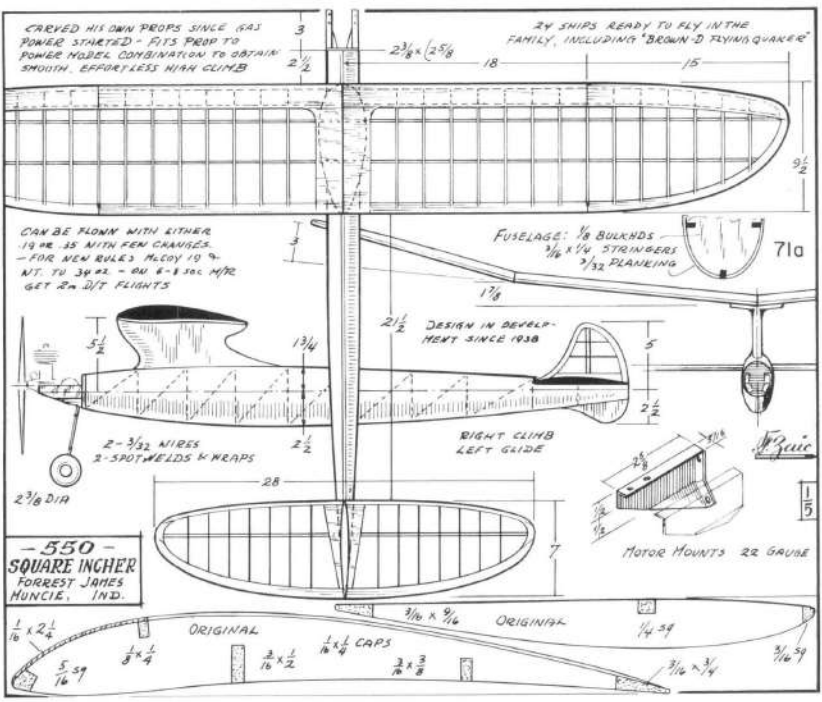

G610B
8% CLARK Y
ENGINE - TORP. 19
PROP - 9×6 TOP FLITE
WING - 680 Sq. In.
STAB - 297 Sq. In.
WT. - 35 oz
SILKSPAN WING & FUSELAGE
JAP TISSUE STAB
DESIGN CHANGED IN SIZE FOR ALL CLASSES.
PERFORMED EXTREMELY WELL
PLATFORM 1/16th SHEET
TRIM
RIGHT POWER
LEFT GLIDE
C.G.
3 LAM'S 3/16th SHEET
1/8th SHEET
OFFSET TAB 1/8 LEFT
3° DOWN
5° RIGHT
DOUBLE WRAP TIN CAN STOCK AROUND STRUT AND BOLT TO ENGINE LUG.
TICKOFF & TANK
HAS DONE WELL IN CONTESTS PAST 3 YRS. LAST SEASON (1950) 1st 4 CONTESTS MAXED ON ALL FLIGHTS
U.T.O PEGS ON RUDDER & STAB
INK: G. ZEIGENFUSE
CLASS "A"
JERRY BAHULA OMAHA, NEB.

70a


1/16 x 3/16 CAPS
CLARK Y
1/8 x 1/4 SPARS
1/16 RIBS
1/16 Ribs
1/16 x 3/16 CAPS
1/8 x 3/16 SPARS
CLARK Y
TANK
ENGINE RADIAL MOUNT. ADJUSTED WITH SPACERS & WASHERS FOR THRUST SETTING.
MAKE BALSA COWL AFTER ADJUSTMENTS
FUSELAGE PLANKED WITH 5/32 x 3/16 & COVERED WITH SILK
INGERSOLL D/T (1957-1958 Y.B.)
1/8 x 1/4 KEELS
STRING
Wt. 33.25 ozs.
TIP PLATES 1 3/4 x 6
2 - 1/16th LAM CROSS GR.
'HIGHLANDER' CL. A
CLIFF McBAIN LAHABRA CALIF.



71
BEST PERFORMANCES: 10 CONSECT/FLTS 3 MIN. MAX'S -(DALLAS MAY MEET DEC. 1958)
1958 RULES: 14m 23s 1959 RULES 13m 22s
- FLIGHT PATTERN - RT. CLIMB - LFT/GLIDE
BUILT-UP PYLON STREAMLINE C/SEC
TRIANGULAR C/SEC FROM HERE TO END
Y.T.O. — 2 WHL DETACH. L.G. USED TO ABSORB D/T LAND'G SHOCK UNDER 1959 RULES
WING 794□" STAB 276□"
TYPICAL C/S AFT OF PYLON
3/32 CAP
3/32 SHEET SIDES & FORMER HALVES
1/8 x 1/8 CRUTCH & CROSS PIECES
1/8TH SHEET BOT.
10/5 TORNADO
- 1958 RULES - .35 K+B 35.5 oz.
- 1959 RULES - .29 K+B 51.0 oz.
2° D/T
0° S/T
3/32 RIBS
1/16 RIBS
'C' DIAMONDBACK
N.P. INGERSOLL FT. WORTH, TEX.



CARVED HIS OWN PROPS SINCE GAS POWER STARTED - FITS PROP TO POWER MODEL COMBINATION TO OBTAIN SMOOTH, EFFORTLESS HIGH CLIMB
24 SHIPS READY TO FLY IN THE FAMILY, INCLUDING "BROWN-D FLYING QUAKER"
CAN BE FLOWN WITH EITHER .19 OR .35 WITH FEW CHANGES. - FOR NEW RULES McCOY 19 & WT. TO 34 oz. - ON 6-8 sec M/R GET 2m D/T FLIGHTS
FUSELAGE: 1/8 BULKHDS 3/16 x 1/4 STRINGERS 3/32 PLANKING
71a
DESIGN IN DEVELOPMENT SINCE 1938
2 - 3/32 WIRES 2-SPOTWELDS & WRAPS
RIGHT CLIMB LEFT GLIDE
2 3/8 DIA
MOTOR MOUNTS 22 GAUGE
- 550 - SQUARE INCHER
FORREST JAMES MUNCIE, IND.
ORIGINAL
1/16 x 1/4 CAPS

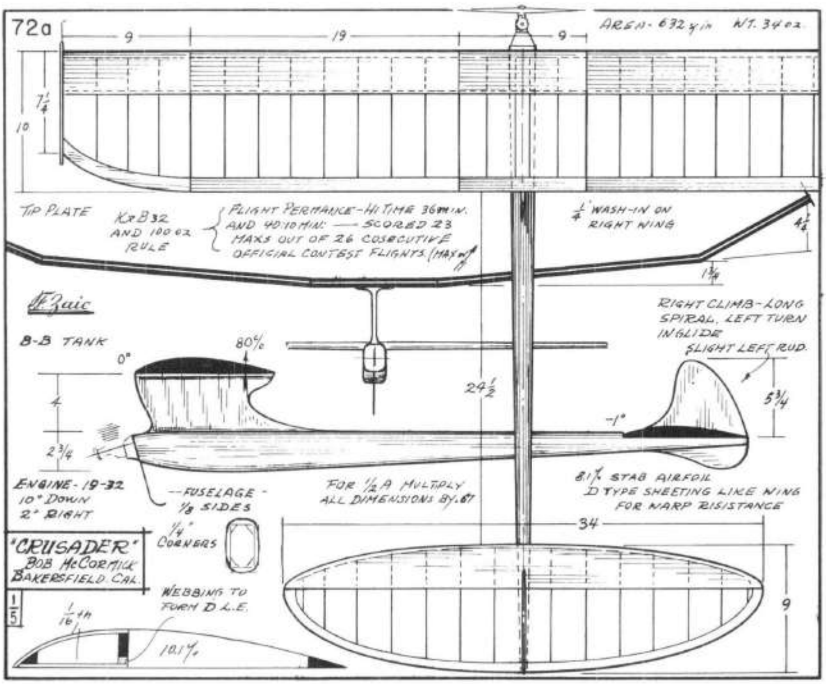
NOTES ON CRUSADER——Bob McCormick

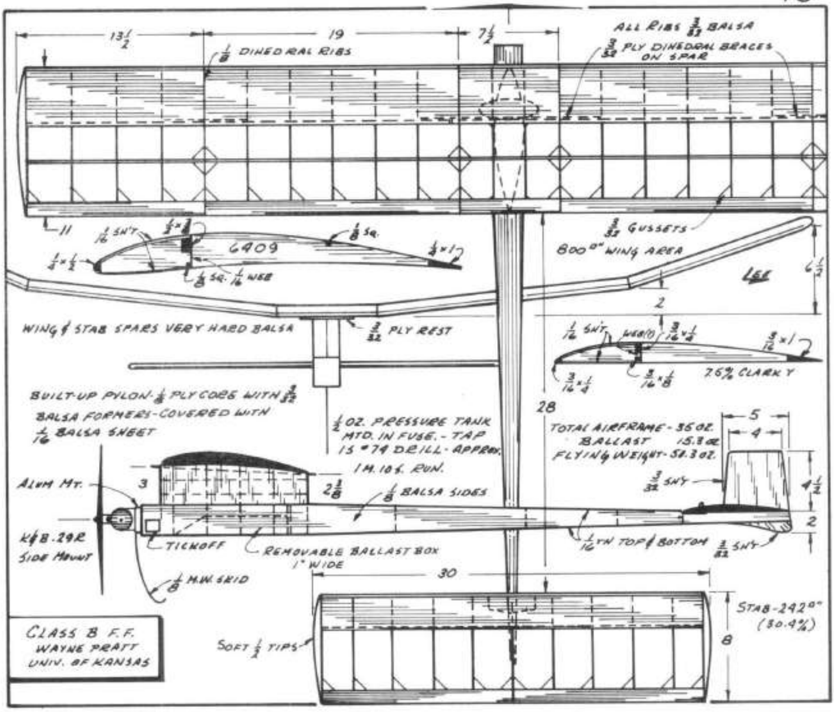
The following are a few notes on the development of the Crusader.

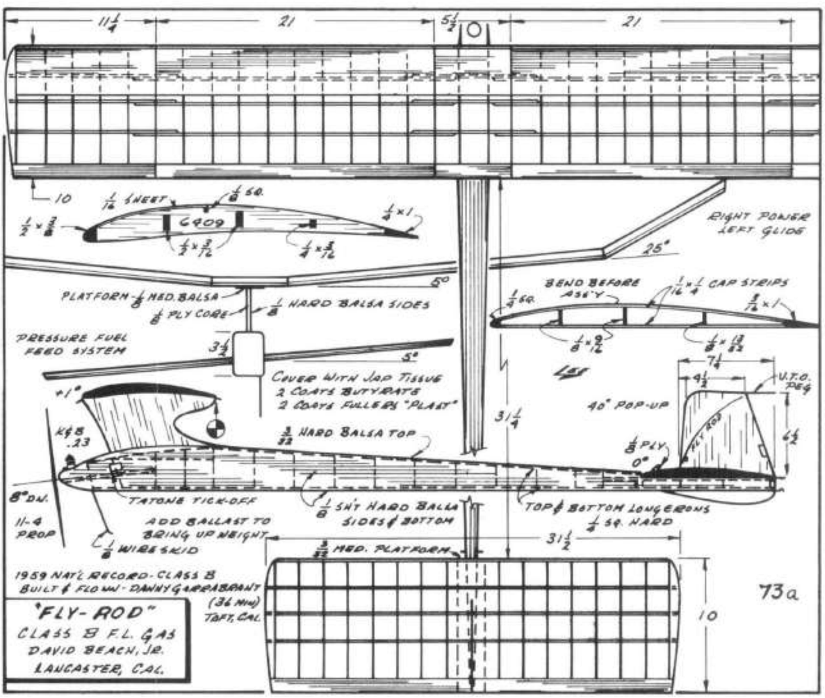
The design is based on the observation that other factors affect sinking speed beside wing loading. On several different occasions I have seen B-C Zeeks weighing 32 oz. on 575 square inches equaling or exceeding the glide of Spacers weighing 22 oz. on 600 square inches; all of this on dead calm days, no visible lift and all ships in a close area. With an efficient plane you not only get a glide that is close to the floaters, but you have better wind penetration so they will stay in sight longer.

The 632 square inches was chosen as an all purpose plane under the old 100 oz. rule, it was flown with 19's—29's—and 32's; climbs ranged from hot to torrid. Under new rules the size is good for 19's. All of the original ships are still flying after three years. In competition none have ever augered in. I think this is due mainly to the "D" leading edge on the wing and stab. I can't say enough for these structures; they surely make a wing stiff and resistant to warps. The flight characteristics have never been changed and no adjustments have ever been made on the airplane since it was tested three years ago. This is a big help at contests, all you have to worry about is good air.

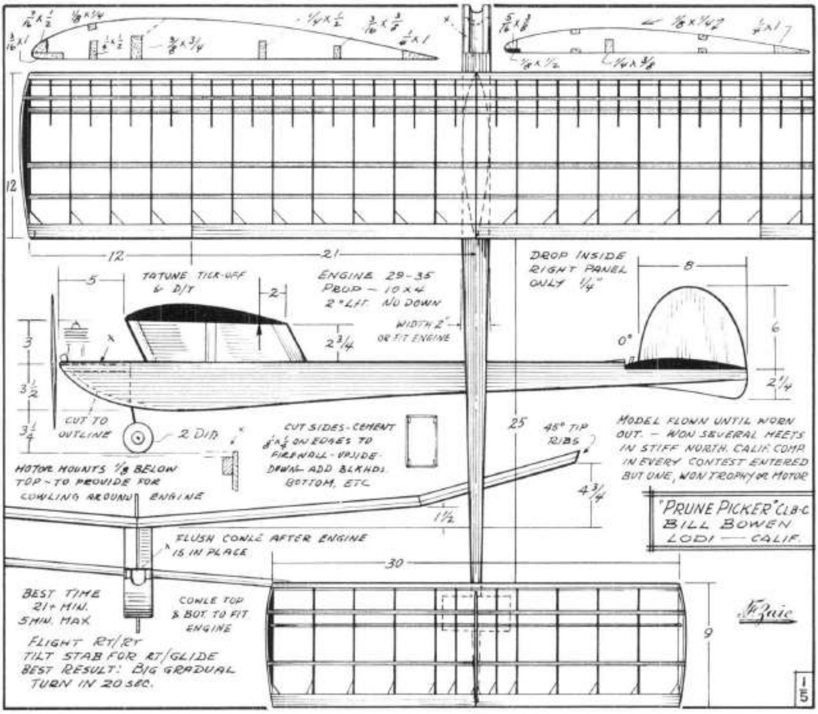
High times for the airplane is 36:00 and 40:00 min. also scoring 23 out of 26 consecutive official contest flights as maxes or unlimited fourth flights. This was under the 100 oz. rule with a K & B 32 up front.



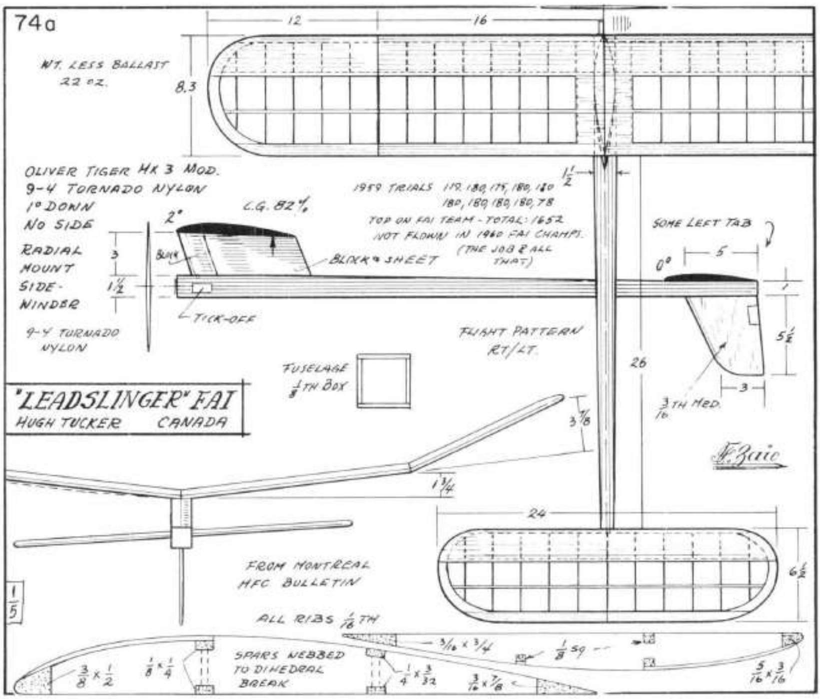

ALL RIBS 3/32 BALSA
1/8 DIHEDRAL RIBS
3/32 PLY DIHEDRAL BRACES ON SPAR
1/16 SH'T
6409
1/8 SQ.
1/4 × 1
1/4 × 1/2
1/8 SQ. 1/16 WEB
3/32 GUSSETS
800 □" WING AREA
LEE
WING & STAB SPARS VERY HARD BALSA
3/32 PLY REST
7.6% CLARK Y
BUILT-UP PYLON - 1/8 PLY CORE WITH 3/32 BALSA FORMERS - COVERED WITH 1/16 BALSA SHEET
1/2 OZ. PRESSURE TANK MTD. IN FUSE. - TAP 1.5 #74 DRILL - APPROX. 1 M. 10 S. RUN.
TOTAL AIRFRAME - 35 OZ.
BALLAST 15.3 OZ.
FLYING WEIGHT - 50.3 OZ.
ALUM MT.
K&B .29R SIDE MOUNT
1/8 BALSA SIDES
TICKOFF
REMOVABLE BALLAST BOX 1" WIDE
1/16TH TOP & BOTTOM
3/32 SH'T
1/8 M.W. SKID
SOFT 1/2 TIPS
STAB - 242 □" (30.4%)
CLASS B F.F.
WAYNE PRATT
UNIV. OF KANSAS


1/16 SHEET
1/8 SQ.
6409
1/4 × 1
1/2 × 3/8
1/2 × 3/16
1/4 × 3/16
RIGHT POWER LEFT GLIDE
25°
5°
PLATFORM - 1/8 MED. BALSA
1/8 PLY CORE
1/8 HARD BALSA SIDES
BEND BEFORE ASS'Y
1/16 × 1/4 CAP STRIPS
3/16 × 1
PRESSURE FUEL FEED SYSTEM
COVER WITH JAP TISSUE
2 COATS BUTYRATE
2 COATS FULLER'S "PLAST"
40° POP-UP
U.T.O. PEG
FLY-ROD
K&B .23
3/32 HARD BALSA TOP
1/8 PLY
0°
8° DN.
11-4 PROP
TATONE TICK-OFF
1/8 SH'T HARD BALSA SIDES & BOTTOM
TOP & BOTTOM LONGERONS 1/4 SQ. HARD
ADD BALLAST TO BRING UP WEIGHT
1/8 WIRE SKID
3/32 MED. PLATFORM
1959 NAT'L RECORD - CLASS B
BUILT & FLOWN - DANNY GARRABRANT (36 MIN) TAFT, CAL.
"FLY-ROD"
CLASS B F.L. GAS
DAVID BEACH, JR.
LANCASTER, CAL.

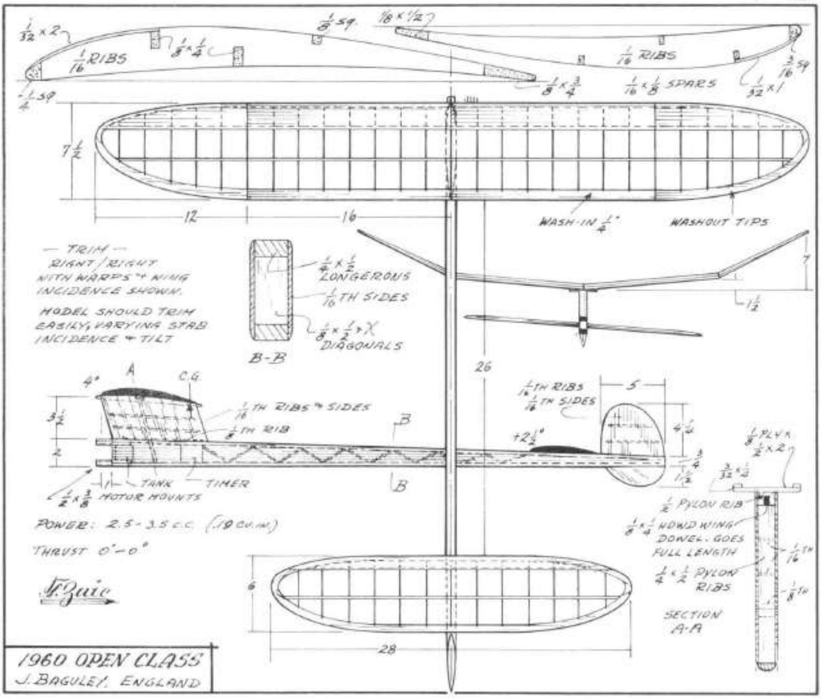
74

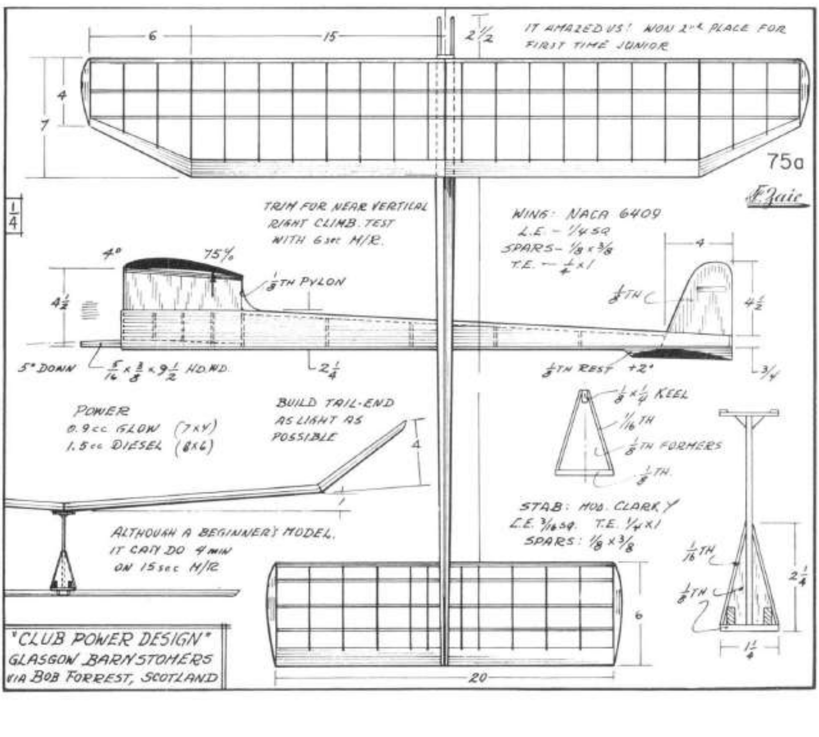


12
21
5
TATUNE TICK-OFF & D/T
ENGINE 29-35
PROP — 10 x 4
2° LFT. NO DOWN
WIDTH 2" OR FIT ENGINE
2 3/4
DROP INSIDE RIGHT PANEL ONLY 1/4"
8
6
0°
2 1/4
3
3 1/2
3 1/4
CUT TO OUTLINE
2 DIA.
CUT SIDES - CEMENT 1/8 x 1/4 ON EDGES TO FIREWALL - UPSIDE-DOWN - ADD BLKHDS. BOTTOM, ETC.
25
45° TIP RIBS
MODEL FLOWN UNTIL WORN OUT. — WON SEVERAL MEETS IN STIFF NORTH. CALIF. COMP. IN EVERY CONTEST ENTERED BUT ONE, WON TROPHY OR MOTOR
MOTOR MOUNTS 1/8 BELOW TOP - TO PROVIDE FOR COWLING AROUND ENGINE
4 3/4
1 1/2
"PRUNE PICKER" CLB-C
BILL BOWEN
LODI — CALIF.
FLUSH COWLE AFTER ENGINE IS IN PLACE
30
BEST TIME 21+ MIN. 5 MIN. MAX.
COWLE TOP & BOT. TO FIT ENGINE
9
FLIGHT RT/RT
TILT STAB FOR RT/GLIDE
BEST RESULT: BIG GRADUAL TURN IN 20 SEC.
1/5

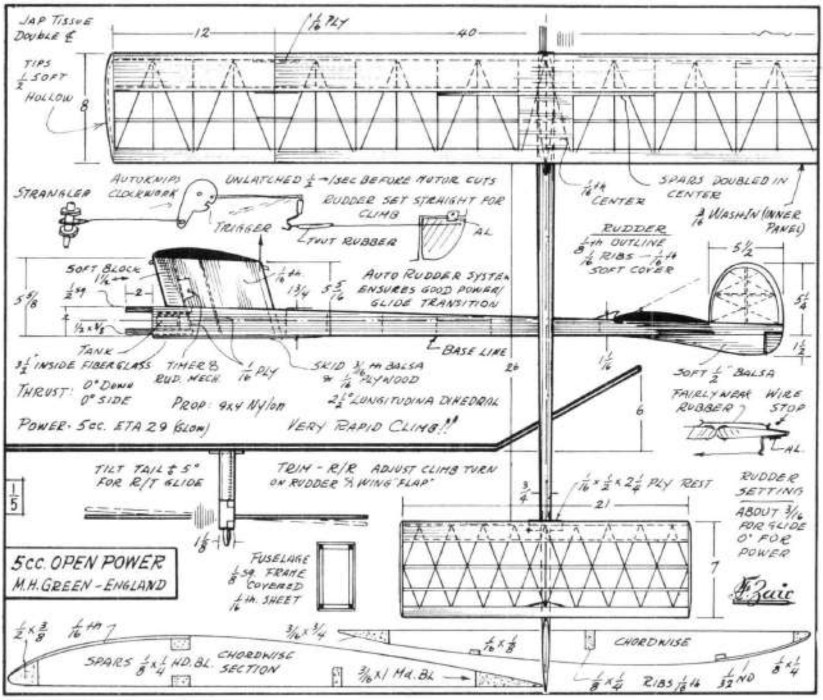


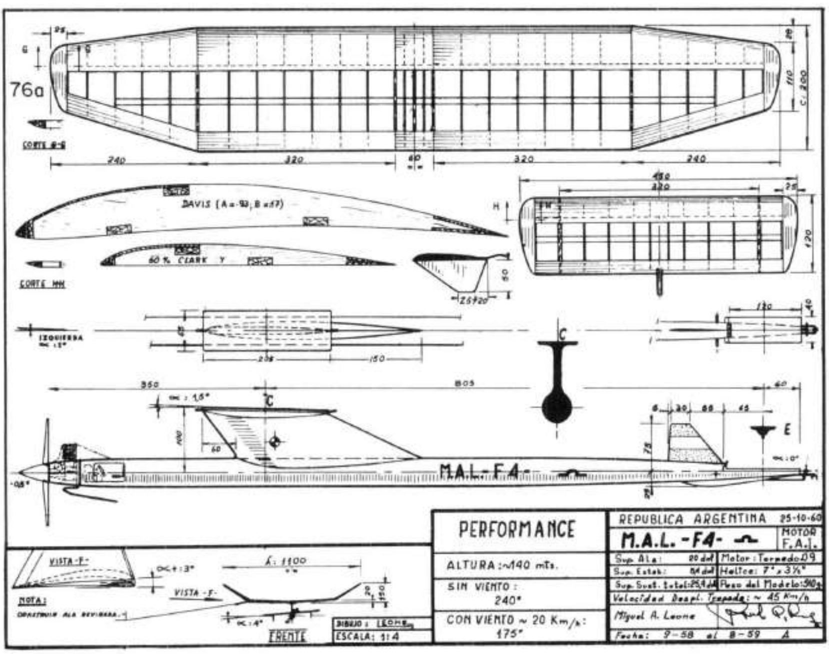
74a
12
16
WT. LESS BALLAST 22 oz.
8,3
OLIVER TIGER MK 3 MOD.
9-4 TORNADO NYLON
1° DOWN
NO SIDE
RADIAL MOUNT SIDE-WINDER
C.G. 82%
2°
3
1 1/2
BLOCK & SHEET
TICK-OFF
9-4 TORNADO NYLON
1959 TRIALS 179, 180, 175, 180, 180 180, 180, 180, 180, 78
TOP ON FAI TEAM - TOTAL: 1652
NOT FLOWN IN 1960 FAI CHAMPS. (THE JOB & ALL THAT)
1 1/2
SOME LEFT TAB
0°
5
5 1/2
3
FLIGHT PATTERN RT/LT.
26
FUSELAGE 1/8 TH BOX
3/16 TH MED.
"LEADSLINGER" FAI
HUGH TUCKER CANADA
3 7/8
1 3/4
24
6 1/2
FROM MONTREAL MFC BULLETIN
1/5
ALL RIBS 1/16 TH
SPARS WEBBED TO DIHEDRAL BREAK
3/8 x 1/2
1/8 x 1/4
1/4 x 3/32
3/16 x 7/8
3/16 x 3/4
1/8 sq
5/16 x 3/16

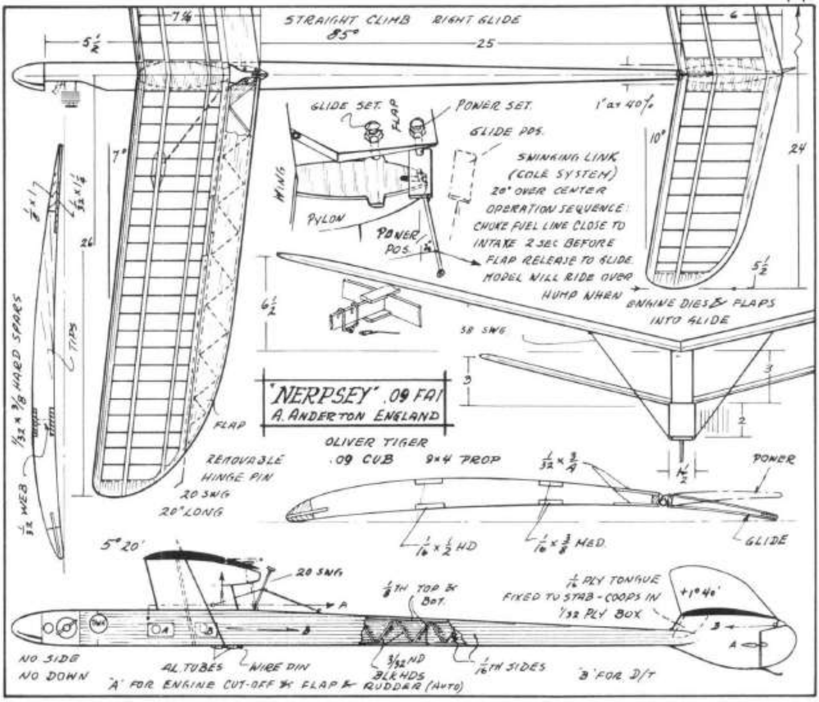

— TRIM —
RIGHT / RIGHT
WITH WARPS + WING INCIDENCE SHOWN.
MODEL SHOULD TRIM EASILY, VARYING STAB INCIDENCE + TILT
POWER: 2.5 - 3.5 c.c. (.19 cu.in.)
THRUST 0°-0°
WASH-IN 1/4"
WASHOUT TIPS
LONGERONS
DIAGONALS
B-B
MOTOR MOUNTS
TANK
TIMER
PYLON RIB
DOWEL. GOES FULL LENGTH
PYLON RIBS
SECTION A-A
1960 OPEN CLASS
J. BAGULEY, ENGLAND

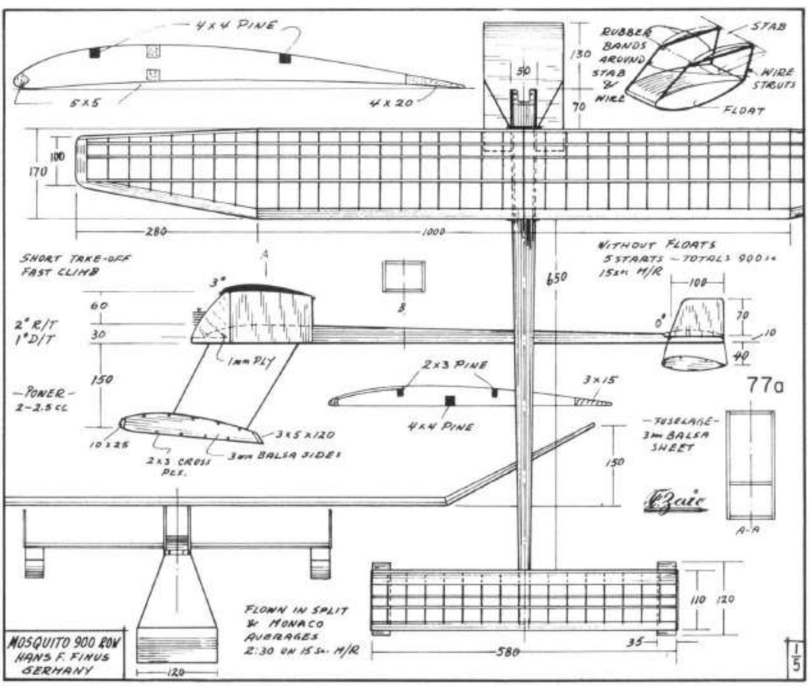

IT AMAZED US! WON 2nd PLACE FOR FIRST TIME JUNIOR
75a
TRIM FOR NEAR VERTICAL RIGHT CLIMB. TEST WITH 6 sec M/R.
WING: NACA 6409
L.E. - 1/4 SQ
SPARS - 1/8 x 3/8
T.E. - 1/4 x 1
POWER
0.9 cc GLOW (7x4)
1.5 cc DIESEL (8x6)
BUILD TAIL-END AS LIGHT AS POSSIBLE
STAB: MOD. CLARK Y
L.E. 3/16 sq. T.E. 1/4 x 1
SPARS: 1/8 x 3/8
ALTHOUGH A BEGINNER'S MODEL, IT CAN DO 4 min ON 15 sec M/R
"CLUB POWER DESIGN"
GLASGOW BARNSTOMERS
VIA BOB FORREST, SCOTLAND

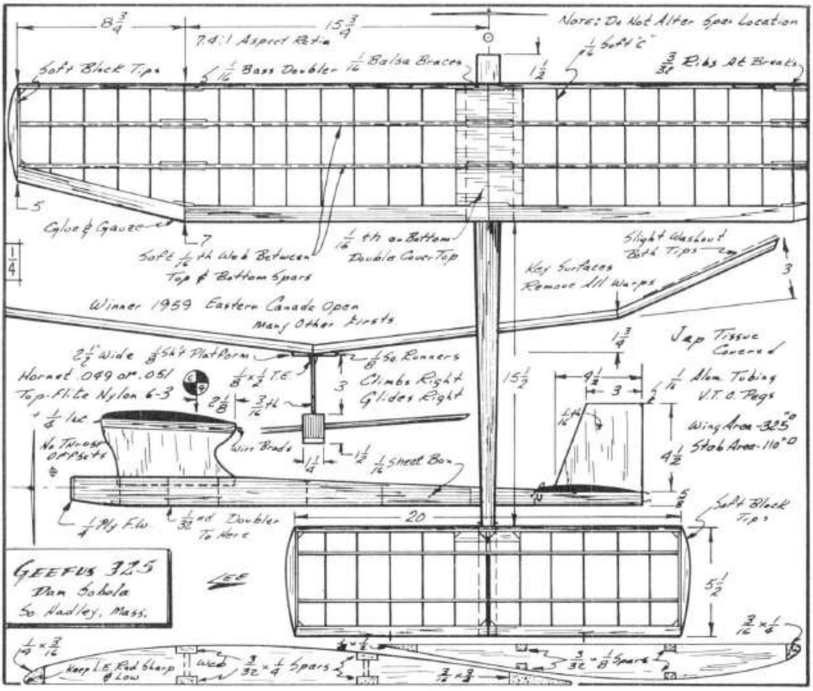
76

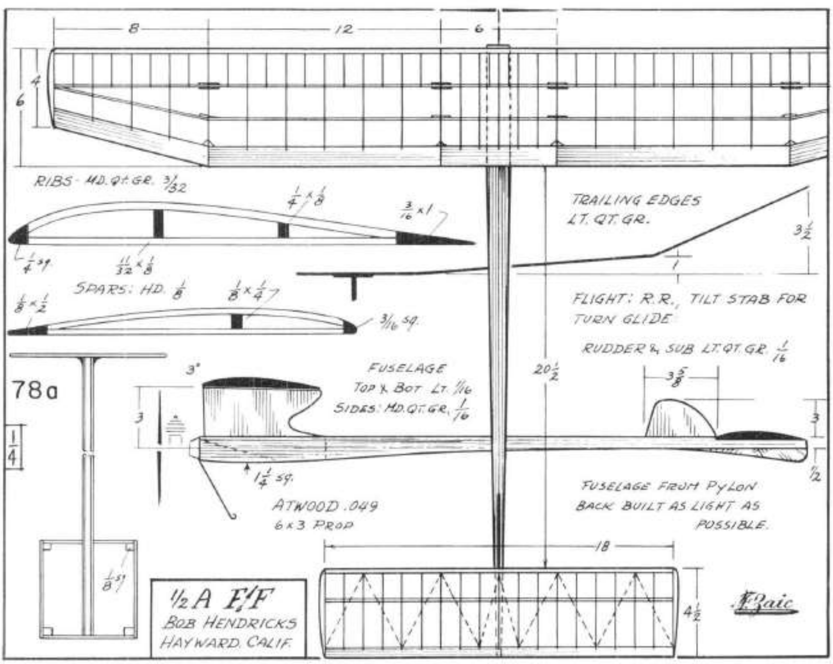

JAP TISSUE DOUBLE ₵
TIPS 1/2 SOFT HOLLOW
12
40
1/16 PLY
8
AUTOKNIPS CLOCKWORK
STRANGLER
UNLATCHED 1/2 → 1SEC BEFORE MOTOR CUTS
RUDDER SET STRAIGHT FOR CLIMB
TRIGGER
TWT RUBBER
AL
1/16 th CENTER
SPARS DOUBLED IN CENTER
3/16 WASHIN (INNER PANEL)
RUDDER
1/8 th OUTLINE
1/16 RIBS — 1/16 th SOFT COVER
5 1/2
5 1/4
1 1/2
SOFT BLOCK
1 1/2
1/2 sq.
2
5 5/8
1/16 th
1 3/4
5 5/16
AUTO RUDDER SYSTEM ENSURES GOOD POWER/GLIDE TRANSITION
TANK
3 1/2" INSIDE FIBERGLASS
TIMER & RUD. MECH.
1/16 PLY
SKID 3/16 th BALSA & 1/16 PLYWOOD
BASE LINE
26
1 1/16
SOFT 1/2" BALSA
THRUST: 0° DOWN 0° SIDE
PROP: 9x4 Nylon
2 1/2° LONGITUDINAL DIHEDRAL
6
FAIRLY NEAR RUBBER
WIRE STOP
POWER - 5cc. ETA 29 (Glow)
VERY RAPID CLIMB!!
AL
TILT TAIL ₵ 5° FOR R/T GLIDE
TRIM - R/R ADJUST CLIMB TURN ON RUDDER & WING FLAP
1/5
3/4
1/16 x 1/2 x 2 1/4 PLY REST
21
RUDDER SETTING ABOUT 3/16 FOR GLIDE 0° FOR POWER
1 1/8
FUSELAGE 1/8 sq. FRAME COVERED 1/16 th SHEET
7
5cc. OPEN POWER
M.H.GREEN - ENGLAND
F. Zaic
1/2 x 3/8
1/16 th
3/16 x 3/4
1/16 x 1/8
CHORDWISE
SPARS 1/8 x 1/4 HD.BL.
CHORDWISE SECTION
3/16 x 1 Md.BL.
1/8 x 1/4
RIBS 1/16
1/32 hd
1/8 x 1/4


76a
25
6
110
C: 200
CORTE G-G
240
320
60
320
240
DAVIS (A = 93; B = 57)
H
450
420
25
120
60 % CLARK Y
CORTE H-H
50
IZQUIERDA
205
150
120
40
C
350
805
60
∝ : 1,5°
C
100
60
6
20
88
75
E
M.A.L.-F4-
∝ : 0°
PERFORMANCE
ALTURA: ~140 mts.
SIN VIENTO: 240"
CON VIENTO ~ 20 Km/h: 175"
REPUBLICA ARGENTINA
25-10-60
M.A.L.-F4-
MOTOR F.A.I.
Motor: Torpedo 09
Hélice: 7" x 3 1/2"
Peso del Modelo
Velocidad Despl. Trepada: ~ 45 Km/h
Miguel A. Leone
Fecha: 9-58 al 8-59
VISTA -F-
∝ + 3°
VISTA -F-
L: 1100
NOTA:
∝ : 4°
FRENTE
DIBUJO: LEONE
ESCALA: 1:4

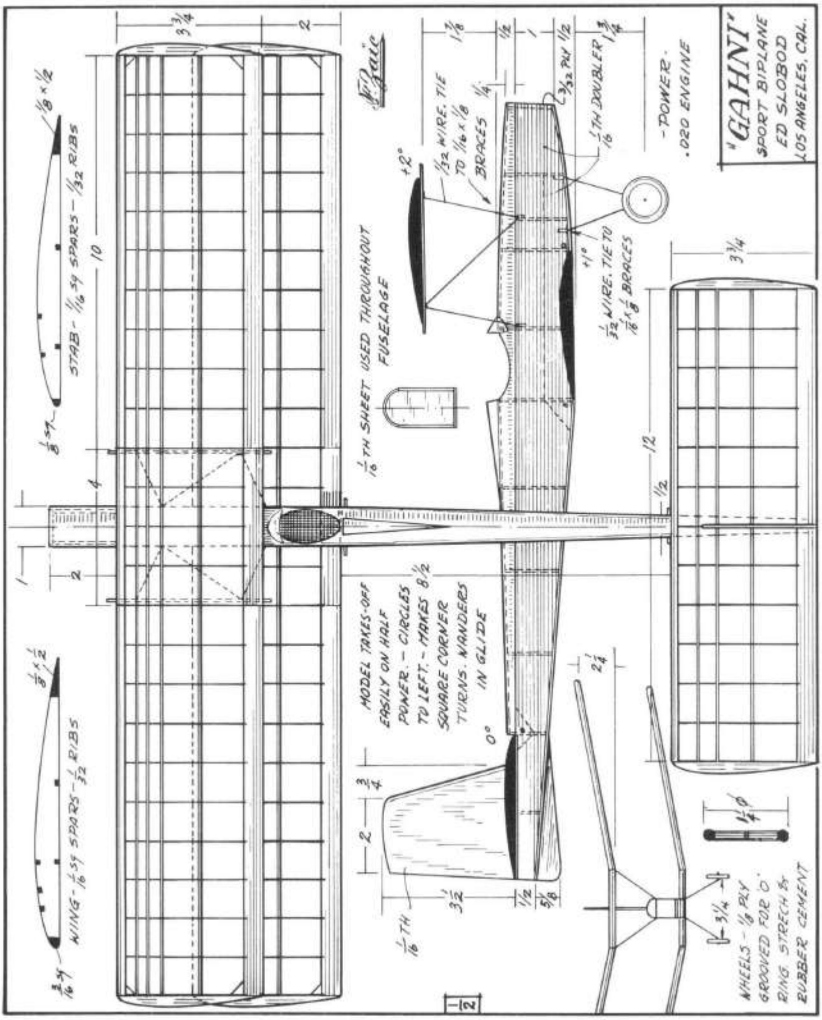

STRAIGHT CLIMB 85°
RIGHT GLIDE
"NERPSEY" .09 FAI
A. ANDERTON ENGLAND
OLIVER TIGER .09 CUB 9×4 PROP
GLIDE SET.
FLAP
POWER SET.
GLIDE POS.
WING
PYLON
POWER POS.
SWINGING LINK (COLE SYSTEM)
20° OVER CENTER
OPERATION SEQUENCE: CHOKE FUEL LINE CLOSE TO INTAKE 2 SEC BEFORE FLAP RELEASE TO GLIDE. MODEL WILL RIDE OVER HUMP WHEN ENGINE DIES & FLAPS INTO GLIDE
1" at 40%
58 SWG
FLAP
REMOVABLE HINGE PIN
20 SWG
20" LONG
1/32 × 3/8 HARD SPARS
1/32 WEB
TIPS
1/32 × 3/4
1/16 × 1/2 HD
1/16 × 3/8 MED.
POWER
GLIDE
5° 20'
20 SWG
1/8 TH TOP & BOT.
1/16 PLY TONGUE FIXED TO STAB - COOPS IN 1/32 PLY BOX
+1° 40'
NO SIDE
NO DOWN
AL. TUBES
WIRE PIN
3/32 HD BLKHDS
1/16 TH SIDES
'A' FOR ENGINE CUT-OFF & FLAP & RUDDER (AUTO)
'B' FOR D/T

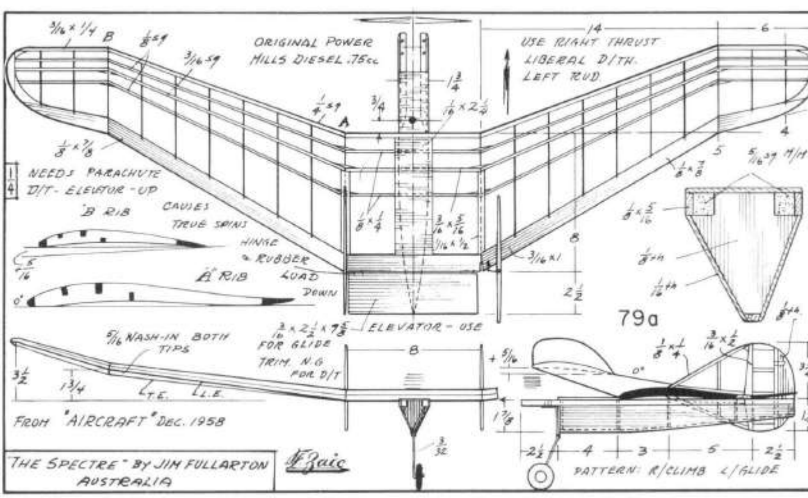

4×4 PINE
5×5
4×20
RUBBER BANDS AROUND STAB & WIRE
STAB
WIRE STRUTS
FLOAT
SHORT TAKE-OFF
FAST CLIMB
WITHOUT FLOATS
5 STARTS - TOTALS 900 in 15 sec M/R
2° R/T
1° D/T
-POWER-
2-2.5 cc
1mm PLY
2×3 PINE
4×4 PINE
3×15
3×5 ×120
10×25
2×3 CROSS PCS.
3mm BALSA SIDES
-FUSELAGE-
3mm BALSA SHEET
77a
A-A
FLOWN IN SPLIT & MONACO AVERAGES 2:30 ON 15 Sec. M/R
MOSQUITO 900 ROW
HANS F. FINUS
GERMANY


Note: Do Not Alter Spar Location
7.4:1 Aspect Ratio
Soft Black Tips
1/16 Bass Doubler
1/16 Balsa Braces
1/16 Soft "C"
3/32 Ribs At Breaks
Glue & Gauze
Soft 1/16 th Web Between Top & Bottom Spars
1/16 th on Bottom Double Cover Top
Slight Washout Both Tips
Key Surfaces Remove All Warps
Winner 1959 Eastern Canada Open Many Other Firsts
2 1/2 Wide 1/8 Sh't Platform
1/8 Sq. Runners
Hornet .049 or .051
Top-Flite Nylon 6-3
Climbs Right
Glides Right
No Thrust Offsets
Wire Brads
1/16 Sheet Box
Jap Tissue Covered
1/16 Alum. Tubing V.T. & Pegs
Wing Area-325
Stab Area-110
Soft Black Tips
1/4 Ply F.W.
1/32 ed Doubler To Here
GEEFUS 325
Dan Sobola
So. Hadley, Mass.
Keep L.E. Rad Sharp & Low
Web
3/32 × 1/4 Spars
3/32 × 1/8 Spars

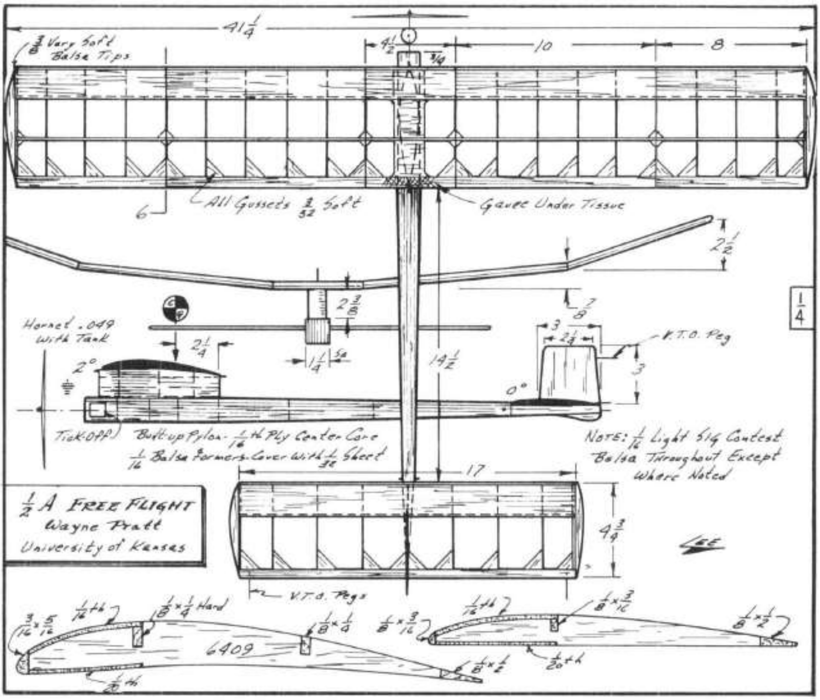

RIBS - MD. QT. GR. 3/32
TRAILING EDGES LT. QT. GR.
SPARS: HD. 1/8
FLIGHT: R.R., TILT STAB FOR TURN GLIDE
RUDDER & SUB LT. QT. GR. 1/16
FUSELAGE TOP & BOT LT. 1/16 SIDES: MD. QT. GR. 1/16
ATWOOD .049 6×3 PROP
FUSELAGE FROM PYLON BACK BUILT AS LIGHT AS POSSIBLE.
1/2 A F/F
BOB HENDRICKS
HAYWARD, CALIF.

78a

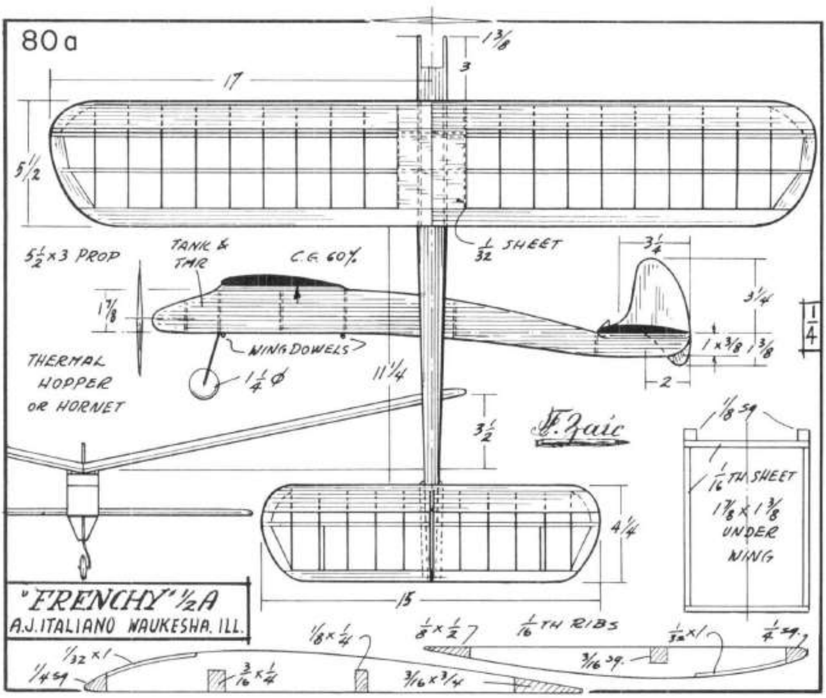

"GAHNI"
SPORT BIPLANE
ED SLOBOD
LOS ANGELES, CAL.
-POWER-
.020 ENGINE
1/16 TH SHEET USED THROUGHOUT FUSELAGE
MODEL TAKES-OFF EASILY ON HALF POWER. - CIRCLES TO LEFT. - MAKES 8 1/2 SQUARE CORNER TURNS. WANDERS IN GLIDE
STAB - 1/16 SQ SPARS - 1/32 RIBS
WING - 1/16 SQ SPARS - 1/32 RIBS
1/32 WIRE. TIE TO 1/16 x 1/8 BRACES
1/32 WIRE. TIE TO 1/16 x 1/8 BRACES
1/16 TH DOUBLER
3/32 PLY
WHEELS - 1/8 PLY GROOVED FOR 'O' RING STRECH & RUBBER CEMENT


ORIGINAL POWER
MILLS DIESEL .75cc
USE RIGHT THRUST
LIBERAL D/TH.
LEFT RUD.
NEEDS PARACHUTE D/T - ELEVATOR - UP
'B' RIB
CAUSES TRUE SPINS
HINGE & RUBBER LOAD DOWN
'A' RIB
5/16 WASH-IN BOTH TIPS
3/16 x 2 1/2 x 7 5/8 ELEVATOR - USE FOR GLIDE TRIM. N.G FOR D/T
FROM "AIRCRAFT" DEC. 1958
79a
PATTERN: R/CLIMB L/GLIDE
"THE SPECTRE" BY JIM FULLARTON
AUSTRALIA

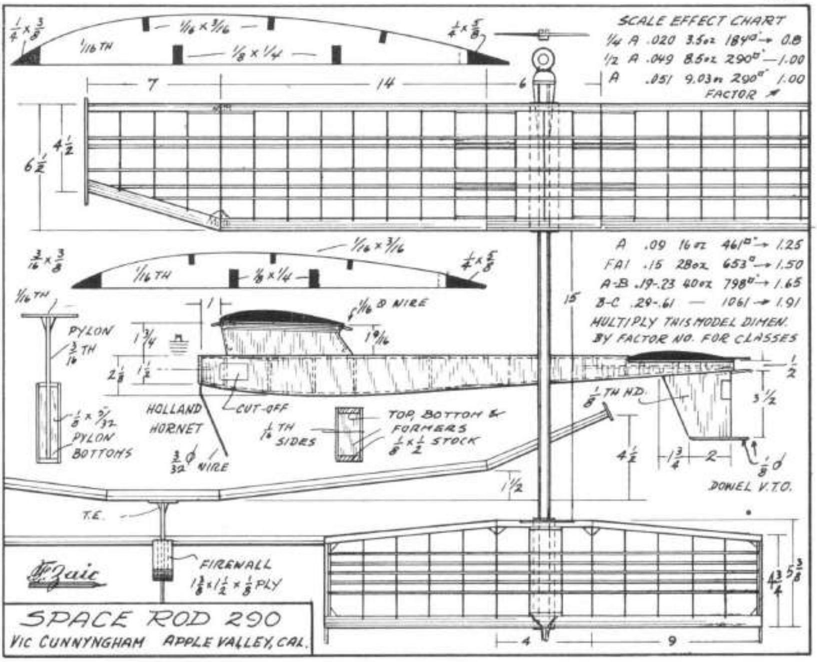
80



$41\frac{1}{4}$
$\frac{3}{8}$ Very Soft Balsa Tips
$4\frac{1}{2}$
3/4
10
8
6
All Gussets $\frac{3}{32}$ Soft
Gauze Under Tissue
$2\frac{1}{2}$
$2\frac{3}{8}$
$\frac{7}{8}$
Hornet .049 With Tank
$2\frac{1}{4}$
$1\frac{1}{4}$
2°
0°
$14\frac{1}{2}$
3
$2\frac{1}{4}$
V.T.O. Peg
3
Tick-OFF
Built-up Pylon - $\frac{1}{16}$ th Ply Center Core
$\frac{1}{16}$ Balsa Formers. Cover With $\frac{1}{32}$ Sheet
NOTE: $\frac{1}{16}$ Light Sig Contest Balsa Throughout Except Where Noted
17
$\frac{1}{2}$ A FREE FLIGHT
Wayne Pratt
University of Kansas
$4\frac{3}{4}$
V.T.O. Pegs
$\frac{3}{16} \times \frac{5}{16}$
$\frac{1}{16}$ th
$\frac{1}{8} \times \frac{1}{4}$ Hard
$\frac{1}{8} \times \frac{1}{4}$
6409
$\frac{1}{8} \times \frac{3}{16}$
$\frac{1}{8} \times \frac{1}{2}$
$\frac{1}{16}$ th
$\frac{1}{8} \times \frac{3}{16}$
$\frac{1}{8} \times \frac{1}{2}$
$\frac{1}{20}$ th
$\frac{1}{4}$



80 a
$1\frac{3}{8}$
3
17
$5\frac{1}{2}$
$\frac{1}{32}$ SHEET
$5\frac{1}{2} \times 3$ PROP
TANK & TMR
C.G. 60%
$3\frac{1}{4}$
$3\frac{1}{4}$
$1\frac{7}{8}$
WING DOWELS
$1 \times \frac{3}{8}$
$1\frac{3}{8}$
2
THERMAL HOPPER OR HORNET
$1\frac{1}{4}$ Ø
$11\frac{1}{4}$
$3\frac{1}{2}$
F. Zaic
1/8 SQ
$\frac{1}{16}$ TH SHEET
$1\frac{7}{8} \times 1\frac{3}{8}$ UNDER WING
$4\frac{1}{4}$
15
"FRENCHY" 1/2A
A.J. ITALIANO WAUKESHA. ILL.
$\frac{1}{8} \times \frac{1}{4}$
$\frac{1}{8} \times \frac{1}{2}$
$\frac{1}{16}$ TH RIBS
$\frac{1}{32} \times 1$
$\frac{1}{4}$ SQ.
$\frac{1}{32} \times 1$
$\frac{1}{4}$ SQ
$\frac{3}{16} \times \frac{1}{4}$
$\frac{3}{16} \times \frac{3}{4}$
$\frac{3}{16}$ SQ.
$\frac{1}{4}$



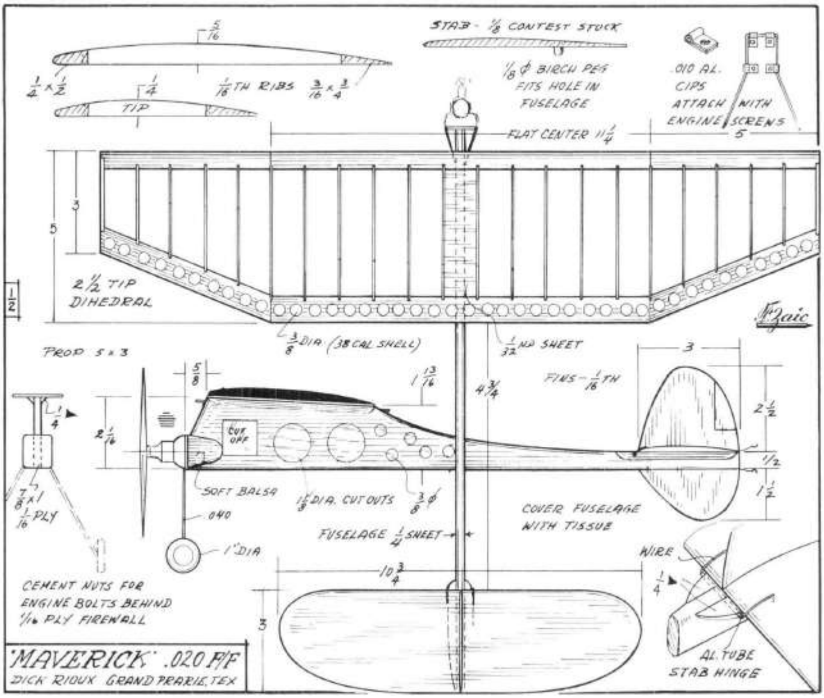
WITHOUT FANFARE, a West Coast Free Flight Gas model has been quietly chalking up records over the past few months at an ever increasing rate.

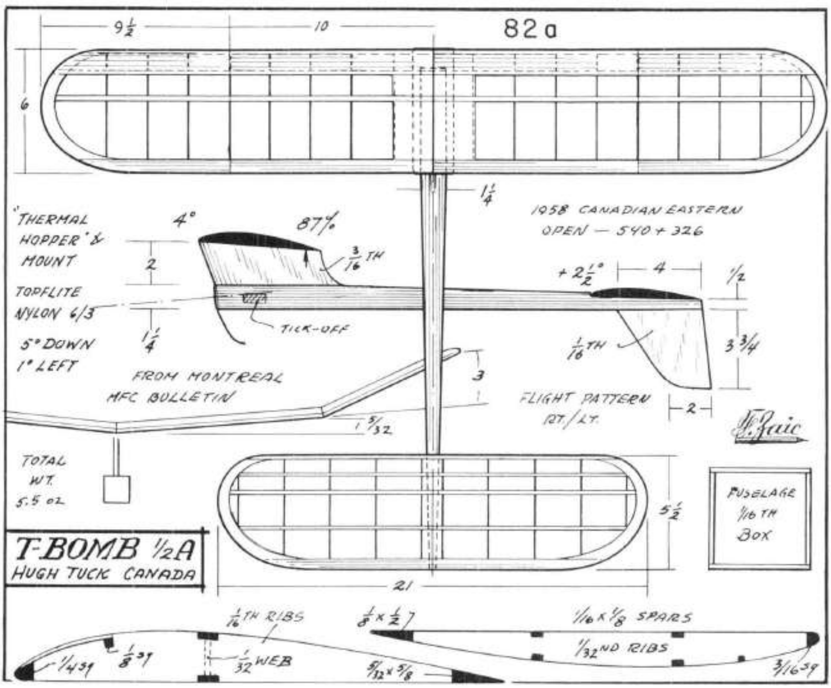
Space Rod as the model is called by its designer, Victor Cunnyngham of Baldwin Park, California, is of purely conventional design and construction, and the dizzy heights of success to which the model has climbed is probably puzzling to many free flighters.

Initially, the **Space Rod** was conceived as a ½A gassie, and inspired by its success, designer Cunnyngham got busy with the slide rule and worked out a decimal equation whereby all of the ½A's parts are multiplied in order to find out the right size model for the weight and engine used for a given class.

Vic and his son, Vic Junior, are members of the Long Beach Thunderbugs M.A.C. whose members have standardized on this one design. And the results, well for one thing, all nine **Space Rod** records are held by members of the Thunderbugs. At the 1959 Nationals, contestants flying **Space Rods** placed nine times in the top five places in the various Free Flight Gas events, including 1st place in ½A Open, 2nd in ½A Senior and R.O.W. Jr. Following is a list of AMA National Records chalked up by **Space Rods.**

Class ½A Senior, 19 min., 52.0 secs. held by Vic Cunnyngham, Jr.; Class ½A Open, 37 min., 16.0 secs. held by Howard Johnson (both used Holland Hornet .049s); Class B Senior, 35 min., 50.0 secs. held by Gary Duncan (K & B Torp. .23); FAI Power, Senior, 18 min., 40.5 secs. held by Gary Duncan (Rivers Silver Streak .15 diesel); Class ½A R.O.W. Senior, 10 min., 26.8 secs. held by Vic Cunnyngham, Jr. (Holland Hornet .049); Class A R.O.W. Senior, 11 min., 25.7 secs. held by Jack Arkovich (Holland Hornet .051); Class A R.O.W. Open, 9 min., 59.2 secs. held by David Vincent (Holland Hornet .051); Class B R.O.W. Senior, 8 min., 38.0 secs. held by Vic Cunnyngham, Jr. (K. & B. Torp. .23); Class B R.O.W. Open, 13 min., 28.0 secs. held by Howard Johnson (K & B .201).


STAB - 1/8 CONTEST STOCK
5/16
1/4 x 1/2
1/4
TIP
1/16 TH RIBS
3/16 x 3/4
1/8 φ BIRCH PEG FITS HOLE IN FUSELAGE
.010 AL. CLIPS ATTACH WITH ENGINE SCREWS
FLAT CENTER 11 1/4
5
3
2 1/2 TIP DIHEDRAL
3/8 DIA. (38 CAL SHELL)
1/32 ND SHEET
PROP 5 x 3
5/8
1 13/16
4 3/4
FINS - 1/16 TH
2 1/2
1/2
1 1/2
2 1/16
CUT OFF
SOFT BALSA
1 1/8 DIA. CUT OUTS
3/8 φ
7/8 x 1
1/16 PLY
.040
1" DIA
COVER FUSELAGE WITH TISSUE
FUSELAGE 1/4 SHEET
WIRE
10 3/4
CEMENT NUTS FOR ENGINE BOLTS BEHIND 1/16 PLY FIREWALL
AL. TUBE STAB HINGE
"MAVERICK" .020 F/F
DICK RIOUX GRAND PRARIE, TEX


9 1/2
10
82a
6
1 1/4
1958 CANADIAN EASTERN OPEN — 540 + 326
"THERMAL HOPPER" & MOUNT
4°
87%
3/16 TH
2
+2 1/2°
4
1/2
TOPFLITE NYLON 6/3
TICK-OFF
5° DOWN
1° LEFT
1/16 TH
3 3/4
FROM MONTREAL MFC BULLETIN
3
FLIGHT PATTERN RT./LT.
2
1 5/32
TOTAL WT. 5.5 oz
5 1/2
FUSELAGE 1/16 TH BOX
T-BOMB 1/2A
HUGH TUCK CANADA
21
1/16 TH RIBS
1/8 x 1/2
1/16 x 1/8 SPARS
1/4 sq
1/8 sq
1/32 WEB
5/32 x 5/8
1/32 ND RIBS
3/16 sq

USING PROP DIA. TO SCALE MODELS— Don Assel

Many times we would like to scale a good power design up or down to different classes, hoping for the original zip. Then the question arises: How big or small should the wing area of the new model be to retain the characteristics of the original?

Using engine displacement as a ratio factor could become ridiculous. Scaling a 300 sq. in. model powered by an .049 to one powered by a .35 would call for a 2100 sq. in. wing. $\left(\frac{.35}{.049} = \frac{2100}{300}\right)$

The wing volume procedure works well, but I think that I have found an easier way of doing it. It also takes Reynolds Number into account. It is done by using the prop diameter as a reference factor.

An increase of prop diameter increases prop efficiency in about the same proportion as the wing efficiency is increased with size. Thus, since both items have a common ground, we can resolve the question into working out a ratio of wing area versus area of prop circle.

In comparing the circle areas of various prop diameters, the only number that is significant is the "Diameter²". So lets keep it easy. A formula based on the above would look like this:

$$\frac{\text{PROP CIRCLE } 1}{\text{WING AREA } 1} = \frac{\text{PROP CIRCLE } 2}{\text{WING AREA } 2}$$

Or if you would rather use a Factor and the lazy way:

$$\frac{\text{WING AREA}}{\text{PROP DIA}^2} = F$$

EXAMPLE: 1/2 FF 6" PROP 300□"

$$F = \frac{300}{6^2} = \frac{300}{36} = \text{ABOUT } 8.35$$

15 ENGINE 8" PROP $(8^2 \times F = \text{WING AREA})$ FACTORS →

$64 \times 8.35 = 532$□" WING

19 ENGINE 9" PROP

$9^2 \times 8.35 = 675$□" WING

29 ENGINE 10" PROP

$10^2 \times 8.35 = 835$□" WING

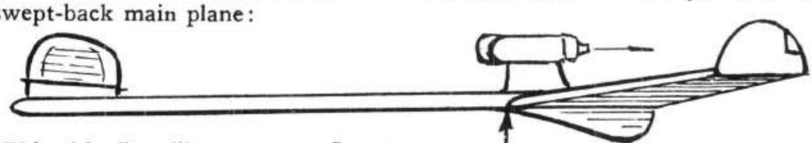
DIA.	7.5	8	9	10
6"	270	288	324	360
7"	388	392	440	490
8"	480	512	575	640
9"	608	648	730	810
10"	750	800	900	1000

You will note from the examples that the wing areas seem about right. It will work equally well in reverse. It is, of course, understood that the stab areas can be kept on the percentage basis. A 40% stab on the original means that the stab on the new design could also be 40%.

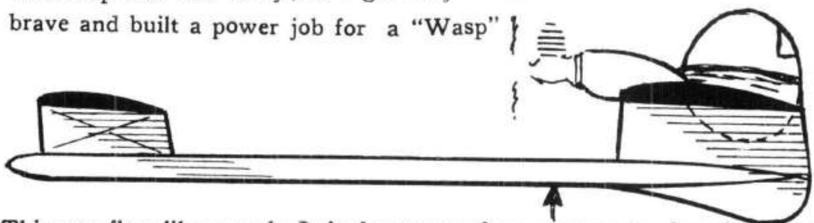
I have even gone so far as to make a table of wing areas found when using different props with several different factors. Factor of 9 or 10 seems about right for new AMA rules. A factor of 7 hits close to a hot FAI ship with a .15 engine.

POWER CANARD DESIGNING —— Bert Striegler

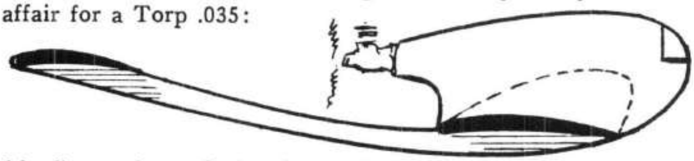
The "Quack" is the result of a series of canards that started with a Jetex job built in Saudi Arabia in 1952. This was a "stick" job with a swept-back main plane:



This ship flew like crazy; so I got very brave and built a power job for a "Wasp"



This one flew like a rock. It had a tremendous nose-up tendency. It was also most unstable—a total failure. My autopsy on this one was that the rudder "area" was too far forward to be effective. Also, a series of sheet balsa gliders confirmed my belief that it is better to have the front wing considerably higher than the rear wing. The next power job was a sheet balsa affair for a Torp .035:



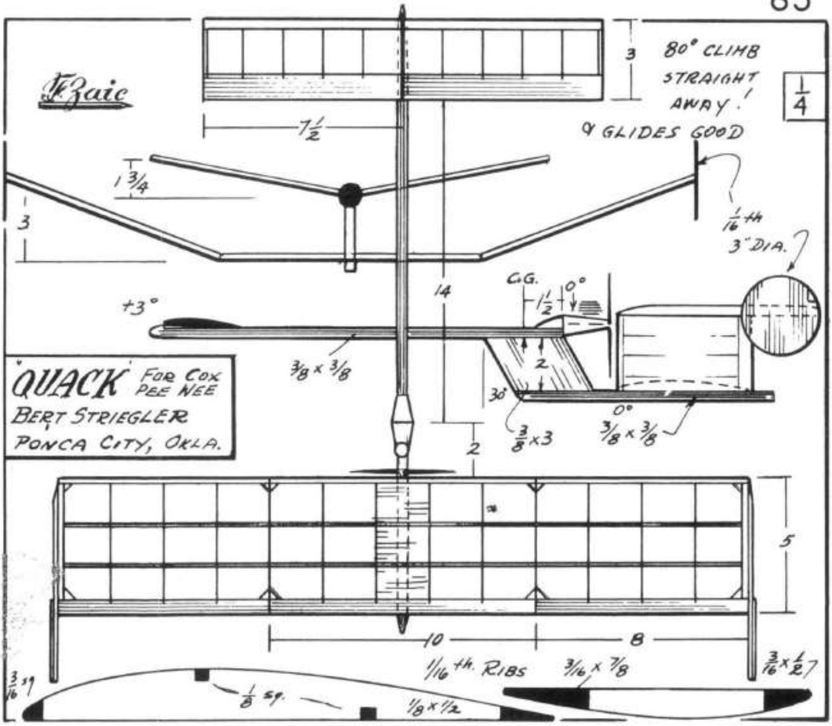
This ship flew quite well, but its configuration was too awkward to be termed practical.

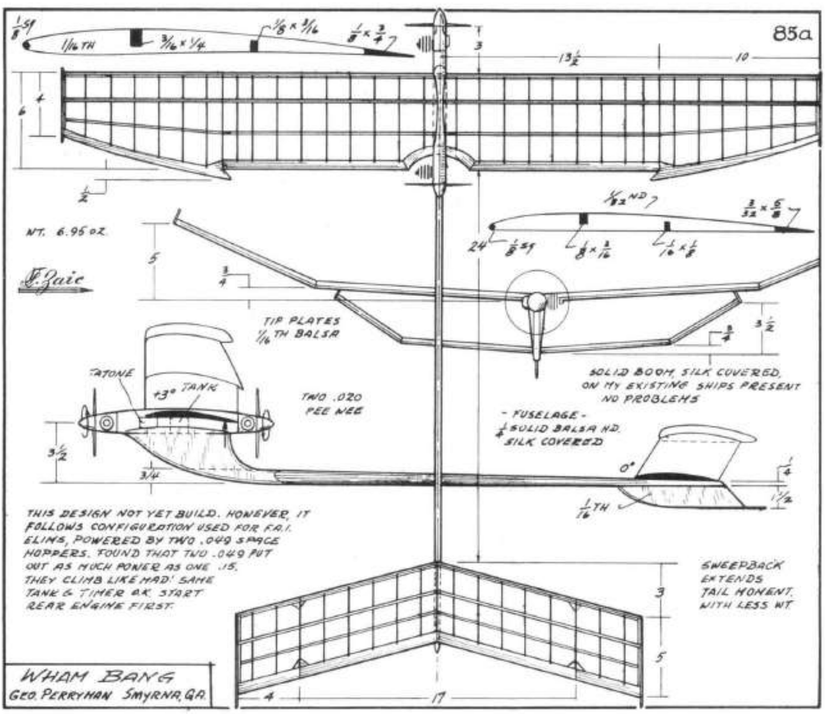
The last of this series was the "Quack". This job will VTO on a Pee Wee .020 at 4 oz. total weight. It climbs as if it were on rails at 55° to 60° angle. It would be a potent contest job, except I have no reliable means of timing the engine run. The next ship is to be for a "Space Hopper".

I prefer to reverse the prop and run the Pee Wee backwards. A 4 x 2½ works well. A straight-away or slight left climb is best, followed by a left turn in the glide. The glide, incidentally, is quite slow and the little monster thermals beautifully.

I feel this is the ideal lay-out for a power canard. The CG is easy to locate with no weight far up in the nose to cause inertial problems. No part of the airplane is in the slipstream and no down-thrust is required to prevent the looping tendency typical of canards. It has an extremely fast climb and instant recovery, so I think I am at last on the right track.

I would appreciate any comments you might have regarding the aerodynamics of good canards. I won't be happy until I have won a contest against conventional jobs with one.


F. Zaic
1/4
80° CLIMB STRAIGHT AWAY! & GLIDES GOOD
7 1/2
3
1 3/4
3
1/16 th 3" DIA.
14
C.G.
1 1/2
0°
+3°
2
3/8 x 3/8
30°
0°
3/8 x 3
3/8 x 3/8
"QUACK" FOR COX PEE WEE
BERT STRIEGLER
PONCA CITY, OKLA.
2
5
10
8
1/16 th. RIBS
3/16 x 7/8
3/16 x 1/2
3/16 sq.
1/8 sq.
1/8 x 1/2


85a
1/8 sq
1/16 TH
3/16 x 1/4
1/8 x 3/16
1/8 x 3/4
3
13 1/2
10
6
4
1/2
1/32 ND
3/32 x 5/8
24°
1/8 sq
1/8 x 3/16
1/16 x 1/8
WT. 6.95 OZ.
F. Zaic
5
3/4
3/4
3 1/2
TIP PLATES 1/16 TH BALSA
SOLID BOOM, SILK COVERED, ON MY EXISTING SHIPS PRESENT NO PROBLEMS
TATONE
+3° TANK
TWO .020 PEE WEE
- FUSELAGE -
1/4 SOLID BALSA HD. SILK COVERED
3 1/2
3/4
0°
1/4
1 1/2
1/16 TH
THIS DESIGN NOT YET BUILD. HOWEVER, IT FOLLOWS CONFIGURATION USED FOR F.A.I. ELIMS, POWERED BY TWO .049 SPACE HOPPERS. FOUND THAT TWO .049 PUT OUT AS MUCH POWER AS ONE .15. THEY CLIMB LIKE MAD! SAME TANK & TIMER O.K. START REAR ENGINE FIRST.
SWEEPBACK EXTENDS TAIL MOMENT. WITH LESS WT.
3
5
4
17
WHAM BANG
GEO. PERRYMAN SMYRNA, GA.

ENGINE TEST GEAR——— John E. Pfeifer, Lansing, Mich.

No secret about the engine test improvement rig around here in Lansing. It is quite simple and very effective. It is surprising to me that no one has used it before.

The "Rig" consists of a proper size tin can with three wheels fixed to it by conventional way using landing gear wire. One should take care that the gear is long enough so that the prop will not strike the ground.

The can then is fitted with an engine to be tested, and this can be as big as Fox 35's or as little as the little .02. To the other end of the can a little hook is bolted on to accept the pull scale. This hook should be in line as close as possible with the line of thrust.

To test an engine (or a prop series)—(or fuels for that matter) merely get the engine running full blast and hook the pull scale to the hind end and read the thrust. By the way—this is useable information since thrust is what the plane uses to fly with and not H. P. One may predict with accuracy, if a free flight has a powerful enough engine for the weight, to VTO or if H.L. must be used. If the thrust is close to the weight of the ship the thing will VTO.

We now have the means to check which fuel is the best for your particular engine. I find that Fox Hi Nitro runs beautifully in the Hornet 049's with much increase if the engine is good to start with. If the engine is a dog it will not take Hi Nitro (generally). New heads may be substituted for a check on performance as well as plugs. Washers on the .049's may sometimes improve the thrust. There are a lot of hop-up ideas for engines and I doubt that any serious testing is behind some of these ideas—now we can tell if improvement is made and how much.

It is interesting how much difference props of the same diameter and pitch, but of a different manufacture, can make with an engine. We can, and do, quickly in a matter of twenty minutes, test a range of props and without flying we are able to get as high as 40% more power. (The plastic props are without exception better than the wood blade and quite seriously so. 15% I get.) Balancing doesn't seem to effect the thrust seriously if the prop isn't badly out.

I started testing three years ago by mounting an engine on a board and measuring the stretch of a strand of 3/16 rubber. Very frustrating. Just as some data started to accumulate the rubber would break and I would have to start over. I have kept a chart of the best thrust for all my engines since; and when the engines are not in use I tag them with the data on the tag with a note stating if the engine is considered good or bad at the time.

A word or two on the size of can to use and techniques:

Use about a one quart can for engines up to .09.
Use one gallon can up to .23 or so.
Use 5 gallon can beyond .23 displacement.

I fill the front end of the can (about ½ in) inside with Poly plastic to stop vibrations. It can be drilled through and is not hard to work with. While the plastic is setting a tank may be inserted inside and thus avoid the shaky tank that I used to get.

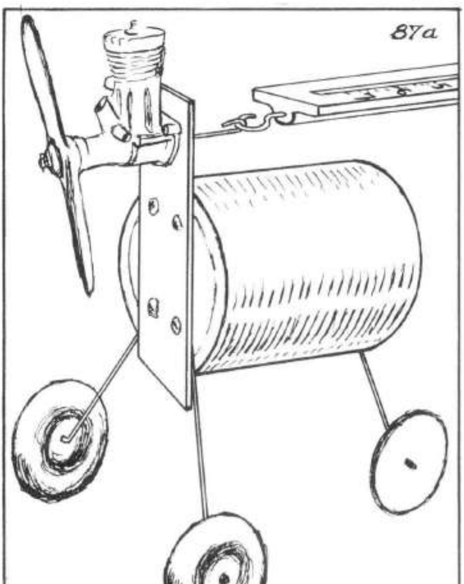
The wheels must be free running and the engine firmly mounted. If considerable machining is to be done on an engine a quick mount is a help. It allows for about three hop-up's a nite.

When I started testing the .049 engines, 8 ounces was about all one would do. Now if we don't get 12-14 oz. we give the engines to the kids. Needless to say, we are quite popular with the kids and the hobby shops. Tried 8 .02's and didn't get over 4 oz. on any of them. The original was 4½ oz. The three blade prop that was used at the King Orange and that Blanchard uses is a fluke, since tests show that a 5-3 is good for the little .02 if the engine will take it without freezing.

The whole story is that some engines do and some don't: Same engine and everything. This method tells what is best for your engine.

Could go on for I am very sold on the practicability of the "Rig" for improving Free Flight primarily. U-C, combat can benefit I suppose but they have a ready made rig when it is up in the air. All they have to do is time it. Radio isn't concerned with power-plus it seems.

It is important to compare different engines with the same exact prop. It is to be expected that a flat pitch props would give better results since this is a static test rig and not a dynamic rig. Talked to Goldberg and he has some results that show that, providing pitch is kept constant, the prop that is best on a static test will also be best dynamically.



ACTUAL THRUST FOUND HERE IN MICHIGAN

ENGINE	PULL OZ.	FUEL
COX.02	4	T.D. RACE
H.H.049	12-14	STRAIGHT
COX.15	26	FOX HI
FOX 15.	17 (4)	NITRO
TORP 15	15 (5)	T.D. RACE
TORP 23	29-31	T.D.
FOX 201	34-36	NITRO STR
FOX 35 (8)	40	NITRO STR.
OS MAX 29 (9)	42	NITRO STR.

(8) COMBAT SPL. (4) SAME ON T.D. RACE
(9) NEW CUST. (5) WILL NOT TAKE NITRO

(Condensed from MAN, January 1959, by Bill Bogart and Bud Rhodes)

TAIL VOLUME AND C.G. LOCATION

The center of gravity location on a model is of primary importance when trimming for the optimum climb. At a forward location, the airplane will fly at a high angle of attack where the drag is high. At an aft location, the airplane will dive into the ground if unstable. There is a location, generally in the wing, such that when the CG is at this point, the airplane will be neutrally stable. For the best climb position, the CG should be just forward of this "neutral point". This point is mainly determined by the physical characteristics of the wing and horizontal stabilizer.

Only four terms need be considered when estimating the proper CG location. These are: Wing area S_W, horizontal stabilizer area S_H, wing mean aerodynamic chord $\bar{c}$, and the tail length l_{t_o}. These four terms are grouped to form a term called "tail volume". It is so called since the units in the numerator and denominator are cubic:

$$TAIL\ VOLUME = \frac{S_H\, l_{t_o}}{S_W\, \bar{c}}$$

The term l_{t_o} is the distance between the leading edge of the wing mean aerodynamic chord and the quarter-chord location of the horizontal stabilizer.

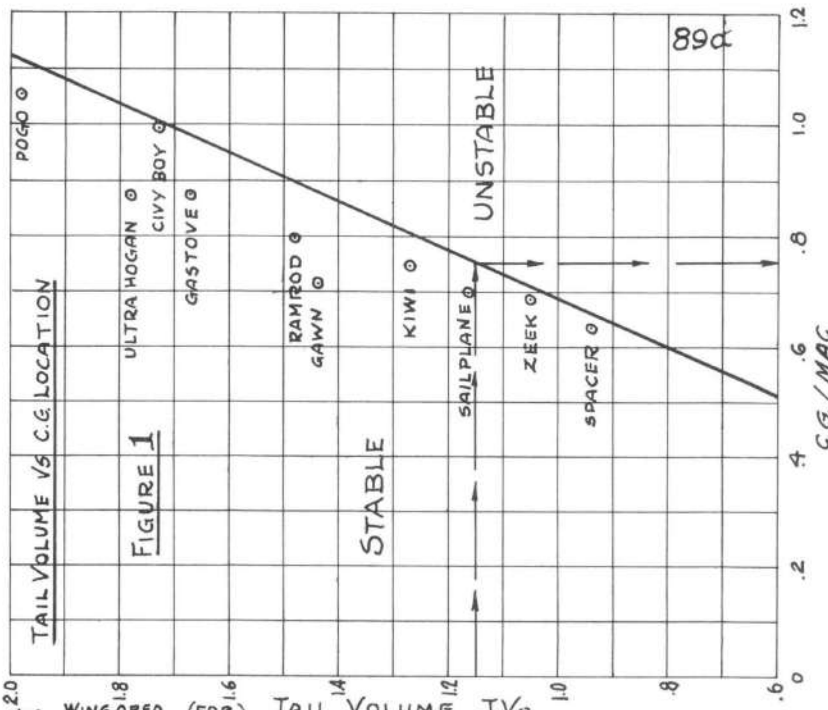
A correlation of tail volume and CG location with respect to the wing mean aerodynamic chord has been made. This correlation includes over sixty competition-free flight models of USA and foreign design which have appeared in various magazines. Several of the more popular and successful airplanes are included in this tail volume plot presented in Figure 1, indicating that the greater the tail volume, the farther aft is the CG. The line drawn should be considered a guide for initial design of flight considerations. Only through flight testing can the final CG location be set. In calm or smooth wind conditions, the model can be safely flown with a CG 10% farther aft than the line shows. However, for gusty weather, keep the CG to the left or stable side of the line.

Incidentally, the MAC presented in Table 1, is based on wing-area/wing-span, which is approximate. However, if the reader can compute the MAC from the proper expression, it should be used.

Downthrust is used solely to keep the nose down while climbing. Without downthrust, some ships will loop. Assuming the stab is set properly for the glide, looping is caused by having too stable an airplane. Or looking at Tail Volume plot, being too far to the left of the line. Take the downthrust out of the Ramrod and it will loop. Move its C.G. back near the line and it will not loop. In essence, downthrust permits a slightly more stable ship to be flown. High thrust line ships do the same thing as downthrust.

With regard to your noting the ships being close to the razor edge, the line was drawn only after knowledge of where the ships were on the plot. My master plot of 60 ships has points on both sides of the line. However, the ones on the right or unstable side are generally European models. It seems their air is non turbulent. A model can be flown on a dead calm day at C.G. 10% aft of the line shown. However, try it in the U.S. on a common flyable Sunday, and it will dive in. In our weather, the ships must be more stable.

I believe that the U. S. teams are at a disadvantage flying in the FAI Finals in Europe because our C.G.'s are too far forward for good flights in calm weather. Jim Horton has recognized this and flies his rubber models and gliders with the wings in two positions—windy weather and calm weather. In windy weather, the wing is aft, putting C.G. at 50% C.G. In calm weather, the wing is forward with C.G. at 100%.



MAC = $\frac{\text{WING AREA}}{\text{WING SPAN}}$ (FOR DATA)

MODEL PLANE DATA TABLE 1

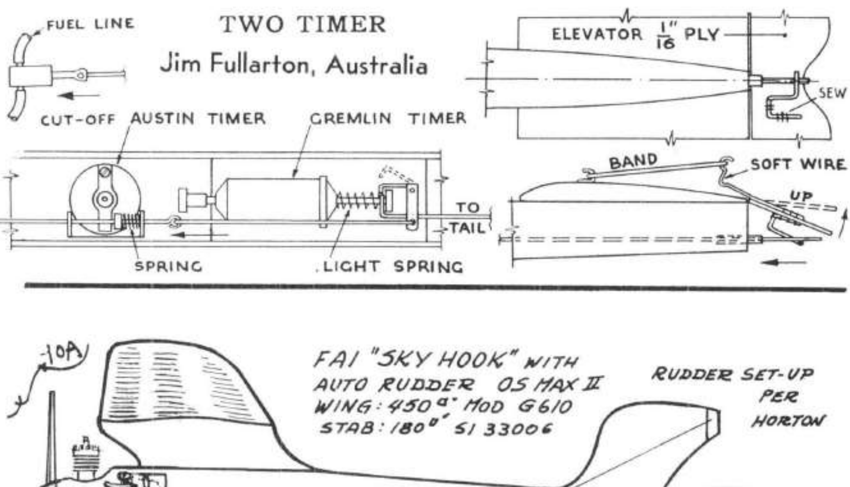
	WING						HORIZONTAL STAB					
MODEL	CLASS	AREA	SPAN	A/R	MAC		AREA	SPAN	A/R	T_L LEN.	T_L VOL.	C.G./MAC
ZEEK	A	381	51	6.6	7.5		120	25	5.1	25.2	1.05	.69
GAWN	A	434	62	9	7		143	26	4.7	30.8	1.45	.715
SPACER	B	590	64	7.0	9.2		175	26	3.8	29.0	.94	.64
KIWI	½A	186	35	6.6	5.3		59	15.3	4.0	21.3	1.27	.75
SAILPLANE	C	880	77.5	6.8	11.4		282	36	4.6	41.6	1.16	.70
RAMROD	C	770	69	6.9	11.2		332	40	4.8	38.6	1.48	.80
GASTOVE	A	380	52.5	7.2	7.2		153	28	5.1	29.3	1.67	.88
CIVY BOY	B	575	61.2	6.6	9.4		265	33	4.0	35.4	1.73	1.00
UL. HOGAN	B	504	59	6.9	8.5		256	32	4.0	29.8	1.78	.88
POGO	½A	170	34.5	7.0	5.0		85	18	3.8	19.8	1.98	1.06

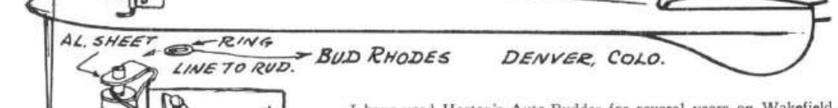
Initial experiments with timer operated elevator gave terrific straight away climb, but shocking stall at top. When the timer operated, the elevator went up immediately, but model was still going full speed, and the motor would run on momentarily, thus causing the stall. One effort had timer to rudder and elevator, and gave perfect flick rolls. Ask a flying instructor what happens if you pull back and kick rudder while flying at full speed.

What I needed was a delay on the elevator action, and after a year or so, hit on the solution shown. Motor timer is old Austin Ignition job. The former contact spring hold back a brass stop, when this is released, the push rod moves forward, closes the fuel cut off and triggers off timer No. 2, which is set from 5-10 secs. (Not critical.) This eventually withdraws wire protruding from tail, allowing elevator to go up.

Elevator is quite small, about 10% of stab. Angle may be adjusted either for climb or glide merely by bending that crazy looking hook affair. Climb is dead straight at a steep angle, and very fast. No power wasted looping or spiralling, and very easy to regulate.

It sounds complicated, but I have had a lot of flights without trouble, and won the F.A.I. event at our last Nationals with an O.S. 15 job. The whole works are mounted under a hinged cover just behind the pylon.





Trigger wire bent so that rudder snaps ½ to 1 sec. before engine cuts. Rudder line ring slips over the top of "DE" pin. When triggered pin pulls down below alum. sheet, rudder line is released.

I have used Horton's Auto-Rudder for several years on Wakefield. And two years ago I put one on my FAI Power model. This allows it to climb with less turn, hence more altitude, yet I get glide transition from a tight right turn.

The ship uses right thrust and left rudder in the climb. (Makes about 180° turn in 15 seconds.) During the last ½ to 1 sec. of power, the rudder is tripped and causes the ship to go into a tight right turn, and the glide transition is achieved with little or no stall after the power cuts. Only once has the "gadget" misfired on launch. This, of course, is disastrous. If DE valve gets sticky, the rudder is slow going "right", and you get the regulation number of stalling turns before settling down.

NOTES ON FLYING SCALE MODELS

Ray Weber, Jr.

I am thoroughly convinced that the average flying scale model builder tries to make his model too small. While this is entirely understandable from the transportation standpoint, it is nevertheless true that he is starting with two strikes against him in the aerodynamic consideration.

The average flying scale model is HEAVY. The builder piles on details and finish till the model is overloaded beyond the point of good consistant flights. The model may gain a lot of scale points but without a successful qualifying flight, it won't even retain the scale points.

My recent experience as a flying scale judge at the Dallas National Model Airplane Meet confirms these thoughts. Let me illustrate. In the Control Line scale open class Norstog's beautiful Spad XIV was first in scale points. The model also flew well in a scale-like manner. The second place model by Carpenter was the largest C/L scale model in the contest. In my book it flew the best of all the entries. Because of this fine flying ability, his model almost won the contest. If points could have been given for a wheels-up landing Carpenter's model might have won. As it was, Carpenter's skill and the models fine flying ability produced the most beautiful wheels-up landing I have ever seen. I was pleased that beyond a few scratches the model was undamaged.

Several other beautiful high scale point models did not fare so well. A beautiful fiberglass T28B equipped with retractable gear succeeded in attaining only enough height to seriously damage the landing gear when it struck the ground. This was simply a case of too little wing area and power for its weight. The model was very strong and beautifully finished, but just too heavy. A tiny SBJ-3 also proved incapable of flight. Several large multi-engine planes flew well.

In free flight scale a similar pattern developed. The larger models flew best and it takes a pretty good model to do 40 seconds of flying.

In R/C scale the size and aerodynamics is even more important. This plane must carry quite a load even without a lot of detail added to the model. The prettiest scale flying was done by Morgan's 9 ft. Cub. In flight, his plane could hardly be told from the full-size Cub which was on the field. The most beautiful R/C scale, McCullough's AM-1 Mauler proved my point by weighing in at 10½ lbs. It was designed for a 45 engine, but a McCoy 60 with which it was later fitted, would have a job keeping it flying. This plane had a span of 68 inches which is not so small, but it was too small to do well the job assigned to it.

Perhaps this is the spot to remind you that when the span of a model is doubled, the area is increased four times. By building a model a little bigger, the area is increased by the square of the increase in span.

The efficiency of a wing is measured by the Reynolds number. The Reynolds number, roughly stated, is the number of "air particles" over the wing in a given period of time. The greater the number the more efficient the wing. The number can be increased by increasing the speed of the airflow or increasing the chord, or both. It is quite obvious therefore that the larger model not only has more area to lift its load but the wing is also more efficient.

I have arbitrarily selected the scale of 2 in. = 1 ft. (1/6 size) for R/C scale. A number of kits to this scale are already on the market. Many planes may be built to this scale without reaching the ridiculous size stage. The list includes the light aircraft such as Cub, Aeronca, Navion through the WW II fighter aircraft. Several twin engine planes are also included in this group such as Aero Commander, Piper, Appache, Piaggio Gull. This scale often allows complete cowling of the engine.

SELECTING THE SUBJECT AIRCRAFT

These comments are generally true for all flying scale models, however, control line scale can include a number of planes which lack sufficient stability for free flight models.

We have learned from free flight experience that certain proportions and aerodynamics considerations make better flying planes. Look for these proportions when you select a scale subject. Look for a larger stabilizer; a long tail moment arm, enough dihedral the correct nose moment. Especially in free flight scale is it important to choose the correct proportions for here, once the plane is released, the only controlling factors are the aerodynamics of the model. In R/C scale slightly more latitude in choice exists for here some degree of control is possible in flight. Don't however, expect R/C to permit successful flying of a plane that lacks good proportions and flying characteristics. When looking for your subject plane, keep in mind the engine you wish to use. If possible, try completely to cowl the engine, but remember, you have to keep it cool so select a plane that has enough air scoops for this purpose. A radial engine plane fills this bill well, but many builders prefer to avoid the "built in headwind" this type of plane comes equipped with. Some "in line" engine planes can cowl an inverted engine but remember it is more difficult to run inverted engines.

There are a few sources of scale drawings presently available in the USA. Nietos drawings to ¾ in. scale are available from the Smithsonian Institution. Back issues of Model Airplane News contain some excellent drawings by Nye, Nieto and Wylam. A new standard for scale drawings is currently being set by Superscale Inc., Box 201, Arlington, Texas. These drawings are all to ¾ in scale and include cockpit and landing gear details. They are the result of extensive research and are as accurate as they can be made within the scope of the drawing size involved (30 - 36 in. sheets). Superscale presently features the work of six draftsmen; Willis Nye, probably the best known (in the USA) of the group, because his extensive work for Model Airplane News, has drawn the Douglas B26C to ⅜ in scale (the only deviation from ¾ in. scale. Nye approaches his work as a historian and, thus, his work is of as much interest to the historian and collector as to the model builder.

Kikuo Hashimato, an outstanding artist, known throughout the world for his work in Japanese Magazine Airview, has drawn the A6M5 "Lero" fighter and the Me 109 G fighter.

C.A.G. Cox, with a world wide reputation for his work in Aero Modeler (England), has drawn the Supermarine Spitfire.

E. R. Atkins Jr., the organizer of Superscales, and a scale model builder of great skill, author of two scale model articles (F4U and F8U MAN), has drawn the F4U, P51, B, C, and D and Aero Commander.

Dave Brazelton, also the author of a scale model article (SBU-2 MAN) has drawn the P47-D.

LeRoy Weber, Jr. (that's me!), who has never had anything published, has done the P38-L-5-LO. This drawing is the result of several years of intensive research and sets a new standard for details on scale drawings.

Now for a few hints on presenting your model to the judges:

It is up to the builder to "prove" his scale to the satisfaction of the judges. Go about this carefully and completely.. Point out the features of your model in detail. Illustrate the features with photos, if possible. If you have duplicated an authentic color scheme, verify it with photos and/or other authenticated data. One contestant at the Nats presented the judges with a series of color slides and a viewer to authenticate his detail and color scheme! (I assure you, he received maximum consideration).

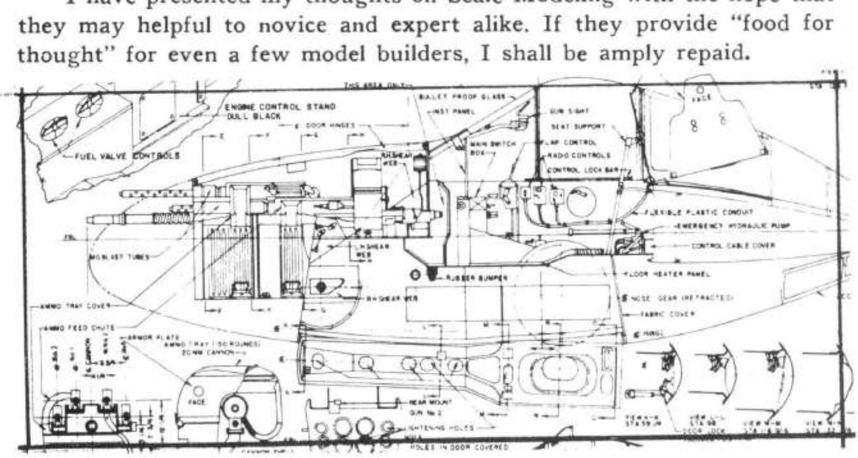
Organize your material so that the judges may go through it quickly and easily. Too large a mass of material may be skipped over so keep your presentation to the point. Several builders at the Nats presented their information in book form which was easily used by the judges.

Here are a few thoughts on finishes:

If your plane uses camouflage, make it authentic! However, verify it for the judges and point this out to them! There has been much (and I'm afraid justified) criticism of judges for "going for" high gloss finishes when in fact a scale finish should have been dull or flat. If there is any other special feature of your finish, point it out (and verify it) to the judges in your presentation.

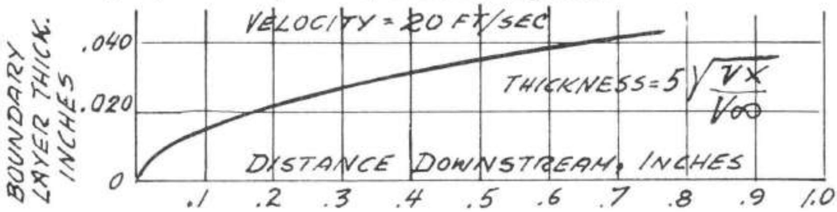
Too many scale models are test-flown at the contest. While the desire to present your model to the judges before it has been flown is entirely understandable, it is highly undesirable. At the 1960 Nats, all the C/L winners had been flown before, as had the R/C scales. In the free-flight scale at least the Open winner had been flown before, and I'm quite sure that the other winners had at least been test-glided and trimmed.

I have presented my thoughts on Scale Modeling with the hope that they may helpful to novice and expert alike. If they provide "food for thought" for even a few model builders, I shall be amply repaid.



AIRFOIL TURBULATORS — Fred Pearce, Hampton, Va.

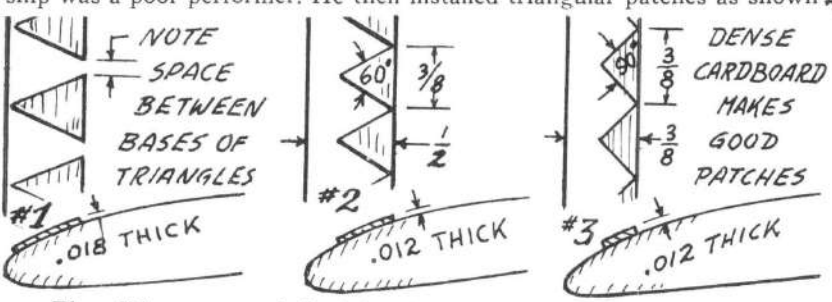
The report on triangular turbulators claims they are four times as effective as square strips in inducing the transition from laminar to turbulent flow ("On Transition from Laminar to Turbulent Flow," by Hama, Long and Hegarty, University of Maryland, Techn. Note BN 81). Unfortunately, triangles don't seem theoretically suitable to the boundary layers as they develop in model airplanes!



What happens is that the boundary layer thickness builds up so quickly from the stagnation point at 20 ft/sec. that a device with a significant chordwise depth has a wide variation in boundary layer thickness from front to back, resulting in the point of the triangle being near the surface and receiving relatively high velocity flow, whereas the base further downstream is buried deeply in the layer and experiencing low velocity flow. Thus, the situation defeats the purpose in trying to use the lowest height device to trip the layer.

The triangles are compatible at higher velocity flow and in fluids with less kinematic viscosity than air (such as in water, where Hama, Long and Hegarty made their tests).

It is difficult to compare turbulators. The triangles may yet be proved better than other devices for flows near 20 ft/sec. Bob Champine's Lindner glider offered a quantitative evaluation of triangles. He built it with sheet balsa wings and used a large leading edge radius (2%?). The ship was a poor performer. He then installed triangular patches as shown #1



The glider was not helped by these patches. It actually declined in performance. He removed these patches and installed a new set as #2

The glider was now an excellent performer with still air time approaching three minutes and very good windy weather performance.

My best guess as to the size of triangles for Nordics and Wakefields is: #3

I hope eventually to have good data about turbulators when Harry Shoaf's wind tunnel is finished soon. He worked with NACA tunnels and is building a terrific low turbulence tunnel at home.

I have worked up an article which gives the effectivity of various simple turbulators with formulae and graphs enabling their size and location to be determined. The weak points in the development are the difficulty in computing boundary layer thickness on a lifting airfoil, the fact that only coarse estimates are available for the Reynolds numbers necessary for transition in a favorable pressure gradient, and the ambiguity in estimating the location of the stagnation point.

Summary: TURBULATORS OR VORTEX GENERATORS

Experimental data for the effectiveness of several turbulator shapes is applied to select the proper size and location for the device. Using Table I to find the Reynolds number for the type of Vortex generator, and Graph A to obtain the size of the device, the proper location is then determined from Graph B.

There are many types of turbulators or Vortex generators:

I. Devices projecting on upper camber of airfoil
   a. Sandpaper type roughness
   b. Row of spheres or other shapes
   c. Round strips
   d. Square strips

II. Special devices on upper camber of airfoil
   a. Triangular patches
   b. Etc.

III. Devices some distance in front of airfoil
   a. Vibrating wire, thread, etc.
   b. Grid or raster

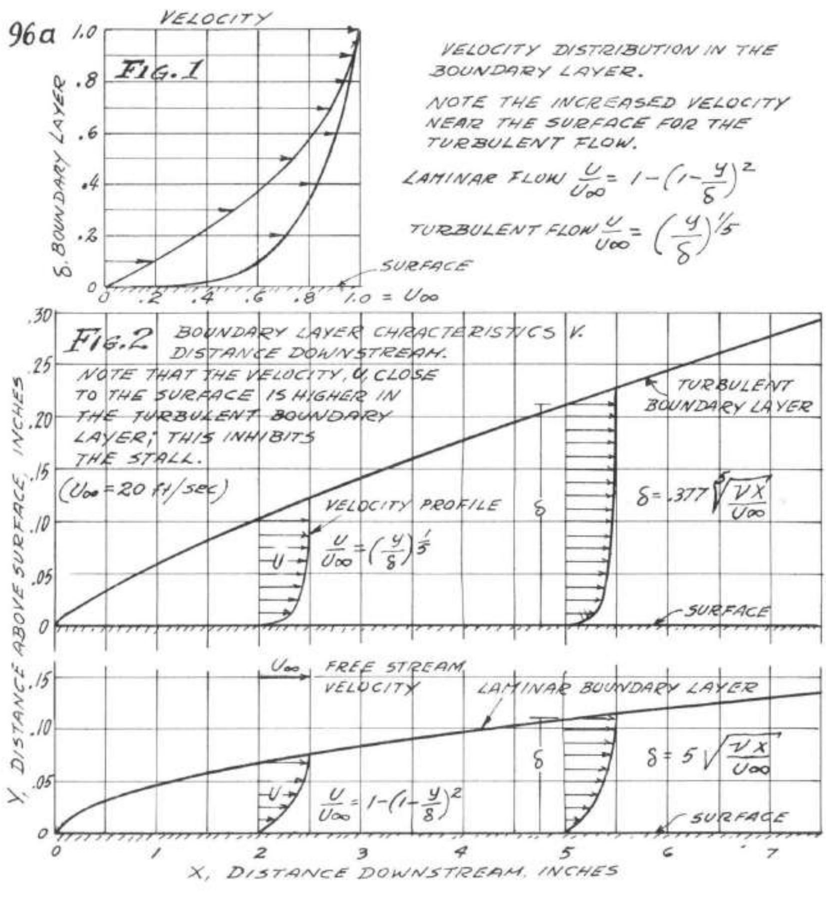
IV. Modification to airfoil shape
   a. Grooves or notches
   b. Steps
   c. Small leading edge radius

Only Type I will be included in this discussion.

In the flow of air or any fluid over a surface, the viscous or frictional effects are more pronounced at low velocities because the viscous shear or frictional force is proportional to velocity, whereas the energy of the airstream is proportional to the velocity squared. This is to say that at higher velocities a layer of air or a streamline may flow over a surface with less tendency to slow down or stagnate as the result of friction. If the streamlines adjacent to the surface become stagnant from giving up too much energy to friction, they break away and separate from the surface. With an airfoil this can result in a stall when the angle of attack becomes too high.

Model airplanes are much more likely to stall than full size airplanes because the airflow is much more subject to separation since there is less energy in proportion to the frictional forces and because the model airplane airfoil has smaller radii of curvature, thus requiring the airflow to negotiate sharper turns.

In order to explain the effect of turbulators, it is necessary to use the boundary layer concept. An airfoil moving through the atmosphere carries along a thin film of air sticking to its surface because of the viscosity or stickiness of the air. In this thin layer, the velocity is zero at the surface, increasing as one moves away from the surface till it reaches the velocity of the free stream air. The distance one must move away from the surface to obtain the freestream velocity is defined as the boundary layer thickness. This thickness increases as we move downstream (see Fig. 2). The boundary layer flowing along a surface is at first smooth with no eddies. If there were layers of smoke in this film of air, the layers would not mix but would flow as streamlines. At some distance downstream, this laminar boundary layer suddenly breaks up into turbulent flow characterized by severe eddies which mix the layers of air speeding up the air close to the surface. The point to be emphasized is that air flowing at higher velocities has less tendency to stagnate and hence to separate, thus causing the airfoil to stall at higher angles of attack. This seems to indicate that if there was turbulent flow over the upper surface of the airfoil, there should be less tendency to stall because the velocities would be greater near the surface. (See Figure 2.)



How can turbulent flow be induced over the upper surface of the airfoil? Without any irregularities to induce eddies, natural transition from laminar to turbulent flow occurs a considerable distance downsteam. If we introduce roughness on the surface, the roughness starts waviness in the laminar flow which causes the transition point to move upstream toward the roughness. If we increase the size of this roughness, the tranition point moves closer and closer to the roughness till it reaches the roughness itself. Roughness of sufficient size to cause transition to turbulent flow immediately behind itself, is called critical roughness. This critical roughness is generally described by Reynolds Number. The Reynolds Number is a ratio of the momentum of the air in contact with a surface divided by the viscosity. Any body having flow characterized by a given Reynolds Number will have the same flow pattern as any other geometrically similar body with the same Reynolds Number.

(1)

$$R_k = \frac{V_\infty k}{\nu}$$

R_k —Critical Reynolds Number for transition at the turbulator
V_∞ —Free stream velocity, ft/sec.
k —Height of turbulator, ft.
ν —Kinematic viscosity, ft^2/sec.

Using the free stream velocity, V_∞, rather than the velocity at the top of the device, is an approximation allowed for in the data. The experimental data for the size of a device to trip the boundary layer so that the flow changes from laminar to turbulent is subject to considerable uncertainty or scatter; so Table I is open to revision.

TABLE I
Critical Reynolds Numbers for Transition from Laminar to Turbulent Flow at the Device

DEVICE	R_k FOR FLAT PLATE AT $\alpha=0$	R_k FOR AIRFOIL AT HIGH LIFT
ROW OF SPHERES	570 MIN.	1140
SANDPAPER TYPE	320 "	640
ROUND STRIP OR WIRE	220 "	440
SQUARE STRIP	180 "	360
TRIANGULAR PATCHES	50 "	100

These data for the Rk for a flat plate at zero angle of attack are derived from several sources. The values of Rk for an airfoil at a high angle of attack are estimated to be twice the value for the flat plate at zero angle of attack. At Rk even slightly below the critical size, turbulators become ineffective.

Experimental data indicate that the most sensitive or effective location for the tripping device is where the boundary layer is 1.25 times as thick as the device.

The thickness of the boundary layer for a flat plate ($\alpha = 0°$) is:

(2)

$$\delta = 5\sqrt{\frac{\nu X}{U_\infty}}$$

δ —Thickness of boundary layer, ft.
ν —Kinematic viscosity, ft^2 sec.
X —Distance downstream, ft.
U_∞ --Free stream velocity, ft/sec.

The computation of the boundary layer thickness on an airfoil at a high angle of attack is quite difficult. The assumption that it is the same thickness downstream from the stagnation point as the boundary layer on a flat plate at zero angle of attack is an approximation. Actually, the layer is slightly thinner on the airfoil at high angle of attack because of the negative pressure gradient, but this difference in thickness is thought to be slight for the parameters of model airplanes.

The stagnation point for the airfoil at high lift is approximated by the point of tangency of the leading edge radius and the lower camber.

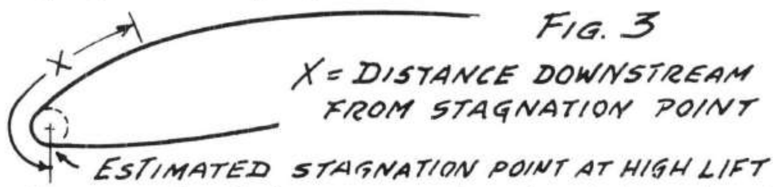


FIG. 3

As an example, selecting a square strip style turbulator, what size and location is necessary for a Wakefield model flying at 20 ft/sec? From Table I, we find Rk = 360. Substituting this value in formula (1):

$$R_k = \frac{U_\infty k}{\nu} \qquad \nu = 1.63(10)^{-4} \quad U_\infty = 20 \quad R_k = 360 \qquad (1)$$

$$k = \frac{\nu R_k}{U_\infty} = \frac{1.63(10)^{-4}}{20} 360 = .00293\text{ Ft.} = .035\text{ IN.}$$

The height, **K** can be found directly from Graph A. Next, to find the location where the boundary layer is 1.25 times as thick as the turbulator, we use formula (2):

$$(2)$$

$$\delta = 5\sqrt{\frac{\nu X}{U_\infty}} \qquad \delta = 1.25k \qquad U_\infty = 20\text{ ft./sec}$$

$$k = .00293\text{ ft.}(.035\text{ IN})$$

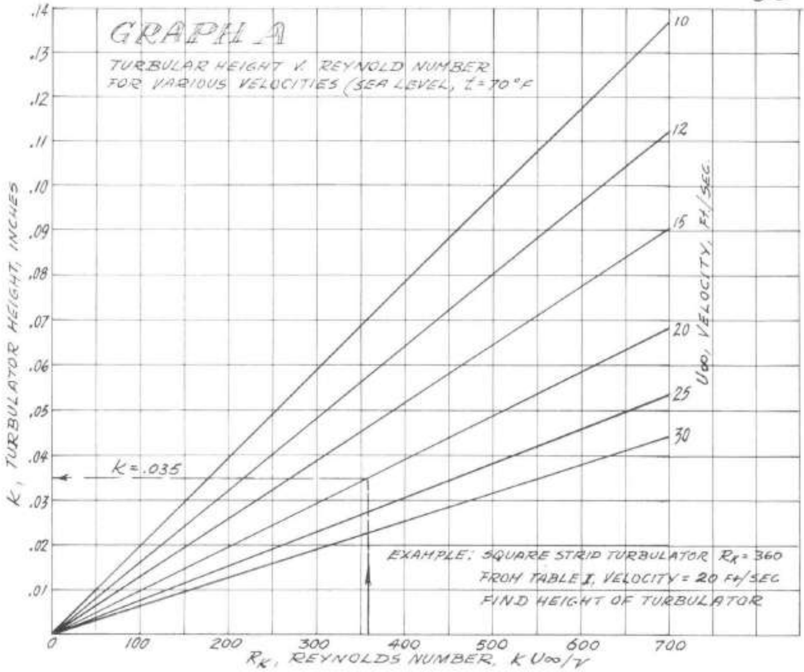
$$X = \frac{k^2 U_\infty}{16 \nu} \qquad \nu = 1.63(10)^{-4}$$

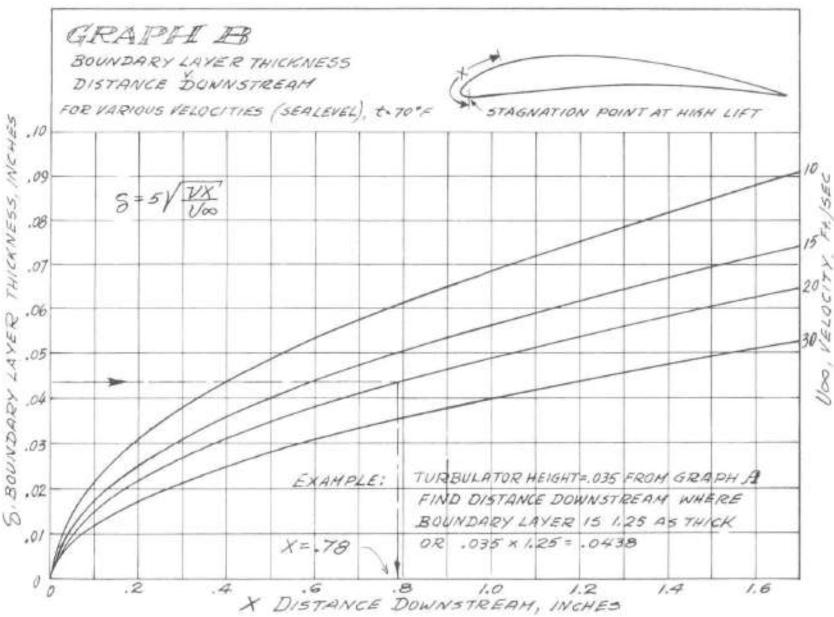
$$X = \frac{(.293)^2 (10)^{-4} 20}{16(1.63)(10)^{-4}} = .0659\text{ Ft.} = .781\text{ IN.}$$

The location can be found directly from Graph B by selecting δ = 1.25K = 1.25(.035) = .0438 on the right and picking X off the curve for 20 ft/sec. velocity, we get X = .78 inches.

Summarizing: We have determined that the size should be .035 inches and it should be located .78 inches from the stagnation point, as shown in Figure 3.

The procedure in the example can be applied to other type devices at different flying speeds.

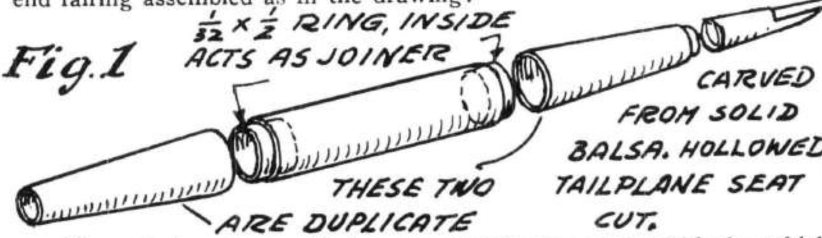

GRAPH A
TURBULAR HEIGHT V. REYNOLD NUMBER
FOR VARIOUS VELOCITIES (SEA LEVEL, t = 70°F
K, TURBULATOR HEIGHT, INCHES
R_K, REYNOLDS NUMBER, $kU\infty/\nu$
$U\infty$, VELOCITY, Ft/SEC.
k = .035
EXAMPLE: SQUARE STRIP TURBULATOR R_K = 360
FROM TABLE I, VELOCITY = 20 Ft/SEC
FIND HEIGHT OF TURBULATOR
.14
.13
.12
.11
.10
.09
.08
.07
.06
.05
.04
.03
.02
.01
0
100
200
300
400
500
600
700
10
12
15
20
25
30


GRAPH B
BOUNDARY LAYER THICKNESS
V.
DISTANCE DOWNSTREAM
FOR VARIOUS VELOCITIES (SEALEVEL), t = 70°F
X
STAGNATION POINT AT HIGH LIFT
$\delta = 5\sqrt{\frac{\nu X}{U\infty}}$
δ, BOUNDARY LAYER THICKNESS, INCHES
X DISTANCE DOWNSTREAM, INCHES
$U\infty$, VELOCITY, Ft/SEC
EXAMPLE: TURBULATOR HEIGHT = .035 FROM GRAPH A
FIND DISTANCE DOWNSTREAM WHERE
BOUNDARY LAYER IS 1.25 AS THICK
OR .035 × 1.25 = .0438
X = .78
.10
.09
.08
.07
.06
.05
.04
.03
.02
.01
0
0
.2
.4
.6
.8
1.0
1.2
1.4
1.6
10
15
20
30

CIRCULAR SHEET FUSELAGES — Alan Nobbs, England

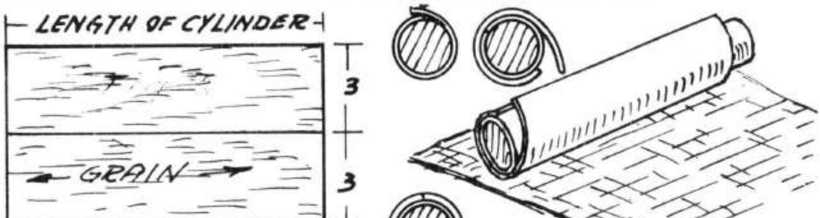
This system was inspired by the beautiful streamline Wakefield built by Ted Evans in 1954. It was specifically for 80 gramme rubber Wakefields, but has since shown that it has applications for all weather Open Rubber, and even more for the newer 50 gramme rubber Wakefields. Apart from the beauty of line, this type of fuselage offers reduced drag over conventional slab and/or diamonds, strength without too much weight, and, most important, rapid building. It seems a contradiction in terms to say "I built a streamline fuselage in a night"—but it is quite possible.

The original, built as long ago as September 1954, consisted of two slightly tapered cylinders, a parallel sided cylinder and a carved block end fairing assembled as in the drawing:



The cylinders are moulded on two previously prepared blocks, which may be turned in balsa or hardwood, and which must be smaller in diameter than the finished article by the thickness of the walls.

The centre portion will be described first. A sheet of 1/32 in., straight grain, white, which curves easily across its width is cut and joined—ordinary cement butt joins will do, so as to produce a rectangular equal in length to that of the desired centre portion, and with the width slightly greater than the circumference of the block—measure this with paper or string. See Fig. 2. This sheet is wrapped around the block.



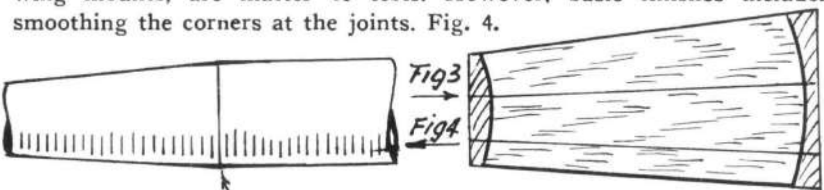
By lapping the sheet over itself it is possible to mark it and cut it to the correct size. If the sheet is rather stiff, it may be damped. Another sheet is made up, this time with the soft sheet wrapped round dry and also cut off to size. The inside of this one is well pasted with one of the cold water glues—Casco on the original. The first sheet is held on the block with the left hand and the second sheet applied with its middle over the joint in the first sheet. This is then worked round, and the whole assembly bound round with wool. (Thread would be too hard and make marks—strip rubber would do.) This may be set aside—near the fire if you like, and left to dry. When it is firm, it is a good idea to tap out the core, because the whole assembly tends to shrink a little.

The other two (tapered) cylinders are made in the same way, but two layers of 1/32 in. sheet are used and of course the sheet before applying to the core will be as Fig. 3.

This shape is easily produced by wrapping the rectangular around the core and marking off. The shaded part may be removed afterwards.

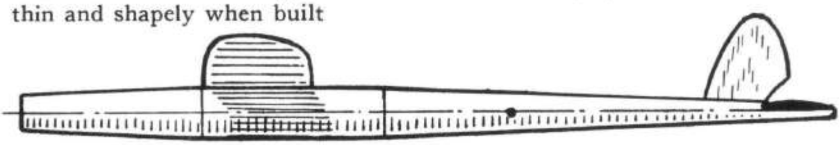
When dry—and I repeat all this may be done in one evening, ½ in. wide strips of 1/32 sheet are glued inside the ends of the center piece with half the width extending for the mating pieces. It is important to make sure that the ends are square here, or bent fuselage will result. A fairing carved from soft block and hollowed is added at the back after fitting ply supports for the rear peg. Before finally glueing up, the three cylinders are best doped internally—to stop lubricant soaking in. A little manipulation may be needed here.

Dimensions have not been put on the drawing because these, and wing mounts, are matter of tests. However, basic finishes includes smoothing the corners at the joints. Fig. 4.



Take off the corner here, the 1/32 interior ring makes up for any strength loss. Reinforcement may be added inside the nose, and of course, the usual ply-former. Covering is with tissue doped on.

I built two fuselages, the first 2½ ozs. Both survived to the give away stage, after more than their share of prangs. Two of my colleagues also had a go. One turned into a successful 80 gr. Wakefield and was abandoned when the 50 gr. rule came in. The other, by Ken Attiwell, was thin and shapely when built



but 80 grs. of rubber went in only under compulsion. This was revived under the 50 gr. rule and is the most successful in the Club at present.

It will be realized that using more sections will produce a more shapely fuselage still.

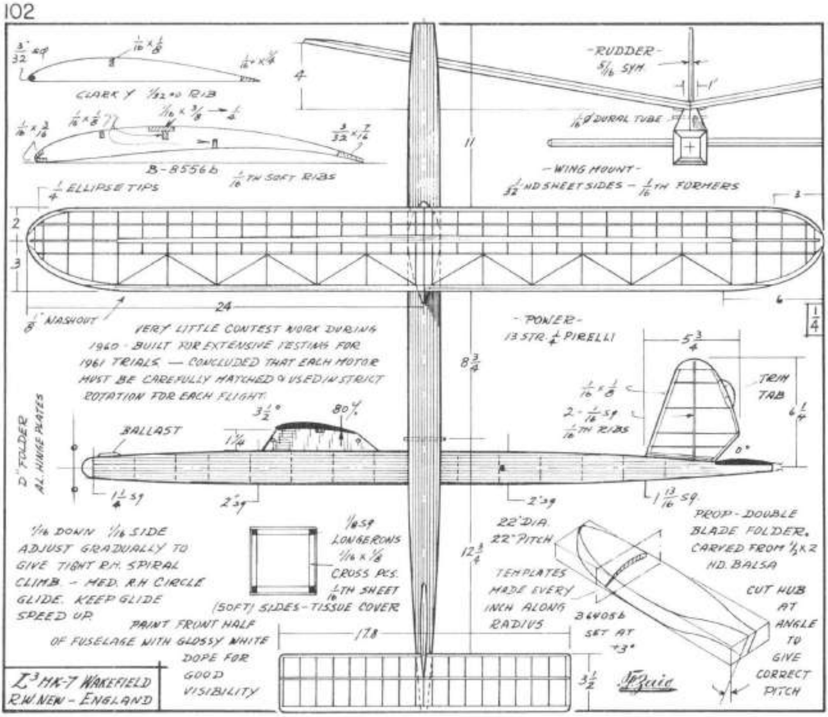
Obvious points to watch are wood selection, and not getting glue on the blocks, which must be well waxed.

Possible developments of this idea are to use very carefully selected light 1/32 sheet for all lamination, with perhaps a grainy tissue between the two laminations, grain opposite to the wood, to prevent longitudinal splitting. This could produce a 1½ ozs. fuselage for Open Rubber—which is no heavier than most light weight fuselages after a couple of repairs.

Many current Wakefield models are also using fuselages which appear to be made on these lines.

Further details were published in Aeromodeller, May 1954.

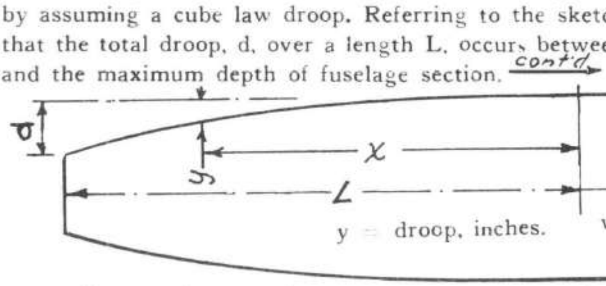
(With thanks to John Pool for preparing this article.)



The enclosed drawing is of my current Wakefield, and is basically the same as I shall build for 1961. I have had some trouble with it which I think is due to the Benedek section, but which I have now sorted out. In hot weather, with nothing but a lazy wind, one can trim the model almost to stall point on the glide and be rewarded by a good climb and a hovering glide. However, this trim is fatal if the wind gets up at all: half way through the glide the nose dips and the model comes down in ever diverging unstable stalls. For this type of weather an increase in stab incidence is necessary in order to increase the glide speed. Usually this difference in trim amounts to only 0.010 to 0-020 inch packing under the stab trailing edge.

FUSELAGE PROFILE FORMULA

When drawing fuselages a good approximation to the natural bend of balsa longerons, and one which gives a smooth profile, can be obtained by assuming a cube law droop. Referring to the sketch it will be noted that the total droop, d, over a length L, occurs between the nose former and the maximum depth of fuselage section. cont'd.



Thus $y = a x^3$

where $a = \dfrac{d}{L^3}$

y = droop, inches.

x = distance from maximum section, inches.

R. W. New, England

50 GRAM WAKEFIELD DEVELOPMENT

Michael Segrave —— Canada

With the advent of the 50 gram rule came a need for a change in the old well-tried layout. Stress would have to be placed upon the glide as the motor run could not be expected to contribute as much to the overall time as before, thus creating a need for a layout of the powered glider type. Since the rubber allowance was small, the model would have to be climbed as fast and as high as possible. Emphasis would have to be placed upon the blend of power and propeller so that good climb characteristics would be obtained together with a run of reasonable length. A figure of 40-45 seconds seemed about right for the run: A prop turned at an average of 10 rps for the duration of the climb, would give a maximum usable turns in the region of 450.

Around this time, a table had been made covering the various arrangements of 50 gms. The motor to be used was selected from it, bearing in mind the quality and availability of types of rubber, and the prop designed accordingly. It was noted that the motors above and below the selected one would be useful as alternates should the particular motor/prop combination prove to be unsatisfactory. The prop used was of the large diameter low pitch variety and featured thin blades as an effort to increase efficiency.

MOTOR SIZES Strs. | Dimensions	Comparative X-Section	Actual X/S sq.in.	Length Inches	Turns per/in.	Max. Turns
16 — 1/4 x 1/24	35.8	0.166	18	19.7	355
26 — 4 x 1 mm.	34.6	0.160	18.5	20.0	370
20 — 5 x 1 mm.	33.3	0.155	18.7	20.3	380
36 — 1/8 x 1/30	32.2	0.150	20	20.6	412
24 — 4 x 1 mm.	32.0	0.149	20	20.6	412
16 — 6 x 1 mm.	32.0	0.149	20	20.6	412
14 — 1/4 x 1/24	31.4	0.146	20.5	20.9	428
34 — 1/8 x 1/30	30.5	0.142	21.2	21.2	449
18 — 5 x 1 mm.	30.0	0.139	20.7	21.5	445
22 — 4 x 1 mm.	29.3	0.136	21.8	21.6	470
32 — 1/8 x 1/30	28.7	0.133	22.5	21.9	493
14 — 6 x 1 mm.	28.0	0.130	23	22.2	510
12 — 1/4 x 1/24	26.9	0.125	24	22.6	542
20 — 4 x 1 mm.	26.9	0.125	24	22.6	542
16 — 5 x 1 mm.	26.6	0.124	23.3	22.8	531
12 — 6 x 1 mm.	24.0	0.112	27	24.0	648

103

← Regarding your comments on the "droop" formula, the notes you made relating to deep sectioned fuselages of yesterday were correct. With today's narrower fuselages one doesn't have such large changes in slope to worry about. Nevertheless, when we look round the contest field, it is obvious that many fuselages are not subjected to a "natural" strain owing to the profile being incorrect, structurally speaking. Using hard-close grained strip for longerons can cause undue distortion if these are not perfectly matched, but the L^3 formula helps to mitigate this distortion and prevent overstrain at localized positions.

In order to achieve as good a glide as possible, a high aspect ratio wing of thin section was employed. This section, based upon previous work with A/2, featured high camber and low profile thickness, factors which necessitated sheeting the top surface to prevent distortion, and was set at a low angle to utilize the stab "power" as much as possible.

Low sinking speed would be of little use if the model was not stable enough to take advantage. Thus a long moment arm and large under-cambered stab were incorporated into the design which, together with ample side area and dihedral, combined to provide this necessary stability.

Early tests on the prototype with C.G. at 50% showed a poor climb and fast glide. The introduction of a flat bottomed stab improved the glide greatly, but the poor climb persisted until the prop was replaced by one of 21 in. dia., 28 in pitch. Things then began to warm during further testing and placed fifth in 1959 Eliminations. The ship was worth about 2:20 at this time.

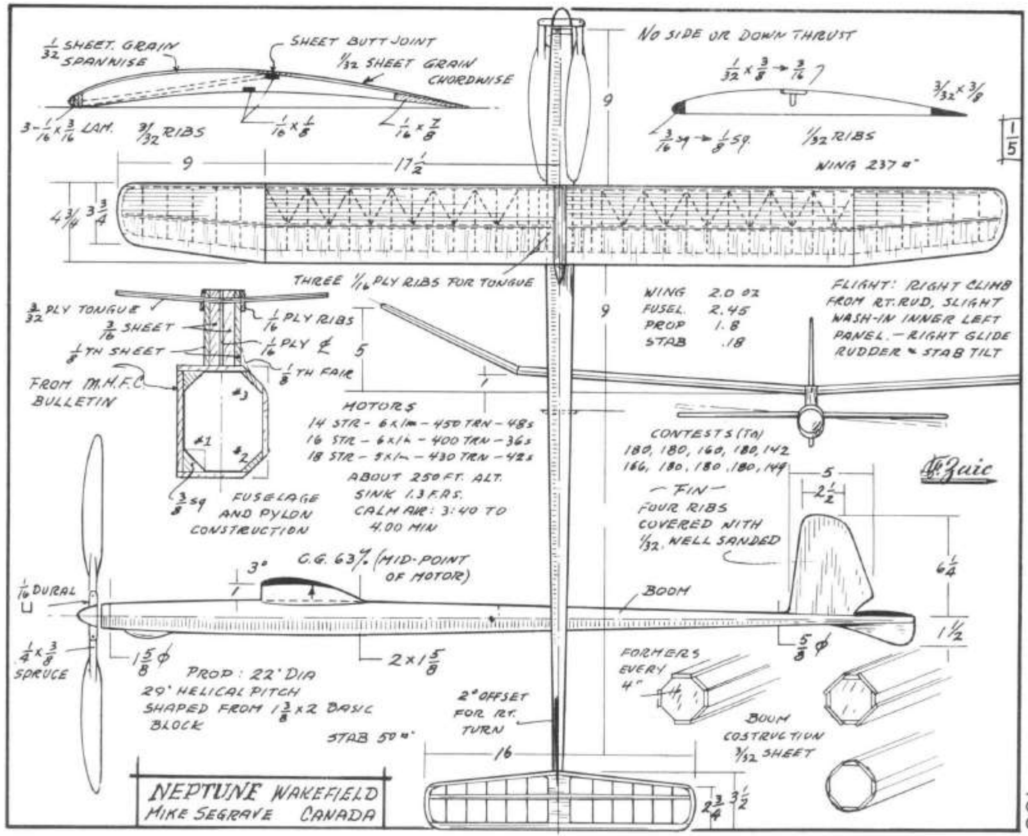
The next step was to move the wing forward, made possible by smaller diameter propeller, and in doing so, relocated the C.G. at 60%. This brought about the largest increase in performance as the model then climbed well and glided very flat. Flights in evening air showed the ship capable of around three minutes.

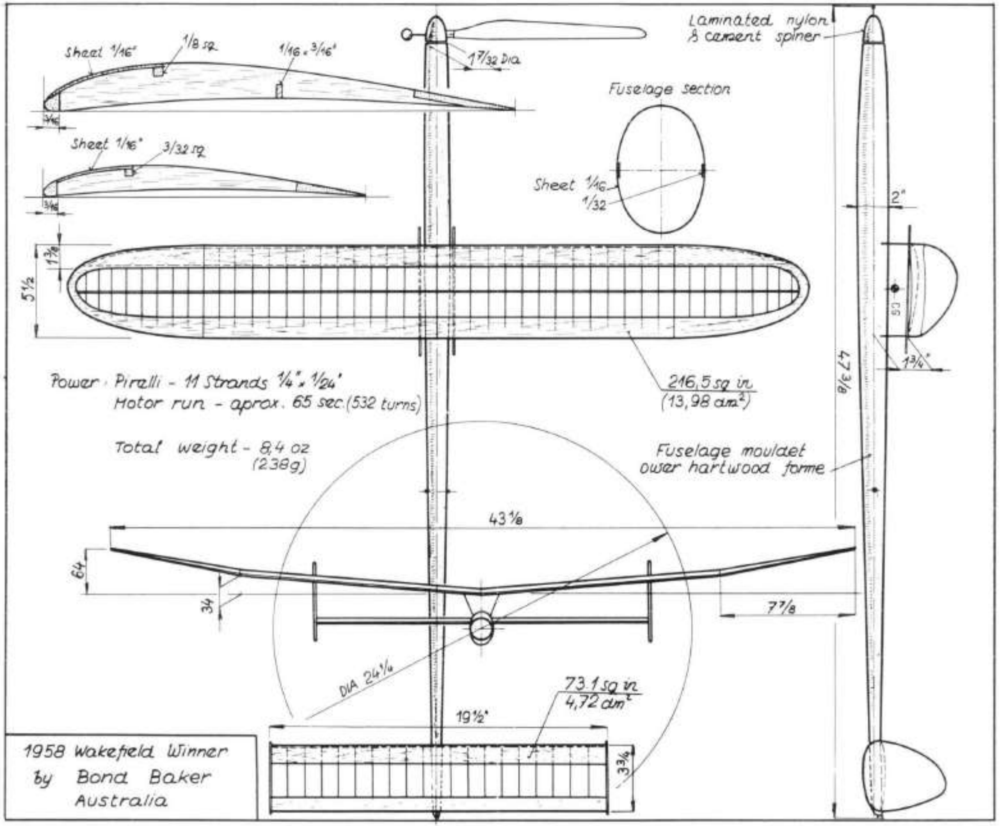
During test flying, the rather extreme looking (for a Wakefield) layout had presented a number of problems which had to be solved. A consistent glide circle could not be achieved, the model turning away in the opposite direction as often as not. The cause of this was the differential warps used on the wing to provide roll on the climb. Removal of these, cured the glide and, surprisingly, had no adverse effect on the power pattern, due, probably, to the high A.R. wing dampening any rolling tendency. At the same time, down and side thrust were removed, which all added up to a more efficient model. It was also thought that the fairly large dihedral and side areas combined to produce stability would not be as necessary as was originally envisaged, particularly as large offsets were required to give a consistent glide circle. A slim model of low dihedral would be easier to turn as well as being more sensitive to thermals.

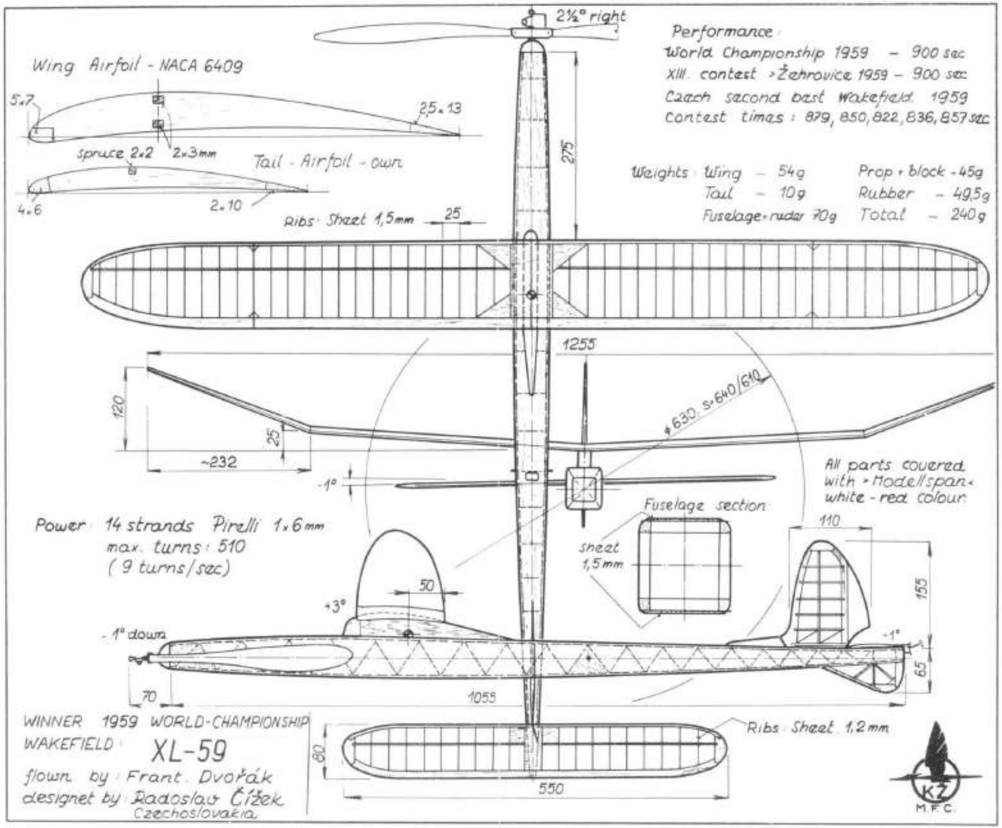
A second version was then built incorporating all the lessons learned on the original. Climb was very much better. Glide was improved by the addition of area to the wing in the form of span which raised the aspect ratio into the bargain. A higher pitch propeller was fitted to take advantage of the lower drag, being turned by a motor of larger cross section. So far, this model has shown up very well and will be flown extensively in preparation for the Eliminations in 1961. Times are good, a figure of 3:30 or more is expected in evening air. Summarizing:

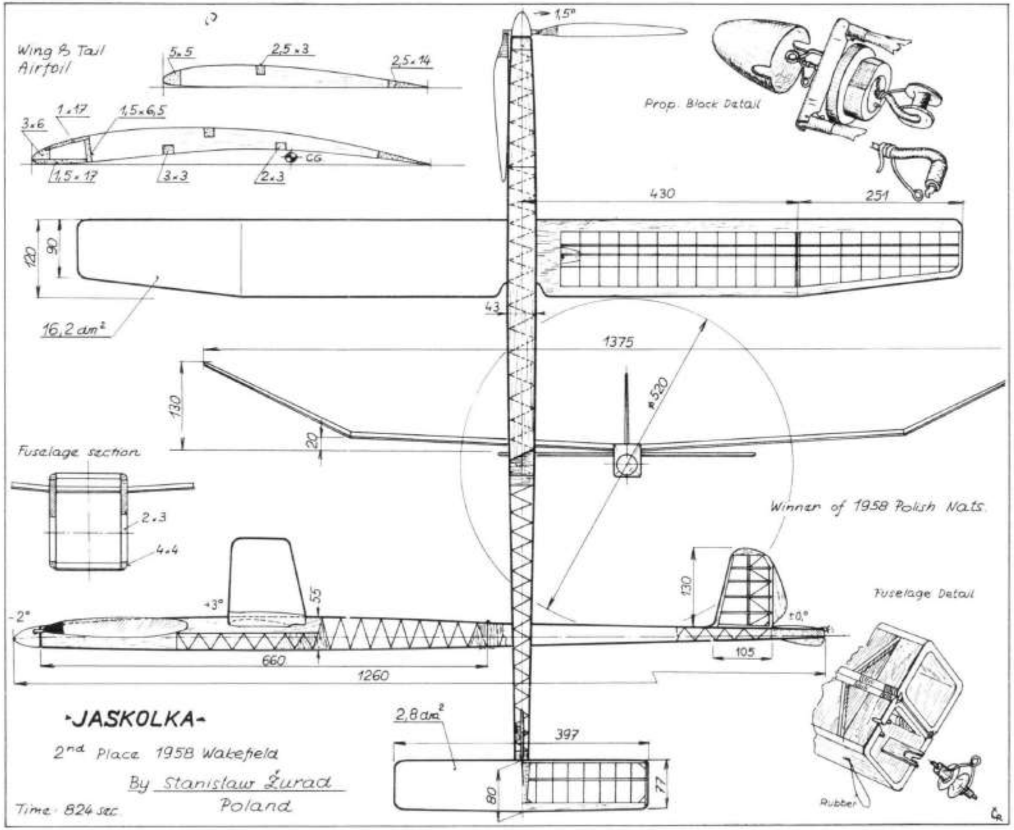
1) Good all weather performance due to good penetration qualities. 2) Ease of maintenance—surface flat tip to tip. 3) Low side area requires small offsets for turn. 4) Climb docile—of the "forgiving" nature. 5) Excellent stability.

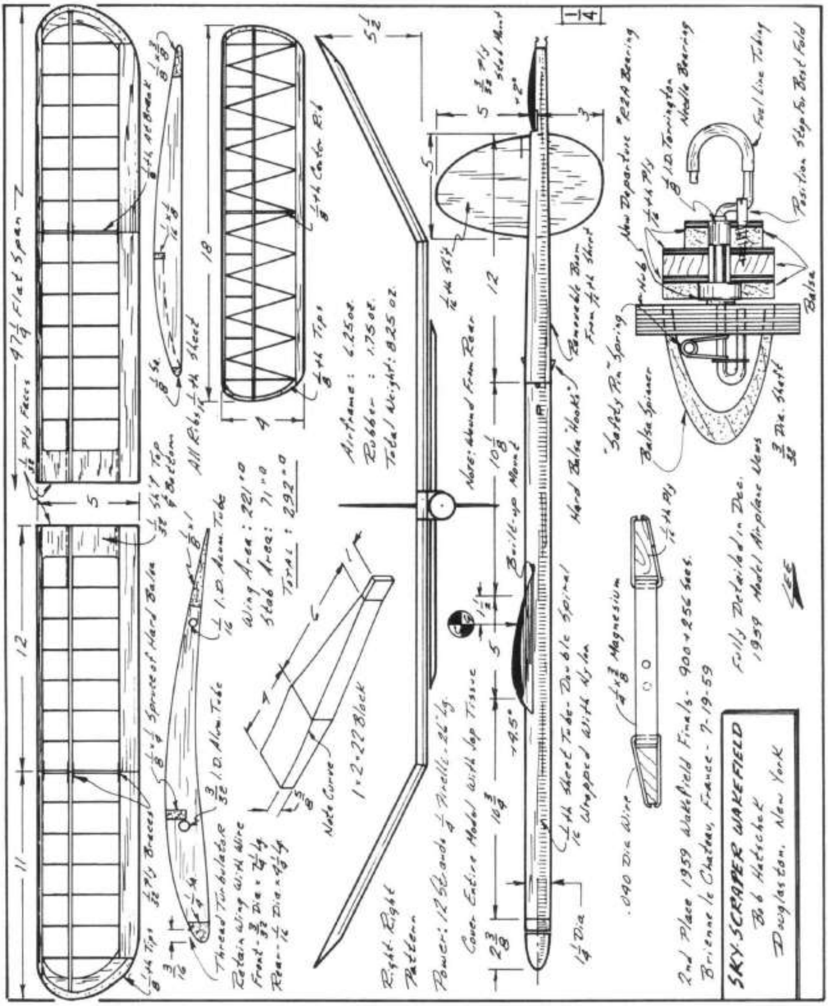
STA.	0	1.25	2.5	5.0	7.5	10	15	20	25	30	40	50	60	70	80	90	100
UPR.	1.1	3.1	4.0	5.17	6.07	6.67	7.73	8.48	9.00	9.34	9.66	8.93	7.95	6.52	4.56	2.53	.2
LWR.	1.1	1.1	0	.12	.34	.79	1.47	2.07	2.63	3.06	3.65	3.70	3.55	3.14	2.27	1.30	0

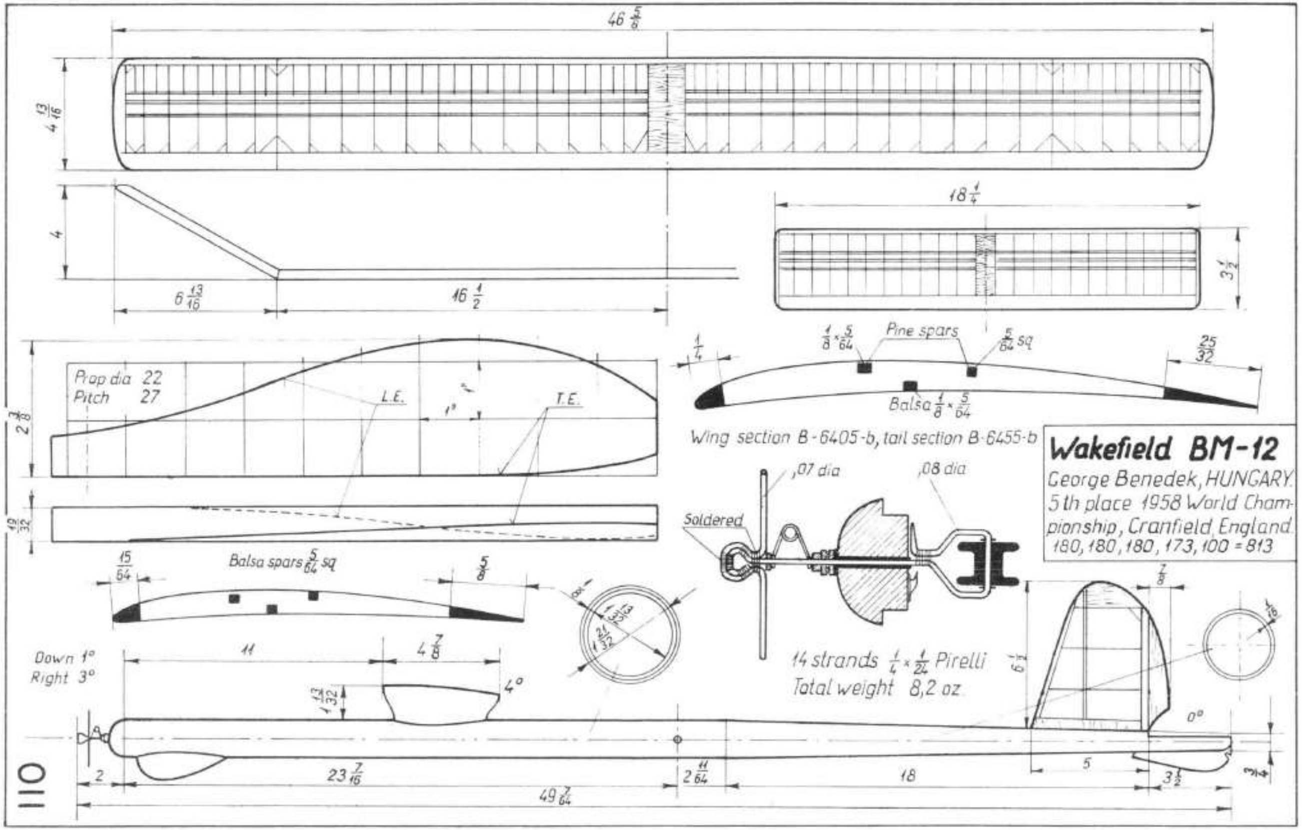



Sheet 1/16"
1/8 sq
1/16 x 3/16"
1/16
Sheet 1/16"
3/32 sq
3/16
1 7/32 Dia
Laminated nylon & cement spiner
Fuselage section
Sheet 1/16
1/32
2"
1 7/8
5 1/2
CG
1 3/4"
47 3/8
Power: Pirelli - 11 Strands 1/4" x 1/24"
Motor run - aprox. 65 sec. (532 turns)
216,5 sq in
(13,98 dm²)
Total weight - 8,4 oz
(238g)
Fuselage mouldet
ower hartwood forme
43 7/8
64
34
7 7/8
DIA 24 1/4
73.1 sq in
4,72 dm²
19 1/2"
3 3/4
1958 Wakefield Winner
by Bond Baker
Australia

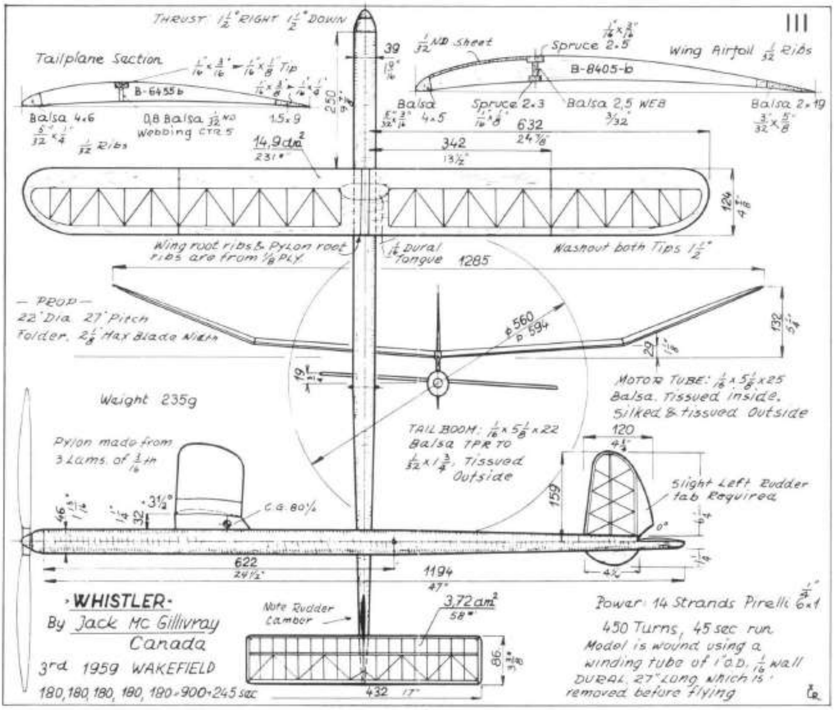

2½° right
Performance
World Championship 1959 – 900 sec
XIII. contest »Žehrovice 1959 – 900 sec
Czech second best Wakefield 1959
Contest times : 879, 850, 822, 836, 857 sec
Wing Airfoil - NACA 6409
5.7
25.13
spruce 2.2
2.3mm
Tail - Airfoil - own
4.6
2.10
Ribs Sheet 1,5mm
25
275
Weights Wing – 54g
Tail – 10g
Fuselage+rudder 70g
Prop+block - 45g
Rubber – 49,5g
Total – 240g
1255
120
25
~232
ϕ630 s=640/610
-1°
All parts covered with »Modellspan« white - red colour
Fuselage section
sheet 1,5mm
110
Power 14 strands Pirelli 1×6mm
max. turns 510
(9 turns/sec)
50
+3°
155
-1° down
-1°
65
70
1055
WINNER 1959 WORLD-CHAMPIONSHIP
WAKEFIELD
XL-59
flown by Frant. Dvořák
designet by Radoslav Čížek
Czechoslovakia
80
550
Ribs Sheet 1,2mm
KZ
M.F.C.

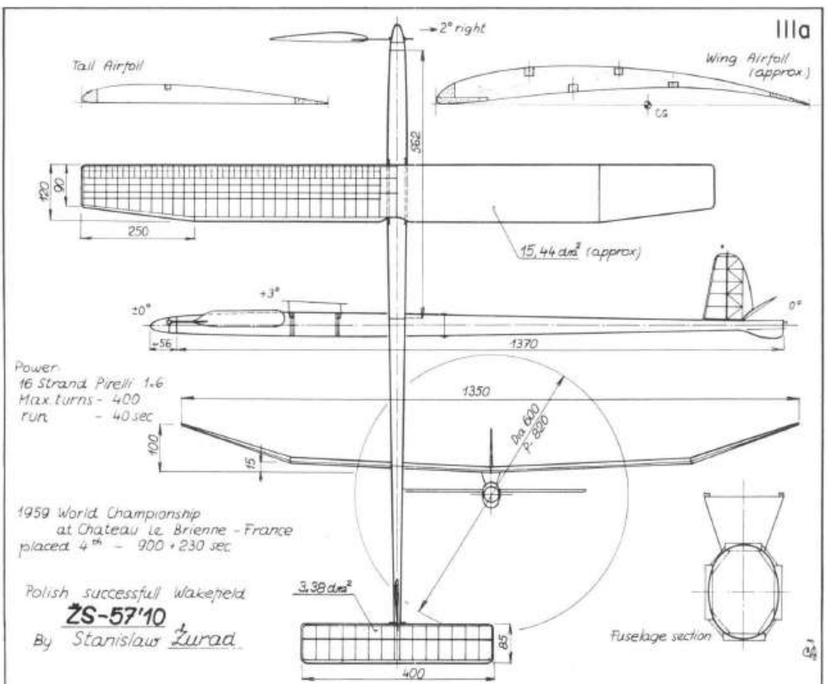

Wing & Tail Airfoil
5×5
2,5×3
2,5×14
1×17
1,5×6,5
3×6
1,5×17
3×3
2×3
CG
1,5°
Prop. Block Detail
430
251
120
90
43
16,2 dm²
1375
130
20
⌀520
Fuselage section
2×3
4×4
Winner of 1958 Polish Nats.
-2°
+3°
55
660
1260
130
±0°
105
Fuselage Detail
Rubber
-JASKOLKA-
2nd Place 1958 Wakefield
By Stanisław Żurad
Poland
Time - 824 sec.
2,8 dm²
397
80
77

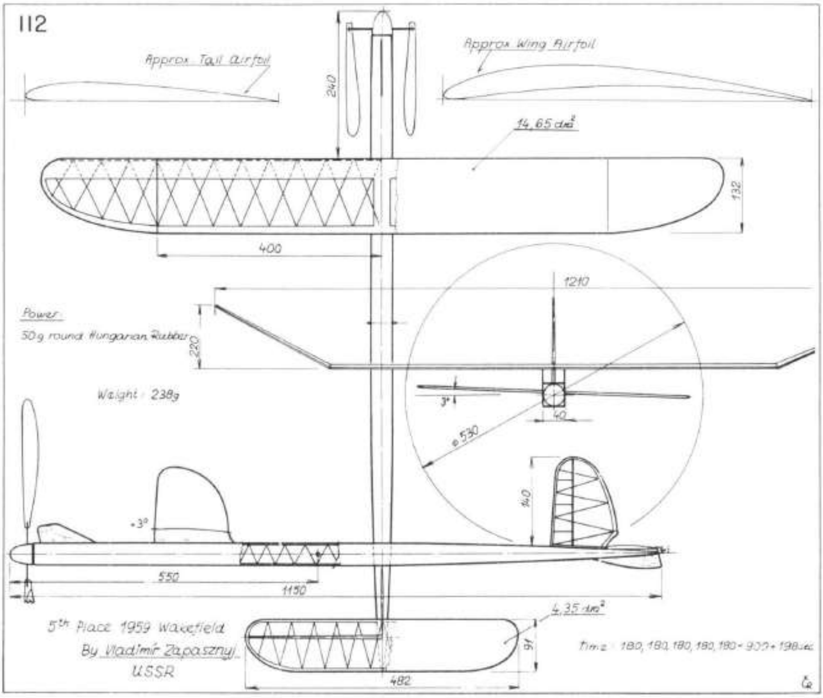

SKY-SCRAPER WAKEFIELD
Bob Hatschek
Douglaston, New York
2nd Place 1959 Wakefield Finals - 900 + 256 Secs.
Brienne le Chateau, France - 7-19-59
Fully Detailed in Dec. 1959 Model Airplane News
47 1/4 Flat Span
Wing Area : 221 □"
Stab Area : 71 □"
TOTAL : 292 □"
Airframe : 6.25 oz.
Rubber : 1.75 oz.
Total Weight : 8.25 oz.
Power: 12 Strands 1/4 Pirelli - 26" Lg.
Cover Entire Model With Jap Tissue
Right-Right Pattern
Note: Wound From Rear
Thread Turbulator
Retain Wing With Wire
All Ribs 1/16 th Sheet
1 x 2 x 22 Block
Note Curve
Built-up Mount
Hard Balsa "Hooks"
Removable Boom From 1/16 th Sheet
1/16 th Sheet Tube - Double Spiral Wrapped With Nylon
.040 Dia Wire
"Safety Pin" Spring
Balsa Spinner
New Departure #R2A Bearing
Needle Bearing
Fuel Line Tubing
Position Stop For Best Fold
Balsa

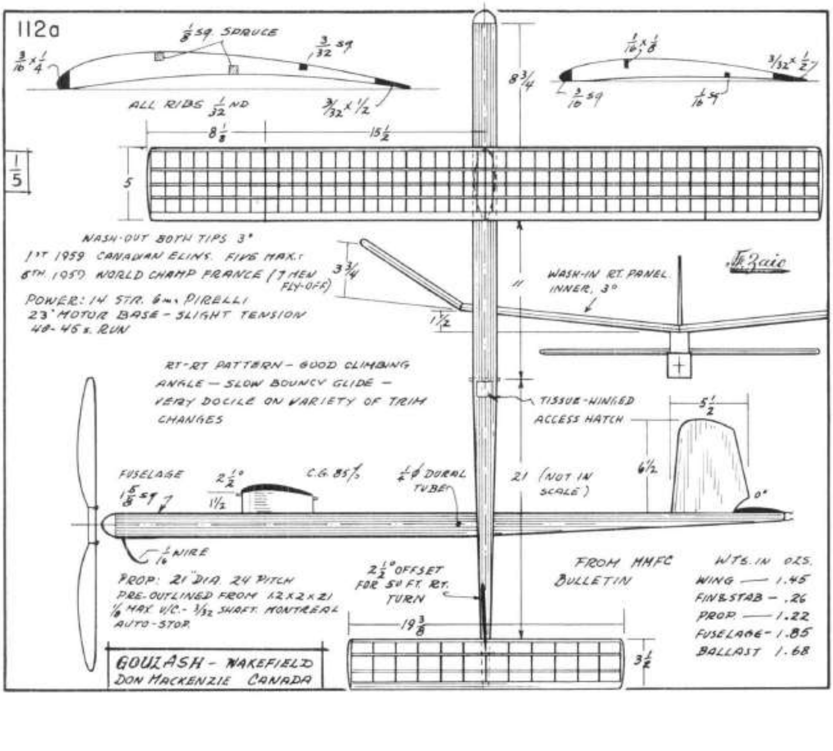


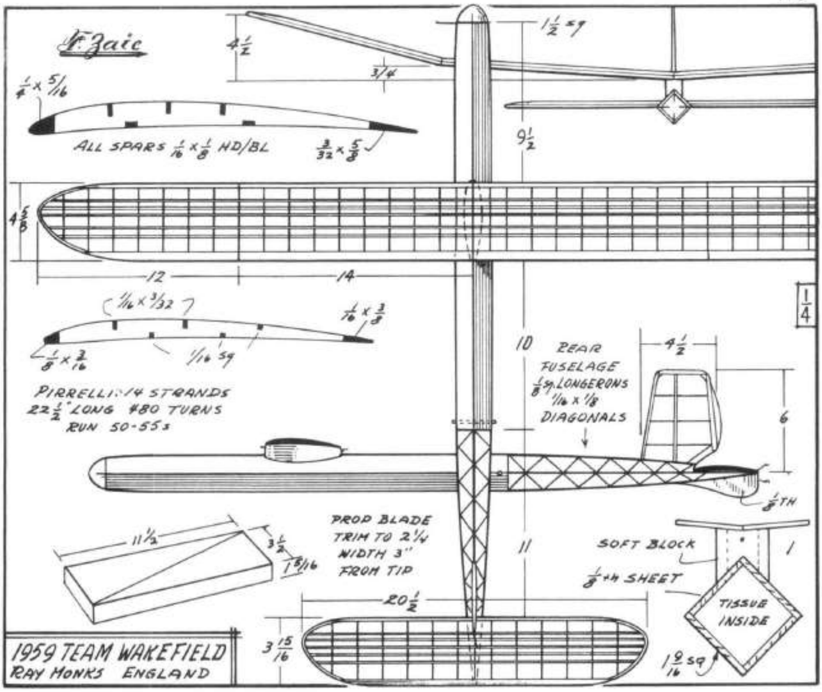
Wakefield BM-12
George Benedek, HUNGARY
5 th place 1958 World Championship, Cranfield, England
180, 180, 180, 173, 100 = 813
Wing section B-6405-b, tail section B-6455-b
Prop dia 22
Pitch 27
L.E.
T.E.
Pine spars
Balsa spars 5/64 sq
Balsa 1/8 × 5/64
1/8 × 5/64
5/64 sq
,07 dia
,08 dia
Soldered
14 strands 1/4 × 1/24 Pirelli
Total weight 8,2 oz
Down 1°
Right 3°
4°
0°
46 5/8
4 13/16
4
6 13/16
16 1/2
18 1/4
3 1/2
2 3/8
19/32
15/64
5/8
1/4
25/32
11
4 7/8
1 13/32
6 1/2
7/8
2
23 7/16
2 11/64
18
5
3 1/2
3/4
49 7/64


III
THRUST 1½° RIGHT 1½° DOWN
Tailplane Section
B-6455 b
Balsa 4×6
0,8 Balsa 1/32 NO Webbing CTR 5
1/32 Ribs
1.5×9
14,9 dm²
231°
1/32 NO sheet
Spruce 2.5
Wing Airfoil 1/32 Ribs
B-8405-b
Balsa 4×5
Spruce 2×3
Balsa 2,5 WEB 3/32
Balsa 2×19
632
24⅞
342
13½
250
39
124
Wing root ribs & Pylon root ribs are from 1/8 PLY
1/16 Dural Tongue
1285
Washout both Tips 1/2°
— PROP —
22" Dia. 27" Pitch
Folder, 2⅛" Max Blade Width
ø 560
P 594
132
29
Weight 235g
MOTOR TUBE: 1/16 × 5⅛ × 25
Balsa. Tissued inside,
silked & tissued outside
TAIL BOOM: 1/16 × 5⅛ × 22
Balsa TPR TO 1/32 × 1¾, Tissued Outside
Pylon made from 3 Lams. of 3/16 th
+3½°
C.G. 80%
46
32
120
159
Slight Left Rudder tab Required
0°
622
24½"
1194
47"
-WHISTLER-
By Jack Mc Gillivray
Canada
3rd 1959 WAKEFIELD
180, 180, 180, 180, 180=900+245 sec
Note Rudder Camber
3,72 dm²
58°
86
432 17"
Power: 14 Strands Pirelli 1/4" 6×1
450 Turns, 45 sec run
Model is wound using a winding tube of 1" O.D. 1/16 wall DURAL, 27" Long which is removed before flying

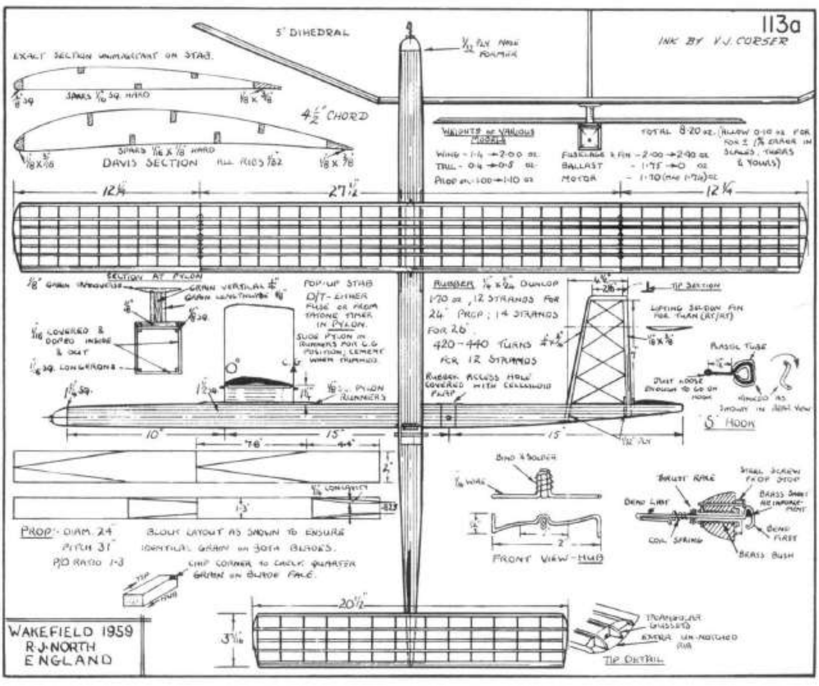

IIIa
2° right
Tail Airfoil
Wing Airfoil (approx.)
CG
562
120
90
250
15,44 dm² (approx)
+3°
±0°
0°
56
1370
Power:
16 Strand Pirelli 1×6
Max. turns - 400
run - 40 sec
1350
Dia 600
P. 820
100
15
1959 World Championship
at Chateau Le Brienne - France
placed 4th - 900 + 230 sec
Polish successfull Wakefield
ŻS-57'10
By Stanislaw Żurad
3,38 dm²
85
400
Fuselage section


112
Approx. Tail airfoil
Approx. Wing Airfoil
240
14,65 dm²
132
400
1210
Power:
50 g round Hungarian Rubber
220
Weight: 238g
3°
40
ø 530
140
+3°
550
1150
4,35 dm²
5th Place 1959 Wakefield
By Vladimir Zapasznyj
USSR
91
482
Time: 180, 180, 180, 180, 180 = 900 + 198 sec.


112a
1/8 SQ. SPRUCE
3/16 x 1/4
3/32 SQ
ALL RIBS 1/32 ND
3/32 x 1/2
8 3/4
1/16 x 1/8
3/32 x 1/2
3/16 SQ
1/16 SQ
8 1/8
15 1/2
1/5
5
WASH-OUT BOTH TIPS 3°
1ST 1959 CANADIAN ELIMS. FIVE MAX.
6TH 1959 WORLD CHAMP FRANCE (7 MEN FLY-OFF)
3 3/4
11
WASH-IN RT. PANEL INNER, 3°
POWER: 14 STR. 6 mm PIRELLI
23" MOTOR BASE - SLIGHT TENSION
40-45 s. RUN
1 1/2
RT-RT PATTERN - GOOD CLIMBING ANGLE - SLOW BOUNCY GLIDE - VERY DOCILE ON VARIETY OF TRIM CHANGES
TISSUE-HINGED ACCESS HATCH
5 1/2
FUSELAGE 1 5/8 SQ
2 1/2°
1 1/2
C.G. 85%
1/4 ø DURAL TUBE
21 (NOT IN SCALE)
6 1/2
0°
1/16 WIRE
PROP: 21" DIA. 24 PITCH
PRE-OUTLINED FROM 1.2 x 2 x 21
1/8 MAX U/C. - 3/32 SHAFT. MONTREAL AUTO-STOP.
2 1/2° OFFSET FOR 50 FT. RT. TURN
FROM MMFC BULLETIN
WTS. IN OZS.
WING — 1.45
FIN & STAB — .26
PROP — 1.22
FUSELAGE — 1.85
BALLAST 1.68
19 3/8
3 1/2
GOULASH - WAKEFIELD
DON MACKENZIE CANADA



V. Zaic
1/4 x 5/16
ALL SPARS 1/16 x 1/8 HD/BL
3/32 x 5/8
4 1/2
3/4
1 1/2 sq
9 1/2
4 5/8
12
14
(1/16 x 3/32)
1/16 x 3/8
1/8 x 3/16
1/16 sq
1/4
PIRRELLI: 14 STRANDS
22 1/2" LONG 480 TURNS
RUN 50-55 s
10
REAR FUSELAGE
1/8 sq. LONGERONS
1/16 x 1/8 DIAGONALS
4 1/2
6
1/8 TH
PROP BLADE
TRIM TO 2 1/4
WIDTH 3"
FROM TIP
11 1/2
3 1/2
1 3/16
11
SOFT BLOCK
1/8 + 1/4 SHEET
1
20 1/2
3 15/16
TISSUE INSIDE
1 9/16 sq
1959 TEAM WAKEFIELD
RAY MONKS ENGLAND



113a
INK BY V.J. CORSER
5° DIHEDRAL
1/32 PLY NOSE FORMER
EXACT SECTION UNIMPORTANT ON STAB.
SPARS 1/16 SQ. HARD
4 1/2" CHORD
SPARS 1/16 X 1/8 HARD
DAVIS SECTION
ALL RIBS 1/32
WEIGHTS OF VARIOUS MODELS
WING - 1.4 → 2.00 oz.
TAIL - 0.4 → 0.5 oz.
PROP etc. 1.00 → 1.10 oz.
FUSELAGE & FIN - 2.00 → 2.90 oz.
BALLAST - 1.75 → 0 oz.
MOTOR - 1.70 (MAX 1.74) oz.
TOTAL 8.20 oz.
12 1/4
27 1/2
12 1/4
SECTION AT PYLON
POP-UP STAB
D/T - EITHER FUSE OR FROM TAYONE TIMER IN PYLON.
SLIDE PYLON IN RUNNERS FOR C.G. POSITION; CEMENT WHEN TRIMMED.
RUBBER 1/4 x 1/24 DUNLOP
1.70 oz, 12 STRANDS FOR 24" PROP; 14 STRANDS FOR 26"
420 - 440 TURNS
FOR 12 STRANDS
RUBBER ACCESS HOLE COVERED WITH CELLULOID FLAP
TIP SECTION
LIFTING SECTION FIN FOR TURN (RT/RT)
PLASTIC TUBE
"S" HOOK
1/16 COVERED & DOPED INSIDE & OUT
1/8 SQ. LONGERONS
1 1/2 SQ.
PYLON RUNNERS
10"
15"
15"
PROP: DIAM. 24"
PITCH 31"
P/D RATIO 1.3
BLOCK LAYOUT AS SHOWN TO ENSURE IDENTICAL GRAIN ON BOTH BLADES.
CHIP CORNER TO CHECK QUARTER GRAIN ON BLADE FACE.
BEND & SOLDER
FRONT VIEW - HUB
THRUST RACE
BEND LIGHT
COIL SPRING
STEEL SCREW PROP STOP
BRASS BUSH
BEND FIRST
20 1/2
3 11/16
TRIANGULAR GUSSETS
EXTRA UN-NOTCHED RIB
TIP DETAIL
WAKEFIELD 1959
R.J. NORTH
ENGLAND

WAKEFIELD NOTES ———— Joe Bilgri, San Jose, Cal.

The sketch of the model that you have was my No. 2 Wakefield which had practically the same planform as my No. 1 Wakefield, except for the airfoils and prop diameters. I flew both models on 12 strands of 1/4 in. Pirelli. As far as I was concerned, there was very little difference in their performances, and it was always a tough decision which one to use in a contest. Although the No. 2 model, with its smaller diameter prop, had a little beter penetration in bad and windy air, the No. 1 model seemed to thermal better. I used No. 1 mainly in very calm conditions where there were a lot of down drafts. With its 65 second motor run I was hopeful of keeping No. 1 high enough off the ground so that it would have a chance at a thermal. And thermal it did; both, in our Semi-Finals and in France. When I said that there was a problem deciding which one to use, you can judge for yourself. In our Semis I used each model for five flights. Over in France I used No. 1 for the first two rounds, and while I got maxes, the large prop did not seem to be able to penetrate for its regular climb. So I used the No. 2 for the last three rounds.

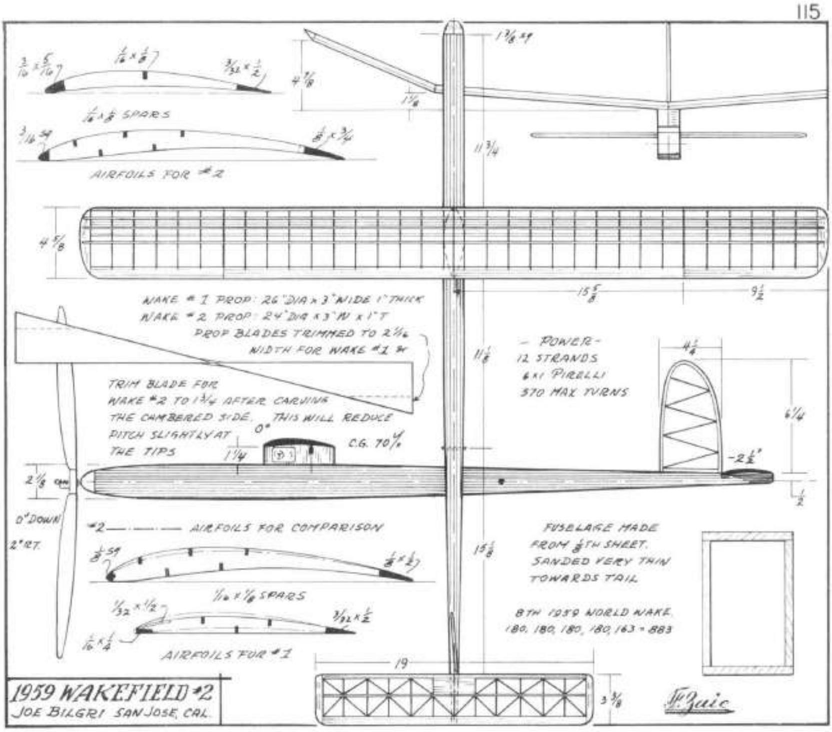
(Lee Renaud wanted to know why Joe used O° wing and negative stab.)

The wings on all my Wakefields since 1951 have been set at Zero, with stabs at approximately -2.5 degrees, because I feel that this gives me a better attitude or nose-up tendency during the latter stages of my motor run. And if I should run into any helpful air during this time, it takes a better advantage of this air. I may be wrong on this but I have always felt that it's the little things that have helped me over the years.

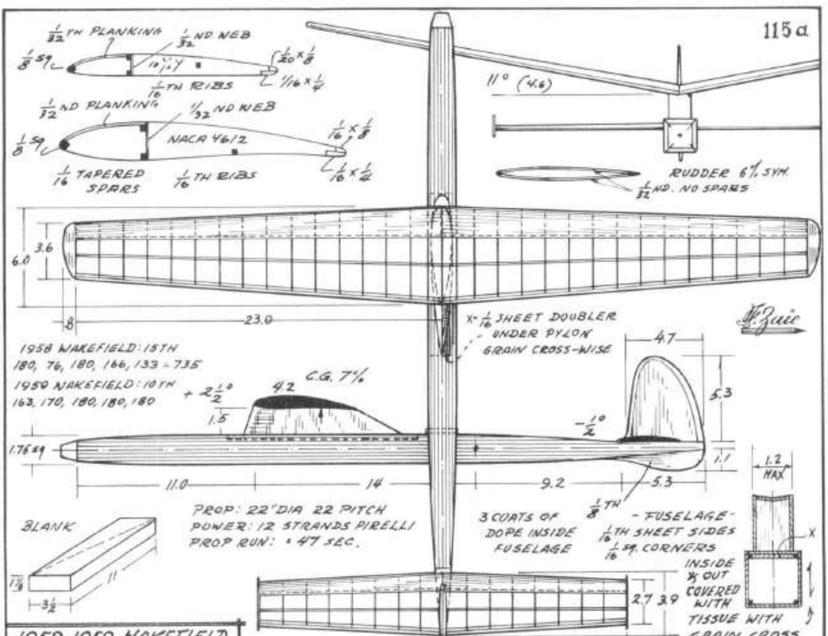
I always try for consistency, and this is one reason that I always use the motor stretched tightly between hooks. No matter how much time you spend trimming a model out, a slack motor will not always leave the knots in the same place when the motor tensioner takes over. A few knots in the rear of the fuselage are just enough to make a mushy glide, and ruin any chance you might have had for riding out a light thermal.

While Pirelli rubber is being made thinner and thinner each year, I find that most modelers will not change their distances between hooks to suit each batch of Pirelli. I usually buy enough rubber at a time to last out the year, and adjust my models around this rubber batch. To show the effect on distance between hooks of different rubber "years" consider the following: 12 strands of well broken-in rubber came to about 27½ in. in 1959. In 1960 I bought another supply of rubber, and I had to poke some new holes 30 in. back of the nose plug to get similar motor tightness. This year (1961) I built a new set of Wakefields but had trouble getting a new supply of rubber. Figured that the rubber could not get any thinner, but I was wrong again. When the new supply did come,, and when I broke some in, the distance necessary for the 12 strands was 32 inches.

I am ready to tear out what little hair that I have left. I tried using 14 strands which come to the 27½ in. length that I used in 1959, but I cannot get nearly the same number of turns in these motors as I could in 12 strands of the thicker stuff. This leaves me in the position of having to carve new props because I now feel that a motor run of approximately 50 seconds is best. With 12 strands of the thin rubber I am getting a little over a minute, and with 14 strands about 40 seconds. And so, the longer I fly these rubber jobs, the more I get to liking the Nordics!

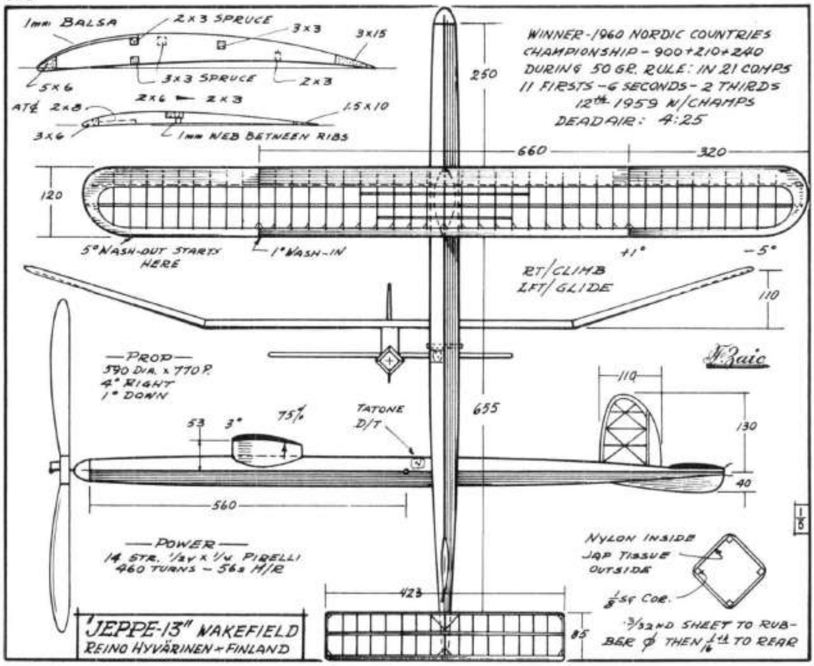


AIRFOILS FOR #2
1/16 x 1/8 SPARS
WAKE #1 PROP: 26" DIA x 3" WIDE 1" THICK
WAKE #2 PROP: 24" DIA x 3" W x 1" T
PROP BLADES TRIMMED TO 2 1/16 WIDTH FOR WAKE #1
TRIM BLADE FOR WAKE #2 TO 1 3/4 AFTER CARVING THE CAMBERED SIDE. THIS WILL REDUCE PITCH SLIGHTLY AT THE TIPS
C.G. 70%
- POWER -
12 STRANDS
6x1 PIRELLI
570 MAX TURNS
#2 — AIRFOILS FOR COMPARISON
1/16 x 1/8 SPARS
AIRFOILS FOR #1
0° DOWN
2° RT.
FUSELAGE MADE FROM 1/8 TH SHEET. SANDED VERY THIN TOWARDS TAIL
8TH 1959 WORLD WAKE.
180, 180, 180, 180, 163 = 883
1959 WAKEFIELD #2
JOE BILGRI SAN JOSE, CAL.

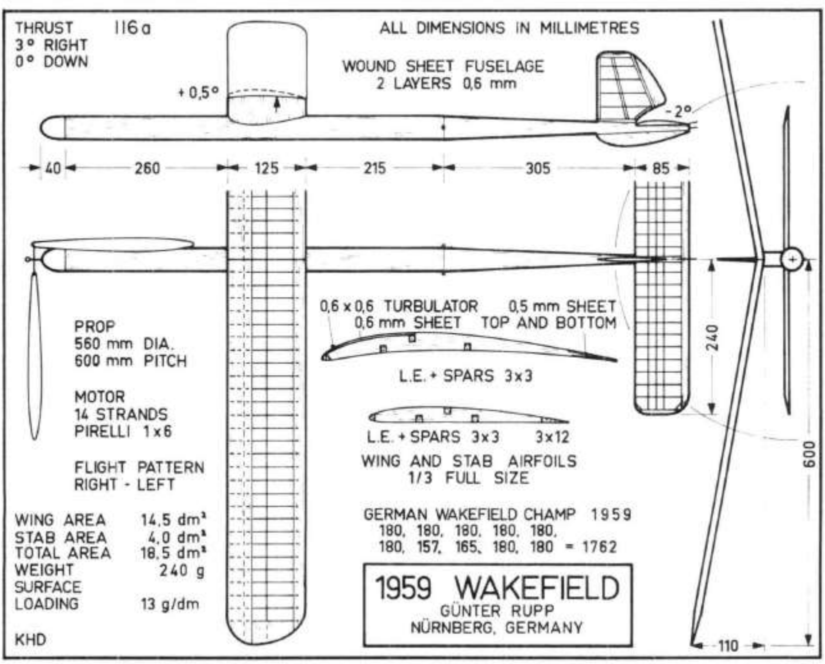


115 a
1/32 TH PLANKING
1/32 ND WEB
1/16 TH RIBS
1/32 ND PLANKING
1/32 ND WEB
NACA 4612
1/16 TAPERED SPARS
1/16 TH RIBS
11° (4.6)
RUDDER 6% SYM.
1/32 ND. NO SPARS
X = 1/16 SHEET DOUBLER UNDER PYLON GRAIN CROSS-WISE
1958 WAKEFIELD: 15TH
180, 76, 180, 166, 133 = 735
1959 WAKEFIELD: 10TH
163, 170, 180, 180, 180
C.G. 7%
PROP: 22" DIA 22 PITCH
POWER: 12 STRANDS PIRELLI
PROP RUN: ±47 SEC.
BLANK
3 COATS OF DOPE INSIDE FUSELAGE
- FUSELAGE -
1/16 TH SHEET SIDES
1/16 SQ. CORNERS
INSIDE & OUT COVERED WITH TISSUE WITH GRAIN CROSS TO WOOD (IMPORTANT)
1958-1959 WAKEFIELD
HERB KOTHE LITTLETON, COLO.

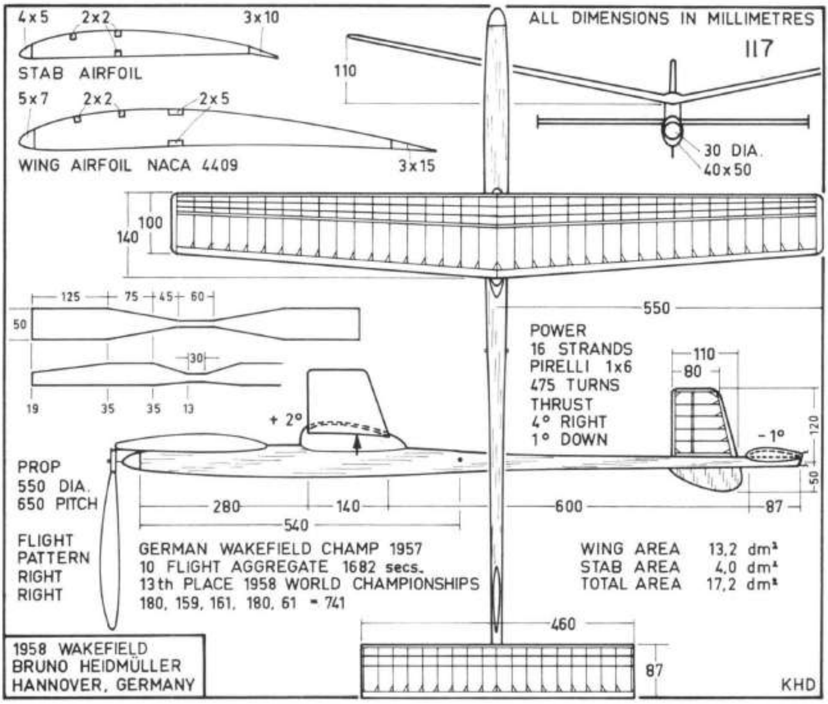
116

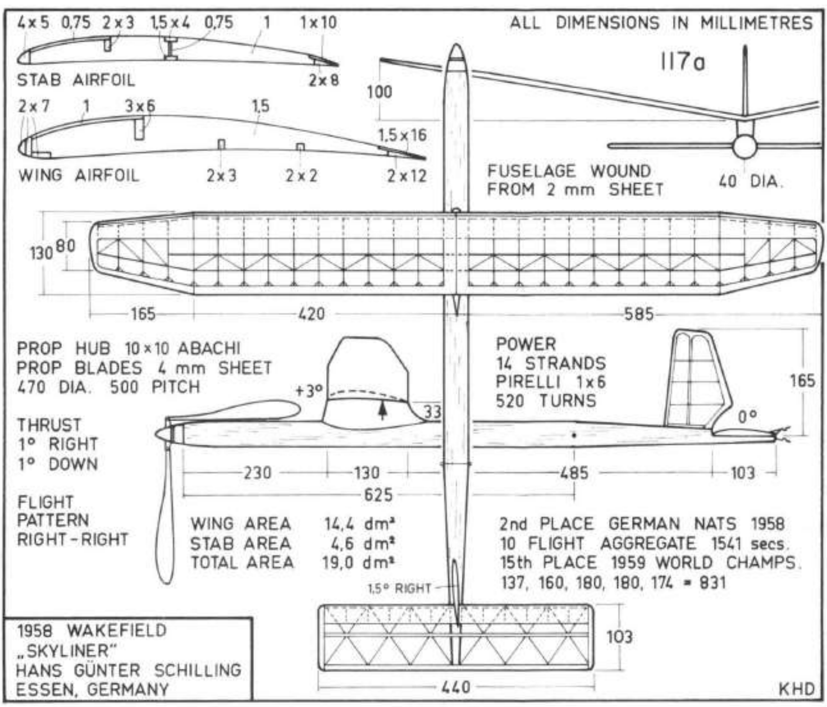


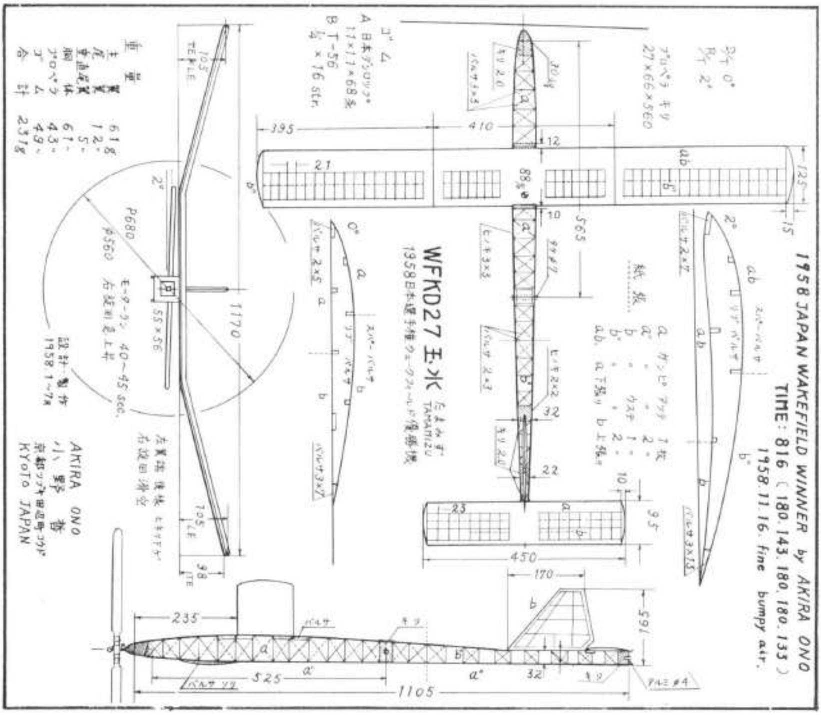
1mm BALSA
2×3 SPRUCE
3×3
3×15
3×3 SPRUCE
2×3
5×6
2×6 — 2×3
AT ℄ 2×8
1.5×10
3×6
1mm WEB BETWEEN RIBS
WINNER-1960 NORDIC COUNTRIES CHAMPIONSHIP - 900+210+240
DURING 50 GR. RULE: IN 21 COMPS
11 FIRSTS - 6 SECONDS - 2 THIRDS
12th 1959 N/CHAMPS
DEADAIR: 4:25
250
660
320
120
5° WASH-OUT STARTS HERE
1° WASH-IN
+1°
-5°
RT/CLIMB
LFT/GLIDE
110
—PROP—
590 DIA. × 770 P.
4° RIGHT
1° DOWN
53
3°
75%
TATONE D/T
655
110
130
40
560
—POWER—
14 STR. 1/24 × 1/4 PIRELLI
460 TURNS - 56s M/R
NYLON INSIDE
JAP TISSUE OUTSIDE
1/8 SQ COR.
3/32ND SHEET TO RUBBER ϕ THEN 1/16TH TO REAR
423
85
"JEPPE-13" WAKEFIELD
REINO HYVÄRINEN - FINLAND



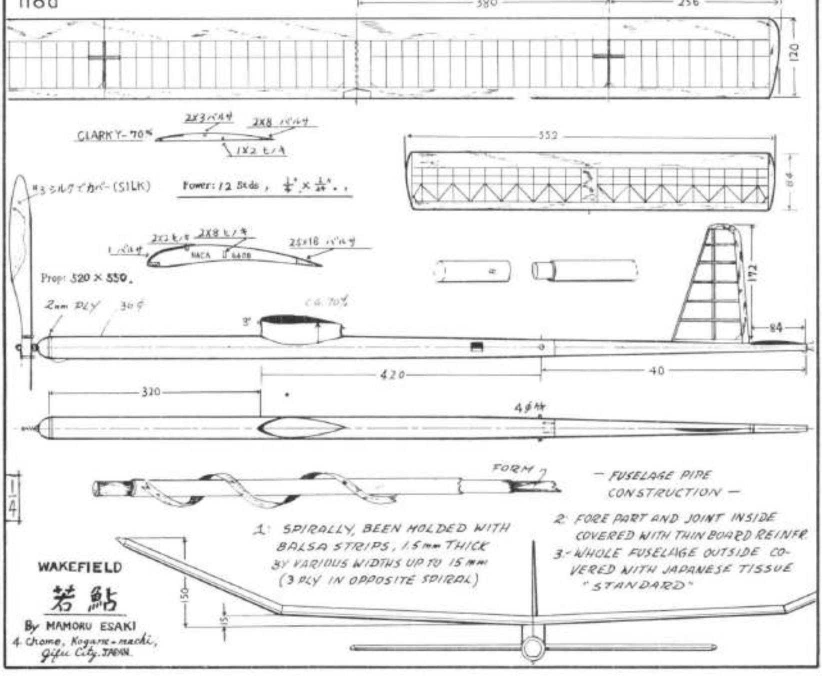
THRUST
3° RIGHT
0° DOWN
116a
ALL DIMENSIONS IN MILLIMETRES
WOUND SHEET FUSELAGE
2 LAYERS 0,6 mm
+0,5°
-2°
40
260
125
215
305
85
0,6 x 0,6 TURBULATOR
0,5 mm SHEET
0,6 mm SHEET TOP AND BOTTOM
L.E. + SPARS 3x3
L.E. + SPARS 3x3
3x12
WING AND STAB AIRFOILS
1/3 FULL SIZE
240
600
110
PROP
560 mm DIA.
600 mm PITCH
MOTOR
14 STRANDS
PIRELLI 1x6
FLIGHT PATTERN
RIGHT - LEFT
WING AREA 14,5 dm²
STAB AREA 4,0 dm²
TOTAL AREA 18,5 dm²
WEIGHT 240 g
SURFACE LOADING 13 g/dm
GERMAN WAKEFIELD CHAMP 1959
180, 180, 180, 180, 180,
180, 157, 165, 180, 180 = 1762
1959 WAKEFIELD
GÜNTER RUPP
NÜRNBERG, GERMANY
KHD


ALL DIMENSIONS IN MILLIMETRES
117
4x5
2x2
3x10
STAB AIRFOIL
5x7
2x2
2x5
WING AIRFOIL NACA 4409
3x15
110
30 DIA.
40x50
100
140
125
75
45
60
50
30
19
35
35
13
550
POWER
16 STRANDS
PIRELLI 1x6
475 TURNS
THRUST
4° RIGHT
1° DOWN
110
80
120
- 1°
50
+ 2°
PROP
550 DIA.
650 PITCH
280
140
540
600
87
FLIGHT
PATTERN
RIGHT
RIGHT
GERMAN WAKEFIELD CHAMP 1957
10 FLIGHT AGGREGATE 1682 secs.
13th PLACE 1958 WORLD CHAMPIONSHIPS
180, 159, 161, 180, 61 = 741
WING AREA 13,2 dm²
STAB AREA 4,0 dm²
TOTAL AREA 17,2 dm²
460
87
1958 WAKEFIELD
BRUNO HEIDMÜLLER
HANNOVER, GERMANY
KHD


ALL DIMENSIONS IN MILLIMETRES
117a
4x5
0,75
2x3
1,5x4
0,75
1
1x10
STAB AIRFOIL
2x8
100
2x7
1
3x6
1,5
1,5x16
WING AIRFOIL
2x3
2x2
2x12
FUSELAGE WOUND
FROM 2 mm SHEET
40 DIA.
130
80
165
420
585
PROP HUB 10x10 ABACHI
PROP BLADES 4 mm SHEET
470 DIA. 500 PITCH
+3°
33
POWER
14 STRANDS
PIRELLI 1x6
520 TURNS
165
0°
THRUST
1° RIGHT
1° DOWN
230
130
485
103
625
FLIGHT
PATTERN
RIGHT-RIGHT
WING AREA 14,4 dm²
STAB AREA 4,6 dm²
TOTAL AREA 19,0 dm²
2nd PLACE GERMAN NATS 1958
10 FLIGHT AGGREGATE 1541 secs.
15th PLACE 1959 WORLD CHAMPS.
137, 160, 180, 180, 174 = 831
1,5° RIGHT
103
440
1958 WAKEFIELD
„SKYLINER"
HANS GÜNTER SCHILLING
ESSEN, GERMANY
KHD



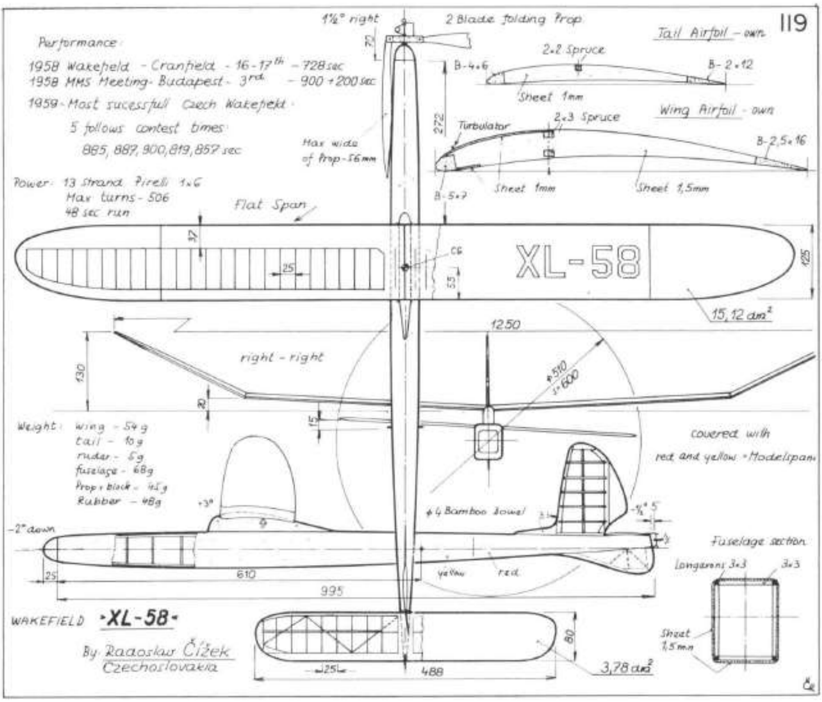
118a

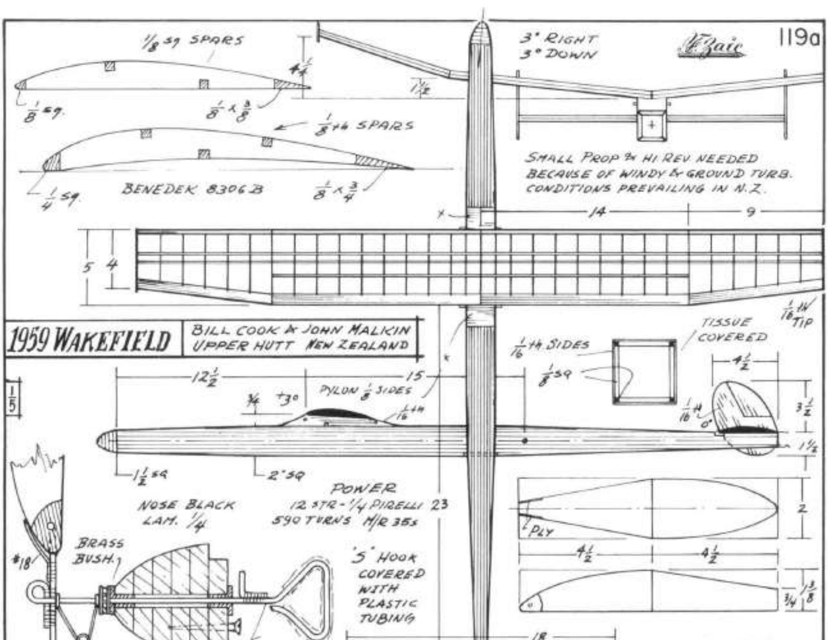


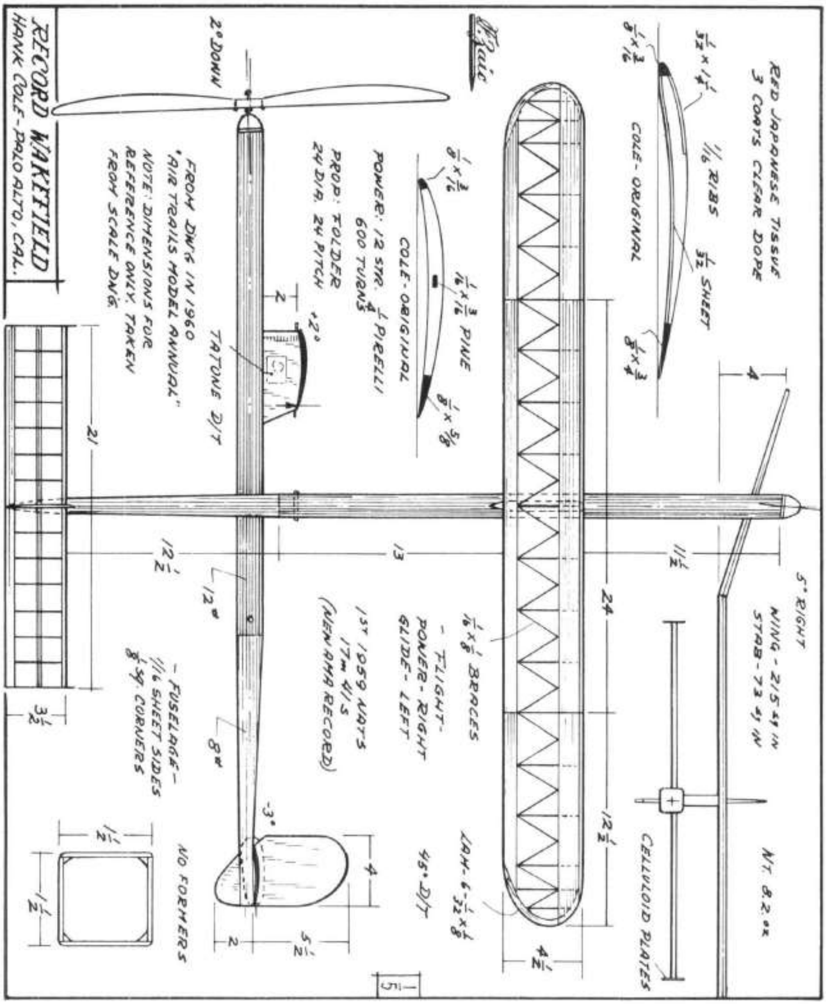
WAKEFIELD

若鮎

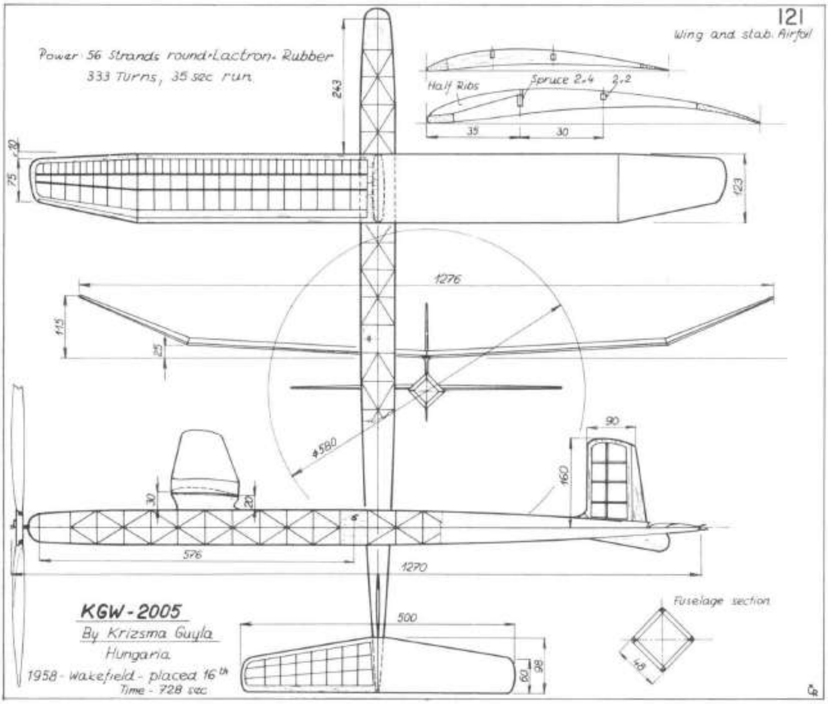
By MAMORU ESAKI
4 Chome, Kogane-machi,
Gifu City, JAPAN

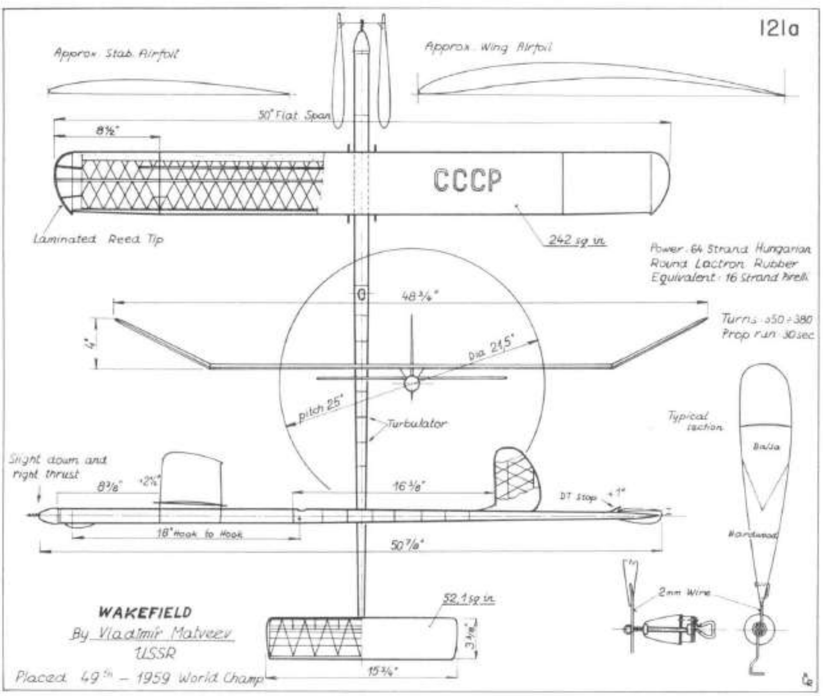

119
Performance
1958 Wakefield - Cranfield - 16-17th - 728 sec
1958 MMS Meeting - Budapest - 3rd - 900 + 200 sec
1959 - Most sucessfull Czech Wakefield
5 follows contest times
885, 887, 900, 819, 857 sec
Power 13 strand Pirelli 1x6
Max turns - 506
48 sec run
1½° right
2 Blade folding Prop
Max wide of Prop - 56 mm
Tail Airfoil - own
2x2 Spruce
B-4x6
B-2x12
Sheet 1mm
Turbulator
2x3 Spruce
Wing Airfoil - own
B-2,5x16
B-5x7
Sheet 1mm
Sheet 1,5mm
Flat Span
CG
XL-58
15,12 dm²
1250
right - right
ø510
s=600
Weight wing - 54g
tail - 10g
rudder - 5g
fuselage - 68g
Prop + block - 45g
Rubber - 48g
covered with
red and yellow »Modelspan«
ø4 Bamboo dowel
-2° down
+3°
yellow
red
610
995
Fuselage section
Longarons 3x3
3x3
Sheet 1,5 mm
WAKEFIELD »XL-58«
By Radoslav Čížek
Czechoslovakia
488
3,78 dm²

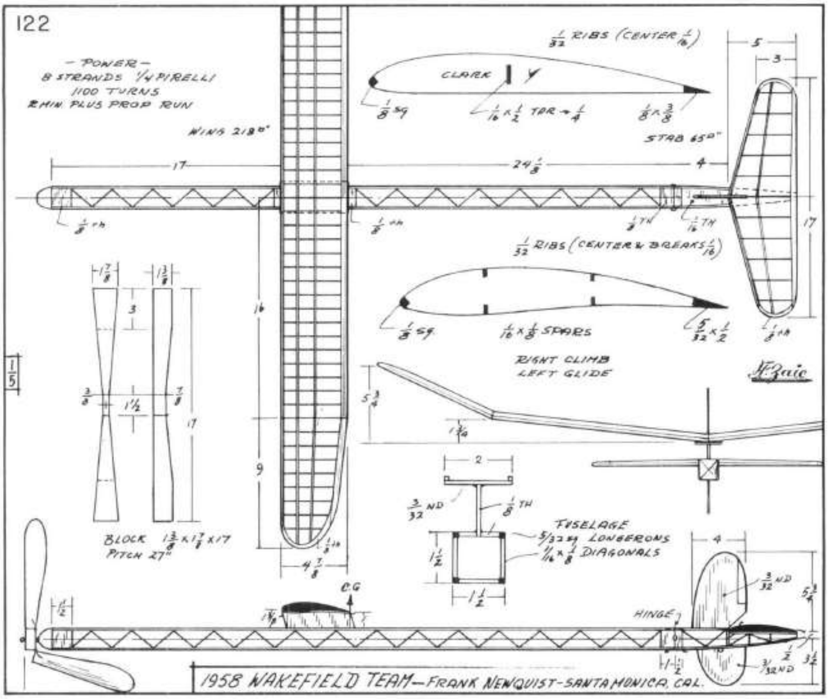

119a
1/8 sq SPARS
1/8 sq.
1/8 x 3/8
1/8 x 1/4 SPARS
BENEDEK 8306 B
1/4 sq.
1/8 x 3/4
3° RIGHT
3° DOWN
SMALL PROP & HI REV NEEDED
BECAUSE OF WINDY & GROUND TURB.
CONDITIONS PREVAILING IN N.Z.
14
9
5
4
1959 WAKEFIELD
BILL COOK & JOHN MALKIN
UPPER HUTT NEW ZEALAND
1/16 x 1/4 SIDES
1/8 SQ
TISSUE COVERED
1/16 W TIP
12½
15
PYLON 1/8 SIDES
+3°
1½ sq
2" SQ
POWER
12 STR - 1/4 PIRELLI 23
590 TURNS M/R 35s
NOSE BLOCK LAM. 1/4
BRASS BUSH.
#18
"S" HOOK COVERED WITH PLASTIC TUBING
14 SWG
18 SWG
HINGE SKEWED FOR SNUG FOLD
5° TO ↓ CTRWT
PLY
4½
18
2"x10" 1958 NATS
1st & 3rd 1959 NATS
29th 1959 WAKE.
81, 151, 180, 180, 180.



The Wakefield is really phenomenal. There was nothing out here last year that could match its performance. At our eliminations I thought I had it made after 8 rounds, then came a fateful downdraft in the ninth in which I clocked only 1 min. 7 sec. This for a solid 3½ minute job! In the 10th round, Joe Bilgri sneaked in after being in third all day. It was exciting to say the least. Nordic was no contest with Bob Wehle walking away. I was knocked out in the third round when a dustdevil picked my model off the ground after dethermalizing and demolished it. Quite a sight! The thing that really killed me off was that stupid schedule of flying all three events at once. With the high wind blowing, it was tough enough to keep in the running in one event, let alone three.


121
Wing and stab. Airfoil
Power: 56 Strands round-Lactron- Rubber
333 Turns, 35 sec run
Half Ribs
Spruce 2x4
2x2
35
30
243
75
10
123
1276
115
25
ø580
160
90
30
20
576
1270
KGW-2005
By Krizsma Guyla
Hungaria
1958 - Wakefield - placed 16th
Time - 728 sec
500
60
98
Fuselage section
48

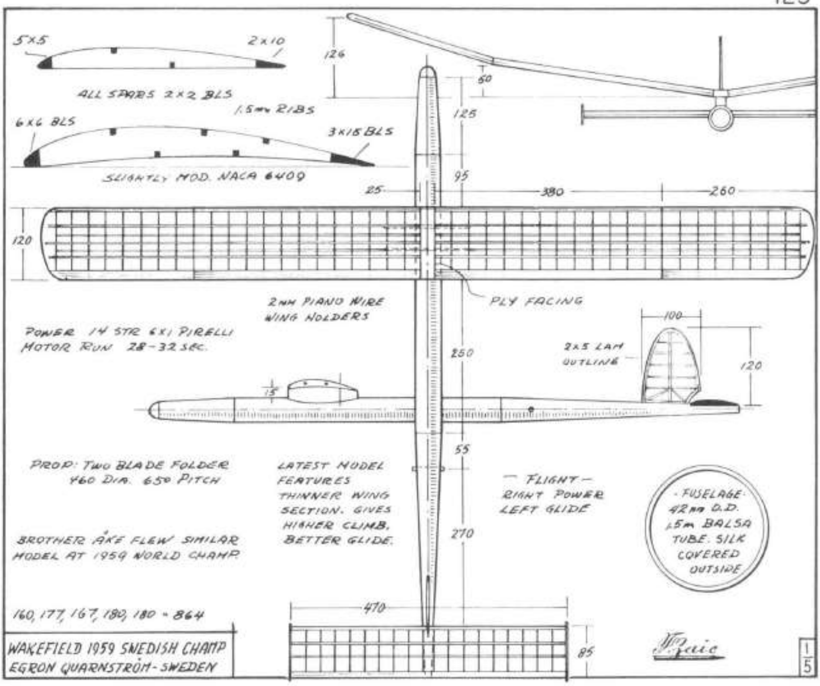

121a
Approx. Stab. Airfoil
Approx. Wing Airfoil
30" Flat Span
8½"
CCCP
Laminated Reed Tip
242 sq in
Power: 64 Strand Hungarian
Round Lactron Rubber
Equivalent: 16 Strand Pirelli
48¾"
4"
Turns: 350÷380
Prop run: 30sec
Dia 21,5"
pitch 25"
Turbulator
Typical section
Balsa
Slight down and right thrust
8⅜"
2¼"
16⅜"
DT Stop
1"
18" Hook to Hook
50⅞"
Hardwood
2mm Wire
WAKEFIELD
By Vladimir Matveev
USSR
Placed 49th – 1959 World Champ
52,1 sq in
3⅜"
15¾"

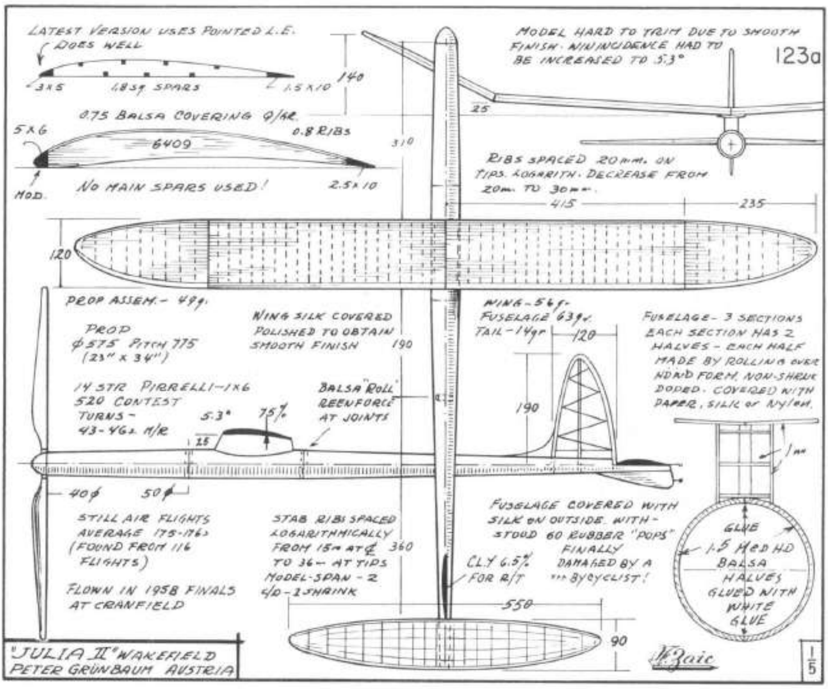


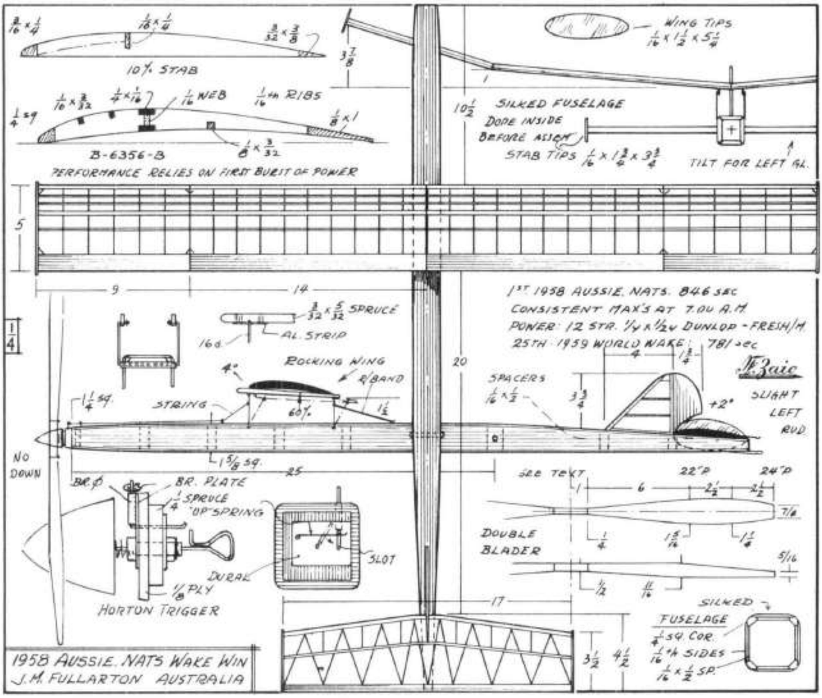
Actually, this model wasn't designed specifically for the 50 gram rules, but is a combination of parts from older Wakefields that I put together with the 1958 local elims coming up and no time to build a new model. The fuselage was from an 80 gram design, the wing from the model flown in the 1952 Wakefield semi-finals and the prop and stab from 1951 Wakefields.

This combination seemed to perform quite well and took first in the local elims, with a time of 13:58. Later it won the Western semi-finals with a time of 13:38. As you know it was practically helpless in that terrible wind at "Crownfield." Another 7-string Wakefield very similar to this with an even longer fuselage and this same prop won 4th place at the 1959 Nats with a time of 14:02. It has no other experience other than the cases mentioned.

This model features an 8 strands 1/4 inch Pirelli motor that is actually stretched several inches and a very high pitch prop. The prop runs 2 minutes or more. Under average conditions the model has a slow, steady climb thruout the entire prop run with enough altitude to make a max. The only times it is in trouble is during high wind or down draft conditions but very seldom makes less than 2 min.


5×5
2×10
126
ALL SPARS 2×2 BLS
1.5mm RIBS
6×6 BLS
3×18 BLS
SLIGHTLY MOD. NACA 6409
60
125
95
25
380
260
120
2MM PIANO WIRE WING HOLDERS
PLY FACING
POWER 14 STR 6×1 PIRELLI
MOTOR RUN 28-32 SEC.
100
2×5 LAM OUTLINE
250
120
15
55
PROP: TWO BLADE FOLDER
460 DIA. 650 PITCH
LATEST MODEL FEATURES THINNER WING SECTION. GIVES HIGHER CLIMB, BETTER GLIDE.
— FLIGHT —
RIGHT POWER
LEFT GLIDE
FUSELAGE 42mm O.D. 1.5m BALSA TUBE. SILK COVERED OUTSIDE
270
BROTHER ÅKE FLEW SIMILAR MODEL AT 1959 WORLD CHAMP.
160, 177, 167, 180, 180 = 864
470
85
WAKEFIELD 1959 SWEDISH CHAMP
EGRON QUARNSTRÖM - SWEDEN
1/5


LATEST VERSION USES POINTED L.E. DOES WELL
MODEL HARD TO TRIM DUE TO SMOOTH FINISH. WINGINCIDENCE HAD TO BE INCREASED TO 5.3°
123a
3×5
1.8 SQ. SPARS
1.5×10
140
0.75 BALSA COVERING Q/GR.
0.8 RIBS
25
5×6
6409
310
RIBS SPACED 20mm. ON TIPS. LOGARITH. DECREASE FROM 20m. TO 30mm.
MOD.
NO MAIN SPARS USED!
2.5×10
415
235
120
PROP ASSEM. - 49g.
WING SILK COVERED POLISHED TO OBTAIN SMOOTH FINISH
WING - 56g.
FUSELAGE 63gr.
TAIL - 14gr
120
FUSELAGE - 3 SECTIONS EACH SECTION HAS 2 HALVES - EACH HALF MADE BY ROLLING OVER WOOD FORM, NON-SHRINK DOPED. COVERED WITH PAPER, SILK or NYLON.
PROP
φ575 PITCH 775
(23" × 34")
190
14 STR PIRRELLI - 1×6
520 CONTEST TURNS -
43-46s. M/R
BALSA "ROLL" REENFORCE AT JOINTS
5.3°
75%
25
190
1mm
40φ
50φ
STILL AIR FLIGHTS AVERAGE 175-176s (FOUND FROM 116 FLIGHTS)
STAB RIBS SPACED LOGARITHMICALLY FROM 15m AT ℄ TO 36m AT TIPS
MODEL-SPAN - 2 C/D - 2 SHRINK
360
FUSELAGE COVERED WITH SILK ON OUTSIDE. WITHSTOOD 60 RUBBER "POPS" FINALLY DAMAGED BY A BYCYCLIST!
CL.Y 6.5% FOR R/T
GLUE
1.5 MED HD BALSA HALVES GLUED WITH WHITE GLUE
FLOWN IN 1958 FINALS AT CRANFIELD
550
90
"JULIA II" WAKEFIELD
PETER GRÜNBAUM AUSTRIA
1/5



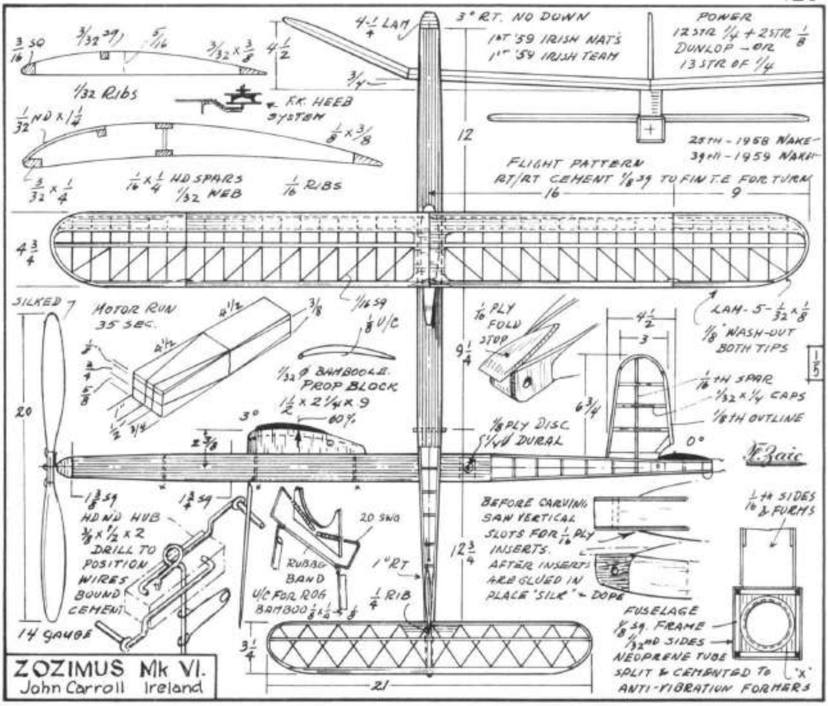
ROCKING WING ——————— Jim Fullarton, Australia

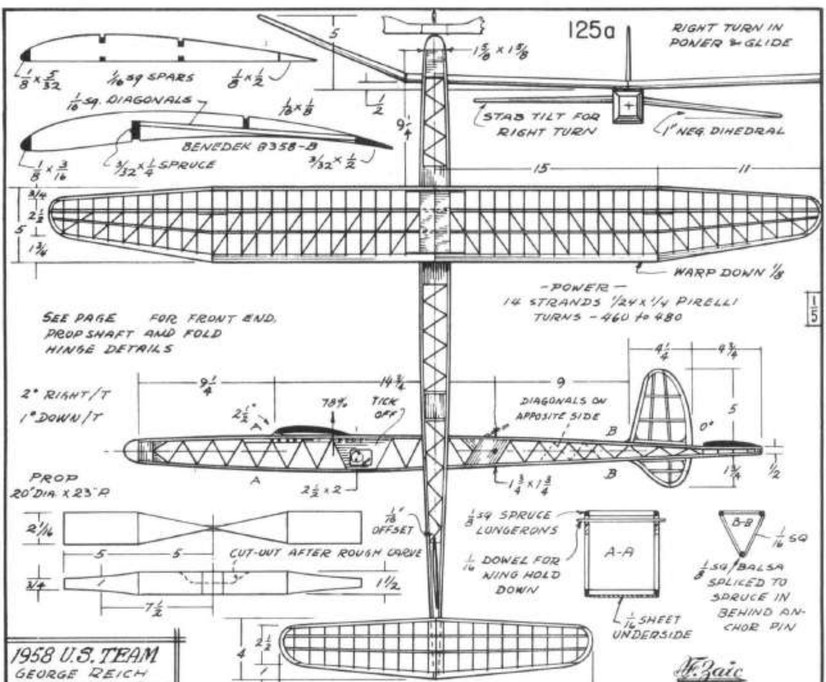
Many of your readers seem to be against gadgets and gimmicks, but I beg to differ. Where would we be without folding props, D.T.'s, ten sioners, etc.? The one that really took my fancy was that trigger device of Jim Horton's in the '51 book, except that I did not fancy the way he used it to give neg. elevator. This looked like it would only aggravate the locping tendency under the first burst of power.

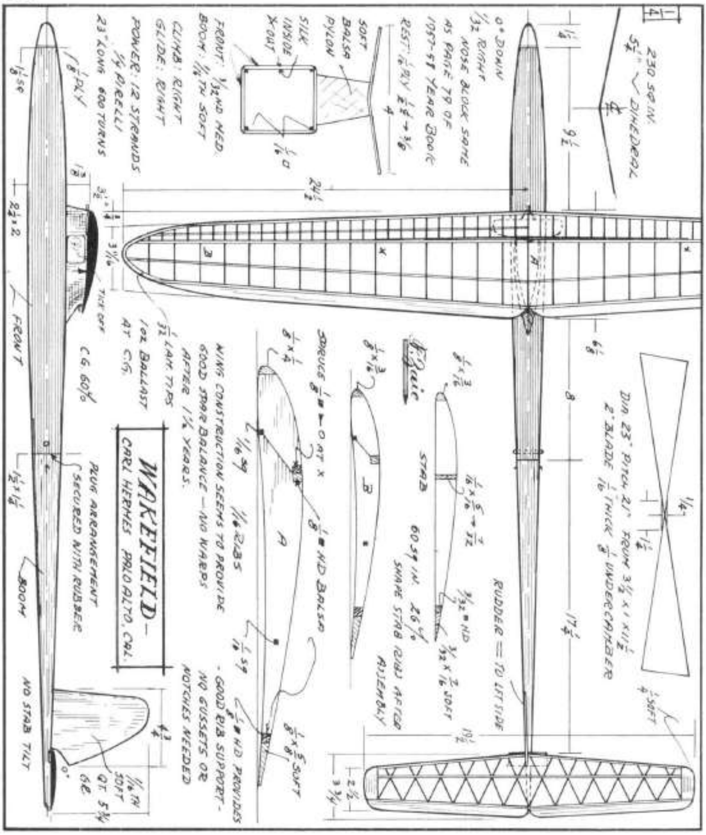
Why not attack the problem at its source, and when the blades fold, move the wing back to compensate? So I mounted the wing on parallel action swinging struts, released to move back when the tensioner cut in, and the "Rocking Wing" was born. It proved a success from the start, has been used in three of the four wins mentioned above, and has never given the slightest trouble.

The travel is only about 3/8 in. to 1/2 in. but it is sufficient to prevent that nose heaviness in the latter part of the power flight, and it can be set to make the model hang on the prop until the last turn.

Propeller: After reading up some helicopter rotor theory, I decided on large diameter with narrow blades. Theory states that thrust is proportional to momentum, m.v., whereas energy used is proportional to $m.v.^2$, where "m" is mass of air affected, "v" is velocity in slipstream. Hence it pays to use a large diameter to keep "m" large and "v" small. In other words, small diameters waste energy by "Blowing holes in the air." It works out, too, the climb is really something.


3° RT. NO DOWN
1st '59 IRISH NATS
1st '59 IRISH TEAM
POWER
12 STR 1/4 + 2 STR 1/8
DUNLOP - OR
13 STR OF 1/4
4-1/4 LAM
3/16 SQ
3/32 SQ
5/16
3/32 x 3/8
4 1/2
1/32 Ribs
3/4
F.K. HEEB SYSTEM
1/32 HD x 1 1/4
1/8 x 3/8
12
25TH - 1958 WAKE
39TH - 1959 WAKE
3/32 x 1/4
1/16 x 1/4 HD SPARS
1/32 WEB
1/16 RIBS
FLIGHT PATTERN
RT/RT CEMENT 1/8 SQ TO FIN T.E FOR TURN
16
9
4 3/4
SILKED
MOTOR RUN
35 SEC.
1/16 SQ
1/8 U/C
1/16 PLY
FOLD
STOP
LAM - 5 - 1/32 x 1/8
1/8" WASH-OUT
BOTH TIPS
1/32 Ø BAMBOO L.E.
PROP BLOCK
1 1/2 x 2 1/4 x 9
60%
9 1/4
4 1/2
3
1/16 TH SPAR
1/32 x 1/4 CAPS
1/8 TH OUTLINE
20
3°
2 3/8
1/8 PLY DISC
1/4 DURAL
6 3/4
0°
F. Zaic
1 3/8 SQ
1 3/4 SQ
HD WD HUB
3/8 x 1/2 x 2
DRILL TO
POSITION
WIRES
BOUND
CEMENT
20 SWG
RUBBER
BAND
U/C FOR ROG
BAMBOO
1° RT
1/4 RIB
BEFORE CARVING
SAW VERTICAL
SLOTS FOR 1/16 PLY
INSERTS.
AFTER INSERTS
ARE GLUED IN
PLACE "SILK" + DOPE
12 3/4
1/16 TH SIDES
& FORMS
FUSELAGE
1/8 SQ. FRAME
1/32 HD SIDES
NEOPRENE TUBE
SPLIT & CEMENTED TO "X"
ANTI-VIBRATION FORMERS
14 GAUGE
3 1/4
21
ZOZIMUS Mk VI.
John Carroll Ireland
1/5

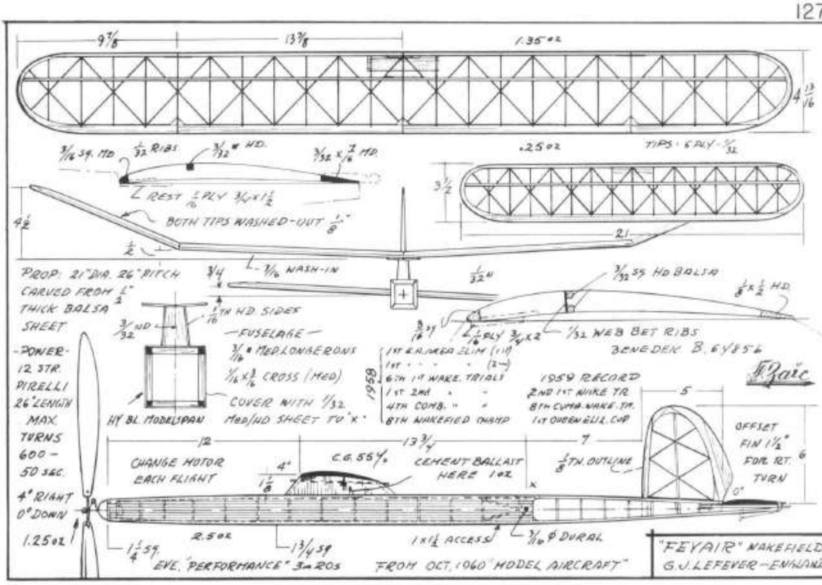

125a
RIGHT TURN IN
POWER & GLIDE
5
1 5/8 x 1 5/8
1/8 x 5/32
1/16 SQ SPARS
1/8 x 1/2
1/16 SQ. DIAGONALS
1/16 x 1/8
1/2
9 1/4
STAB TILT FOR
RIGHT TURN
1° NEG. DIHEDRAL
BENEDEK 8358-B
1/8 x 3/16
3/32 x 1/4 SPRUCE
3/32 x 1/2
15
11
3/4
2 1/2
5
1 3/4
WARP DOWN 1/8
- POWER -
14 STRANDS 1/24 x 1/4 PIRELLI
TURNS - 460 to 480
SEE PAGE FOR FRONT END,
PROPSHAFT AND FOLD
HINGE DETAILS
4 1/4
4 3/4
9 1/4
14 3/4
9
2° RIGHT/T
1° DOWN/T
2 1/2°
78%
TICK
OFF
DIAGONALS ON
APPOSITE SIDE
5
0°
B
A
A
B
1 3/4
1/2
1 3/4 x 1 3/4
2 1/2 x 2
PROP
20" DIA. x 23" P
2 1/16
5
5
3/4
7 1/2
CUT-OUT AFTER ROUGH CARVE
1 1/2
1/4" OFFSET
1/8 SQ SPRUCE
LONGERONS
1/16 DOWEL FOR
WING HOLD
DOWN
A-A
1/16 SHEET
UNDERSIDE
B-B
1/16 SQ
1/8 SQ BALSA
SPLICED TO
SPRUCE IN
BEHIND AN-
CHOR PIN
2 1/2
4
1
22
1958 U.S. TEAM
GEORGE REICH
CLEVELAND, OHIO
F. Zaic
1/5

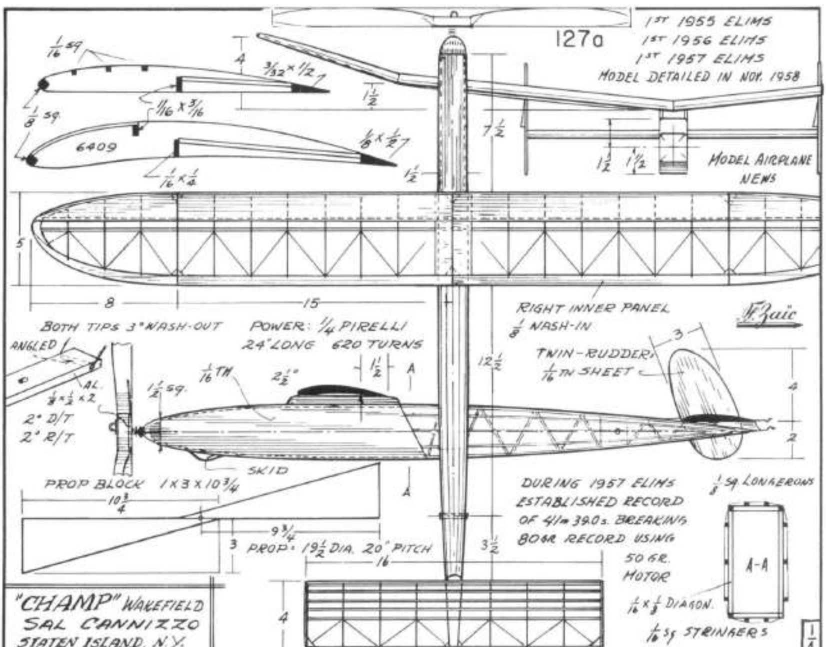


The long fuselage was inspired by things I was reading back in mid-1959. The ship was built and given a few winds just prior to the long haul to Calif. I was worried about the long moment having good turbulent stability, but it seems to do very well out here in the western thermals. This Californian weather is hard to believe after the violent stuff in Texas.

The set-up does very well when it hits the lift—tends to wheel into a vertical bank and then maintain a tighter turn with no hint of a stall. The long tail seems to add to the penetrating ability. The straight tapered wing has a positive way about it that poly job cannot approach. There is nothing prettier than a straight taper job in a thermal.

This morning I was out and did three minutes in the fog right under a flock of birds who subsequently disaproved of it.

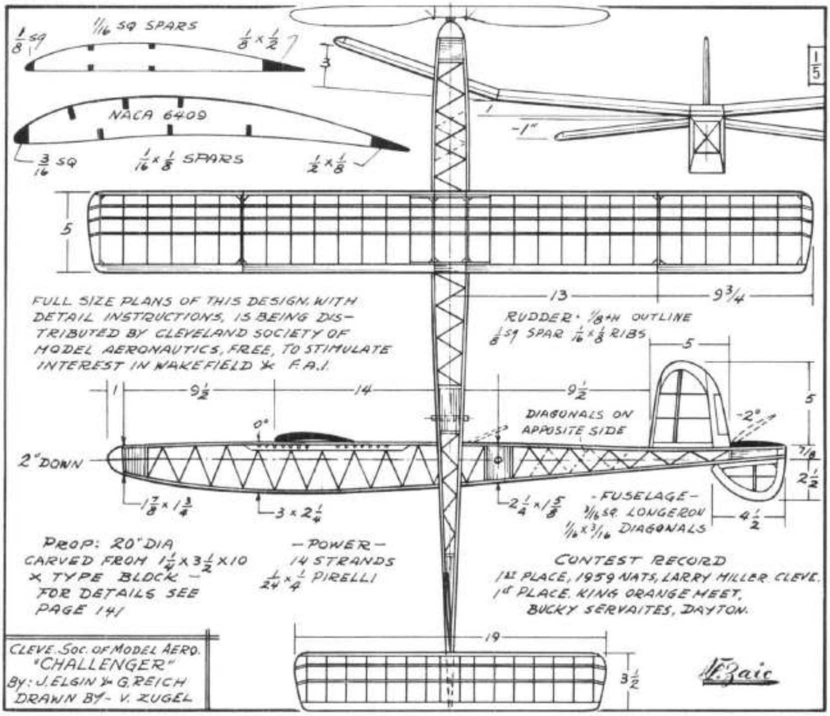


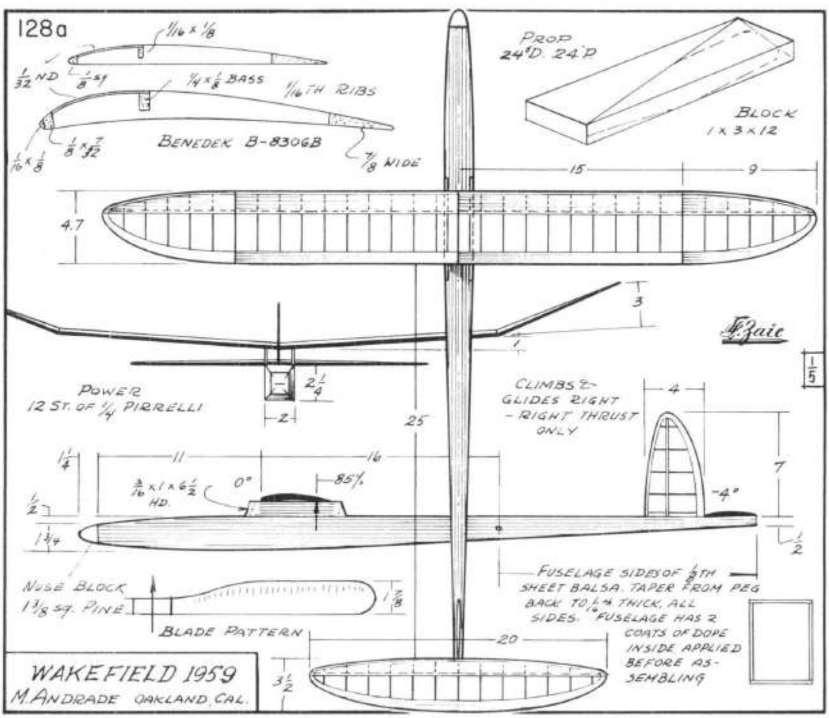


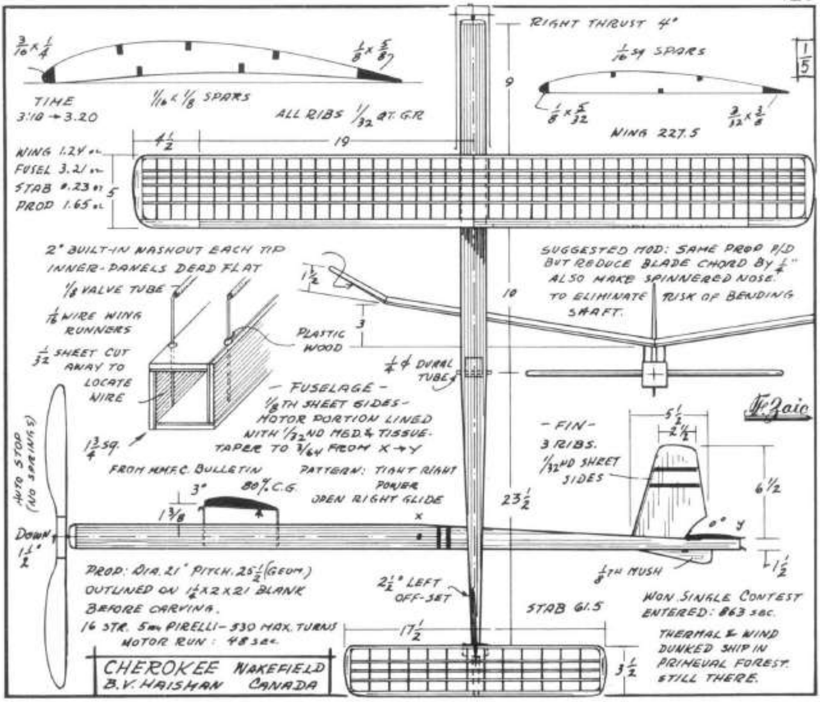
"Powers LeFebore passed away two years ago. His love and devotion toward modelling will be remembered by us on Staten Island and vicinity."

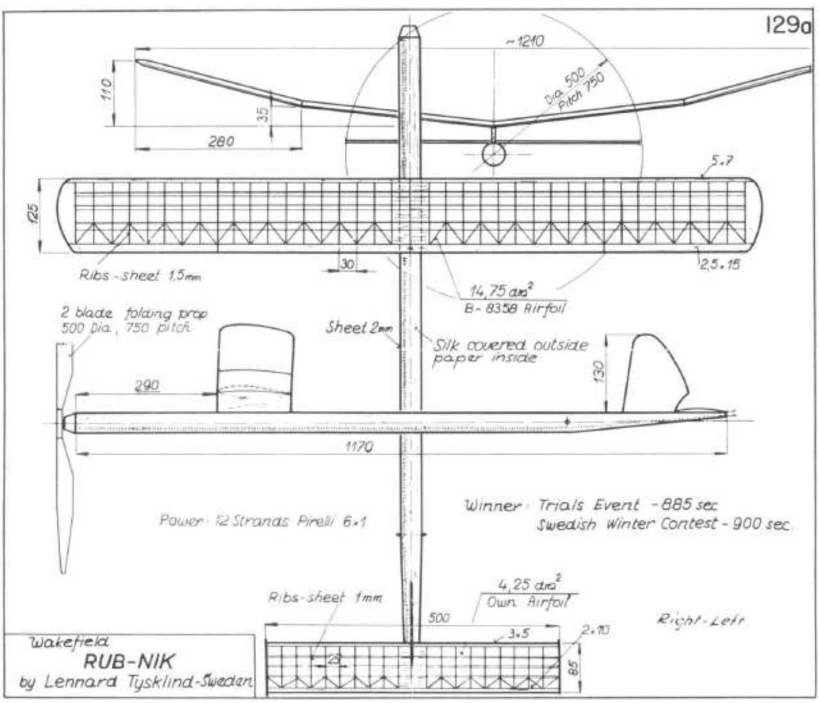
—Sal Cannizzo, 1960.

128

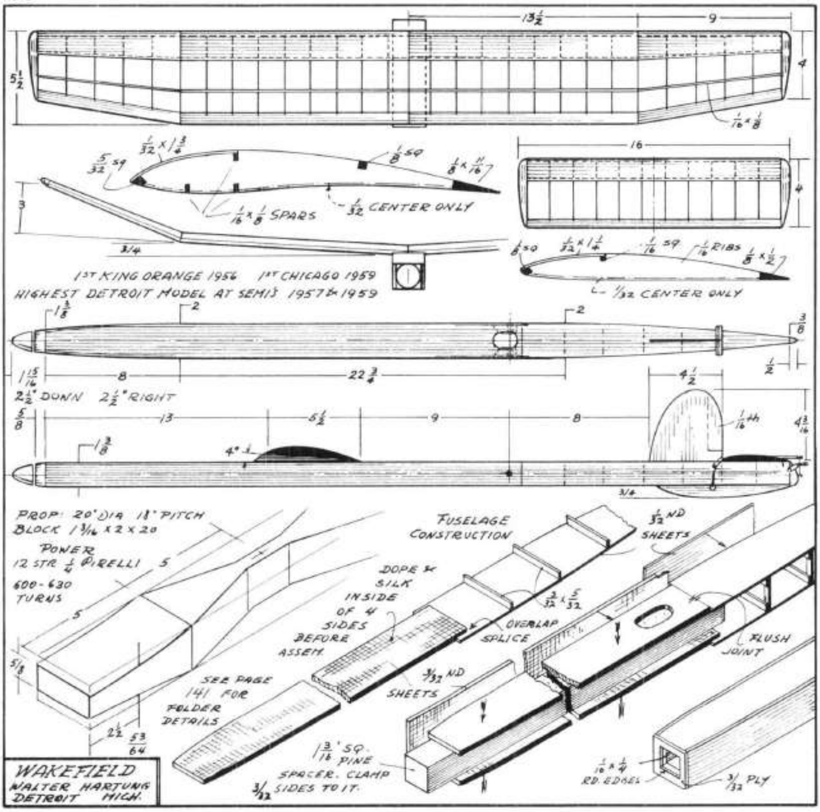

1/16 SQ SPARS
1/8 SQ
1/8 x 1/2
NACA 6409
3/16 SQ
1/16 x 1/8 SPARS
1/2 x 1/8
FULL SIZE PLANS OF THIS DESIGN, WITH DETAIL INSTRUCTIONS, IS BEING DISTRIBUTED BY CLEVELAND SOCIETY OF MODEL AERONAUTICS, FREE, TO STIMULATE INTEREST IN WAKEFIELD & F.A.I.
RUDDER - 1/8 SQ OUTLINE
1/8 SQ SPAR 1/16 x 1/8 RIBS
DIAGONALS ON APPOSITE SIDE
2° DOWN
0°
-2°
1 7/8 x 1 3/4
3 x 2 1/4
2 1/4 x 1/5 8
- FUSELAGE -
3/16 SQ. LONGERON
1/16 x 3/16 DIAGONALS
PROP: 20" DIA
CARVED FROM 1 1/4 x 3 1/2 x 10
X TYPE BLOCK -
FOR DETAILS SEE
PAGE 141
- POWER -
14 STRANDS
1/24 x 1/4 PIRELLI
CONTEST RECORD
1st PLACE, 1959 NATS, LARRY MILLER CLEVE.
1st PLACE, KING ORANGE MEET, BUCKY SERVAITES, DAYTON.
CLEVE. SOC. OF MODEL AERO.
"CHALLENGER"
By: J. ELGIN & G. REICH
DRAWN BY - V. ZUGEL
W. Zaic


128a
1/16 x 1/8
1/32 HD
1/8 sq
1/4 x 1/8 BASS
1/16 TH RIBS
1/8 x 7/32
1/16 x 1/8
BENEDEK B-8306B
7/8 WIDE
PROP
24"D. 24"P
BLOCK
1 x 3 x 12
W. Zaic
POWER
12 ST. OF 1/4 PIRRELLI
CLIMBS & GLIDES RIGHT - RIGHT THRUST ONLY
3/16 x 1 x 6 1/2 HD.
0°
85%
-4°
NOSE BLOCK
1 3/8 sq. PINE
BLADE PATTERN
FUSELAGE SIDES OF 1/8 TH SHEET BALSA. TAPER FROM PEG BACK TO 1/16 TH THICK, ALL SIDES. FUSELAGE HAS 2 COATS OF DOPE INSIDE APPLIED BEFORE ASSEMBLING
WAKEFIELD 1959
M. ANDRADE OAKLAND, CAL.

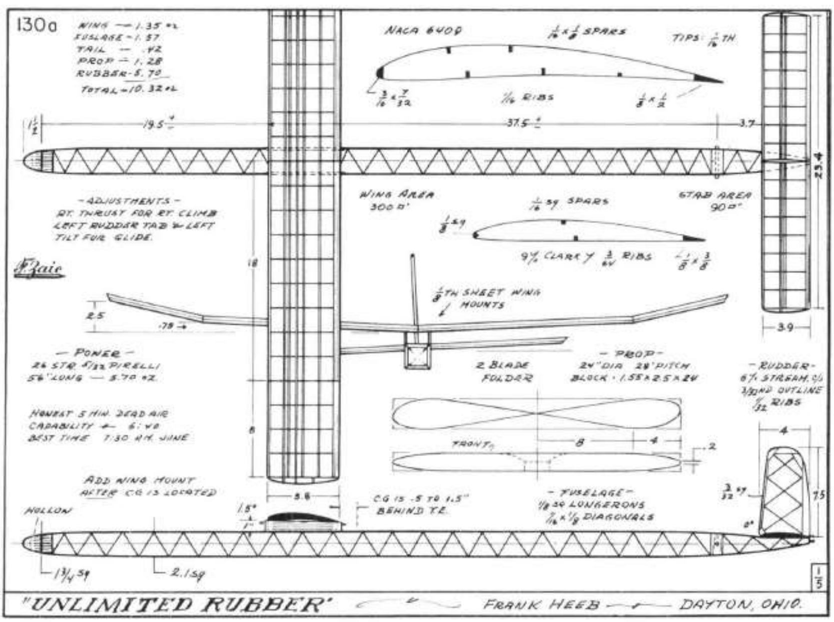

RIGHT THRUST 4°
1/16 SQ SPARS
1/5
1/16 x 1/8 SPARS
ALL RIBS 1/32 QT. GR
TIME 3:18 → 3.20
1/8 x 5/32
3/32 x 3/8
WING 227.5
19
WING 1.24 oz
FUSEL 3.21 oz
STAB 0.23 oz
PROP 1.65 oz
2" BUILT-IN WASHOUT EACH TIP
INNER-PANELS DEAD FLAT
1/8 VALVE TUBE
1/16 WIRE WING RUNNERS
1/32 SHEET CUT AWAY TO LOCATE WIRE
PLASTIC WOOD
1/4 ϕ DURAL TUBE
SUGGESTED MOD: SAME PROP P/D BUT REDUCE BLADE CHORD BY 1/4"
ALSO MAKE SPINNERED NOSE. TO ELIMINATE RISK OF BENDING SHAFT.
- FUSELAGE -
1/8 TH SHEET SIDES -
MOTOR PORTION LINED WITH 1/32 ND MED. & TISSUE.
TAPER TO 3/64 FROM X → Y
1 3/4 SQ.
FROM M.M.F.C. BULLETIN
PATTERN: TIGHT RIGHT POWER OPEN RIGHT GLIDE
80% C.G.
- FIN -
3 RIBS.
1/32 ND SHEET SIDES
AUTO STOP (NO SPRINGS)
DOWN
23 1/2
6 1/2
1/8 TH MUSH
PROP: DIA. 21" PITCH. 25 1/2 (GEOM)
OUTLINED ON 1 1/4 X 2 X 21 BLANK BEFORE CARVING.
16 STR. 5mm PIRELLI - 530 MAX. TURNS
MOTOR RUN: 48 sec.
2 1/2° LEFT OFF-SET
STAB 61.5
17 1/2
WON SINGLE CONTEST ENTERED: 863 sec.
THERMAL & WIND DUNKED SHIP IN PRIMEVAL FOREST. STILL THERE.
CHEROKEE WAKEFIELD
B.V. HAISMAN CANADA


129a
~1210
Dia 500
Pitch 750
110
35
280
5.7
125
30
2,5×15
Ribs - sheet 1.5mm
14,75 dm²
B - 8358 Airfoil
2 blade folding prop
500 Dia., 750 pitch
Sheet 2mm
Silk covered outside
paper inside
130
290
1170
Winner: Trials Event - 885 sec
Swedish Winter Contest - 900 sec.
Power: 12 Strands Pirelli 6×1
4,25 dm²
Own Airfoil
Ribs-sheet 1mm
500
3×5
2×10
Right-Left
25
85
Wakefield
RUB-NIK
by Lennard Tysklind-Sweden

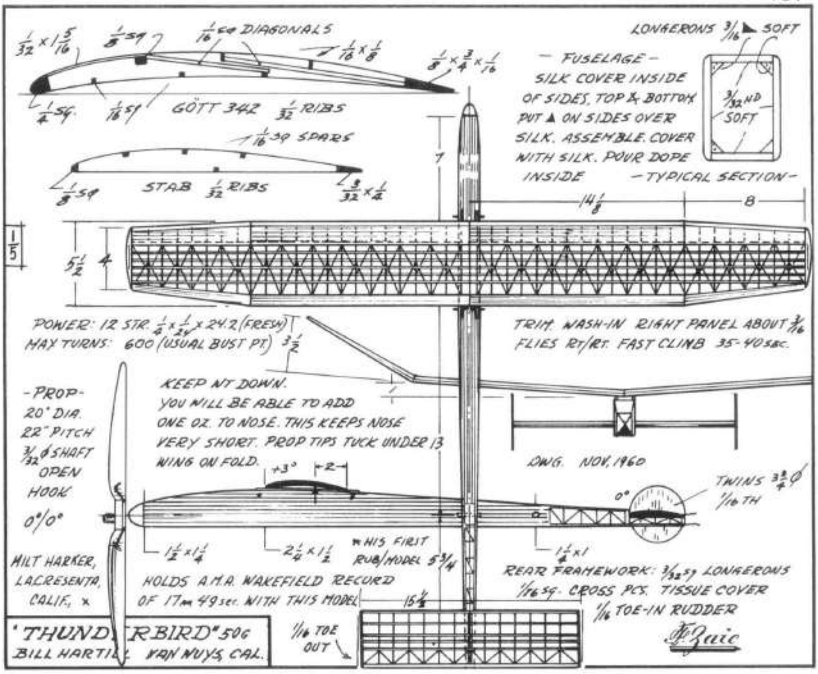
130

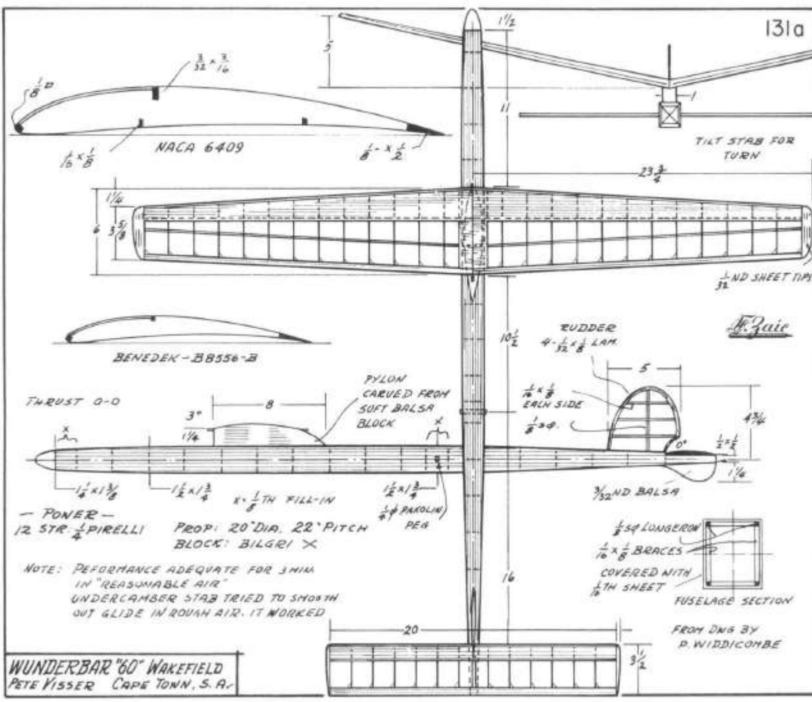


1ST KING ORANGE 1956 1ST CHICAGO 1959
HIGHEST DETROIT MODEL AT SEMI'S 1957 & 1959
1/16 x 1/8 SPARS
1/32 CENTER ONLY
1/32 CENTER ONLY
1/16 RIBS
2 1/2° DOWN 2 1/2° RIGHT
PROP: 20" DIA 18" PITCH
BLOCK 1 3/16 x 2 x 20
POWER
12 STR 1/4 PIRELLI
600-630 TURNS
FUSELAGE CONSTRUCTION
DOPE & SILK INSIDE OF 4 SIDES BEFORE ASSEM.
OVERLAP SPLICE
FLUSH JOINT
1/32 ND SHEETS
3/32 ND SHEETS
SEE PAGE 141 FOR FOLDER DETAILS
1 3/16" SQ. PINE SPACER. CLAMP 3/32 SIDES TO IT.
1/16 x 1/4 RD. EDGE
3/32 PLY
WAKEFIELD
WALTER HARTUNG
DETROIT MICH.

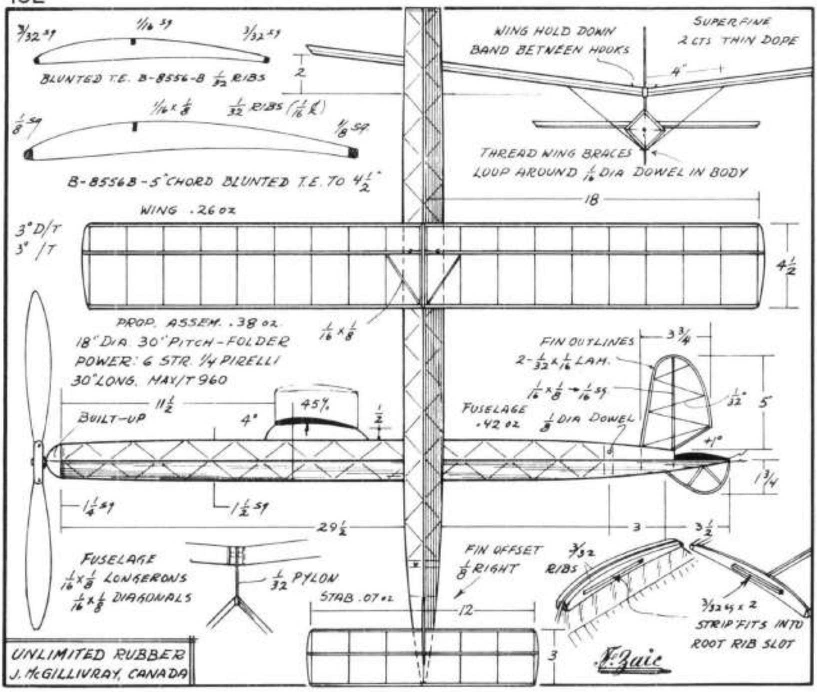


130a
WING — 1.35 oz
FUSLAGE — 1.57
TAIL — .42
PROP — 1.28
RUBBER — 5.70
TOTAL — 10.32 oz
NACA 6409
1/16 x 1/8 SPARS
TIPS: 1/16 TH
1/16 RIBS
WING AREA 300 □"
STAB AREA 90 □"
1/16 SQ SPARS
9% CLARK Y 3/64 RIBS
- ADJUSTMENTS -
RT. THRUST FOR RT. CLIMB
LEFT RUDDER TAB & LEFT TILT FOR GLIDE.
1/8 TH SHEET WING MOUNTS
- POWER -
26 STR 5/32 PIRELLI
56" LONG — 5.70 oz.
2 BLADE FOLDER
- PROP -
24" DIA 28" PITCH
BLOCK - 1.55 x 2.5 x 24
- RUDDER -
6% STREAM. 1/16
3/32 ND OUTLINE
1/32 RIBS
HONEST 5 MIN. DEAD AIR CAPABILITY — 6:40
BEST TIME 7:30 4 M. JUNE
FRONT
ADD WING MOUNT AFTER CG IS LOCATED
CG IS .5 TO 1.5" BEHIND T.E.
- FUSELAGE -
1/8 SQ LONGERONS
1/16 x 1/8 DIAGONALS
HOLLOW
"UNLIMITED RUBBER"
FRANK HEEB — DAYTON, OHIO.


"THUNDERBIRD" 50G
BILL HARTILL VAN NUYS, CAL.
GÖTT 342 1/32 RIBS
1/16 SQ DIAGONALS
1/16 SQ SPARS
STAB 1/32 RIBS
LONGERONS 3/16 SOFT
– FUSELAGE –
SILK COVER INSIDE OF SIDES, TOP & BOTTOM. PUT ▲ ON SIDES OVER SILK. ASSEMBLE. COVER WITH SILK. POUR DOPE INSIDE
– TYPICAL SECTION –
3/32 ND SOFT
POWER: 12 STR. 1/4 x 1/24 x 24.2 (FRESH)
MAX TURNS: 600 (USUAL BUST PT.)
TRIM. WASH-IN RIGHT PANEL ABOUT 3/16
FLIES RT/RT. FAST CLIMB 35-40 SEC.
KEEP WT DOWN. YOU WILL BE ABLE TO ADD ONE OZ. TO NOSE. THIS KEEPS NOSE VERY SHORT. PROP TIPS TUCK UNDER 13 WING ON FOLD.
– PROP –
20" DIA.
22" PITCH
3/32 ø SHAFT
OPEN HOOK
0°/0°
DWG. NOV. 1960
TWINS 3 3/4 ø 1/16 TH
*HIS FIRST RUB/MODEL
MILT HARKER, LACRESENTA, CALIF. *
HOLDS A.M.A. WAKEFIELD RECORD OF 17m 49sec. WITH THIS MODEL
REAR FRAMEWORK: 3/32 SQ LONGERONS 1/16 SQ. CROSS PCS. TISSUE COVER
1/16 TOE-IN RUDDER
1/16 TOE OUT
F. Zaic

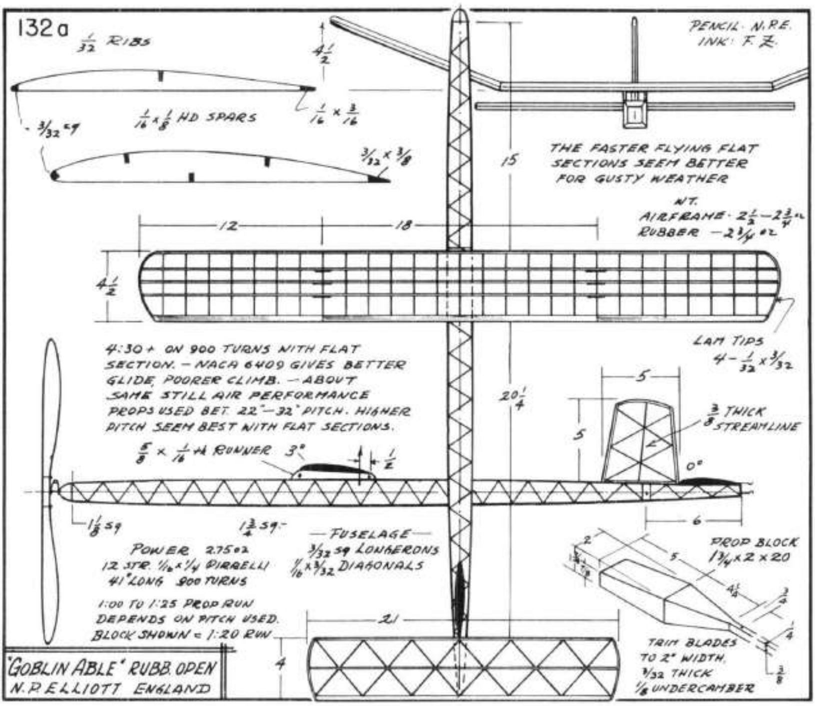

131a
NACA 6409
BENEDEK - B8556-B
TILT STAB FOR TURN
1/32 ND SHEET TIPS
RUDDER 4 - 1/32 x 1/8 LAM.
1/16 x 1/8 EACH SIDE
THRUST 0-0
PYLON CARVED FROM SOFT BALSA BLOCK
x - 1/8 TH FILL-IN
1/4 ø PAKOLIN PEG
3/32 ND BALSA
– POWER –
12 STR. 1/4 PIRELLI
PROP: 20" DIA. 22" PITCH
BLOCK: BILGRI X
1/8 SQ LONGERON
1/16 x 1/8 BRACES
COVERED WITH 1/16 TH SHEET
FUSELAGE SECTION
NOTE: PERFORMANCE ADEQUATE FOR 3 MIN. IN "REASONABLE AIR"
UNDERCAMBER STAB TRIED TO SMOOTH OUT GLIDE IN ROUGH AIR. IT WORKED
FROM DWG BY P. WIDDICOMBE
WUNDERBAR "60" WAKEFIELD
PETE VISSER CAPE TOWN, S. A.
F. Zaic

132

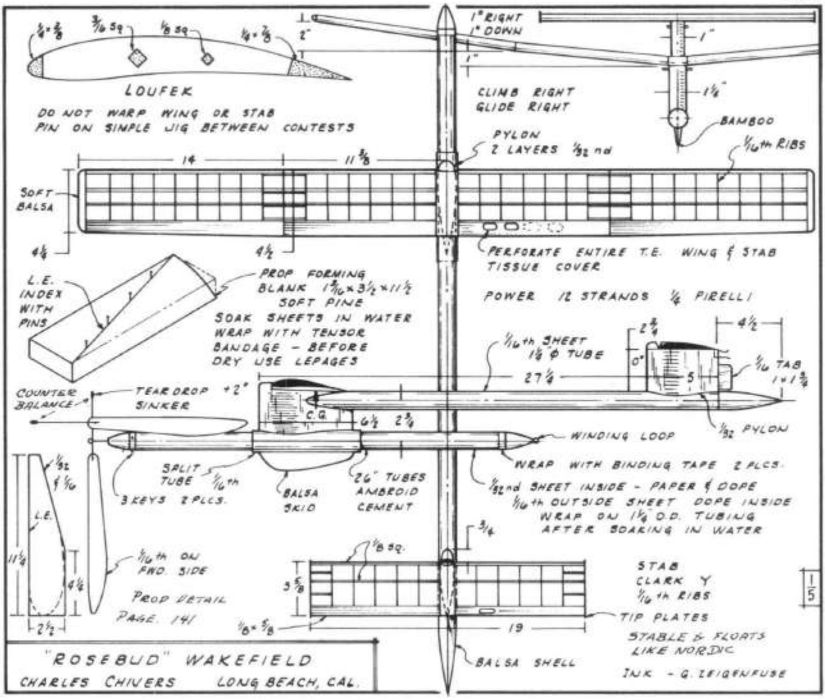


UNLIMITED RUBBER
J. McGILLIVRAY, CANADA

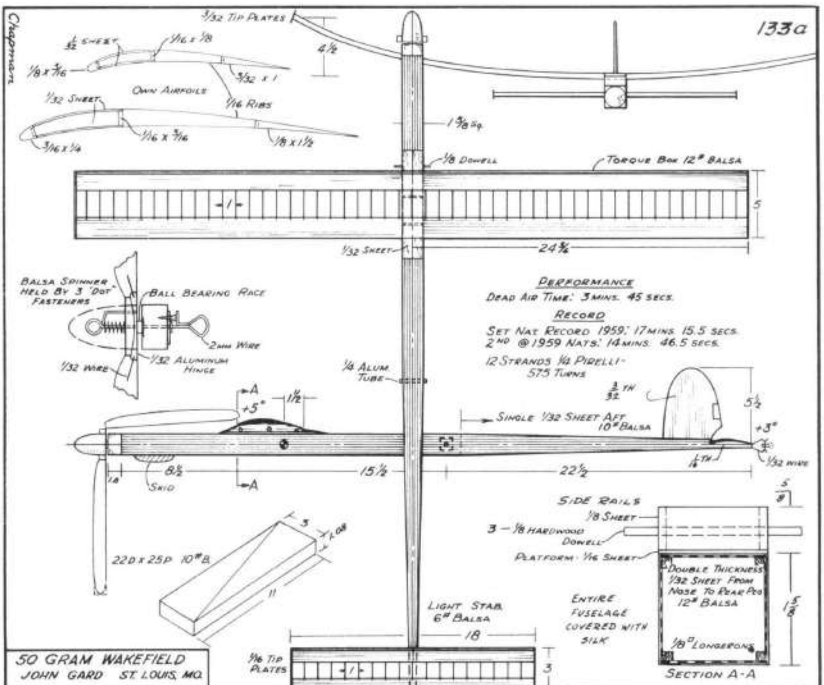
132a



"GOBLIN ABLE" RUBB. OPEN
N. P. ELLIOTT ENGLAND

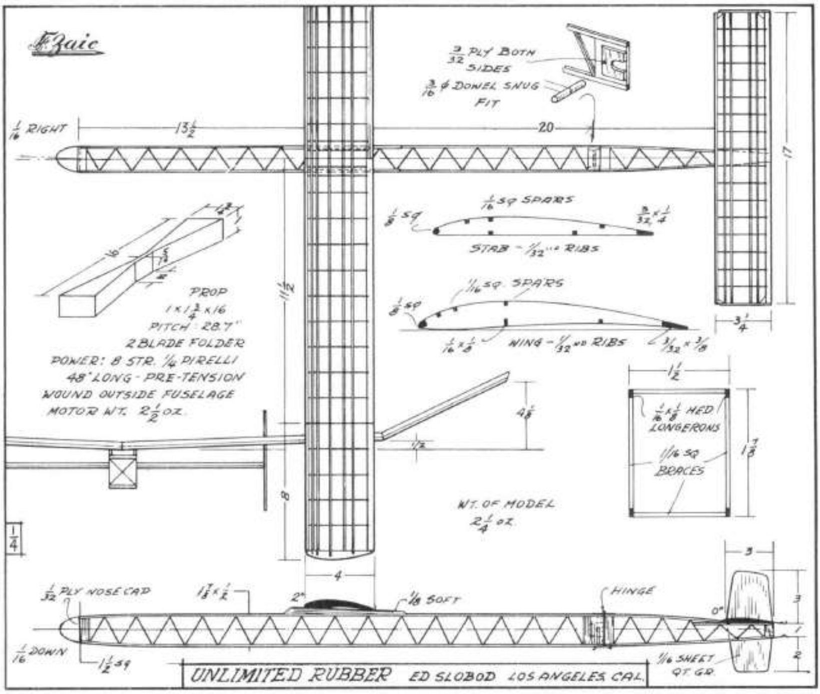


"ROSEBUD" WAKEFIELD
CHARLES CHIVERS LONG BEACH, CAL.

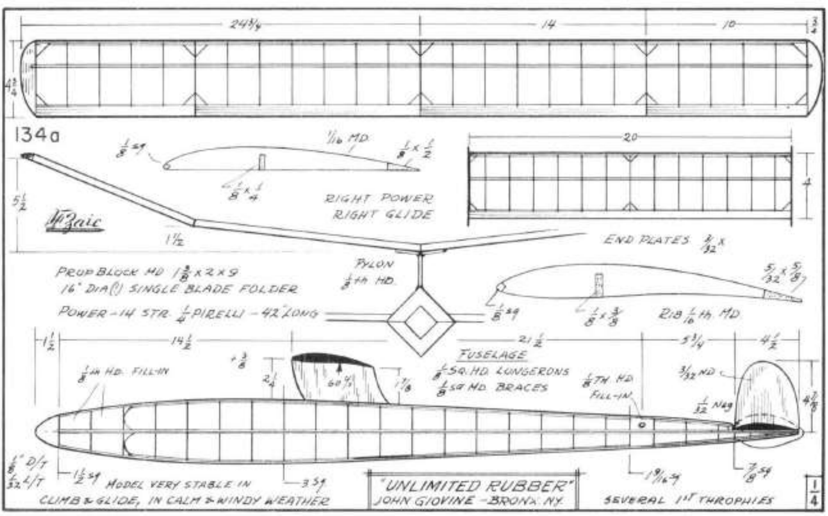


50 GRAM WAKEFIELD
JOHN GARD ST. LOUIS, MO.

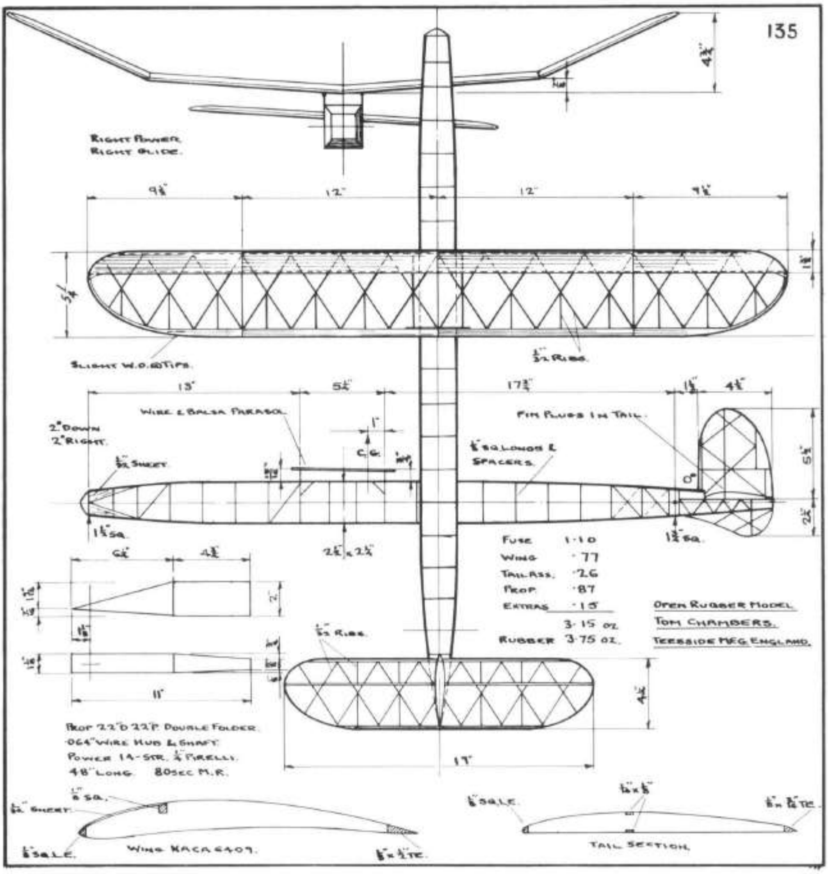
134

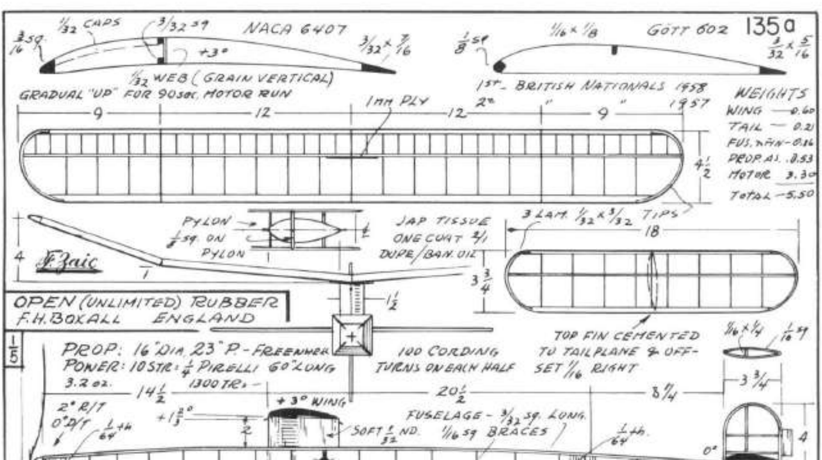


Zaic
3/32 PLY BOTH SIDES
3/16 ϕ DOWEL SNUG FIT
1/16 RIGHT
13 1/2
20
17
1/16 SQ SPARS
1/8 SQ
3/32 x 1/4
STAB - 1/32 MD RIBS
1/16 SQ. SPARS
1/8 SQ
1/16 x 1/8
WING - 1/32 MD RIBS
3/32 x 3/8
3 1/4
PROP
1 x 1 3/4 x 16
PITCH 28.7"
2 BLADE FOLDER
POWER: 8 STR. 1/4 PIRELLI
48" LONG - PRE-TENSION
WOUND OUTSIDE FUSELAGE
MOTOR WT. 2 1/2 OZ.
11 1/2
4 5/8
1 1/2
1/16 x 1/8 MED LONGERONS
1/16 SQ BRACES
1 7/8
WT. OF MODEL
2 1/4 OZ.
8
4
3
1/4
1/32 PLY NOSE CAP
1 7/8 x 1/2
2"
1/8 SOFT
HINGE
0°
1/16 DOWN
1 1/2 SQ
1/16 SHEET QT. GR.
UNLIMITED RUBBER ED SLOBOD LOS ANGELES CAL.

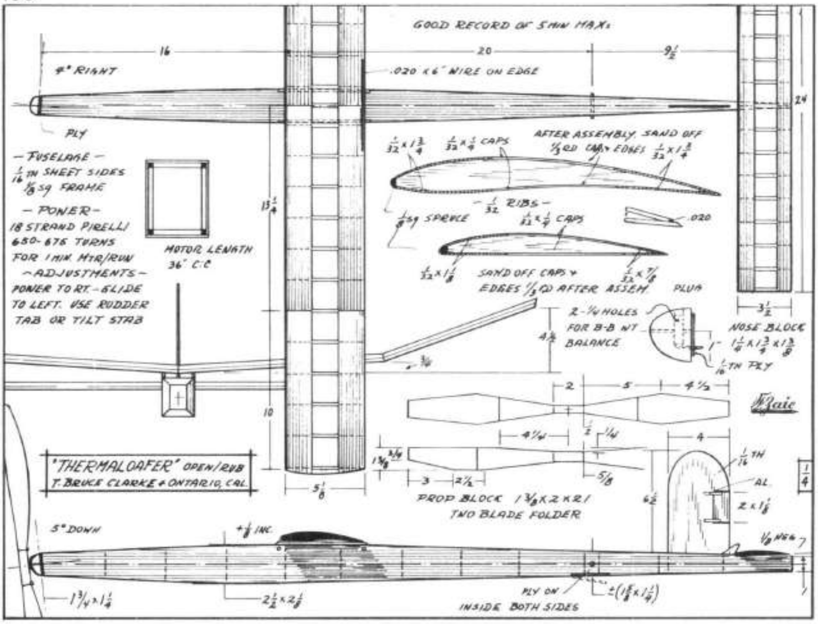


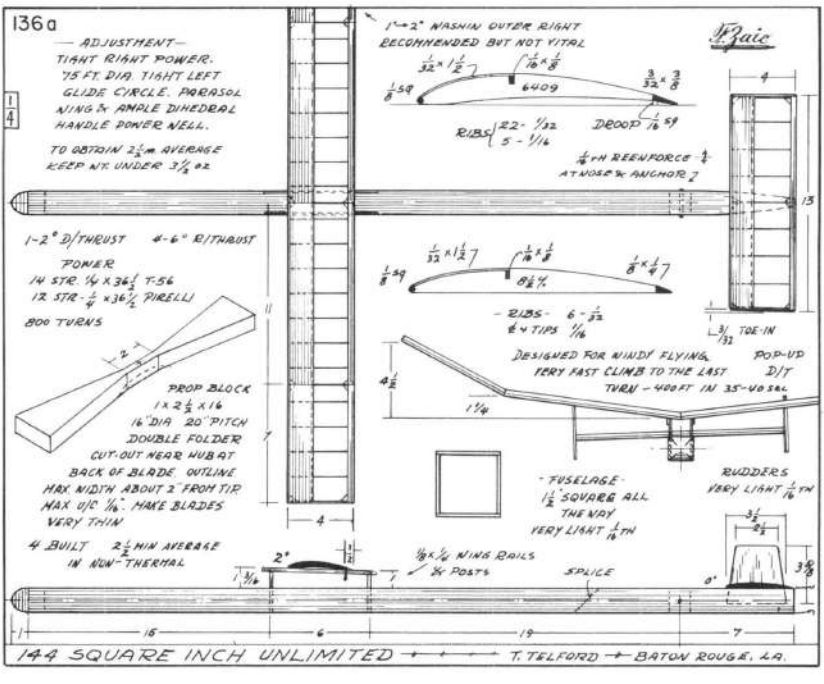
24 3/4
14
10
3/4
4 3/4
134a
1/8 SQ
1/16 MD.
1/8 x 1/2
1/8 x 1/4
20
4
5 1/2
Zaic
RIGHT POWER
RIGHT GLIDE
1 1/2
END PLATES 1/32 x
PYLON
1/8 th MD.
PROP BLOCK MD 1 3/8 x 2 x 9
16" DIA(?) SINGLE BLADE FOLDER
POWER - 14 STR. 1/4 PIRELLI - 42" LONG
5/32 x 5/8
1/8 SQ
1/8 x 3/8
RIB 1/16 th MD
1 1/2
14 1/2
21 1/2
5 3/4
4 1/2
FUSELAGE
1/8 SQ. MD. LONGERONS
1/8 SQ MD. BRACES
1/8 TH MD FILL-IN
3/32 MD
1/32 NEG
1/8 th MD. FILL-IN
+3/8
2 1/4
60%
1 7/8
4 7/8
1/8" D/T
1/32 L/T
1 1/2 SQ
MODEL VERY STABLE IN
CLIMB & GLIDE, IN CALM & WINDY WEATHER
3 SQ
"UNLIMITED RUBBER"
JOHN GIOVINE - BRONX N.Y.
19/16 SQ
7/8 SQ
SEVERAL 1ST THROPHIES
1/4

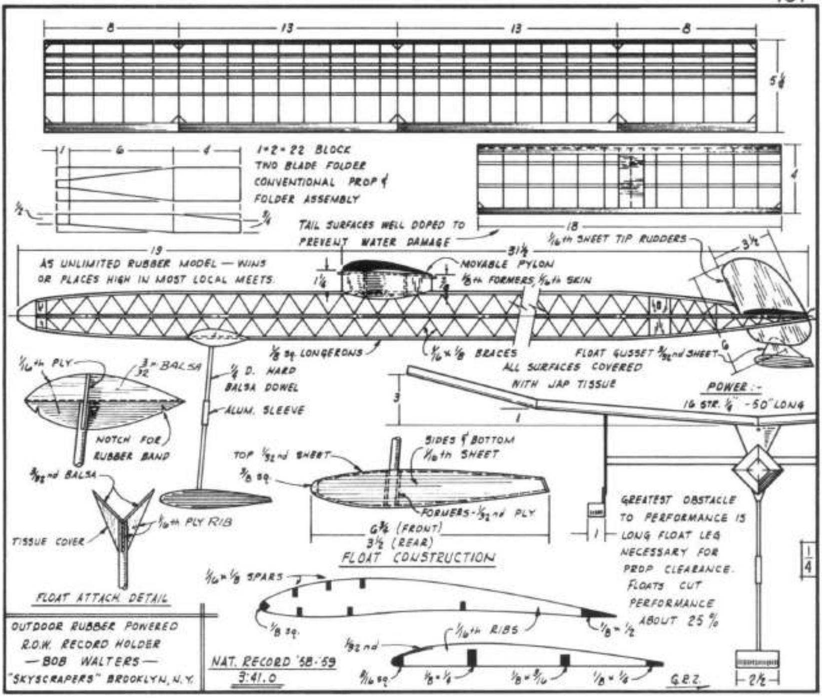

135
RIGHT POWER
RIGHT GLIDE.
SLIGHT W.O. @ TIPS.
WIRE & BALSA PARASOL
2° DOWN
2° RIGHT.
C.G.
FIN PLUGS IN TAIL.
SPACERS.
FUSE 1·10
WING ·77
TAIL ASS. ·26
PROP. ·87
EXTRAS ·15
3·15 OZ
RUBBER 3·75 OZ.
OPEN RUBBER MODEL
TOM CHAMBERS.
TEESSIDE MFG ENGLAND.
PROP 22"D 22"P. DOUBLE FOLDER.
·064" WIRE HUB & SHAFT.
POWER 14-STR. ¼" PIRELLI.
48" LONG. 80 SEC M.R.
WING NACA 6407.
TAIL SECTION.

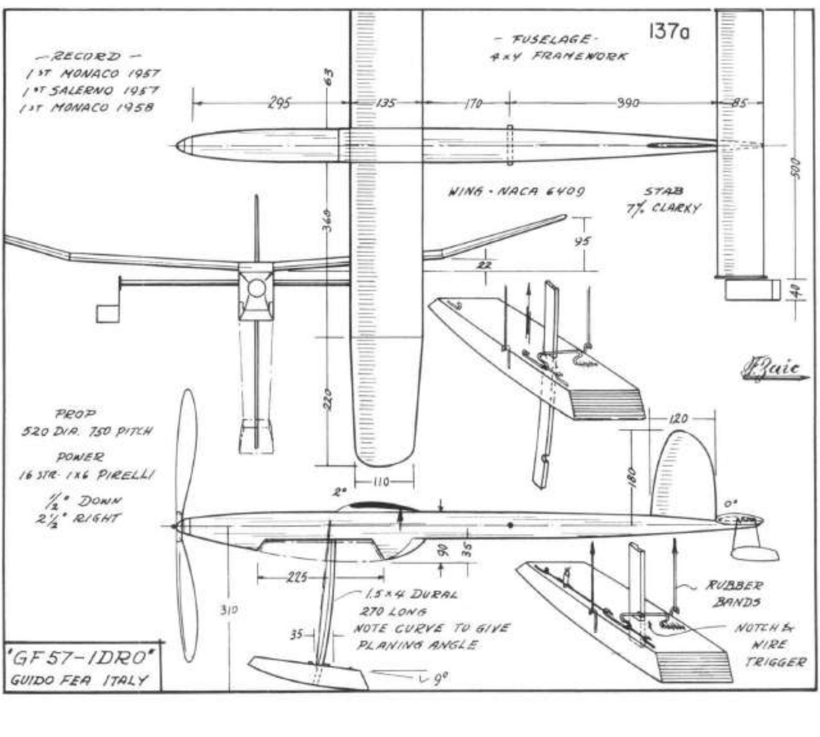

135a
NACA 6407
GÖTT 602
1/32 WEB (GRAIN VERTICAL)
GRADUAL "UP" FOR 90 SEC. MOTOR RUN
1ST - BRITISH NATIONALS 1958
2ND 1957
1 MM PLY
WEIGHTS
WING — 0.60
TAIL — 0.21
FUS. & FIN — 0.86
PROP. AS. — 0.53
MOTOR 3.30
TOTAL — 5.50
PYLON
PYLON
JAP TISSUE
ONE COAT 3/1
DOPE/BAN. OIL
TIPS
F. Zaic
OPEN (UNLIMITED) RUBBER
F.H. BOXALL ENGLAND
PROP: 16" DIA. 23" P. - FREEWHEEL
POWER: 10 STR. ¼ PIRELLI 60" LONG
100 CORDING
TURNS ON EACH HALF
TOP FIN CEMENTED
TO TAILPLANE & OFF-
SET 1/16 RIGHT
+3° WING
FUSELAGE - 3/32 SQ. LONG.
1/16 SQ BRACES
LOW POWER
EASY TRIM
3/32 SQ BRACES ON TOP ONLY

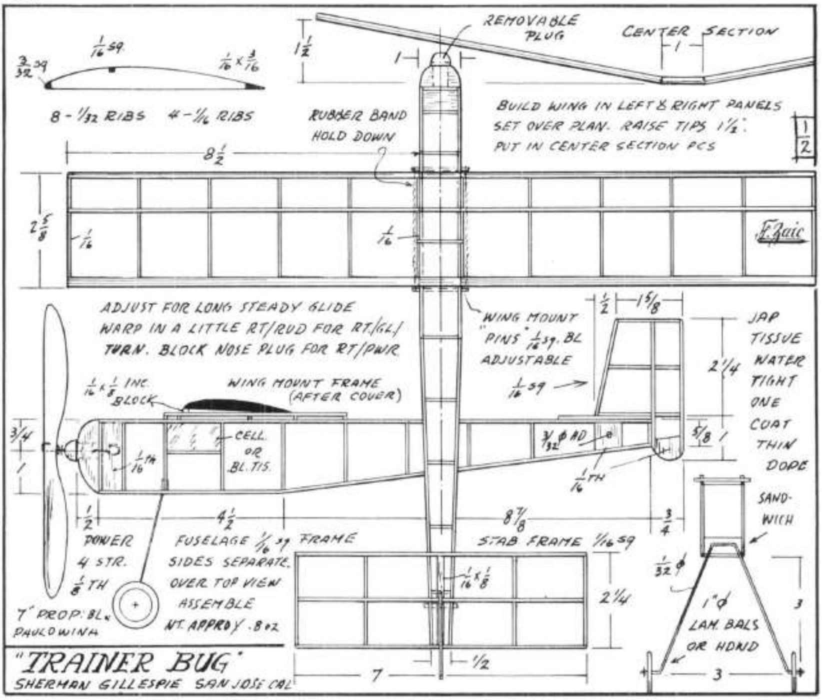
136


GOOD RECORD OF 5 MIN MAX.
16
20
9½
4° RIGHT
.020 x 6" WIRE ON EDGE
24
PLY
— FUSELAGE —
1/16 TH SHEET SIDES
1/8 SQ FRAME
— POWER —
18 STRAND PIRELLI
650-675 TURNS
FOR 1 MIN. MTR/RUN
— ADJUSTMENTS —
POWER TO RT. – GLIDE
TO LEFT. USE RUDDER
TAB OR TILT STAB
MOTOR LENGTH
36" C/C
13¼
1/32 x 1¾
1/32 x ¼ CAPS
AFTER ASSEMBLY, SAND OFF
1/3RD CAPS & EDGES 1/32 x 1¾
— 1/32 RIBS —
1/8 SQ SPRUCE
1/32 x ¼ CAPS
.020
1/32 x 1⅛
SAND OFF CAPS &
EDGES 1/3 RD AFTER ASSEM.
1/32 x 7/8
PLUG
2 – ¼ HOLES
FOR B-B WT
BALANCE
4½
3½
NOSE BLOCK
1¼ x 1¾ x 1⅜
1/16 TH PLY
¾
2
5
4½
F. Zaic
10
4¼
1/4
4
1/16 TH
"THERMALOAFER" OPEN/RUB
T. BRUCE CLARKE • ONTARIO, CAL.
1⅜
3
2½
5/8
5⅛
AL
2 x 1⅛
PROP BLOCK 1⅜ x 2 x 21
TWO BLADE FOLDER
6½
5° DOWN
+⅛ INC.
⅛ NEG.
1¾ x 1¼
2½ x 2½
PLY ON
INSIDE BOTH SIDES
±(1⅛ x 1½)
1

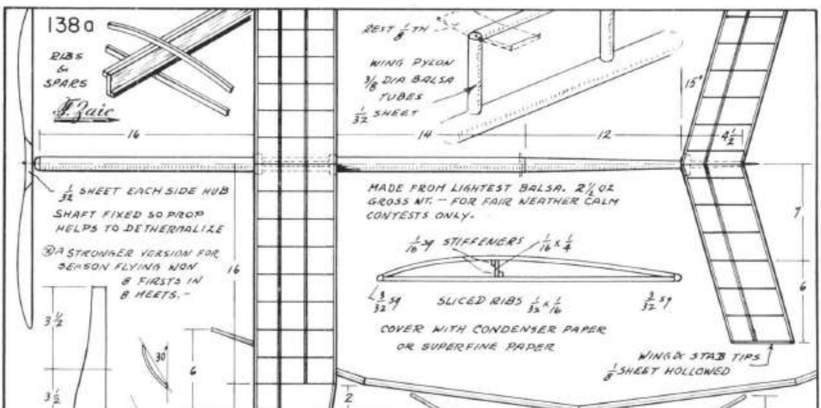

136a
— ADJUSTMENT —
TIGHT RIGHT POWER.
75 FT. DIA. TIGHT LEFT
GLIDE CIRCLE. PARASOL
WING & AMPLE DIHEDRAL
HANDLE POWER WELL.
TO OBTAIN 2½ m AVERAGE
KEEP WT. UNDER 3½ oz
1°→2° WASHIN OUTER RIGHT
RECOMMENDED BUT NOT VITAL
F. Zaic
1/32 x 1½
1/16 x ⅛
1/8 SQ
6409
3/32 x ⅜
4
RIBS 22 – 1/32
5 – 1/16
DROOP 1/16 SQ
1/16 TH REENFORCE
AT NOSE & ANCHOR
13
1-2° D/THRUST
4-6° R/THRUST
POWER
14 STR. ¼ x 36½ T-56
12 STR. – ¼ x 36½ PIRELLI
800 TURNS
1/32 x 1½
1/16 x ⅛
1/8 SQ
8½ %
1/8 x ¼
— RIBS — 6 – 1/32
& 4 TIPS 1/16
3/32 TOE-IN
2
DESIGNED FOR WINDY FLYING
VERY FAST CLIMB TO THE LAST
TURN – 400 FT IN 35-40 SEC.
POP-UP
D/T
PROP BLOCK
1 x 2½ x 16
16" DIA 20" PITCH
DOUBLE FOLDER
CUT-OUT NEAR HUB AT
BACK OF BLADE. OUTLINE
MAX. WIDTH ABOUT 2" FROM TIP
MAX. U/C 1/16". MAKE BLADES
VERY THIN
11
4½
1¼
7
- FUSELAGE -
1½ SQUARE ALL
THE WAY
VERY LIGHT 1/16 TH
RUDDERS
VERY LIGHT 1/16 TH
3½
2½
4
4 BUILT 2½ MIN AVERAGE
IN NON-THERMAL
2°
½
1 3/16
1
⅛ x ¼ WING RAILS
& POSTS
SPLICE
0°
3⅜
1
16
6
19
7
144 SQUARE INCH UNLIMITED — T. TELFORD — BATON ROUGE, LA.

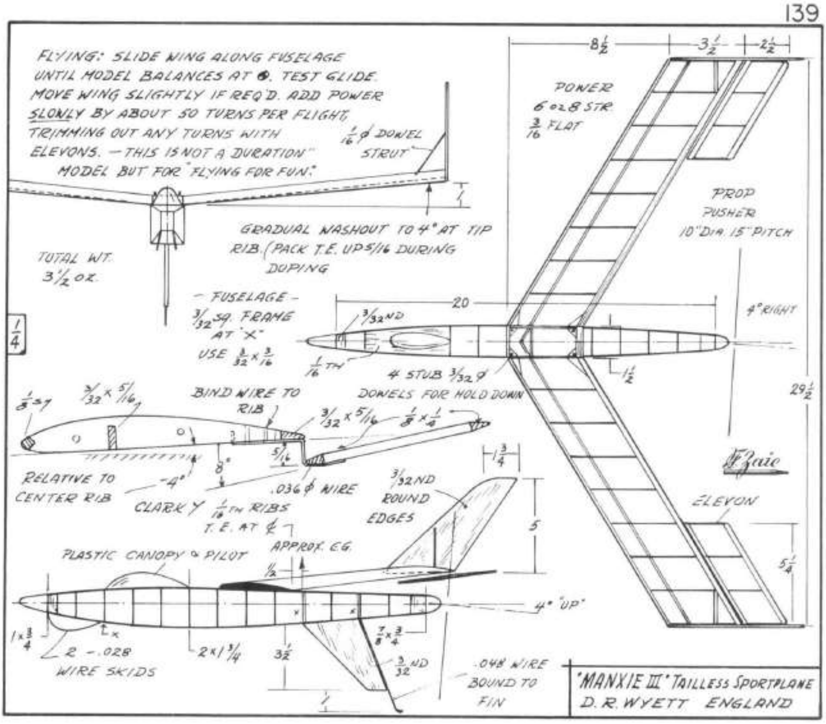

1=2=22 BLOCK
TWO BLADE FOLDER
CONVENTIONAL PROP & FOLDER ASSEMBLY
TAIL SURFACES WELL DOPED TO PREVENT WATER DAMAGE
1/16th SHEET TIP RUDDERS
AS UNLIMITED RUBBER MODEL — WINS OR PLACES HIGH IN MOST LOCAL MEETS.
MOVABLE PYLON
1/8th FORMERS, 1/16th SKIN
1/8 sq. LONGERONS
1/16 x 1/8 BRACES
FLOAT GUSSET 3/32nd SHEET
ALL SURFACES COVERED WITH JAP TISSUE
POWER :- 16 STR. 1/4" -50" LONG
1/16th PLY
3/32" BALSA
1/4 D. HARD BALSA DOWEL
ALUM. SLEEVE
NOTCH FOR RUBBER BAND
3/32nd BALSA
1/16th PLY RIB
TISSUE COVER
FLOAT ATTACH. DETAIL
TOP 1/32nd SHEET
SIDES & BOTTOM 1/16th SHEET
3/8 sq.
FORMERS-1/32nd PLY
6 3/4 (FRONT)
3 1/2 (REAR)
FLOAT CONSTRUCTION
GREATEST OBSTACLE TO PERFORMANCE IS LONG FLOAT LEG NECESSARY FOR PROP CLEARANCE. FLOATS CUT PERFORMANCE ABOUT 25 %
1/16 x 1/8 SPARS
1/8 sq.
1/8 = 1/2
1/16th RIBS
3/32nd
3/16 sq.
1/8 = 1/4
1/8 = 3/16
1/8 = 1/4
G.R.Z.
OUTDOOR RUBBER POWERED R.O.W. RECORD HOLDER
— BOB WALTERS —
"SKYSCRAPERS" BROOKLYN, N.Y.
NAT. RECORD '58-'59
3:41.0

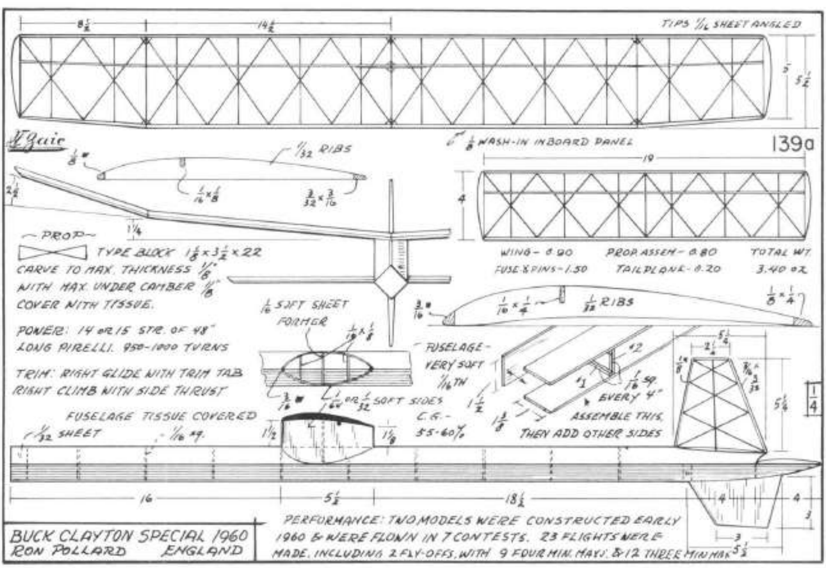

137a
— RECORD —
1ST MONACO 1957
1ST SALERNO 1957
1ST MONACO 1958
— FUSELAGE —
4 x 4 FRAMEWORK
WING - NACA 6409
STAB 7% CLARKY
PROP
520 DIA. 750 PITCH
POWER
16 STR. 1x6 PIRELLI
1/2° DOWN
2 1/2° RIGHT
1.5 x 4 DURAL
270 LONG
NOTE CURVE TO GIVE PLANING ANGLE
RUBBER BANDS
NOTCH & WIRE TRIGGER
"GF 57-IDRO"
GUIDO FEA ITALY


REMOVABLE PLUG
CENTER SECTION
8 - 1/32 RIBS 4 - 1/16 RIBS
RUBBER BAND HOLD DOWN
BUILD WING IN LEFT & RIGHT PANELS SET OVER PLAN. RAISE TIPS 1 1/2". PUT IN CENTER SECTION PCS
F. Zaic
ADJUST FOR LONG STEADY GLIDE WARP IN A LITTLE RT/RUD FOR RT/GL/ TURN. BLOCK NOSE PLUG FOR RT/PWR
WING MOUNT "PINS" 1/16 sq. BL ADJUSTABLE
JAP TISSUE WATER TIGHT ONE COAT THIN DOPE
WING MOUNT FRAME (AFTER COVER)
CELL. OR BL. TIS.
SAND-WICH
POWER 4 STR. 1/8 TH
FUSELAGE 1/16 sq FRAME SIDES SEPARATE. OVER TOP VIEW ASSEMBLE
WT. APPROX .8 oz
STAB FRAME 1/16 sq
1" ⌀ LAM. BALS OR HDWD
7" PROP: BL. or PAULOWNIA
"TRAINER BUG"
SHERMAN GILLESPIE SAN JOSE CAL

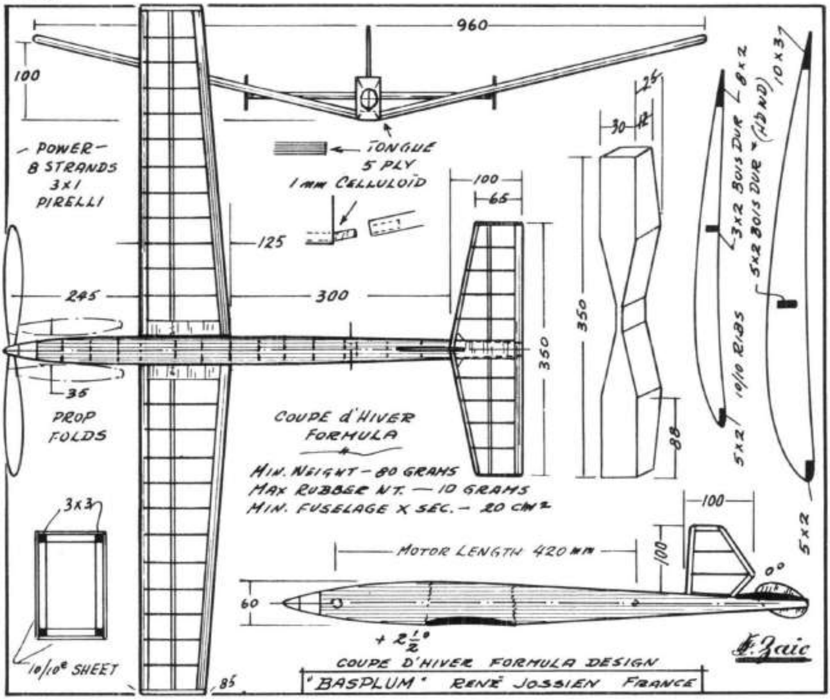
138a

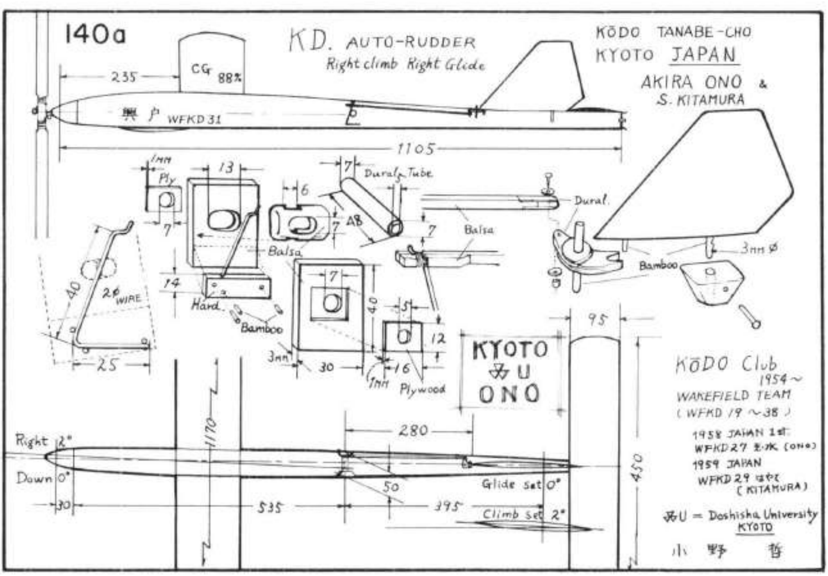

RIBS & SPARS
F. Zaic
1/32 SHEET EACH SIDE HUB
SHAFT FIXED SO PROP HELPS TO DETHERMALIZE
Ⓐ A STRONGER VERSION FOR SEASON FLYING WON 8 FIRSTS IN 8 MEETS.-
WING PYLON 3/8 DIA BALSA TUBES 1/32 SHEET
MADE FROM LIGHTEST BALSA. 2 1/2 OZ GROSS WT. — FOR FAIR WEATHER CALM CONTESTS ONLY.
SLICED RIBS 1/32 x 1/16
COVER WITH CONDENSER PAPER OR SUPERFINE PAPER
WING & STAB TIPS 1/8 SHEET HOLLOWED
POWER— 6 STRANDS PIRELLI 1/16 x 36" LONG. 1200 TURNS 5 1/2 MIN. PROP RUN
Ⓐ WING ON SQUARE FUSELAGE FOR TOTAL WT. — 12 ST. OF 1/4
PROP 24 DIA. x 26 P. MAKE FROM LIGHT 1/16 SHEET. WARP TO GIVE UNDERCAMBER & PITCH ROLL-OUT.
Ⓐ SAME WING & STAB BUT STRENGTHENED.
1" DIA. 1/32 BALSA SHEET TUBES
"PRACTICALLY NOTHIN"
UNLIM RUBBER
George Perryman SMYRNA, GA.

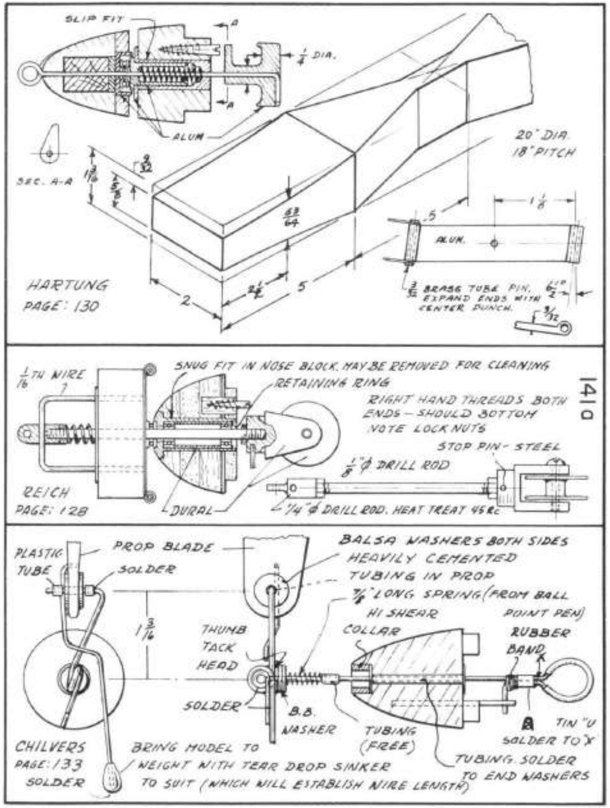

FLYING: SLIDE WING ALONG FUSELAGE UNTIL MODEL BALANCES AT ⊕. TEST GLIDE. MOVE WING SLIGHTLY IF REQ'D. ADD POWER SLOWLY BY ABOUT 50 TURNS PER FLIGHT, TRIMMING OUT ANY TURNS WITH ELEVONS. — THIS IS NOT A "DURATION" MODEL BUT FOR "FLYING FOR FUN."
1/16 ϕ DOWEL STRUT
GRADUAL WASHOUT TO 4° AT TIP RIB. (PACK T.E. UP 5/16 DURING DOPING
TOTAL WT. 3 1/2 OZ.
POWER 6 OR 8 STR. 3/16 FLAT
PROP PUSHER 10" DIA. 15" PITCH
— FUSELAGE — 3/32 SQ. FRAME AT "X" USE 3/32 x 3/16
3/32 RND
1/16 TH
4 STUB 3/32 ϕ DOWELS FOR HOLD DOWN
4° RIGHT
1/4
1/8 SQ
3/32 x 5/16
BIND WIRE TO RIB
3/32 x 5/16
1/8 x 1/4
5/16
8°
RELATIVE TO CENTER RIB
-4°
.036 ϕ WIRE
CLARK Y 1/16 TH RIBS T.E. AT ℄
3/32 RND ROUND EDGES
APPROX. C.G.
PLASTIC CANOPY & PILOT
ELEVON
4° "UP"
1 x 3/4
2 - .028 WIRE SKIDS
2 x 1 3/4
3 1/2
7/8 x 3/4
3/32 RND
.048 WIRE BOUND TO FIN
8 1/2
3 1/2
2 1/2
20
1 1/2
29 1/2
1 3/4
5
5 1/4
1/2
1
"MANXIE III" TAILLESS SPORTPLANE
D. R. WYETT ENGLAND

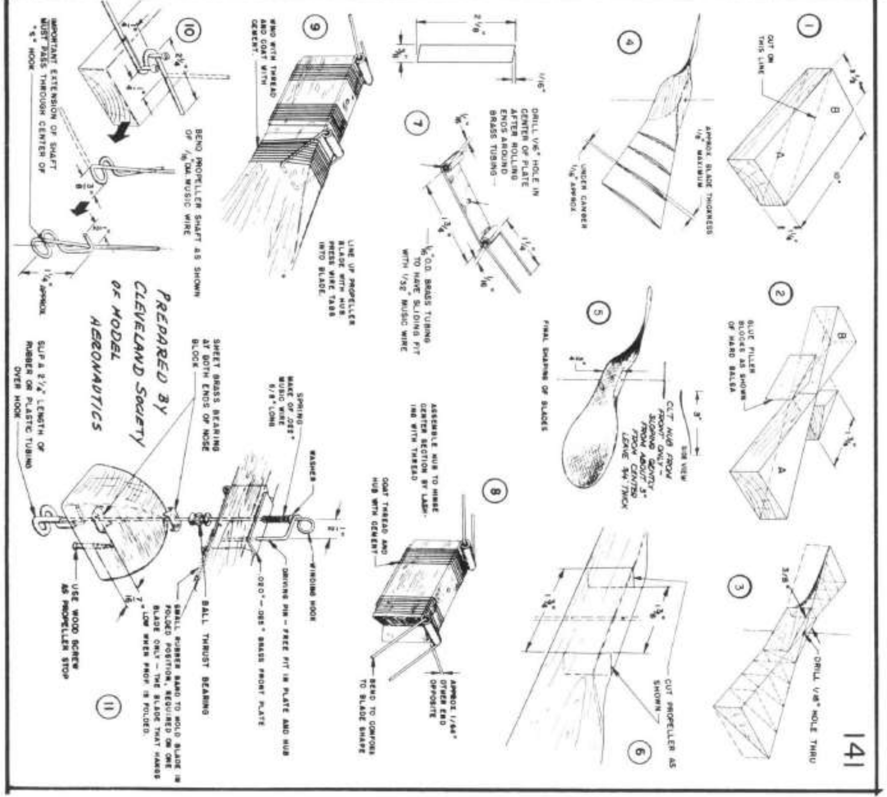

8 1/2
14 1/2
TIPS 1/16 SHEET ANGLED
5
5 1/2
139a
1/8 SQ
1/32 RIBS
6" 1/8 WASH-IN INBOARD PANEL
19
2 1/2
1/16 x 1/8
3/32 x 3/16
4
1 1/4
— PROP —
TYPE BLOCK 1 1/8 x 3 1/2 x 22
CARVE TO MAX. THICKNESS 1/8" WITH MAX. UNDER CAMBER 1/8" COVER WITH TISSUE.
WING - 0.90
PROP. ASSEM - 0.80
TOTAL WT. 3.40 OZ
FUSE. & PINS - 1.50
TAILPLANE - 0.20
1/16 SOFT SHEET FORMER
3/16 SQ
1/16 x 1/4
1/32 RIBS
1/8 x 1/4
POWER: 14 OR 15 STR. OF 48" LONG PIRELLI. 950-1000 TURNS
TRIM: RIGHT GLIDE WITH TRIM TAB RIGHT CLIMB WITH SIDE THRUST
FUSELAGE - VERY SOFT 1/16 TH
1/16 x 1/8
#2
#1
1/16 SQ. EVERY 4"
ASSEMBLE THIS, THEN ADD OTHER SIDES
3/16 SQ
1/64 OR 1/32 SOFT SIDES
C.G. - 55-60%
FUSELAGE TISSUE COVERED
1/32 SHEET
1/16 SQ.
1 1/2
1 1/8
1 1/2
1 3/8
2 1/4
5 1/4
5 1/4
1/4
16
5 1/2
18 1/2
4
4
3
3
5 1/2
BUCK CLAYTON SPECIAL 1960
RON POLLARD ENGLAND
PERFORMANCE: TWO MODELS WERE CONSTRUCTED EARLY 1960 & WERE FLOWN IN 7 CONTESTS. 23 FLIGHTS WERE MADE, INCLUDING 2 FLY-OFFS, WITH 9 FOUR MIN. MAXS. & 12 THREE MIN MAX

140


960
100
POWER
8 STRANDS
3x1
PIRELLI
TONGUE
5 PLY
1mm CELLULOID
125
100
65
25
30
12
245
300
350
350
36
PROP
FOLDS
COUPE d'HIVER
FORMULA
MIN. WEIGHT – 80 GRAMS
MAX RUBBER WT. — 10 GRAMS
MIN. FUSELAGE X SEC. – 20 CM²
88
3x2 BOIS DUR
5x2 BOIS DUR
8x2
10x3
(HD WD)
10/10 RIBS
5x2
5x2
3x3
100
MOTOR LENGTH 420 mm
100
0°
60
+ 2½°
10/10° SHEET
85
COUPE D'HIVER FORMULA DESIGN
"BASPLUM" RENÉ JOSSIEN FRANCE
F. Zaic


140a
K.D. AUTO-RUDDER
Right climb Right Glide
KŌDO TANABE-CHO
KYOTO JAPAN
AKIRA ONO &
S. KITAMURA
235
CG 88%
WFKD 31
1105
1mm Ply
13
7
6
7
Dural Tube
Dural
A8
7
Balsa
Balsa
3mm ø
Bamboo
7
40
14
20 WIRE
Hard
Bamboo
40
25
5
12
3mm
30
16
1mm
Plywood
KYOTO
U
ONO
95
KŌDO Club
1954 ~
WAKEFIELD TEAM
(WFKD 19 ~ 38)
1958 JAPAN 1st
WFKD 27 (ONO)
1959 JAPAN
WFKD 29 (KITAMURA)
280
1170
Right 2°
Down 0°
50
450
Glide Set 0°
30
535
395
Climb Set 2°
U = Doshisha University
KYOTO
小 野 哲


141a
SLIP FIT
A
1/4 DIA.
SEC. A-A
ALUM
20" DIA.
18" PITCH
63/64
ALUM.
3/32 BRASS TUBE PIN. EXPAND ENDS WITH CENTER PUNCH.
HARTUNG
PAGE: 130
1/16TH WIRE
SNUG FIT IN NOSE BLOCK. MAY BE REMOVED FOR CLEANING
RETAINING RING
RIGHT HAND THREADS BOTH ENDS — SHOULD BOTTOM
NOTE LOCK NUTS
STOP PIN - STEEL
1/8" Ø DRILL ROD
REICH
PAGE: 128
DURAL
1/4" Ø DRILL ROD. HEAT TREAT 45Rc
PLASTIC TUBE
PROP BLADE
SOLDER
BALSA WASHERS BOTH SIDES
HEAVILY CEMENTED
TUBING IN PROP
3/4" LONG SPRING (FROM BALL POINT PEN)
HI SHEAR COLLAR
RUBBER BAND
THUMB TACK HEAD
SOLDER
B.B. WASHER
TUBING (FREE)
TIN "U"
SOLDER TO "X"
CHILVERS
PAGE: 133
SOLDER
BRING MODEL TO WEIGHT WITH TEAR DROP SINKER TO SUIT (WHICH WILL ESTABLISH WIRE LENGTH)
TUBING. SOLDER TO END WASHERS


141
PREPARED BY
CLEVELAND SOCIETY
OF MODEL
AERONAUTICS

SMALL AREA STABILIZER ON A/2 Dick Foster, Canada

The Nordic A/2 glider, in spite of its relatively recent conception, has evolved into a highly efficient aircraft. It has advanced through the generally accepted NACA 6409 and Cheeseman eras and now stands on the threshold of becoming a reasonably consistent 2 minute 50 second model. In attempting to solve the 3 minute riddle, many approaches have been employed, some of which have been based on profound theoretical knowledge, and some strictly on guesswork. However, the 3 minute Nordic as I see it, remains something yet to be attained.

Although the designs I flew during 1959 seemed to be fairly consistently capable of 2 minutes 40 seconds, I was not familiar with the aerodynamic characteristics of my airfoil, and since any change to the airfoil at this time would have been sheer speculation, I decided to try increasing the existing endurance using a completely different approach.

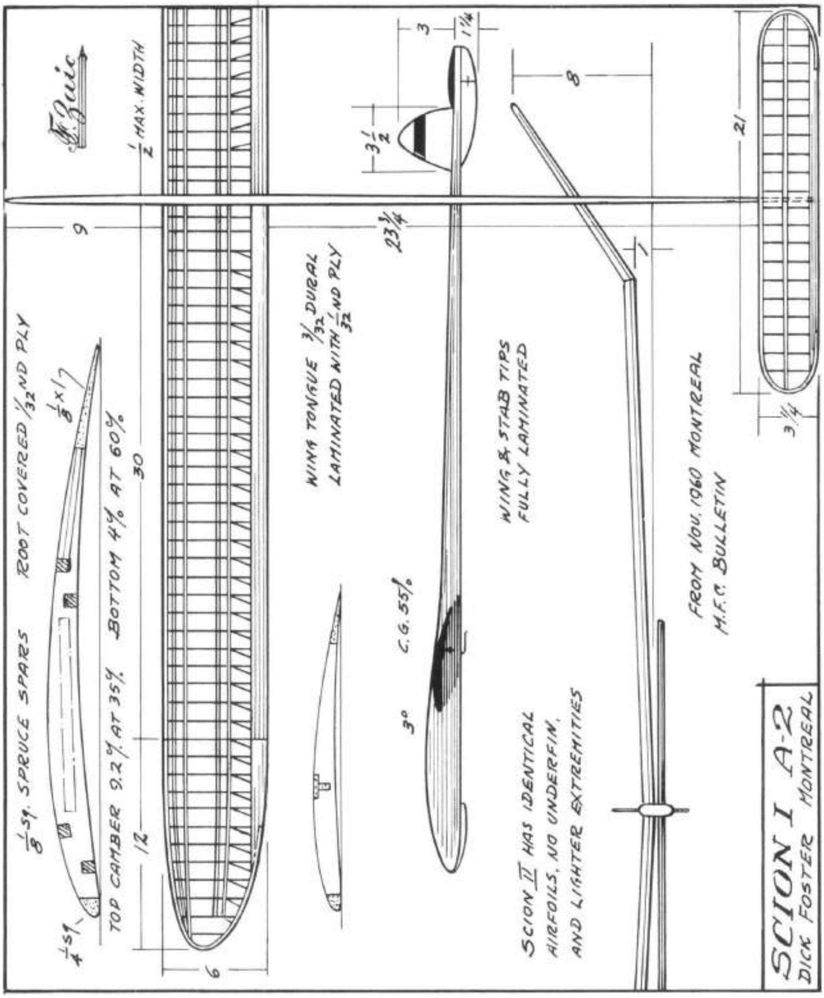
When thinking in terms of optimum gliding efficiency, I have often considered the possibilities of an all wing design. It becomes immediately obvious, however, that, in order to maintain longitudinal stability with such a short moment, the airfoil must be distorted, resulting in a decreased lift-to-drag ratio and, therefore, in part, defeating its own purpose. Conversely, if an all wing glider could be flown having, for example, a Lindner type airfoil which was undistorted throughout its span, I feel certain that its performance would prove superior to any present day A/2. My approach, therefore, was to put as many of the 527 square inches into the wing as would be practical without suffering a loss of stability.

With the foregoing in mind, I designed SCION 1. This model had a 55 square inch stabilizer which was virtually bottomed, the tail moment (CG to ¼ stabilizer chord) was 30 inches with the CG positioned at 56% of wing chord. The performance of this A/2, as originally built, far exceeded my expectations. There appeared to be no apparent loss of longitudinal stability and the stall characteristics were reasonable. The only apparent drawback was the inability of the model to dethermalize properly and, although this appeared an insignificant characteristic at the time, it later proved to be most important.

Just prior to the eliminations I managed to snap a wing tip due to a poor d/t and on my last flight at the first eliminations I snapped the fuselage boom. The patched up model was flown at the second eliminations and performed very well.

Having been fortunate enough to gain a place on the team I decided to provide a new and stronger (but also heavier) fuselage for the model. The outcome of all this revealed the following.

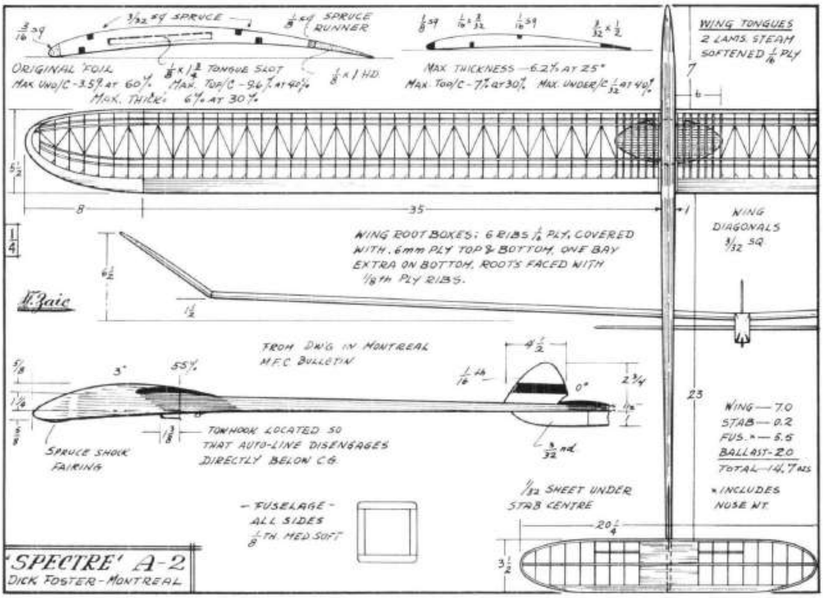
(a) A Nordic with a relatively small stabilizer becomes increasingly sensitive to small alterations in weight, i.e. if the weight aft of the CG is increased slightly, the power of the stabilizer must be increased considerably.



(b) In order to achieve successful d/t's when using a small stabilizer, the d/t angle must be very carefully adjusted for and, since the angle is very critical, it is also extremely susceptible to small changes in weight.

The problem presented in (a) above becomes even greater when one considers that, as the stabilizer is lessened in area, the tail moment arm must be increased to maintain acceptable longitudinal stability. Therefore, the fuselage boom must be built stronger but lighter as its length is increased.

Another point which I feel may be considered is the maintenance of a reasonably practical stabilizer aspect ratio (approximately 7:1). This would probably not only provide acceptable stabilizer efficiency (L/D ratio) but may also relieve somewhat the poor dethermalizing characteristics as the stabilizer area is decreased. This latter issue will be a point for investigation during the coming flying season.



The following points are presented in summation:

(a) The tail should be kept as light as possible without sacrificing strength.

(b) If one is not capable of predetermining the power requirement of the stabilizer, a number of stabilizers should be tried which are equal in area and with the same maximum top camber location. The power of the stabilizer should be increased or decreased by using more or less undercamber while similarly keeping the maximum point of undercamber at the same location. This would keep the variables to a minimum. The model should then be flown in all weather conditions before selecting the suitable stabilizer.

NOTE: Item (b) above assumes that the CG and wing/stabilizer rigging angles have been predetermined and remain fixed.

(c) If a new fuselage is built for the model which differs in weight from the original, the stabilizer should be redesigned accordingly to produce more or less power.

(d) The new model should be dethermalized in high grass until the correct d/t angle is discovered.

(e) The stabilizer should be constantly checked for warps.

In conclusion, I would like firstly to say that I am presently building two Nordics which will be flown using stabilizers of 50 and 40 square inches in area. Secondly, I would appreciate comments, observations, data, etc. from any modeller who has been involved in the small stabilizer problem. Thirdly, I would like to thank Mr. Frank Zaic for this opportunity to sound off and to congratulate him for the wonderful job he is doing.

TOWING —————— W. R. Thompson, Canada

The most important factor in towing is the correct position of the towhook. This position shou!d be as far forward of the C.G. as possible before weaving on the line occurs. Determination is largely a result of trial and error since hook positioning is solely dependent upon the lifting "stability" of the stabilizer, an entity which is usually unknown in the case of a new model.

A stabilizer of 55-65 sq. in. with negligible undercamber may dictate a hook position of $1\frac{1}{4}$ - $1\frac{1}{2}$ in. in front of the C.G., whereas a stabilizer of 75 sq. in. with much flap and undercamber may call for a hook location $\frac{3}{4}$ in. in front of the C.G. In both cases the models may be led about on the line with equal facility provided that, in each instance, the hook is in the position emphasized in the first paragraph. This arrangement will enable any model to get overhead in both windy and calm conditions.

Some points to watch should be mentioned here. A model which tows straight in calm air may weave a bit in a breeze, therefore, hook positioning should be checked out in rough weather after a satisfactory "still air" setting has been achieved. Auto rudder setting must be precise if the model is to follow on tow, e.g. a certain setting may enable the ship to tow straight but may render it capable only of following he tower in a straight line or perhaps a left circle. A shade more right offset would then permit the model to be led in both direcions.

Most of us have encountered the occasional calm (not "still") air contest where there is no wind to maintain any tension on the line. All tension must be supplied by running. The above-mentioned hook position will enable the machine to rise overhead, but if a downdraught is encountered in zero drift conditions, it cannot be vacated because no amount of running will restore line tension.

The flyer will soon exhaust himself, and the line will remain completely slack with the model sinking rapidly. A hook position more rearward than recommended in this article (one which produces a whistling tow in a 3 m.p.h. drift) would prove most useful in such a situation, for the flyer could then restore line tension with relatively little effort. But the ability of the model to be led in any direction is completely lost. So all one can do, it seems, is keep running in a straight line which, at any rate, is the shortest exit from a downdraft.

If one releases immediately after getting overhead (in normal contest conditions) without any concern for "hunting" on the line, then there is, supposedly, a 50/50 chance of hitting lift. Thermal hunting increases the chances of contacting lift and the wind acts as a line tensioner if "down" is encountered during the search. In zero drift conditions there is no line tension to aid the flyer in running out of "down," and in the great majority of such cases, it is nearly impossible to leave the sinking air. Tow control is therefore, almost useless once bad air is encountered and you are helpless.

In zero drift conditions, thermal contact is entirely dependent upon one's choice of the time to fly. This choice (barring the use of "pilot" models) is one of pure chance, 50/50 of hitting lift or of being totally bogged down. With the more rearward "kiting" hook set-up, the flyer increases his chances of surviving an unlucky downdraught because tension on the line is more likely to be maintained. Another advantage of this set-up is that the effect of weak thermals, which are common in such conditions, is greatly magnified, so that thermals which were not felt with the more forward hook position, are now readily discernible. But it must be stressed that the rearward hook position should be used only in zero drift conditions.

I have often wished for such a rearward hook set-up for calm conditions, which seem to occur at at least one contest every season. In the past I have always used one hook firmly anchored in the forward position. Dick Foster, on the other hand, employs a simple and effective means of hook attachment that permits movement. He screws a threaded L-shaped curtain hook into a hardwood block in the fuselage, the block drilled for a number of hook positions. When the right ones are found, the remaining holes are filled; simple—no gimmickry or external apparati.

In searching for lift on a normal contest day, one must distinguish between line tension caused by wind and that caused by a thermal. In the former, the model lags behind the flyer and the line is bowed by the wind. Thermal causes the line to come taut and the model to rush overhead or, sometimes, off to one side. After a little experience, one can idenify that insistent tug followed by the strong and sustained pull—the hallmark of a thermal.

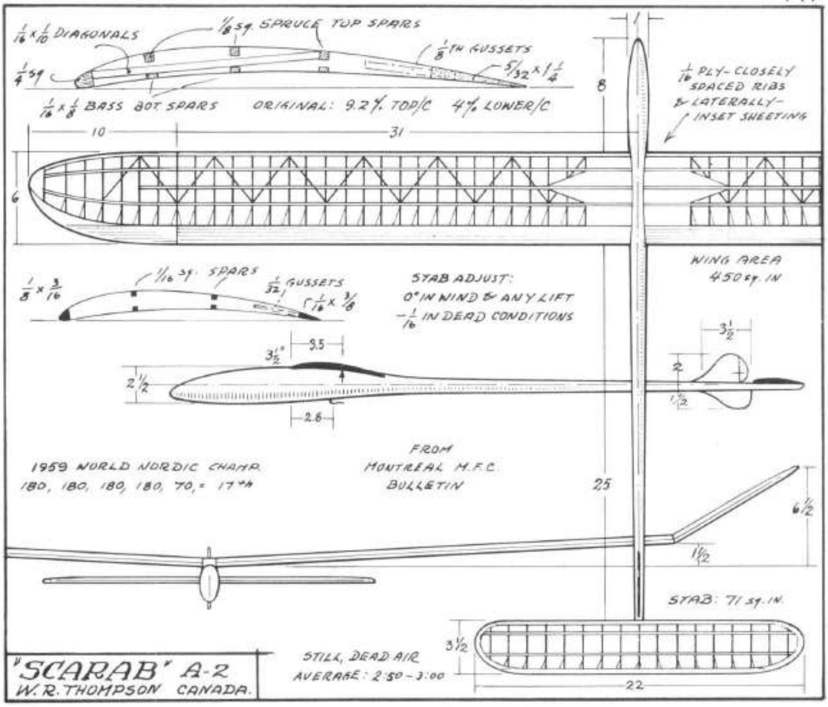
In conclusion, there is one aspect of towing that has been completely neglected on this continent, namely, the physical condition of the flyer. He must often wade long distances through swampy air before being able to serve his ship to a thermal. How many of us can run flat out during that extra minute or two which is added to the fuse for hunting purposes? How many of the top Europeans can do this? I have reason to believe, and fear, that a great many can.

SCARAB—NOTES ON DESIGN AND PERFORMANCE

The SCARAB is essentially a development of a previous A/2, STILETTO. The basic changes made to the STILETTO layout were an increase in aspect ratio (73 in. span on the former, 79 in. span on the above ship) and the use of an airfoil with a lower top and undercambers.

The aim of the above changes was to increase the still air duration beyond STILETTO'S 2:45. The times are 5-10 seconds better, a difference which appears attributable mainly to the increase in span. It seems that "thin" sections, especially those with undercamber in excess of 4.5%, take kindly to an increase in A.R. However, when the chord drops below 6 in., Thomann states that a turbulator must be added to allow the upward trend in duration associated with increasing span to continue.

The search for ever-decreasing sinking speed is one to be undertaken for personal satisfaction. Dead air duration has scant relation to contest work, which places its premium on towing technique, stability, and the knowledge of the precise time to start towing.



The following evaluation of SCARAB's performance under normal contest conditions applies equally to STILLETO for in this area there is little to choose between the two models. SCARAB tows well, and is adequately stable, stall recovery occurring after one shallow dive. The windy weather trim produces a steady, penetrating glide which appears profitable under windy conditions with weak lift. What would otherwise be a perfect steady and penetrating wind glide, is sometimes marred by the occasional bouncing characteristics usually exhibited by models of short tail moment.

The glide circle remains quite constant under all conditions and tightens a little in strong lift, i.e. the model, like STILETTO, is not an out-and-out thermal hunter which one can set to fly in corkscrew when lift is found. Hence on a good sunny day abounding in thermals, SCARAB is no contest threat; it must be towed into lift, for its chances of picking it up on the glide are small. Perhaps wings much lighter than the eight-ounce ones now used could be employed in conjunction with a slightly lower dihedral. The resultant lowering of lateral inertia and area might be enough to sharpen the ship's response to the turning force which is unexplainably generated by thermals.

In short, I feel that SCARAB's overall performance is adequate. The writer is looking for an A/2 with fabulous still air duration, a steady penetrating wind glide, and astounding thermal hunting qualities. But then, who isn't?

(From Montreal MFC Bulletin.)

FLOATER HISTORY —— Frank Zaic

"At this point I should like to thank you for introducing me to this wonderful sport of towing. Your old "Floater" was a most remarkable machine, and my earlier A/2's were merely unprofitable modifications of it. The introduction of "thin" airfoils necessitated a reluctant departure from your short coupled layout."—W. R. Thompson.

" My wife built a "Floater" about 10 years ago. It has been a mainstay of the flight group. Always ready to go on the towline days. Last week we lost it. After 10 years the old Austin timer D/T gave up the ghost and the "Floater" was last seen at 35 min. headed Northwesterly from San Berdoo! Beautiful way to go. Gives a tug at the old heartstrings." —Bill Kincheloe.

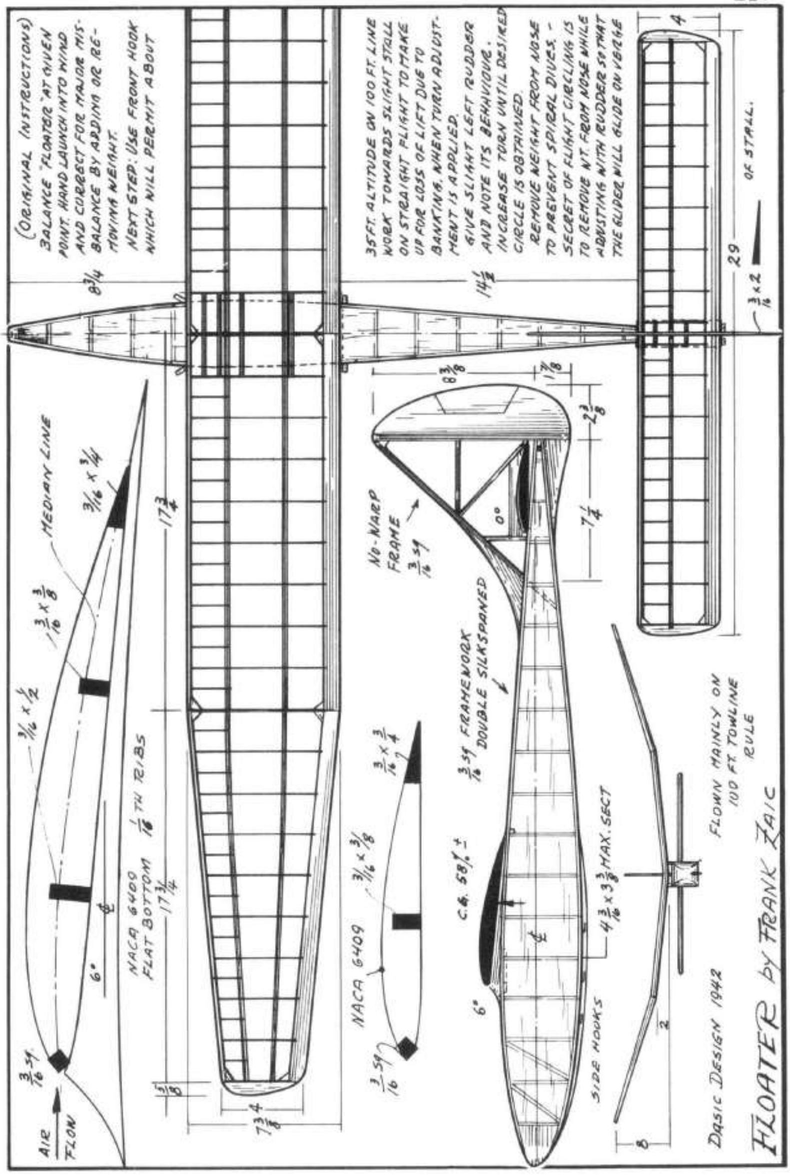
The prototype of the "Floater" was "designed" and built in 1942 to take care of little boys with big ideas. It had hardwood construction to suit supply situation. (Cut ribs from 1/32 pine sheets. Just as easy as from balsa.) However, it was not produced as a kit. (I had to go on a long vacation in Italy.) It was finally kitted, redesigned for balsa, 18 in. box and $2.00, in 1946. Aside from changing straight dihedral to poly-dihedral (18 in. strips, you know), the kit design was identical to the original prototype.

Now back to 1942 and Fort Monroe, where I was with the Coast Artillery Board.

If you recall, we had $(L/100)^2$ fuselage cross section rule. (Foisted on us by power men.) This meant a big box fuselage. (A 50 in. length would call for 25 sq. in. cross section. Wonder what Ritz would do if his design calculations called for 50 in. fuselage and he had to use the $(L/100)^2$ rule.) So, the basic problem was how to minimize the drag of the fuselage and still make it easy to make? First, it could be made as short as possible. Second, it could be placed in the airflow so that it would have minimum of drag.

Deciding on the fuselage length with such a brutal rule, was a curious floating game. You sketched the plan view, and you wanted to put the stab way over to the right side. But a bit of calculations would get a monster for the fuselage. So, stab came closer and closer to the wing until it looked as though it couldn't possibly be any good. The only consolation was in the "chord" lengths behind the wing. So that if you could have three chords, you would feel consoled. And at the same time, the fact that you could use as much stab area as you wanted, helped. (If you think a "double cross" is bad, you should try a "square cross"!)

Deciding on the position of the fuselage in relation to the airflow during the glide was a bit on the unknown side. I already had the feeling that models fly at high angles of 5 to 6 degrees, but until this time I did not have the nerve to go full "angle." But with the big box in my hands, I had no choice but to assume 6 degrees angle of attack. (Note:



An angle of attack recorder was used on the prototype "Floater," and it proved that I was right on the 6 degree angle of attack. As far as I know, it was the first test of its kind—and since 1942 I have not heard of another.—Where are you all?)

Feeling that the stabilizer should be used to keep the wing at 6 degrees, I set it at zero. It was of generous size, and it actually showed up to be so. Just what led me to think so, I forget now, but I did reduce the chord 1 in. and got a high A/R planform.

There was no hesitation in using NACA 6409 for the wing airfoil.

The NACA 6409 was first introduced in the 1935 Year Book, and it was used on some of the previous gliders. However, the Junior would have a lot of trouble covering the undercambered portion. So, the NACA 6409 was made with flat bottom.

The prototype showed its characteristic bounce on its very first test flights, and accentuated it after the stab chord was reduced. I could feel that here was one of those designs that used to come around once in a while.

In retrospect, we can now analyze the "design" and determine why it had its particular characteristics.

The airfoil: It could be that with spars on the bottom portion, a fair undercamber was introduced in time by the paper tension and cement pull in loose notches. Although, the initial leading edge was square, set on edge, and corners faired with the airfoil, I wonder how many builders actually took the trouble to fair the corner, and instead, just let the square corners stick up—and so we have a natural built-in turbulator. So, here we have an undercamber wing with turbulator, not planned.

As many of you may have noted, "Floater" had no provision for D/T. The big box, with fair front length to help balance with light weight, called for an extra large rudder. A sense of form would not let me even think of putting the stab behind the rudder. (Although Sweitzer used it on full size). And placing it in front would make the fuselage still longer and fatter. Besides, it was the best flight, not limited, out of three that counted. So, the stab was cemented in place. Something very unusual, then and now. The result was that the builder was forced to use the angular setting built into the construction.

As we now know, this 6 degree of angular setting on relatively short moment arm, forced by fuselage rule, was just made for circular airflow requirements. The "Floater" was able to make small and tight turns without losing altitude. This worked out especially well in high and/or gusty winds as well as in strong thermals. It simply had lots of lift under all circumstances. And constant tight circling also kept its "momentum" steady so that it would ride "up" when it turned to face the wind. While the large rudder was very definite and had full control over the dihedral effect.

The towing was a problem which was never satisfactorily solved at that time. The angular setting, which was meant for tight circling, was actually excessive for straight flight. So we can only imagine the load it must have been on the line and how difficult it was to get it up straight. But this was more or less a universal problem at that time, so that I did not feel too awkward when the "Floaters" would peel off to one side, etc. Besides, we were all too busy watching another "Floater" getting smaller and smaller upstairs. Nothing like having the average work for you!

(I would like to suggest that each club member should take turns building a quickie light-weight glider, without D/T, and give the rest of the members the big thrill of the day.)

CORRESPONDENCE ON "DYNAMIC SOARING"

Jim Horton and Frank Zaic, Febr. 1961

Dear Jim:

Been looking over your "inertia" business and still do not feel satisfied that we are using the right word for the action. So—"Inertia is a state of being at a particular moment." This is my own explanation. I did have kinetic energy in mind when I wrote, and very likely mixed the two terms. But on to the action on the field:

While kiting a glider on the end of a tow line—air particles have inertia of motion—while the glider has inertia of rest. Results of reaction of air particles on the wing are lift and drag.

Release the glider. The drag moves it with the wind. If it not possess aerodynamical balance system—the glider would eventaually be a part of the air mass, like a leaf, and there would be no reaction of air particles on glider or glider on air particles. It's ground speed would be that of the wind. The glider now has inertia of motion. But since it is moving at the same speed as air, and with it, it cannot react against it—unless it acquires a direction of motion of its own. It can do this with its aero balance.

Aerodynamical balance is such that it will try to position the wing into a specific angle of attack. When this angle of attack is reached, the forward component of Lift and Gravity forces will provide a forward or "pulling" force which will give the glider a definite speed or velocity against or through the air, regardless of its (wind) motion. This forward speed is not measured in relation to the ground, but in relation to or against air particles. A glider may be standing still in relation to the ground while it is facing a 15 mph wind. Here again, we have the glider in an inertia of rest. And as far as I am concerned, a glider in such a condition is wholly dependent on the air flow. A gust against such a glider would mean that the glider would move back as soon as the initial shock of the gust is absorbed. I think that the problem or explanation of our discussion lies at this point or moment. What happens when a gust hits a glider which has no kinetic energy? (It was standing still in relation to the ground.)

When we have the glider going with the wind, it's speed in relation to the ground is its own normal flying speed plus the velocity of the wind. And its kinetic force value depends on its speed in relation to the ground speed. Obviously, it should have a large kinetic force under such conditions. Therefore, the question presented is: Why does the model tend to flop and mush when it is forced to make or go into wind turn?

Here, the problem is further modified by the fact that we know that if a glider is able to make a sharp and quick turn back into the wind, it can take advantage of the kinetic energy it picks up on a relatively short space of "with the wind" ground speed and "balloon" upward. While a model that makes long turns—during which it can build up full "with the wind" ground speed—tends to be undecided what to do, and flops and mushes into the wind turn. Could it be that the large turn control does not have the ability to make the change rapidly enough to use up the kinetic energy and that, by the time it gets around, it has lost it and is drifting back with the wind?

On the above, could you check it over and see if it fits your observation and deduction project? If so, could you re-write it to go along with your observations? Would like to do it myself and let you know of the outcome, but I am getting nervous as there is still a lot of the book work ahead.

In all, I can see nice work for a mathematician to tell us what size circles we hould have the gliders make in different wind velocities. And/or design a gimmick that would snap the glider around into the wind whenever it reached a certain predetermined ground speed.

Dear Frank: March 20, 1961

Just reread your letter, and think that you should publish it as it is. I think that you have summarized the problem as well as possible. On our end, Dave Bevan and I have done quite a bit of flying lately and I could present the results noted so far. Let's take my latest Nordic out on a calm nite and set it up as follows:

C.G.—Aft, Incidence difference—2 degrees, Circle—wide.

We tow it up. It floats off the top and glides down in a floaty glide, just off stall, for two minutes plus.

Now, let's take the same glider out the next day. Wind 15 mph.

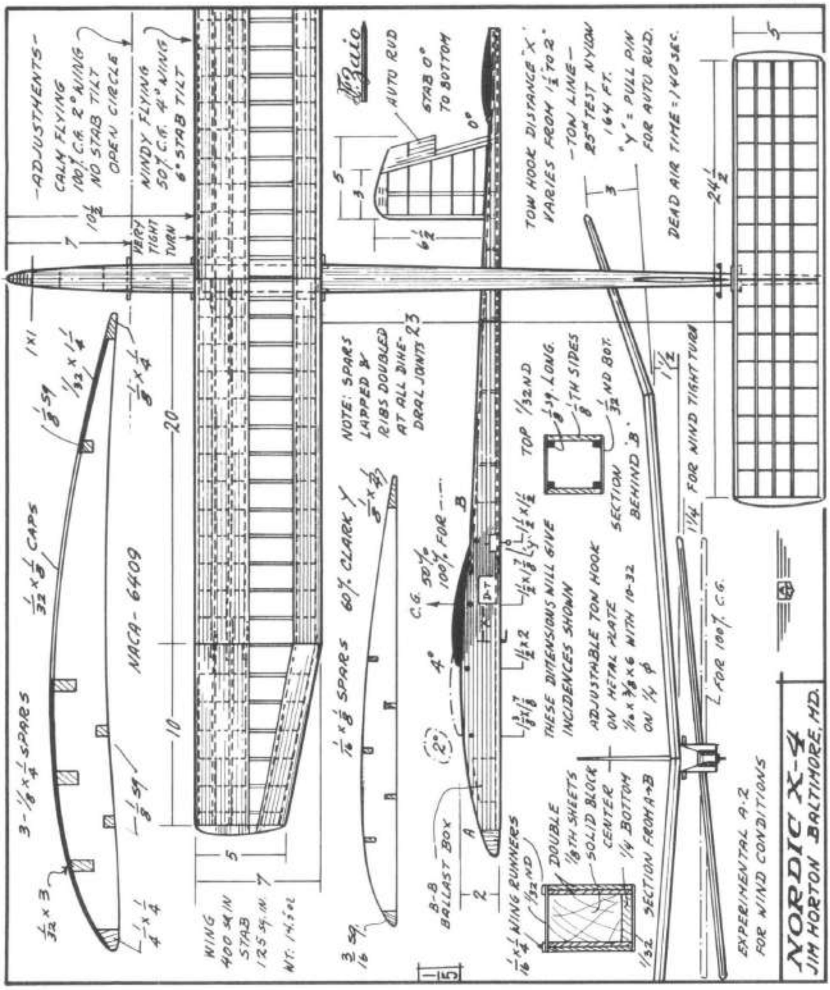
It tows up nicely. Comes off overhead. Attitude appears normal, but it is in a rapid sink. Turn has opened up. As model approaches ground, the turn begins to tighten. It begins to pick up speed and glide just as it runs into the ground. Time—one minute.

What adjustment should be made to make it behave? Cannot reduce wing incidence. It only has 2 degrees now, and anything less will not make it able to recover from a stall. Crank in more rudder. But the model does not seem to pay any attention to the rudder. Still bounces off ground in one minute. Throw in some tail tilt. Now it peels off the line during the tow. Correct with auto-rudder. Now, at last, it is improving. Throw more tilt. It peels off in climb. Adjust auto-rudder. Now we have it up for one and half minutes. The glider still is not in a normal glide until it gets low, and then it has missed all the good air.

Let us make some major changes. . . . . Move C.G. forward. Increase incidence to 6 degrees. And adjust the circle as tight as possible; just off spin. Now, let us see what it will do in the 15 mph wind.

The glider tows overhead. We get it slightly cross wind on turn side. Give it a good heave. It peels up, over and into its "natural" turn at high speed. It whips quickly back into the wind; bounces up and around. Watch it close. It is gliding clean way up there. Takes advantage of every gust and riser. It is in normal glide circle right off the line—moving fast—alive not dead—bouncing—dipping—alive!

That is about as far as we have progressed. Launch is very important. Model must bias wind. Dave uses "S" tow launching model overhead on turn side. I carry tow rudder on turn side, pull ship straight up with C.G.



towhook couple until it gets overhead. Then, let it enter its turn. Either method seems to work.

As you mentioned, glide speed is important. I think the speed range you can adjust to is even more important. Here are suggested settings for different wind conditions.

Wind M.P.H.	C.G. Position	Incidence Diff.	Circle
0-5	100%	2 degrees	Open
5-15	75%	4 degrees	Medium
15-35	50%	6 degrees	Tight

The truth of the matter is that with the forward C.G. we can do a lot of adjusting before it becomes unstable. With aft C.G. we are very limited. In wind we need (if I can borrow a British expression) penetration. It is very important. Well, that is about it.

"STILL AIR" PERFORMANCE

Ray Hansen,—Long Beach, Cal.

Here are my notes on "still-air" performance. They may not be what you are expecting, but I think I have a point.

In the early morning hours at Sepulvada Basin in Los Angeles, "still-air" times are recorded which rival the outlandish claims of European A-2 and Wakefield experts. Six minute flights with ½A gas and 3½ minute flights with A-2's are seen, with no apparent thermaling. How do we know that these flights are not made without the assistance of rising air? Because we fly hand launched gliders at the same time.

I'm a mediocre hand launch flier, and get 50 to 55 seconds indoors in blimp hangers. With the indoor HL record at 77 seconds, it is obvious that an outdoor flight of 1½ minutes is getting a lot of help. I was flying a HL glider one morning when one of the well known locals was establishing a "still-air" average of 2:42 for his Nordic. I was getting about 80 seconds a throw in the same air. By simple ratio, figuring the glider's indoor time at 50 seconds, I would estimate the Nordic's time in still air at 1:41. A six minute flight in the same air would be the equivalent of 4 minutes indoor.

Thus a flier who has some idea of the time he can record with an indoor HL can estimate the performance of any other model outdoors. It matters little whether he can do 30 seconds or 70 seconds. I realize my calculations are a bit crude, but we all realize that most reported still air times are a post-facto guess or a magazine article exaggeration.

Why anyone worries about still air time is questionable. Perhaps a more interesting measure of performance is the lowest time recorded in poor air. I've seen Bob Weihle's fine Nordic do 45 seconds in a downdraft, but have seen an older design (7 in chord, 6409 wing) come down in 26 seconds. These times were recorded by models in good trim and well launched. Only three times since 1956 have 5 maxes been recorded at L.A. The winner at one of our A-2 contests usually has 3 maxes, a 2½ minute flight and a poor one. But it does seem apparent that the better designs will win consistently because of their better performance in weak lift or downdrafts.

Good ½A gas models will clock 3 minutes in poor air. The best ones will seldom go below 4 minutes. At most of our local meets there will be at least 25% of the ½A fliers with 13½ minute totals. The top three places usually have three maxes and get these by flying in what Ron St. Jean aptly calls "dew thermals." The heavy dew on the alfalfa is evaporated by the early morning sun. The slowly rising, moisture laden air provides fine flights. Models do not necessarily rise in this lift, but certainly sink at a slower rate. Around 10:00 A.M. the grass is dry, a breeze comes up, and true thermals and downdrafts are in evidence.

TURBULATORS — Jim Fullarton, Australia

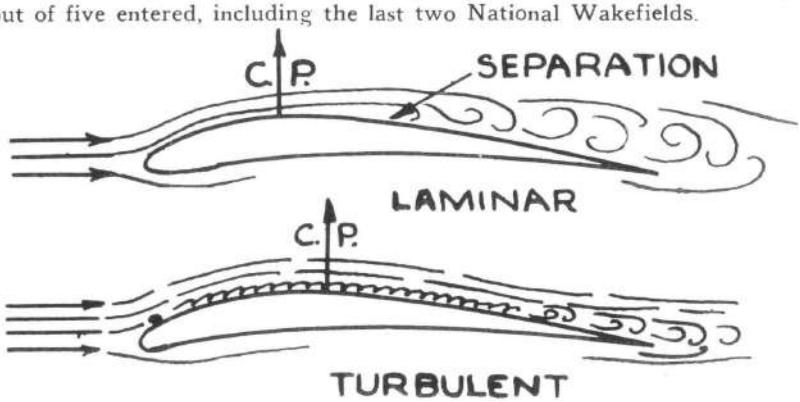
Never having seen a copy of Schmidt's classic, "Aerodynamick des Flugmodels", I never understood turbulators, and could not figure how you could improve performance by adding drag to a wing. Then I read that fine article by Henry Jex in "Soaring", and it all became clear. Immediately rushed out and strung a cord in front of my old Wakefield wing, with fairly thick 6412 section and sheeted leading edge.

Right from the start it was obvious that something had happened. The model previously prone to stalling, assumed a nose down trim, and needed 1/8 in. under the tail to bring her nose up. From the attitude on the glide, it seemed as though the stall had been delayed some 4-5 degrees. The extra lift slowed her down, but there was drag there too, and she seemed to be mushing. Overall performance was only slightly up but more consistent. As a check, we removed the cord, whereupon it stalled right out of the sky.

The obvious deduction was that the turbulator had moved the centre of pressure back, and I remember Ellila making a similar observation. My own explanation for this is as follows:

Most of the lift comes from the upper surface. With laminar flow at low (sub critical) R.N., separation occurs well forward, near the point of max. camber. This means that the back part of the wing is doing very little work, so that most lift comes from the forward part, hence forward C.P. With turbulator, the flow "Sticks" to the upper surface much longer, the back of the wing produced more lift, and the C.P. moves back. (See sketch.)

After this, I set out to build a wing to Jex's recommendations, using B 6356b section and multispars for turbulators. Suzuki says these are no good, but my experience is to the contrary. Jex does insist, however, that there must be no upper spar or bump aft of 40% as it might promote separation. This wing showed anti stall characteristics typical of turbulent flow, and the glide is quite outstanding. With it I have won four contests out of five entered, including the last two National Wakefields.



A/2 TOWING & THERMAL HUNTING

Reino Hyvarinen, — Finland

Sandy Pimenoff asked me to write to you, because I happened to be the Team Manager of our victorious 1959 A/2 Team. He told me that you had read some rumors about my "magic tricks" in thermal hunting. In fact, there are scarcely none, but I shall try to describe in some words our efforts in A/2 towing and thermal detection, hoping that there would be something worth printing and reading.

After those magnificent articles in "Aeromodeller" (12-59 and 4-60) of A/2 towing and thermal hunting by Tom Thompson and Hansheiri Thomann respectively, I am afraid I can't add many words to their writings.

Thermal detection is fairly easy only under some circumstances, e.g. as the sky is cloudless or covered with an even haze, the terrain is homogenous and the wind is not too strong, e.g. at the 1959 finals at Bourg Leopold in Belgium. Under those circumstances, you could by merely using your watch have been able to tell the time the thermal bubbles were rising, as Gerry Ritz did.

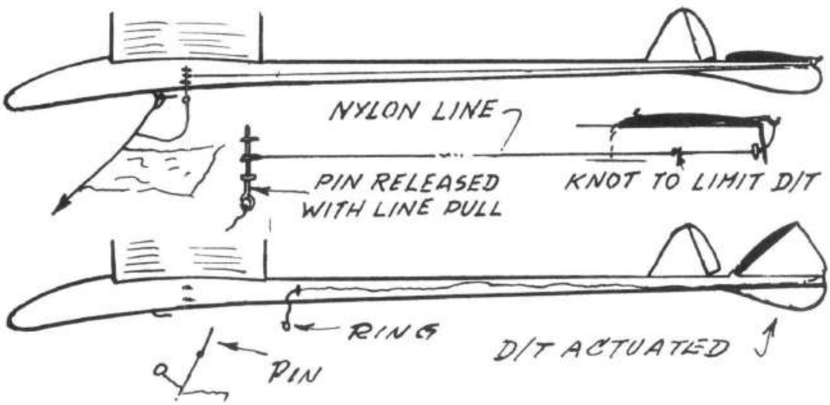
It was of great advantage to our victorious team having at home a flying field nearly identical with that in Belgium, especially as to the soil and the surroundings. Because the absence or presence of thermal is based on temperature differences, our contest clothing was at its minimum so we could have the full benefit of those parts in human body which are most sensitive to temperature changes.

After the thermal had risen, there was an even cold breeze for a minute or two. It was a pity that many a competitor forgot or was ignorant of the principle rule of a thermal i.e. there must be warm air to build a thermal. Many flyers launched their models during that cold moment and wondered at those low times thus achieved.

We let those cold puffs and that cold moment pass by, after that the breeze got weaker and the temperature began slowly to rise. This process took also a minute or two. Then, there was windstill, noteable increase in temperature and warm breeze began. This was the time to launch. The whole process follows the normal birth of a thermal bubble.

In strong winds or in occasional sun shine through the holes in clouds one must have very much experience and meteorological knowledge to be able to say just when is the right moment for launching. So it is better or safer to hunt with the model following up there. Of course, the model must be able to follow its "master," as "a good dog ought to do with its master when walking in leading string." The flyer must also be capable of some athletics or cross country running as well as feeling a thermal from his tow-line.

The two latter points can be achieved by training, but to train you must have a model to train with. Alhough there has been much writing about those side areas etc., the only points absolutely necessary to make the model follow is the correct positioning of the towhook (e.g. Tom Thompson's article in Aeromodeller 12-59) and fairly warp-free wing. Movable towhook, bending it upwards and having a reasonable length in it are favorable features. If you still have a clockwork D.T. timer which begins its working from release, you can begin training. Unless you are a timer owner, you can use the system shown below:



Using this system, you can run as long as you can, and at release the model will D.T. to your feet. The only snag in this system, as compared with D.T. timer set up at 20 seconds, is that you cannot always say if you are released in a thermal, but if your model is climbing after releasing you can be proud of finding a real thermal. As compared with the usual burning fuse, this system (in training, not in competition) has many advantages. For example, you need not watch your watch thinking "there's still two minutes left" when you must perhaps release, or the model gets loose in strong wind with those two minutes still to D.T.

If you seriously want to learn that "hunting system" you must train a lot in different kinds of weather, and if you do not have an unselfish and eager helper, you must train launching solo. Once learned, it is very easy, especially in windy weather. Keep the model in your left hand, nose pointed some 45 degrees upwards, the winch in your right hand, commence running upwind, releasing the model from your left and braking evenly the winch reel with your right finger(s) as the line pays out. In still air, you may have to run fast, but if you want to be a sprinter, this gives you real practicing. As the model gets up in the line, you need not run very fast, in an even breeze, you can walk and in stronger winds you can stay where you are or run towards the model.

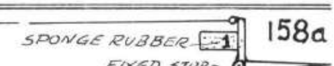
As soon as your model follows you, you can begin that searching. From the line tension, you will learn to know those ups and downs and also those many times misleading puffs in wind velocity. If your model gets in a downdraught, you must get soon away from it, but when you find that sudden tension of an updraught, do not hasten too much in releasing, the model may turn to the downdraught, and it might be less encouraging to hear your strong words just then!

Much could be still written on this subject, but experience is a good teacher, and this experience can be gained by training. Besides, this running will give you better physique, drop those needless pounds around your stomach and help you placing high in competitions. Personally, I don't like running because I was not born to be a "miler" (6 ft. 1½ in., 200 lbs.), but having a glider above you in line, you can run safely for better physique without getting that extra name of "mad in sport" from your friends, as you surely would get running without that model. But remember that running is not end in itself, in competitions you run only as much as you need to find a thermal for those three minutes!

158a

TOWHOOK

Andy Anderton,
England

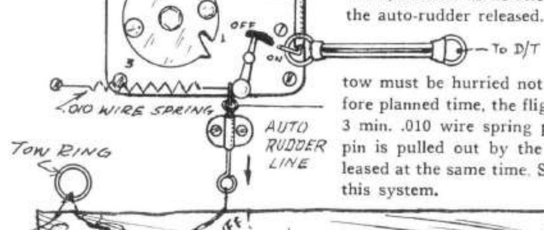


The gimmick I use on tow is a towhook raked forward and down (about 5 degrees) so that a vector of the pull (assumed at right angle to model's datum) also provides a component of noseward thrust, which you will note, drags the rudder to its stop.[1] Steering in opposite direction, set by the auto-rudder, can be done by a really sharp tug on the line. This will squash the sponge rubber and allow the auto-rudder to act. Reversion to normal pull zeroes to straight tow.

Assuming the arrangement shown, slacking the line will phase into the left. Normal line should give straight up tow. While a sharp tug should give a start to the right. If you do nothing but hold tow line with glider near-overhead, a turn to the left will mean a sink (line slackens). But if model tends to the right, a riser is tensioning the line.—Tow Ring shown also a big help. HANDY D/T position is just behind the wing.

LOCKING D/T FOR TOWING

John Tatone



This arrangement allows the flyer to tow his model around for an unlimited amount of time until he feels the thermal. Then, as soon as he releases the towline, the timer is set and the auto-rudder released. His model will then D/T at exactly 3 minutes or the setting.

If this set-up is not used, then the tow must be hurried not to D/T too soon. Or if released before planned time, the flight might last longer than the needed 3 min. .010 wire spring pulls switch to "ON" position when pin is pulled out by the falling towline. Auto-Rudder is released at the same time. Switch should work freely when using this system.

ASPECT RATIO & NORDIC PERFORMANCE

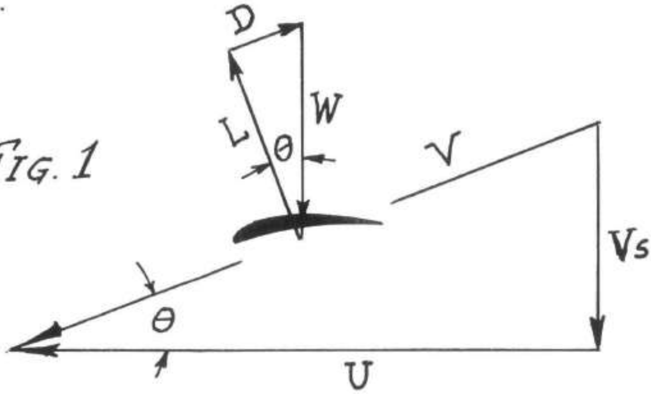
Bill Hartill ——————————————————— Van Nuys, Cal.

One of the easiest ways to lose your friends is to claim a three-minute Nordic. Dead air—what is it, where is it? This question often obliterates the true performance of a model. At any rate, let's take the bull by the horns and fly on paper, then we can be sure of "dead air."

Of course, there are those who will be eager to claim that "adjustment" is more important than design or that "theory" and model airplanes don't mix. However, I think these arguments can be rendered meaningless if all of Frank's students do their homework.

Nordic analysis is a little easier than power or Wakefield because the components of drag that are the hardest to estimate such as fuselage, interference, stabilizer, rudder, are a minimum and affect the overall performance the least. Study of a force diagram for a model in gliding flight reveals the relationships of lift, weight, glide speed and sinking speed.

FIG. 1



This diagram shows that the glide angle θ is equal to the arctan D/L. Of importance is that the angle of attack of the wing is not equal to the glide angle, but is usually much higher. Also, the lift is less than the weight.

The important parameter is V_S, sinking speed. From the diagram, V_S is reduced, thus raising glide time, by reducing the glide angle and/or reducing the glide velocity.

To make a long story short, a hypothetical Nordic was calculated:

Total Weight — 14.46 oz.	Wing Aspect Ratio ——— Varied
Wing Area — 453 sq. in.	Wing Angle of Attack —— Varied
Stab Area —— 68 sq. in.	Wing Lift Loading ——— Elliptical
Wing Section-NACA 4409	Section Reynolds No.– 41,700 Fixed
Stab Section–NACA 4409	

The NACA 4409 was selected for the study because of the availability of data at the proper Reynolds Number. Other airfoils are available that probably give better performance but accurate lift/drag data have not been measured.

The component drag coefficients, all based on wing area, are shown in Figure 2. The values shown for the fuselage, rudder, and interference, are strictly estimates, based on extrapolation of existing experimental data at higher Reynolds Numbers. The 15% stabilizer adds only a small percentage of the total drag. Assumptions here were; a constant decalage such that as the down wash from the wing decreases with increase in aspect ratio, the stabilizer is adjusted to fly at a constant angle of attack. Stab aspect ratio of 5 was used.

The wing profile drag is a function of angle attack (or lift coeff.) Therefore computations were made at all lift coefficients so that the minimum sinking speed could be determined. This occurs at the minimum of $C_D / C_L^{3/2}$ where the coefficients are for the complete model. It was found that the minimum sinking speed occurred at a C_L between 0.8 and 0.9 over the aspect ratio range 5 to 20. The profile drag coeff. varied little in this range and was assumed constant for simplicity.

Wing induced drag, provides the greatest interest in this analysis for several reasons. It is easy to calculate, it is a large portion of the total drag, and it can be reduced considerably by increases in Aspect Ratio.

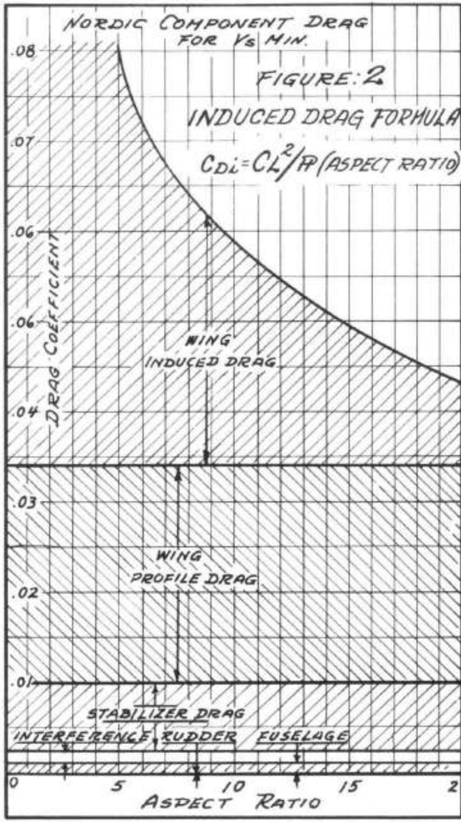
Fig. 2 shows how much the drag can be reduced by increasing the Aspect Ratio. The <u>total</u> model drag is reduced over 45% by increasing aspect ratio from 5 to 20.

Fig. 3 plots the pay-off-seconds glide time from 164 ft. altitude for a range of Aspect Ratios and glide speed. Don't worry about glide speed, that's what adjusting is for. Just trim for the minimum sink.

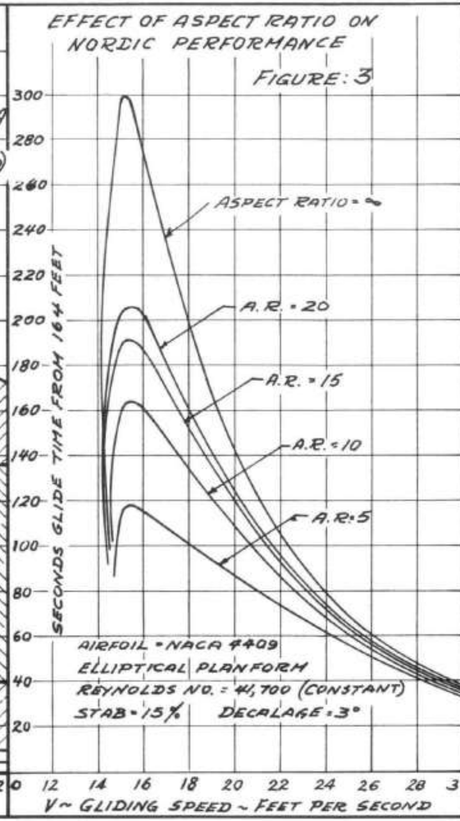
The flight times shown, certainly are not too exact, but they do show the importance of Aspect Ratio.

Fig. 4 cross-plots the data and also shows that as Aspect Ratio increases, the flight time becomes more sensitive to the glide speed. That is, adjustment is more difficult. With ideal atmospheric conditions it might be possible to trim right to the minimum sink condition but if unstable air and/or an unstable model cause a deviation from the optimum, drastic losses in flight time will result from only a slight shift in glide speed, particularly toward the stall speed. As the Aspect Ratio is increased minimum sink occurs at higher C_L, approaching closer to the stall. If the airfoil is relatively unstable, as many high performance sections are, and longitudinal stability inadequate, it is possible to stall a Nordic off the line with little forward speed and have it mush all the way down in about a minute. It isn't always due to down drafts!

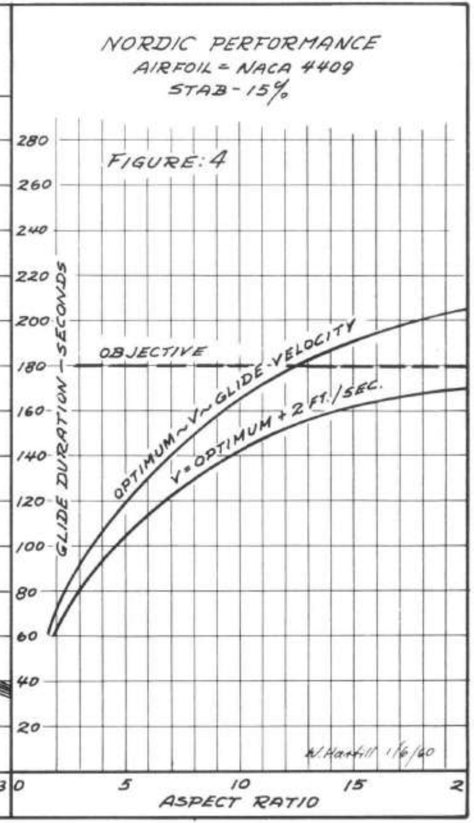
This is just to point out the obvious, that stability is a very important factor of practical consideration, that has not yet been solved, and becomes more acute with higher Aspect Ratio.



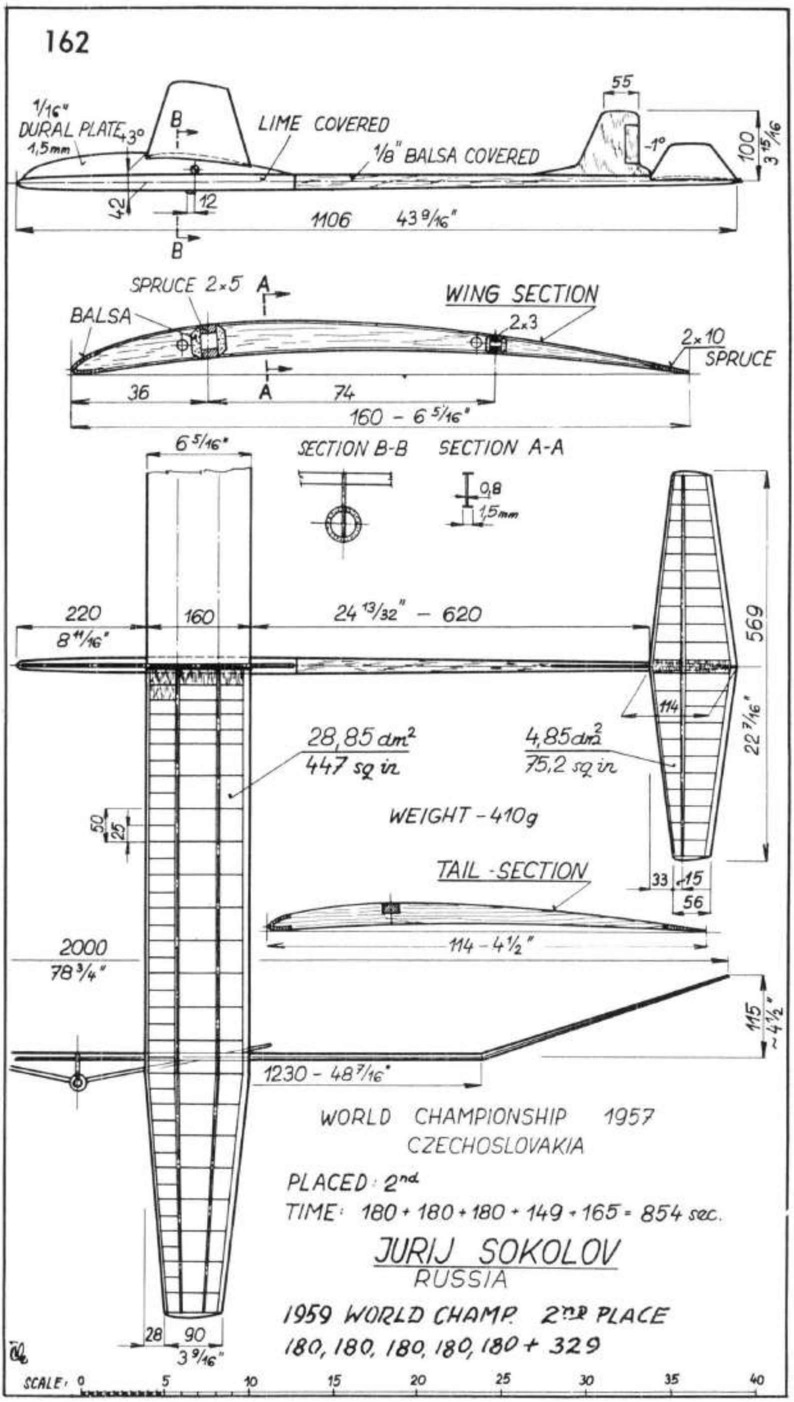
NORDIC COMPONENT DRAG FOR Vs MIN.
FIGURE: 2
INDUCED DRAG FORMULA
$C_{Di}=C_L^2/\pi$ (ASPECT RATIO)
DRAG COEFFICIENT
WING INDUCED DRAG
WING PROFILE DRAG
STABILIZER DRAG
INTERFERENCE
RUDDER
FUSELAGE
ASPECT RATIO



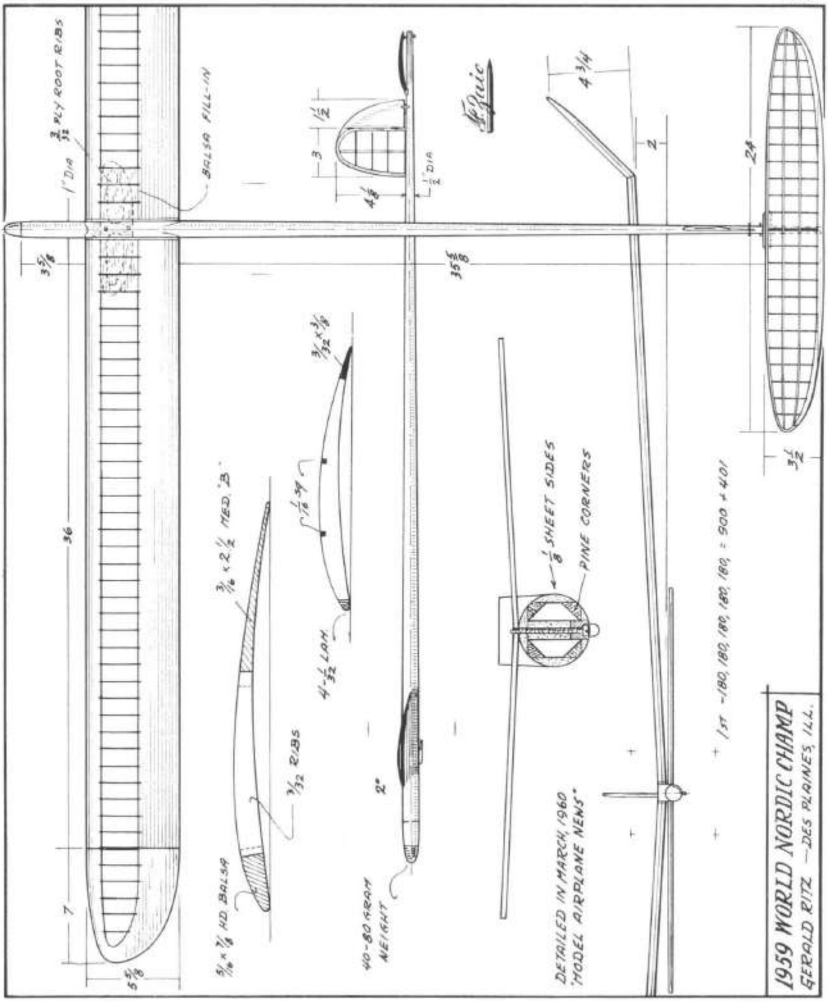
EFFECT OF ASPECT RATIO ON NORDIC PERFORMANCE
FIGURE: 3
ASPECT RATIO = ∞
A.R. = 20
A.R. = 15
A.R. = 10
A.R. = 5
SECONDS GLIDE TIME FROM 164 FEET
AIRFOIL = NACA 4409
ELLIPTICAL PLANFORM
REYNOLDS NO. = 41,700 (CONSTANT)
STAB = 15%
DECALAGE = 3°
V ~ GLIDING SPEED ~ FEET PER SECOND



NORDIC PERFORMANCE
AIRFOIL = NACA 4409
STAB - 15%
FIGURE: 4
OBJECTIVE
OPTIMUM ~ V ~ GLIDE VELOCITY
V = OPTIMUM + 2 FT./SEC.
GLIDE DURATION - SECONDS
ASPECT RATIO

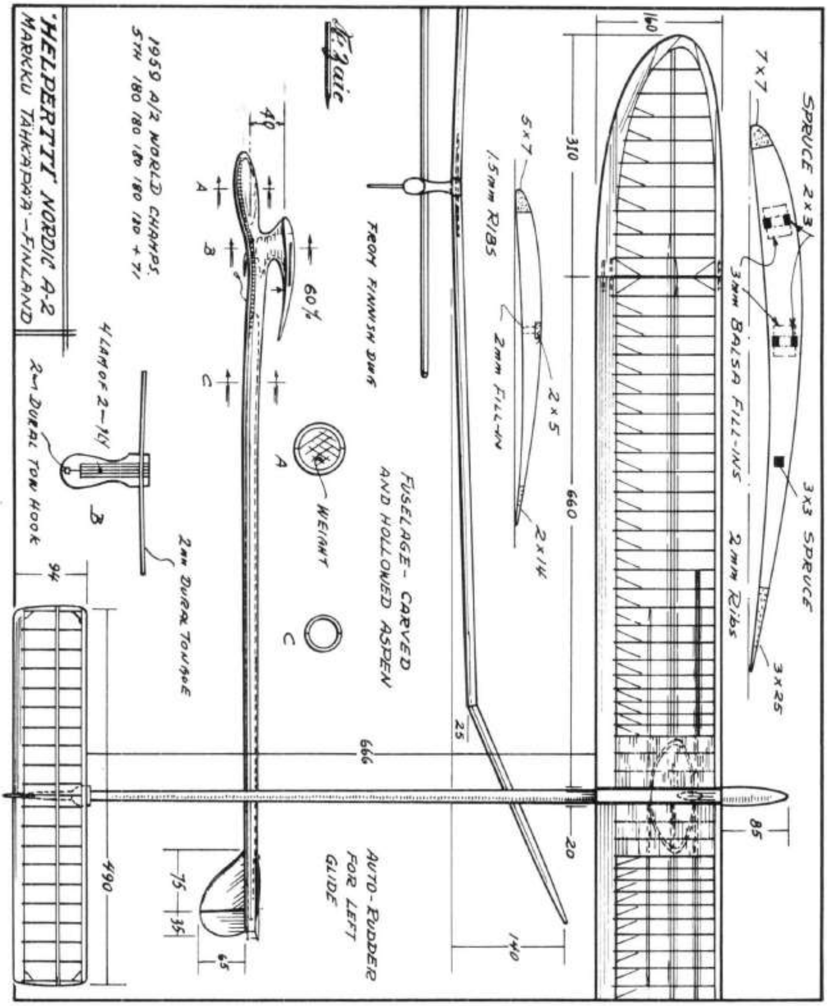


162
1/16" DURAL PLATE 1,5mm
+3°
B
LIME COVERED
1/8" BALSA COVERED
55
-1°
100
3 15/16
42
12
1106 43 9/16"
B
SPRUCE 2×5
A
BALSA
WING SECTION
2×3
2×10
SPRUCE
36
A
74
160 - 6 5/16"
6 5/16"
SECTION B-B
SECTION A-A
0,8
1,5mm
220
8 11/16"
160
24 13/32" - 620
569
22 7/16"
114
28,85 dm²
447 sq in
4,85 dm²
75,2 sq in
50
25
WEIGHT - 410g
TAIL -SECTION
33
15
56
2000
78 3/4"
114 - 4 1/2"
115
~4 1/2"
1230 - 48 7/16"
WORLD CHAMPIONSHIP 1957
CZECHOSLOVAKIA
PLACED: 2nd
TIME: 180 + 180 + 180 + 149 + 165 = 854 sec.
JURIJ SOKOLOV
RUSSIA
1959 WORLD CHAMP. 2nd PLACE
180, 180, 180, 180, 180 + 329
28
90
3 9/16"
SCALE: 0 5 10 15 20 25 30 35 40



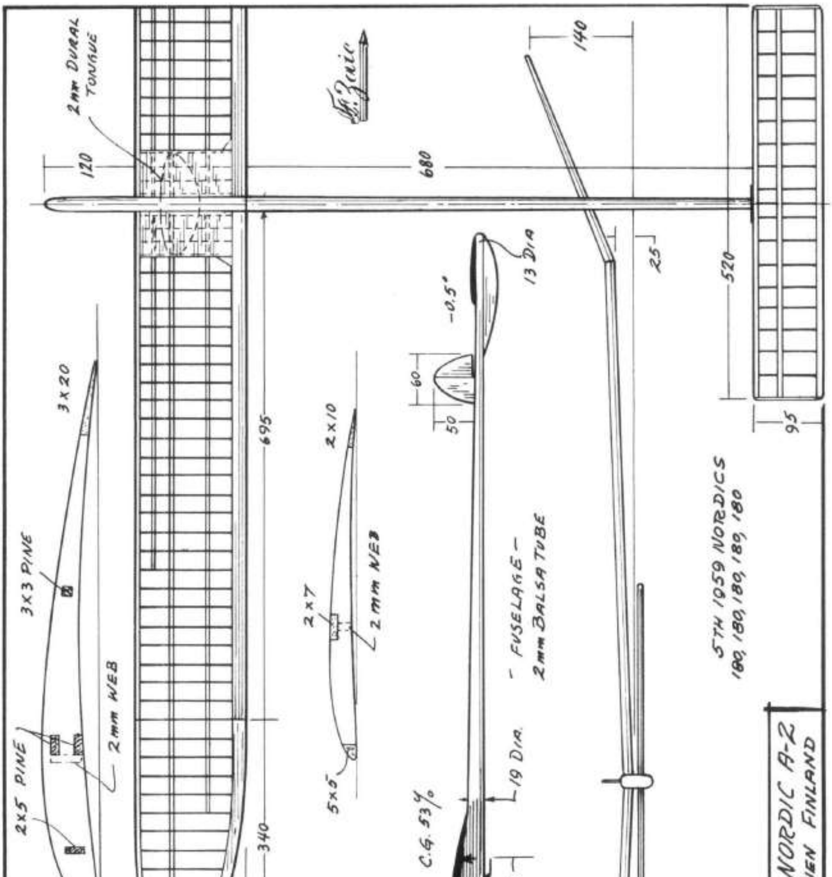
"This "waiting game" of thermal detection was one of patience on the part of those who knew what they were doing and impatience for those who launched by guesswork. As the third man of each team came out to fly, he sought evidence of lift by watching the impatient releases, several of which were lucky enough to hook a riser. Then when one recognised expert selected his moment to tow—the rest of the field leapt into action, presenting the timers with a view not unlike a distant commando assault.

Ray Monks launched into a very powerful thermal to bring Great Britain to equal 8th place with U.S.S.R., but no less than five countries, Czechoslovakia, Denmark, Finland, Holland and Sweden had perfect 540 scores. One had only to watch the strategies of these five nations to realise that towline technique was to be the key factor for team success. There were 33 individual max's recorded.



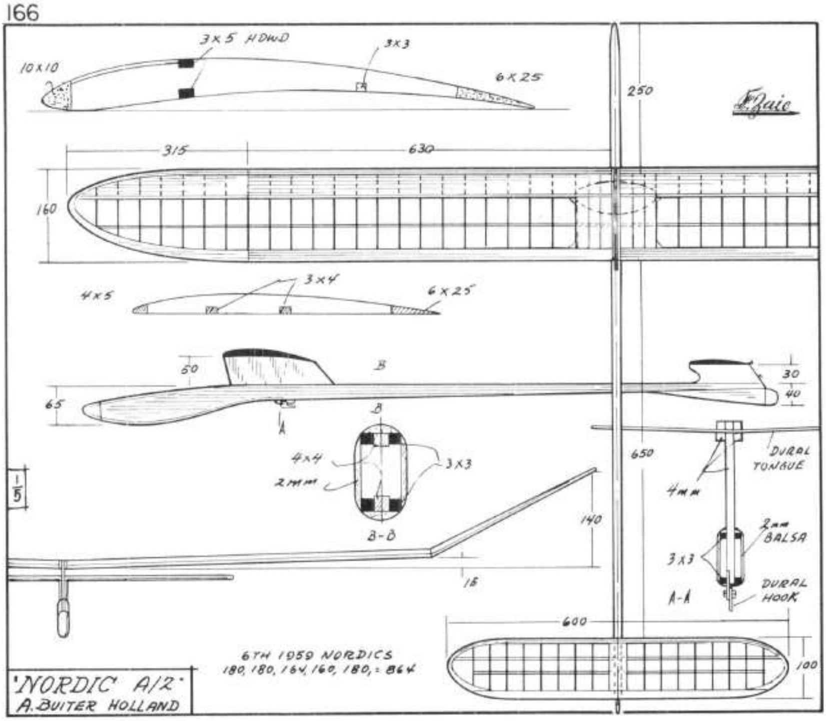
With British hearts hoping that we had collected our one bogey downdraught, the second series of flights were to prove disappointing. First Eddie Black's model wheeled on the line and released low—and though Dame Fortune provided a thermal to take it to "max" height, the model d/t'd at 2:15 for a 2:27 score. Then Ray Shirt launched early—and sank in a downdraught for 1:26, and Ray Monks who just managed to get back in time from the distant woods after his first max went down for 1:48.

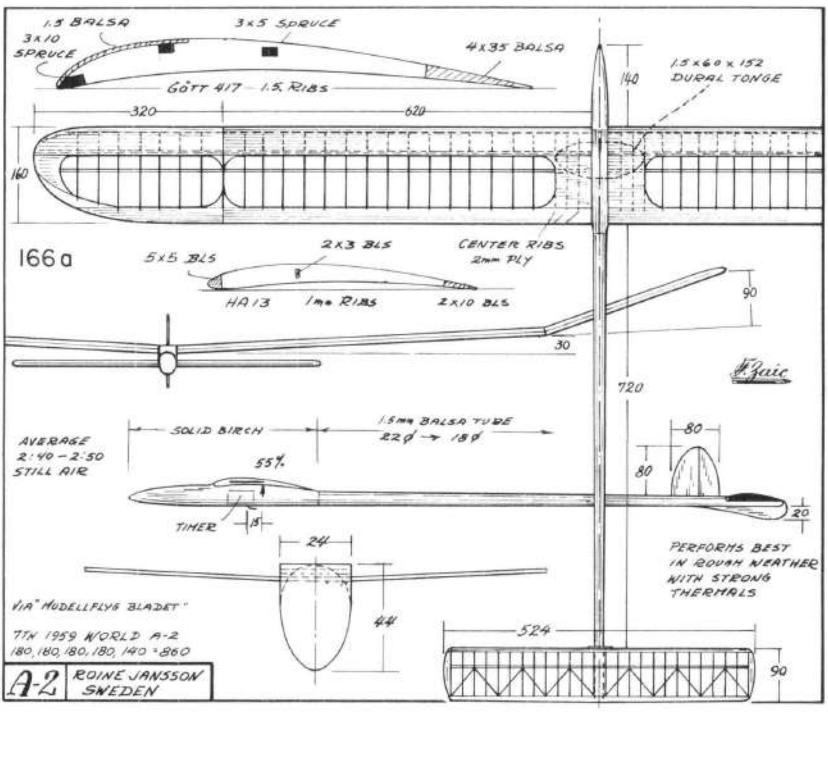
We were not alone in our misfortunes. Borge Hansen, Gunnar Kalen, Kool and Krook of Holland and all three of the Czechs fell wide of a max in this round to spoil their countries' strong lead, yet the Finns continued to demonstrate their seemingly infallible sysem. We paid special attention to their third man in this round to try and fathom out some of their technique. Within 30 seconds of the announcement that his 20 minute

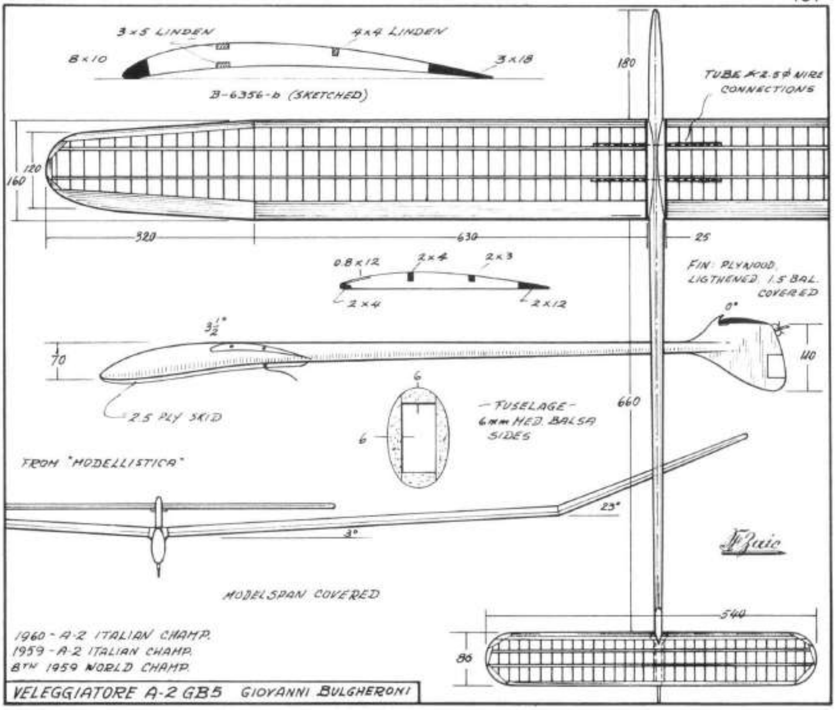


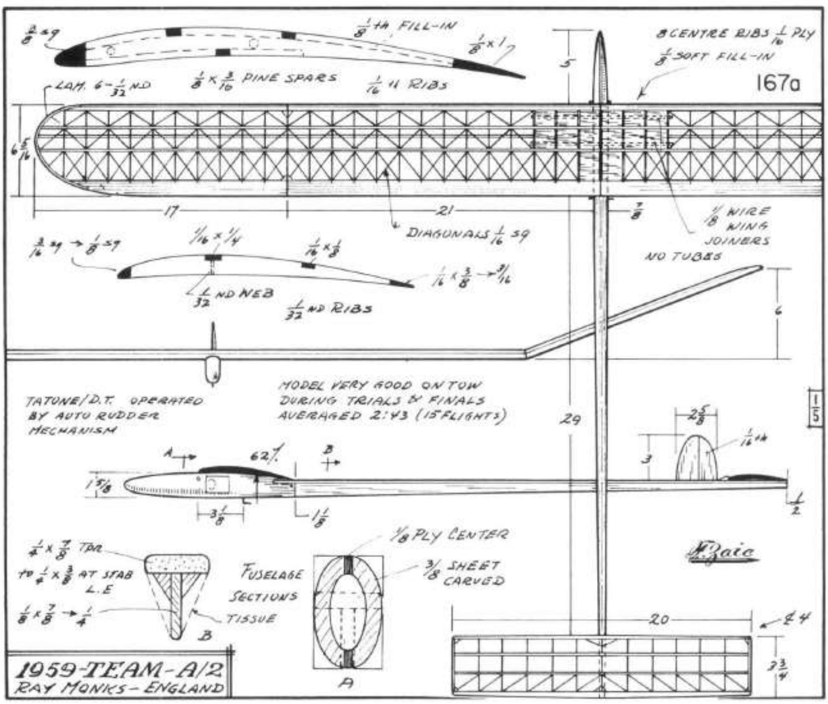
period had started Kekkonen had his line out to full length and Manager Reino Hyvarinen held the model ready. Each was bare to the waist, and keenly attentive of other flight performances, yet they waited and waited—still tensed and ready to go for 5 minutes—10 minutes—12 minutes, 13, 14, and then in the 15th minute their involved Finnish patter (which was as good as any secret code as far as the rest of the field was concerned) signalled, a flurry of activity and the model was away. More Finnish patter—and the red and white A/2 was already climbing at several feet per second! How did they know the thermal was coming. It seemed imprudent to enquire but by observation, and double check on subsequent launchings, they waited for the first trace of a strong breeze after a period of calm. Light puffs were allowed to pass by until a steady wind was felt on their bare chests (Sokolov and Ritz use the cheeks, Thomann, wearing shorts flexes his knees). R. G. MOULTON

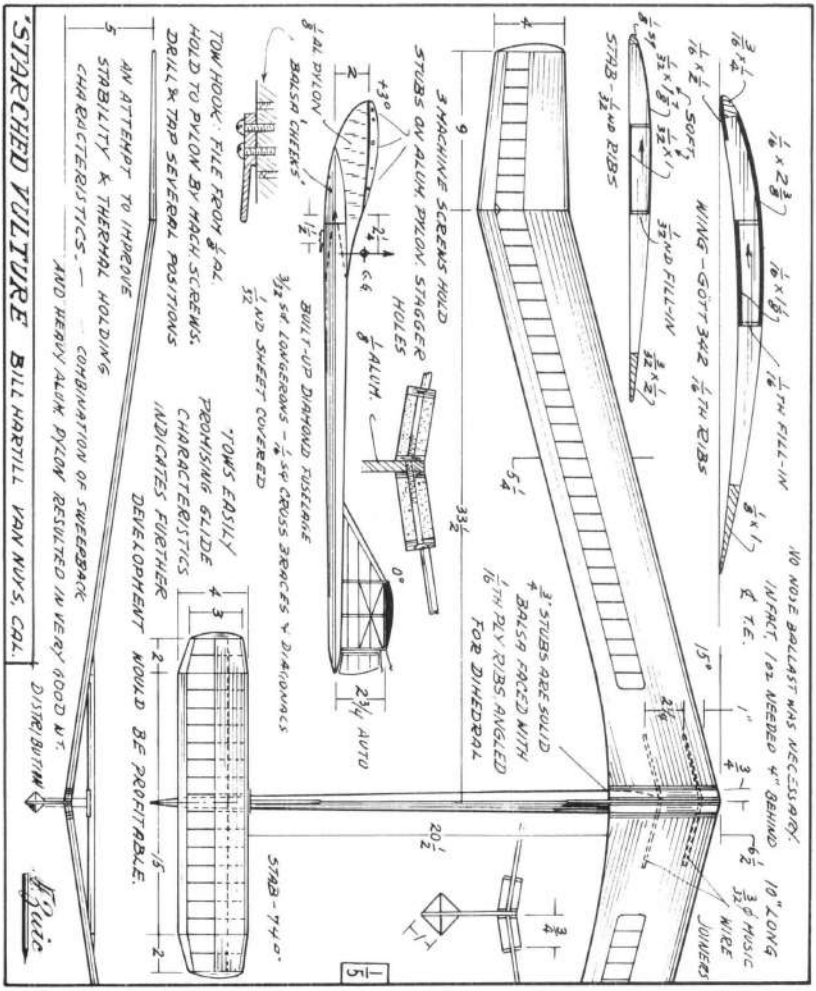
AERO MODELLER October 1959


3×5 HDWD
3×3
10×10
6×25
250
315
630
160
3×4
4×5
6×25
50
B
30
40
65
A
B
4×4
3×3
2mm
650
DURAL TONGUE
4mm
140
2mm BALSA
3×3
B-B
16
A-A
DURAL HOOK
1/5
600
6TH 1959 NORDICS
180, 180, 164, 160, 180, = 864
100
'NORDIC' A/2
A. BUITER HOLLAND


1.5 BALSA
3×5 SPRUCE
3×10 SPRUCE
4×35 BALSA
GÖTT 417 1.5 RIBS
140
1.5×60×152 DURAL TONGE
320
620
160
166a
5×5 BLS
2×3 BLS
CENTER RIBS 2mm PLY
HA 13
1mm RIBS
2×10 BLS
90
30
720
SOLID BIRCH
1.5mm BALSA TUBE 22ø → 18ø
80
AVERAGE 2:40 – 2:50 STILL AIR
55%
80
TIMER
15
20
24
PERFORMS BEST IN ROUGH WEATHER WITH STRONG THERMALS
VIA "MODELLFLYG BLADET"
44
524
7TH 1959 WORLD A-2
180, 180, 180, 180, 140 = 860
90
A-2
ROINE JANSSON SWEDEN

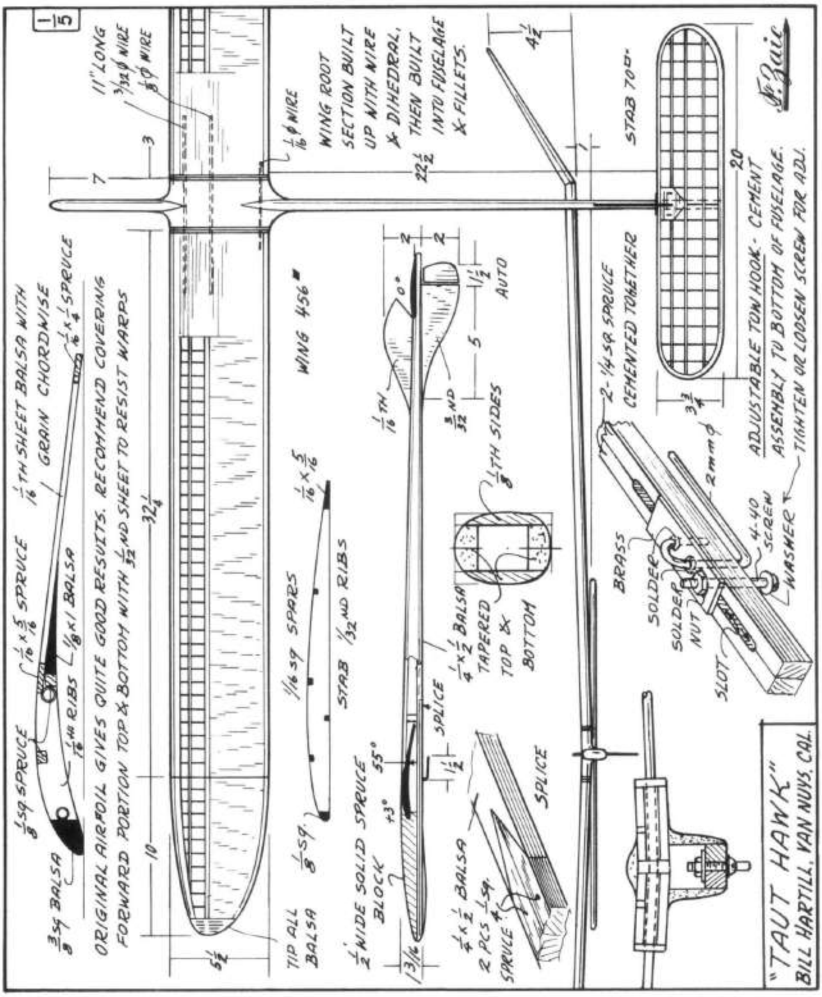

3×5 LINDEN
4×4 LINDEN
8×10
3×18
B-6356-b (SKETCHED)
180
TUBE & 2.5φ WIRE CONNECTIONS
120
160
320
630
25
0.8×12
2×4
2×3
2×4
2×12
FIN: PLYWOOD, LIGTHENED, 1.5 BAL. COVERED
0°
$3\frac{1}{2}$°
70
110
6
6
2.5 PLY SKID
FUSELAGE 6mm MED. BALSA SIDES
660
FROM "MODELLISTICA"
23°
3°
MODELSPAN COVERED
540
86
1960 - A-2 ITALIAN CHAMP.
1959 - A-2 ITALIAN CHAMP.
8TH 1959 WORLD CHAMP.
VELEGGIATORE A-2 GB5 GIOVANNI BULGHERONI


167a
$\frac{3}{8}$ sq
$\frac{1}{8}$ th. FILL-IN
$\frac{1}{8}$×1
8 CENTRE RIBS $\frac{1}{16}$ PLY
$\frac{1}{8}$ SOFT FILL-IN
5
LAM. 6-$\frac{1}{32}$ HD
$\frac{1}{8}$×$\frac{3}{16}$ PINE SPARS
$\frac{1}{16}$ " RIBS
$6\frac{5}{16}$
17
21
$\frac{7}{8}$
DIAGONALS $\frac{1}{16}$ sq
$\frac{1}{8}$ WIRE WING JOINERS
NO TUBES
$\frac{3}{16}$ sq → $\frac{1}{8}$ sq
$\frac{1}{16}$×$\frac{1}{4}$
$\frac{1}{16}$×$\frac{1}{8}$
$\frac{1}{16}$×$\frac{3}{8}$ → $\frac{3}{16}$
$\frac{1}{32}$ HD WEB
$\frac{1}{32}$ HD RIBS
6
TATONE/D.T. OPERATED BY AUTO RUDDER MECHANISM
MODEL VERY GOOD ON TOW DURING TRIALS & FINALS AVERAGED 2:43 (15 FLIGHTS)
29
$\frac{1}{5}$
$2\frac{5}{8}$
$\frac{1}{16}$ th
A
62%
B
3
$1\frac{5}{8}$
$3\frac{1}{8}$
$1\frac{1}{8}$
$\frac{1}{2}$
$\frac{1}{8}$ PLY CENTER
$\frac{3}{8}$ SHEET CARVED
$\frac{1}{4}$×$\frac{7}{8}$ TPR. TO $\frac{1}{4}$×$\frac{3}{8}$ AT STAB L.E
FUSELAGE SECTIONS
$\frac{1}{8}$×$\frac{7}{8}$ → $\frac{1}{4}$
TISSUE
B
A
20
¢ 4
$2\frac{3}{4}$
1959-TEAM-A/2
RAY MONKS-ENGLAND



"STARCHED VULTURE"—— Bill Hartill, Van Nuys, Cal.

The ideas behind "Starched Vulture" were to obtain thermal hunting ability, very good stability and high efficiency. These are all very worthy goals, of course. The sweep back was tried to gain thermal sniffering tendencies. It worked out quite nicely and the flight pattern turned out to be rather unusual. After release from the tow S.V. flies straight ahead without reacting to auto rudder. Straight flight into the wind continues until some sort of disturbance is encountered. If it is a thermal, ship circles in thermal in direction of auto rudder turn. If it is just a gust or down draft ship invariably veers away in a straight line. I know this sounds like too much to hope for, but that is what it does. Stall recovery is quite good, apparently because of the sweepback and tip shape. The cranked tips delay tip stall and provide a favorable stable CP moment.

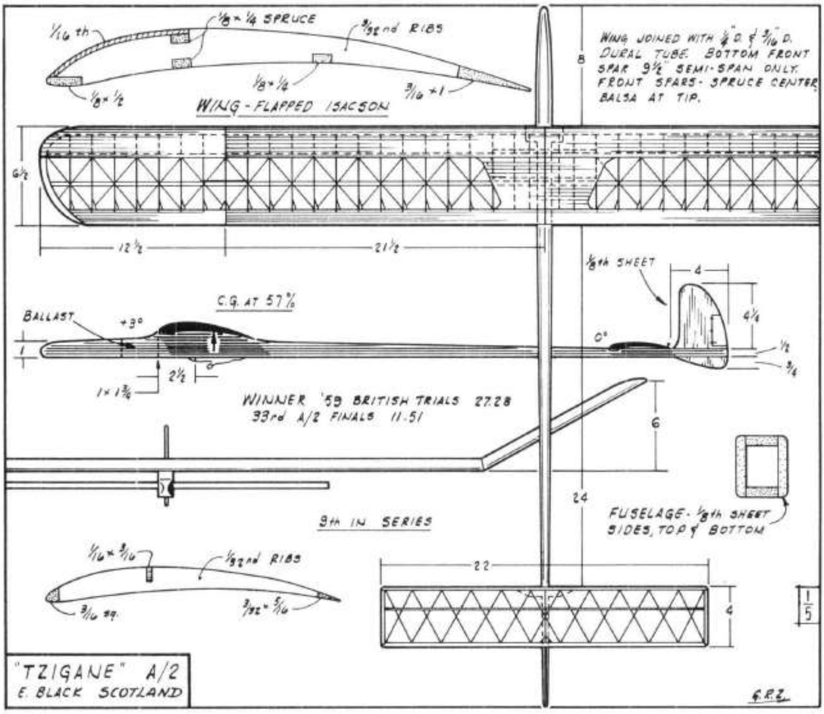


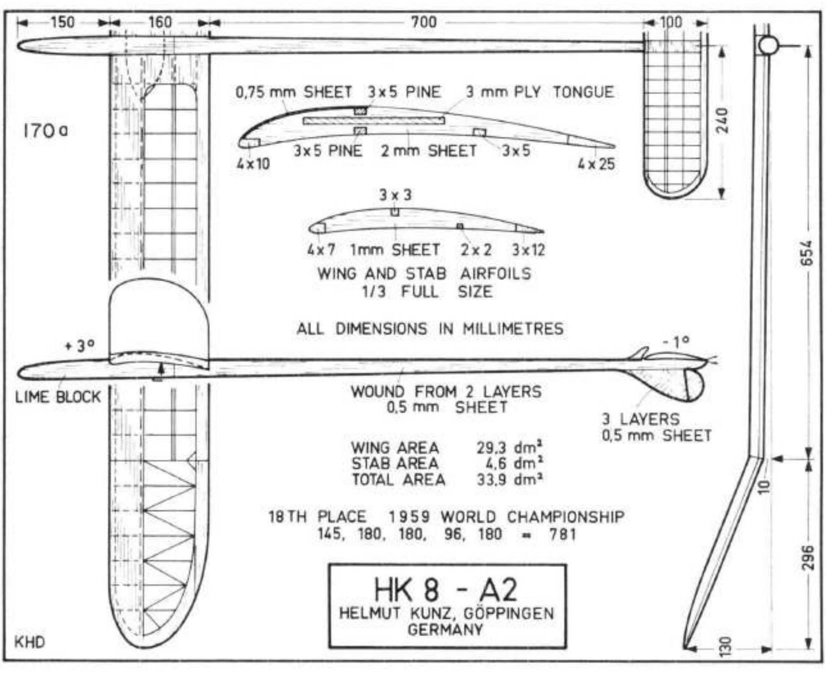
Wing planform also provides a favorable distribution of mass and lifting surface about the C.G. which is $2^1/_4$ inches behind the wing root TE. No nose weight was needed. Several ounces had to be added at the C.G.

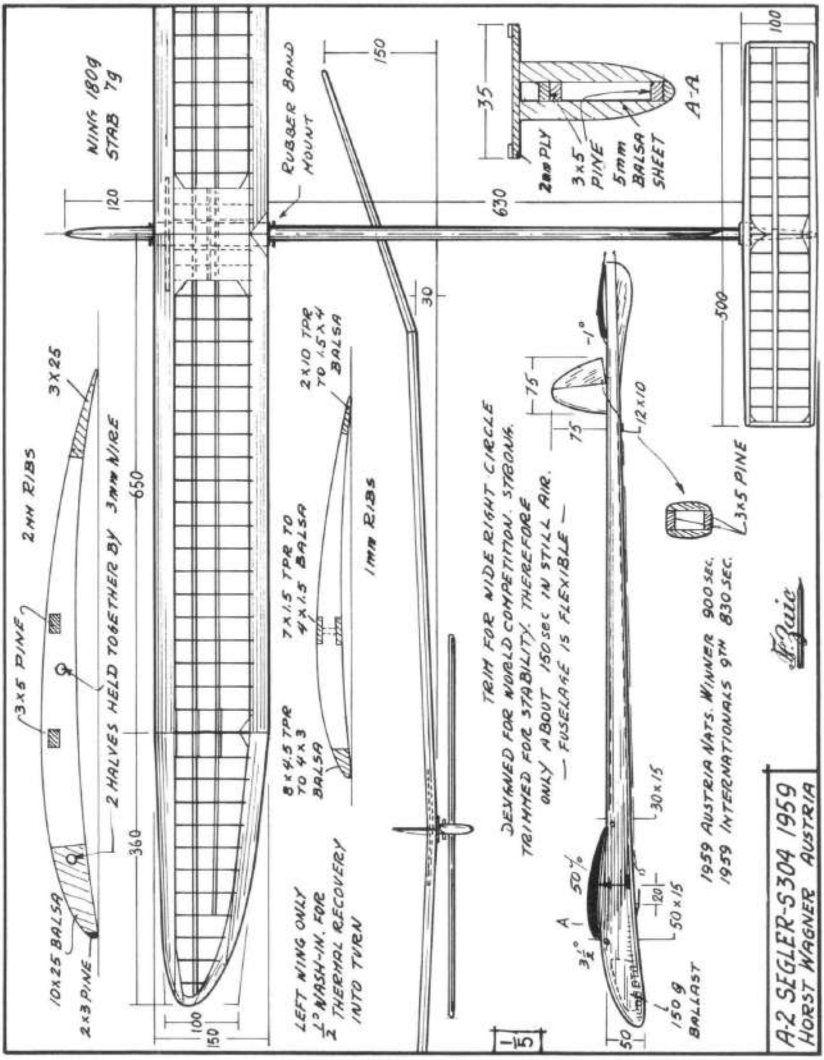
Non-thermal flight time is quite respectable. I have wondered if the sweep-back might lower the sub critical Reynolds number by virtue of the span-wise flow vector creating a three-dimensional energizing of the boundary layer.

Unfortunately the Vulture spent a week in a wet wheat field and, although the wings appeared to be de-warped, the original flight characteristics were not completely regained. Most troublesome fault was a viciousness on the tow that had never exited before. I think that this might be cured by moving the tow hook up (or wing down), and will be tried in the next version.

170


1/16 th
1/8 × 1/4 SPRUCE
3/32nd RIBS
1/8 × 1/2
1/8 × 1/4
3/16 × 1
WING - FLAPPED ISACSON
WING JOINED WITH 1/4" D. & 3/16" D. DURAL TUBE. BOTTOM FRONT SPAR 9 1/2" SEMI-SPAN ONLY. FRONT SPARS - SPRUCE CENTER, BALSA AT TIP.
8
6 1/2
12 1/2
21 1/2
1/8th SHEET
4
4 1/4
1/2
3/4
C.G. AT 57%
BALLAST
+3°
0°
1
2 1/2
1 × 1 3/4
WINNER '59 BRITISH TRIALS 27.28
33rd A/2 FINALS 11.51
6
24
FUSELAGE - 1/8th SHEET SIDES, TOP & BOTTOM
9th IN SERIES
1/16 × 3/16
1/32nd RIBS
3/16 sq.
3/32 × 5/16
22
4
1/5
"TZIGANE" A/2
E. BLACK SCOTLAND
G.R.Z.


170 a
150
160
700
100
0,75 mm SHEET
3 x 5 PINE
3 mm PLY TONGUE
4 x 10
3 x 5 PINE
2 mm SHEET
3 x 5
4 x 25
240
3 x 3
4 x 7
1mm SHEET
2 x 2
3 x 12
WING AND STAB AIRFOILS
1/3 FULL SIZE
ALL DIMENSIONS IN MILLIMETRES
654
+ 3°
- 1°
LIME BLOCK
WOUND FROM 2 LAYERS
0,5 mm SHEET
3 LAYERS
0,5 mm SHEET
WING AREA 29,3 dm²
STAB AREA 4,6 dm²
TOTAL AREA 33,9 dm²
10
18 TH PLACE 1959 WORLD CHAMPIONSHIP
145, 180, 180, 96, 180 = 781
296
HK 8 - A2
HELMUT KUNZ, GÖPPINGEN
GERMANY
KHD
130



THE MAN BEHIND THE A/2— Horst Wagner, Austria

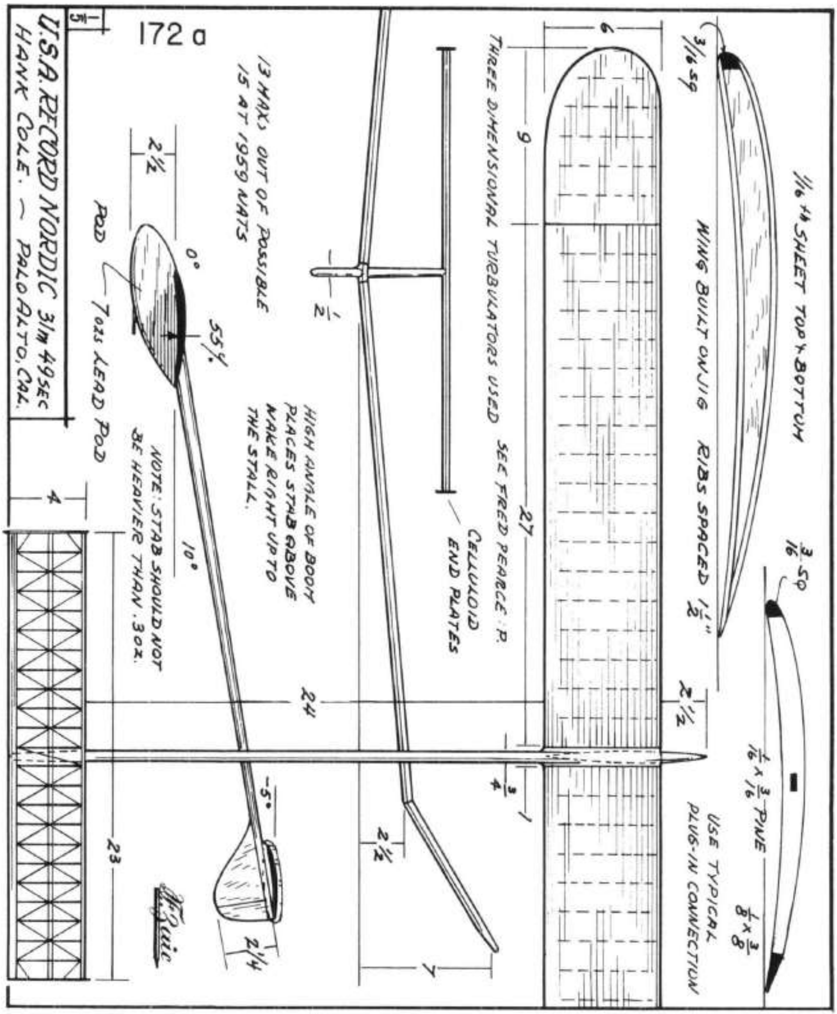
My personal idea about contest flying in the Nordic class is that the glider does not win but the man who flies, and who is able to take advantages from weather, thermals and tactics. Therefore, you should fly as often as possible in any kind of weather and try to hold the launch of the model as long as possible. This ability is very important for thermal hunting. The second important thing is a good "warp." You can never tell whether the one particular warp is good. You must try different ones, and then you can really tell that this special warp will do well in your model and in all derivations of this type. I usually fly a right circle with 110 yards diameter in evening air. The angle of attack on the left wing is increased ½ degrees compared with the right. If the model stalls, it turns into a close circle. This is the same effect when the model meets a thermal. I think that this method of trimming helps a little bit to find the thermals.

SHORT NOSE NORDIC —— Hank Cole, Palo Alto, Cal.

May 15, 1957

The extremely short nose is in accordance with present trends, but the model has several outstanding new features. The tailboom is set at a large angle to the wing so that the stabilizer flies about eight inches above the wake of the wing. The rudder also rides high and gives the model a very unusual nose high turn. Sub rudder dips into the wake when the model stalls and gives it a very unusual sharp, wheeling, nose high turn when it runs into a thermal. Sometimes it acts like it has a pilot.

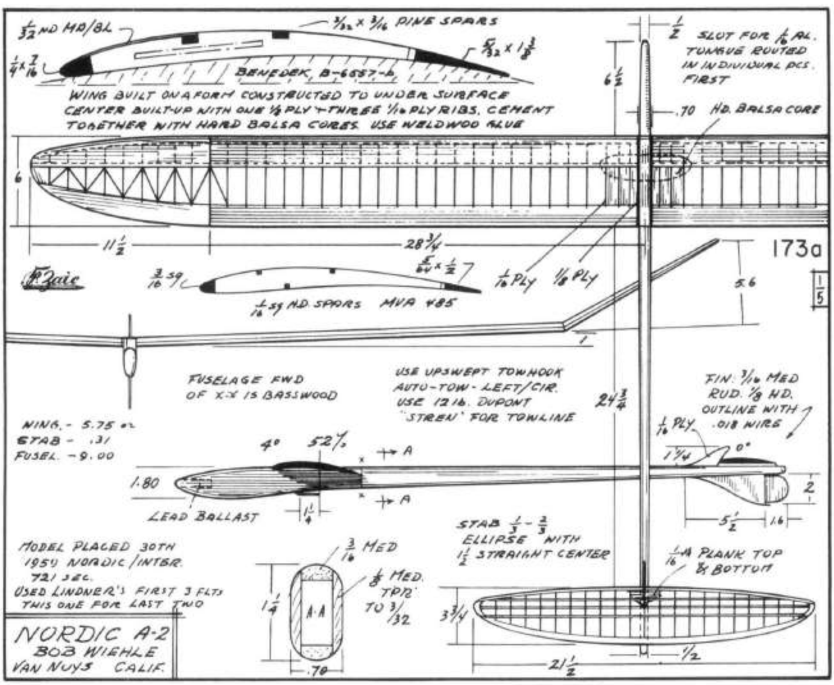
Another unusual feature is the three dimensional turbulators, the v-shaped wedges on the wing and stab. I believe that these are superior to the turbulence wire used by Europeans. The tail moment arm is shorter than usual and the stabilizer larger than usual. This gives better stability and tighter circles for soaring, and wind.

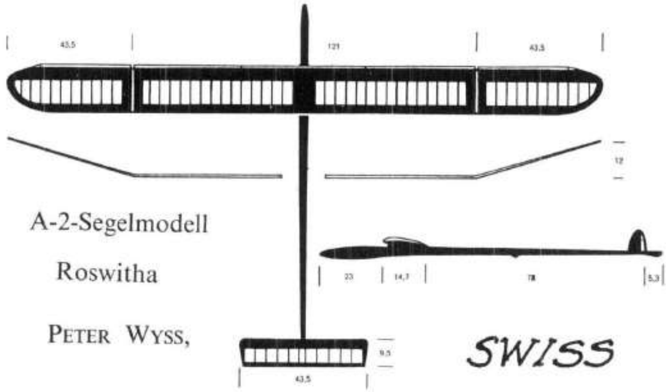


Also you will note that I use a much larger stab than most of the Nordic designs. I do this to give the model good dethermalizing characteristics which is real important in some of our super California thermals. Have seen other Nordics with small stabs sucked up out of sight even though dethermalized. This glider is exceptionally good in the wind as long as it doesn't meet with misfortune like in Fresno when a dust devil picked it up off the ground after it had dethermalized and cartwheeled it down the field. By the way, I don't think the larger stab affects the performance much. According to my calculations, if the wing loading of a Nordic is increased by 1 oz., you only lose 3 seconds out of 3 minutes.

Two weeks ago the model proved it's flying ability at a Sacramento contest, posting 5 maximums and a 6th flight of 16 min. 49 sec. Needless to say the weather was perfect. I used a fuse dethermalizer on the last flight and the model dethermalized from about 1000 feet in sight of the timers. This was not all luck, but largely due to the excellent towing characteristics of the model which I attribute to the high stab. The model has excellent towline stability even when it is straight overhead. On one flight I ran about a quarter of a mile down a road with the model directly overhead before I ran into any lift. Have applied for the AMA record, but haven't heard yet. Should go through alright.

1959 ——— Had four maxs at the Nats with it this year, but goofed one flight when it slipped off the line in a downdraft.

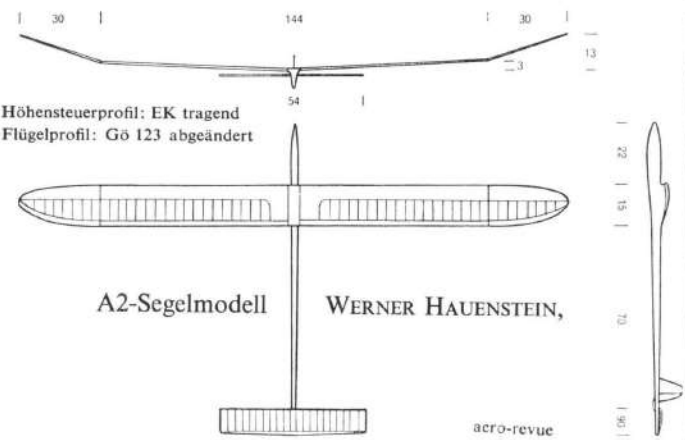




A-2-Segelmodell

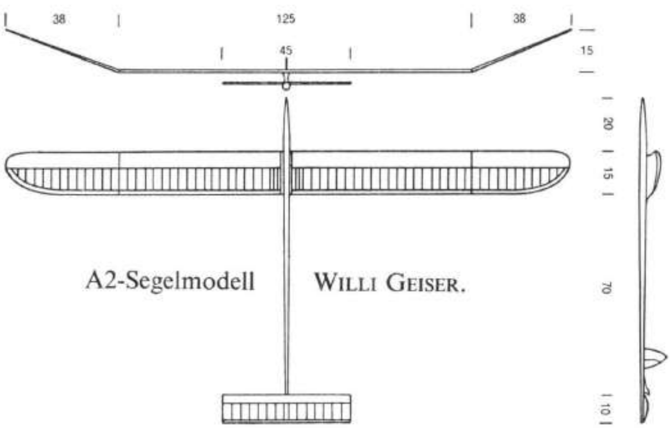
Roswitha

PETER WYSS,

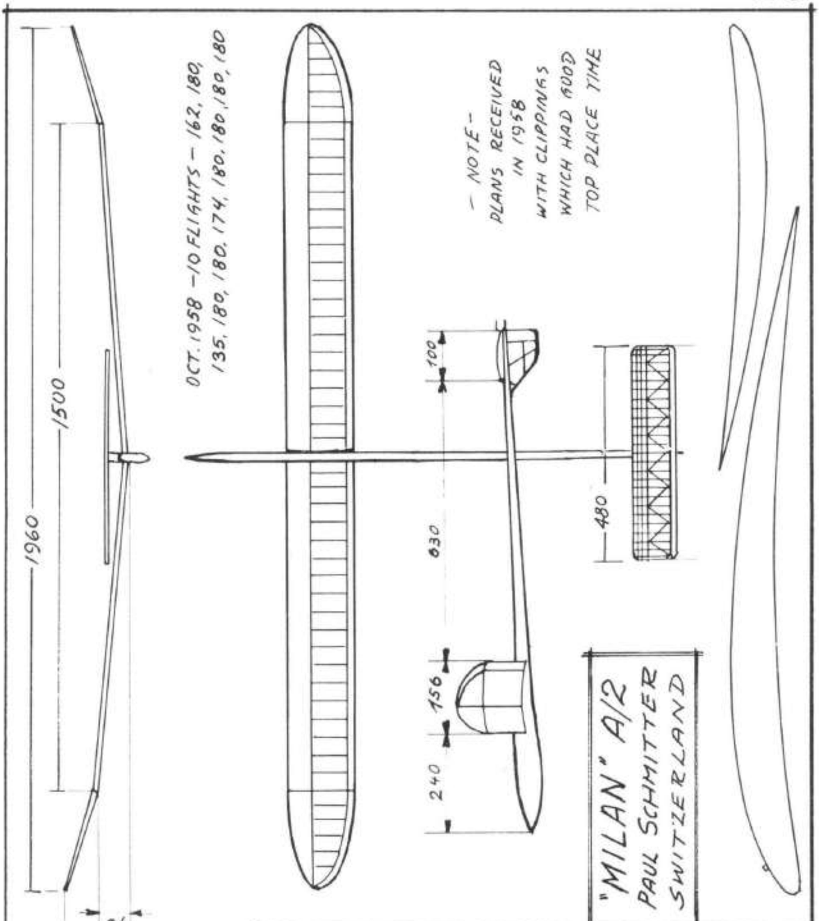


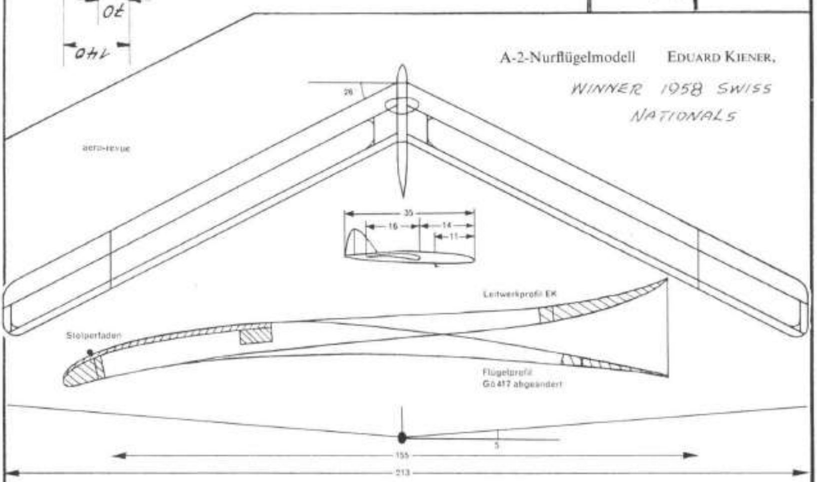
Höhensteuerprofil: EK tragend
Flügelprofil: Gö 123 abgeändert

A2-Segelmodell WERNER HAUENSTEIN,

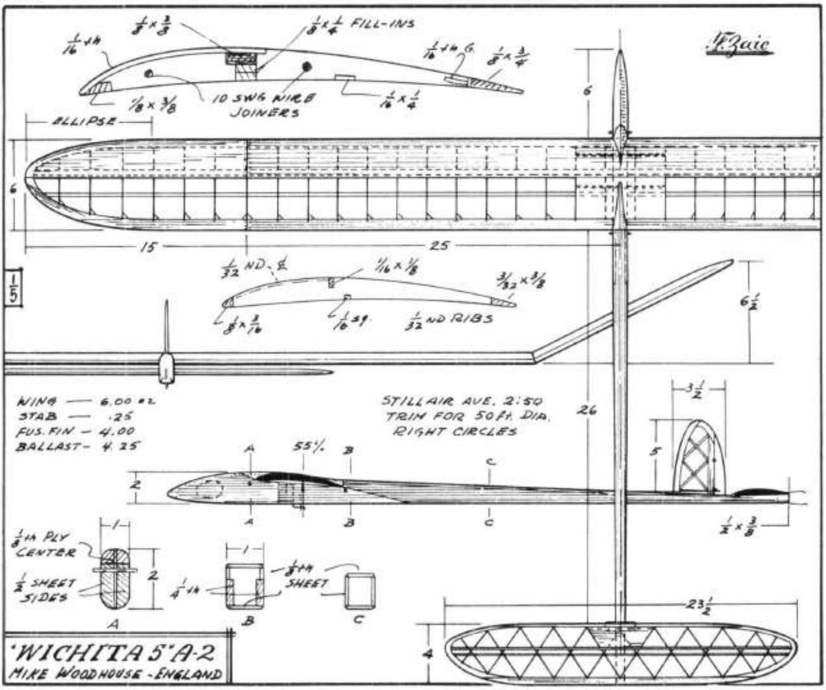


A2-Segelmodell WILLI GEISER.

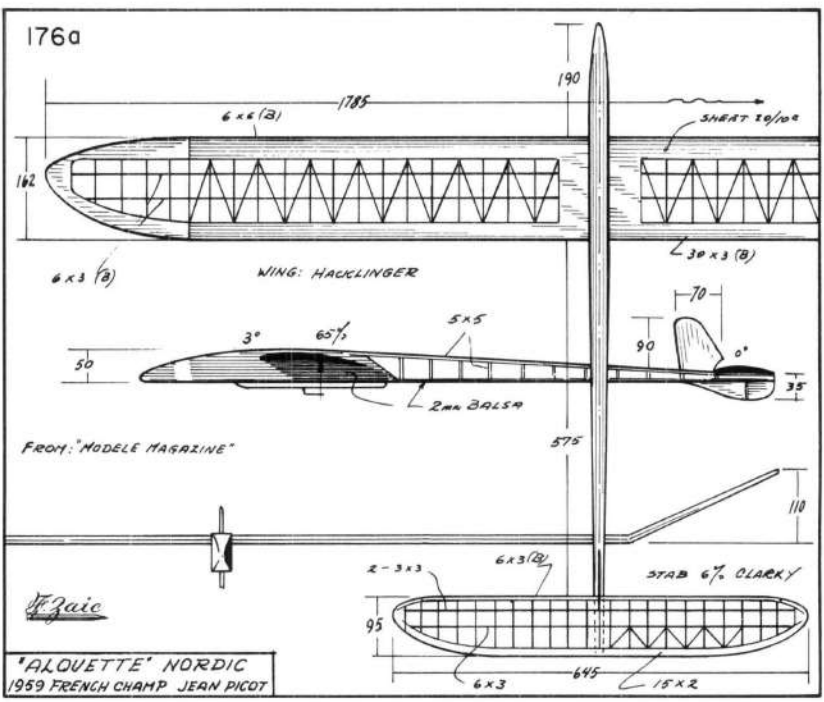

"MILAN" A/2
PAUL SCHMITTER
SWITZERLAND
OCT. 1958 – 10 FLIGHTS – 162, 180, 135, 180, 180, 174, 180, 180, 180, 180
– NOTE –
PLANS RECEIVED IN 1958 WITH CLIPPINGS WHICH HAD GOOD TOP PLACE TIME
1960
1500
140
70
100
830
480
156
240


A-2-Nurflügelmodell EDUARD KIENER,
WINNER 1958 SWISS NATIONALS
aero-revue
Leitwerkprofil EK
Stolperfaden
Flügelprofil Gö 417 abgeändert
35
16
14
11
155
213

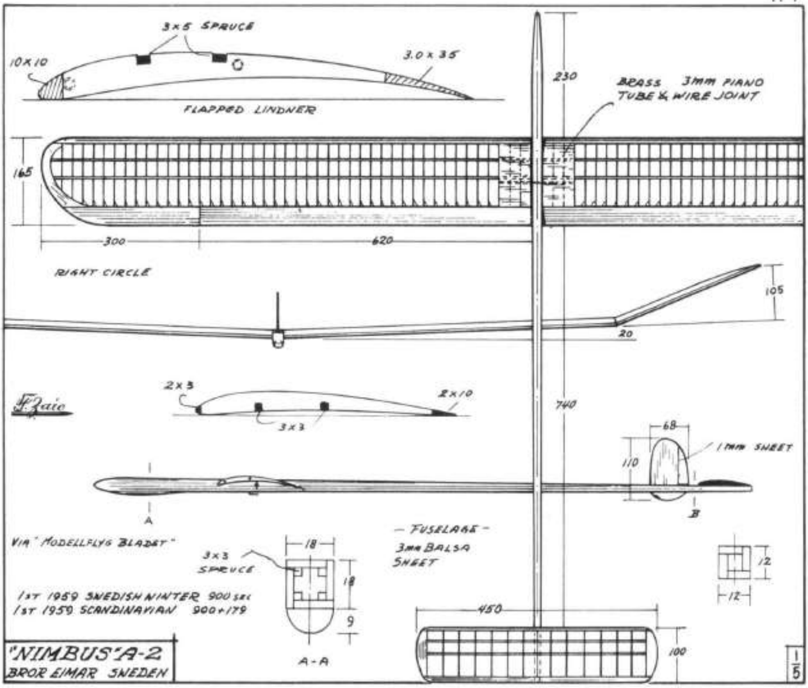
176

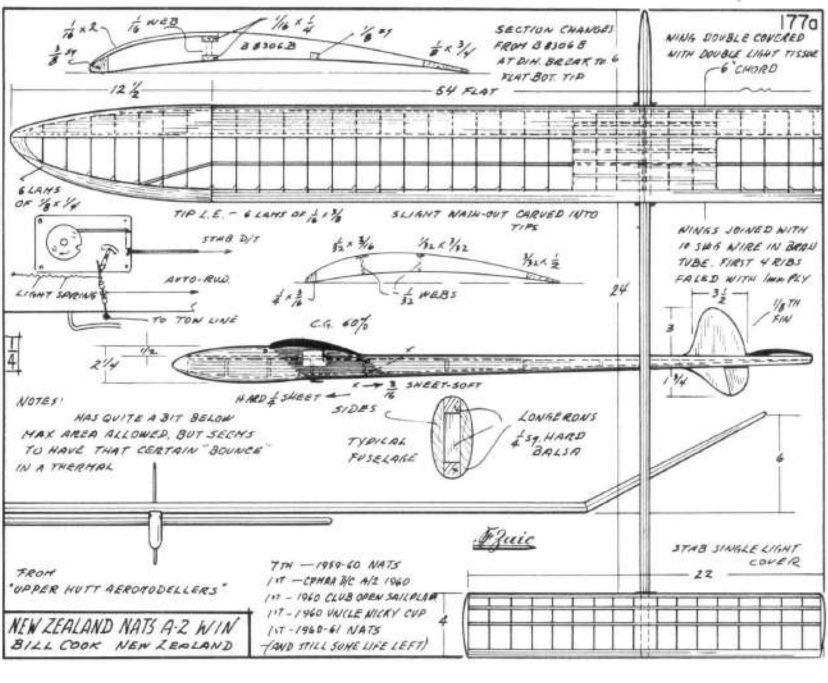


1/16 th
1/8 x 3/8
1/8 x 1/4 FILL-INS
1/16 th G.
1/8 x 3/4
1/8 x 3/8
10 SWG WIRE JOINERS
1/16 x 1/4
ELLIPSE
6
15
25
1/32 WD. ℄
1/16 x 1/8
3/32 x 3/8
1/8 x 3/16
1/16 sq.
1/32 WD RIBS
6 1/2
1/5
WING — 6.00 oz
STAB — .25
FUS. FIN — 4.00
BALLAST — 4.25
STILLAIR AVE. 2:50
TRIM FOR 50 ft. DIA.
RIGHT CIRCLES
26
3 1/2
5
55%
A
B
C
2
1/2 x 3/8
1/8 th PLY CENTER
1/2 SHEET SIDES
1/4 th
1/8 th SHEET
23 1/2
4
'WICHITA 5' A-2
MIKE WOODHOUSE - ENGLAND



176a
190
1785
6 x 6 (B)
SHEET 20/10e
162
30 x 3 (B)
6 x 3 (B)
WING: HACKLINGER
70
5 x 5
3°
65%
90
0°
50
35
2mm BALSA
FROM: "MODELE MAGAZINE"
575
110
2 - 3 x 3
6 x 3 (B)
STAB 6% CLARKY
95
645
6 x 3
15 x 2
"ALOUETTE" NORDIC
1959 FRENCH CHAMP JEAN PICOT


3×5 SPRUCE
10×10
3.0×35
FLAPPED LINDNER
230
BRASS 3mm PIANO
TUBE & WIRE JOINT
165
300
620
RIGHT CIRCLE
105
20
2×3
2×10
3×3
740
68
110
1mm SHEET
A
B
VIA "MODELLFLYG BLADET"
— FUSELAGE —
3mm BALSA
SHEET
3×3
SPRUCE
18
18
9
12
12
1ST 1959 SWEDISH WINTER 900 SEC
1ST 1959 SCANDINAVIAN 900+179
450
100
A-A
"NIMBUS" A-2
BROR EIMAR SWEDEN
1/5


177a
1/16 × 2
1/16 WEB
1/16 × 1/4
1/8 SQ
3/8 SQ
B 8306 B
1/8 × 3/4
SECTION CHANGES
FROM B 8306 B
AT DIH. BREAK TO 6
FLAT BOT. TIP
WING DOUBLE COVERED
WITH DOUBLE LIGHT TISSUE
6" CHORD
12 1/2
54 FLAT
6 LAMS
OF 1/8 × 1/4
TIP L.E. — 6 LAMS OF 1/16 × 3/8
SLIGHT WASH-OUT CARVED INTO
TIPS
STAB D/T
AUTO-RUD.
LIGHT SPRING
TO TOW LINE
1/32 × 3/16
1/32 × 3/32
3/32 × 1/2
1/4 × 3/16
1/32 WEBS
WINGS JOINED WITH
10 SWG WIRE IN BRASS
TUBE. FIRST 4 RIBS
FACED WITH 1mm PLY
24
3 1/2
1/8 TH
FIN
3
1 3/4
C.G. 60%
1/4
2 1/4
1/2
3/16 SHEET-SOFT
HARD 1/4 SHEET
SIDES
NOTES:
HAS QUITE A BIT BELOW
MAX AREA ALLOWED, BUT SEEMS
TO HAVE THAT CERTAIN "BOUNCE"
IN A THERMAL
TYPICAL
FUSELAGE
LONGERONS
1/4 SQ. HARD
BALSA
6
STAB SINGLE LIGHT
COVER
22
FROM
"UPPER HUTT AEROMODELLERS"
7TH — 1959-60 NATS
1ST — CPMAA R/C A/2 1960
1ST — 1960 CLUB OPEN SAILPLANE
1ST — 1960 UNCLE NICKY CUP
1ST — 1960-61 NATS
(AND STILL SOME LIFE LEFT)
4
NEW ZEALAND NATS A-2 WIN
BILL COOK NEW ZEALAND

SWEDISH DESIGN A/2 ———— Stellan Knoos, Sweden

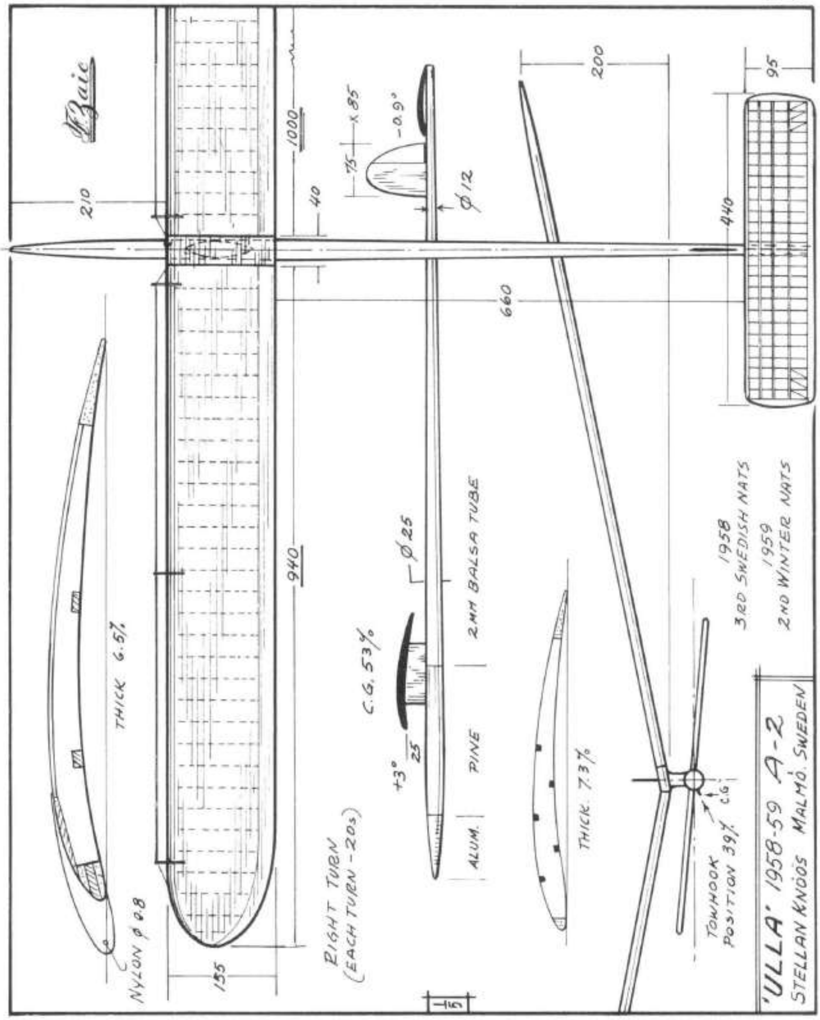
As you have been looking at my girl-named design glider "ULLA" (by the way the name of the model has been changed many times since it was first constructed) I will give you some further information.

The glider was supposed to stand normal Swedish weather conditions. That is quite a strong wind nearly all the year (not an Austria-valley-condition!) and rather small diameter thermals close to great areas of sinking air! So, it is neither a still-air design nor a windy-weather design. A little aerodynamics applied to A-2 models shows that from 50 m tow-line, total time decreases with about 8.5 seconds when the wing-mean chord is increased with 1 cm. Effect of altering Reynolds number must be added. So I have chosen a mean chord of 15,1 cm. Still-air performance is then about 170-175 sec. Same model could fly more than 3 minutes with a mean chord less than 15,1. For example, for a mean chord of 13 cm. a theoretical performance of $170 + (2,1 \times 8,5) = 188$ seconds.

A calculated C_L of 1,1 gave an air speed of 4,3 m/sec. Using quite a tight "termal" turn of 28 m. diameter indicates that an assymetrical wing of about 2,2 cm. The "Thomann-formula": Assymetri $= \frac{b^2}{12R}$. where "b" is the span and "R" the circling radius. It is important to place the tow-hook right below the center of gravity! Towing such an assymetrical model is not a problem, that many pessimists think. Due to assymetri, model is circling by itself without giving, in my case, a right-turn rudder. So, when towing, the rudder tab is indicating left and in flight zero.

Wing airfoil is conventional (in Sweden at least!) It is a modified old good Gottingen 417 6.5 per cent thickness. A little more flapped trailing-edge has been used. Also a little steeper nose upper-tangent and rounded edge. Nylon-wire gives lower flight-time of some seconds, but increases stability very much around the pitching axis.

I have chosen a balsa-covered wing for many reasons. This airfoil has been used in modified version by several of our Swedish maestros in gliding. Rolf Hagel of Malmo has since many years used it with a conventional built-up structure with two main-spars in the middle of the rib. In such a case you have to be very careful with warping. Multi-spars at the airfoil-contoure is better in this respect. However, theory indicates (and some experiments verify) that the boundary-layer is laminar very far away from the leading edge. As this layer has easier to separate, than the turbulent, aft of pressure minimum at the upper side of airfoil, a contour-spar often is an indication for the flow to separate. At the lower side this case is not so probable, and in case of separating, total effect is not so dangerous. Another story is that with help of the spars in contoure, it is possible to get a turbulent boundary-layer. It is however very difficult to get the optimum distances between the spars, to which flow is sensible. Thomann, now living here in Stockholm, has recently built a model with contur-spars based on theory of getting tur-

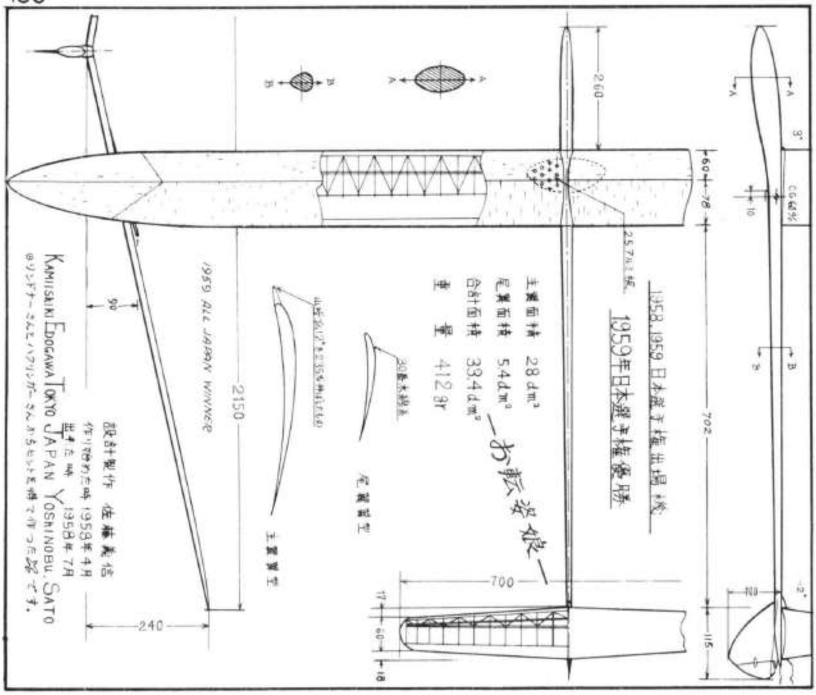


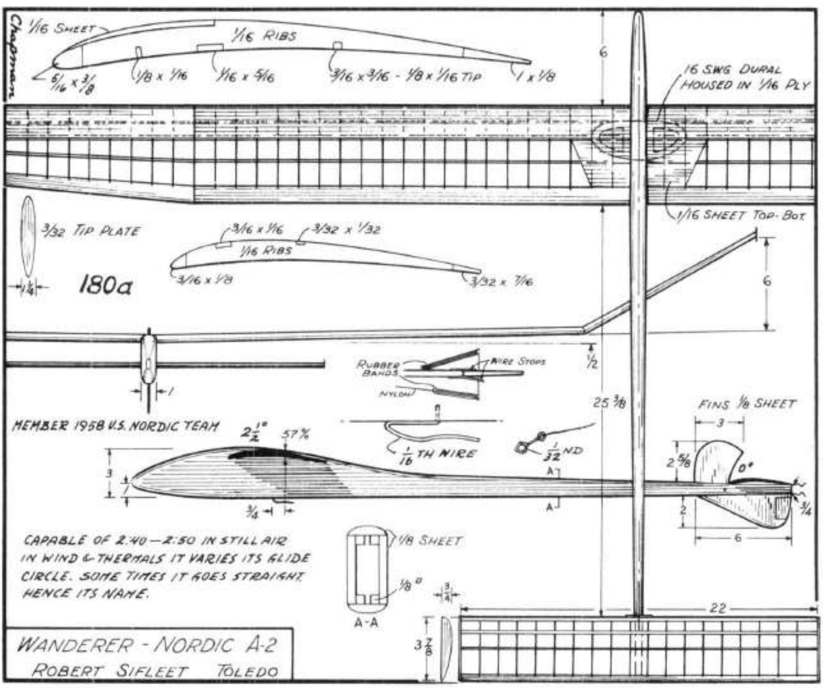
bulence in this way. I think he should like to explain it himself! However, my personal opinion is that (a very fine) turbulence could be achieved with balsa-covered contour and a wavy-wall with variation of the wave-length with distance from leading edge. I think I will do some experiments later if time permits.

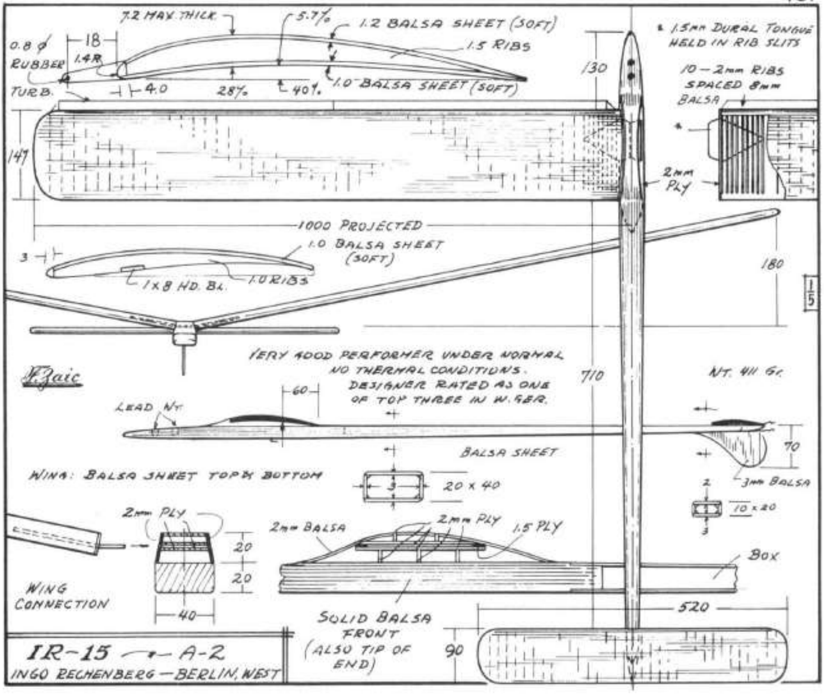
As plan indicates, wing is covered with 1,2 mm. balsa. Without lower two 3 x 5 mm pinespars wings would warp tips down. To increase strength, both sides of the sheet are covered with tissue. In case of collision with a tree, or somewhat, without this arrangement it could happen the sheet to split. So, in addition, quite a soft kind of balsa has been used.

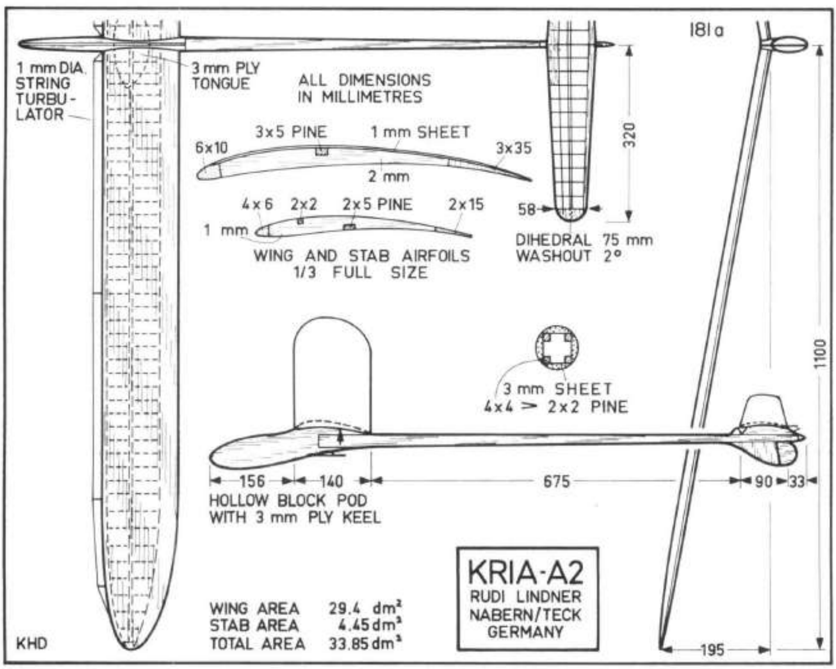
I am a lazy boy so I build with simple V-Wing. Wings are attached with two simple piano-wires, 3 mm. diameter, in a center-piece of hardtree. Due to this configuration, when landing at rough ground, as models always like to do, wings are protected to a great extent. Instead it is the tailplane that takes the hits.

180

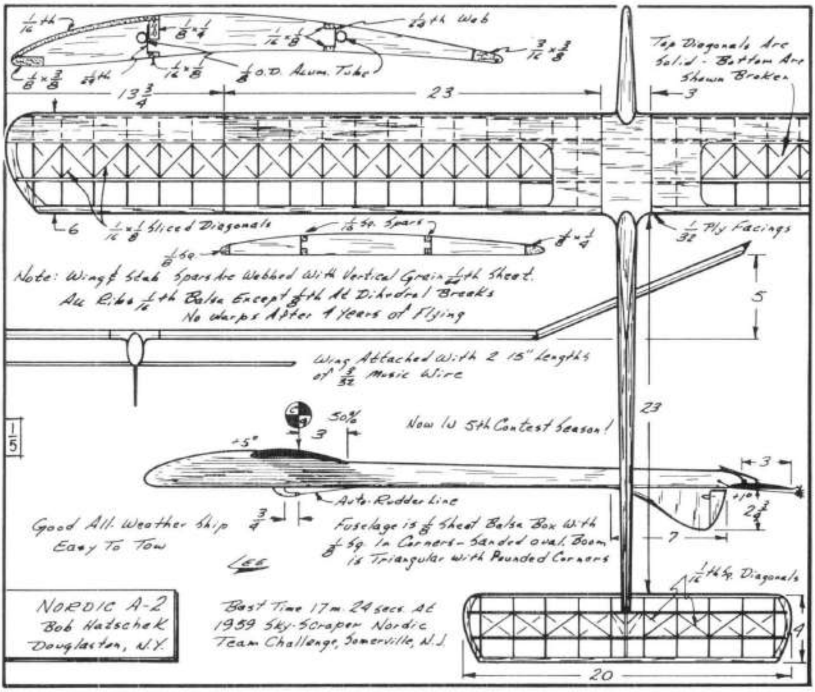

1958.1959 日本選手権出場機
1959年日本選手権優勝
主翼面積 28 dm²
尾翼面積 5.4 dm²
合計面積 33.4 dm²
重量 412 gr
—お転婆娘—
1959 ALL JAPAN WINNER
2150
260
700
702
240
90
115
尾翼翼型
主翼翼型
設計製作 佐藤義信
KAMIISAKI EDOGAWA TOKYO JAPAN YOSHINOBU SATO


Chapman
1/16 SHEET
1/16 RIBS
6/16 x 3/8
1/8 x 1/16
1/16 x 5/16
3/16 x 3/16 - 1/8 x 1/16 TIP
1 x 1/8
16 SWG DURAL HOUSED IN 1/16 PLY
1/16 SHEET TOP-BOT.
3/32 TIP PLATE
3/16 x 1/16
3/32 x 1/32
1/16 RIBS
3/16 x 1/8
3/32 x 7/16
180a
RUBBER BANDS
WIRE STOPS
NYLON
25 3/8
FINS 1/8 SHEET
MEMBER 1958 U.S. NORDIC TEAM
2 1/2°
57%
1/16 TH WIRE
1/32 ND
0°
CAPABLE OF 2:40 — 2:50 IN STILL AIR
IN WIND & THERMALS IT VARIES ITS GLIDE
CIRCLE. SOME TIMES IT GOES STRAIGHT
HENCE ITS NAME.
1/8 SHEET
A-A
22
3 7/8
WANDERER - NORDIC A-2
ROBERT SIFLEET TOLEDO

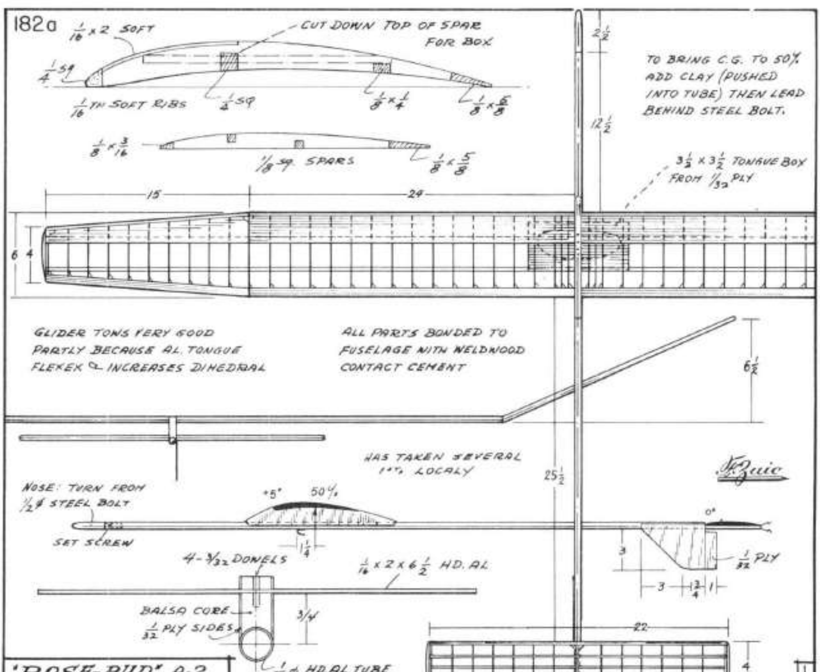

7.2 MAX. THICK.
5.7%
1.2 BALSA SHEET (SOFT)
1.5 RIBS
0.8 ϕ RUBBER TURB.
18
1.4R
4.0
28%
40%
1.0 BALSA SHEET (SOFT)
130
1.5mm DURAL TONGUE HELD IN RIB SLITS
10 — 2mm RIBS SPACED 8mm BALSA
147
2mm PLY
1000 PROJECTED
1.0 BALSA SHEET (SOFT)
1.0 RIBS
1x8 HD. BL.
180
VERY GOOD PERFORMER UNDER NORMAL NO THERMAL CONDITIONS. DESIGNER RATED AS ONE OF TOP THREE IN W. GER.
710
WT. 411 Gr.
60
LEAD WT.
70
BALSA SHEET
WING: BALSA SHEET TOP & BOTTOM
20 x 40
3mm BALSA
10 x 20
2mm PLY
2mm BALSA
2mm PLY
1.5 PLY
20
20
BOX
WING CONNECTION
40
SOLID BALSA FRONT (ALSO TIP OF END)
520
90
IR-15 — A-2
INGO RECHENBERG — BERLIN, WEST


181a
1 mm DIA. STRING TURBULATOR
3 mm PLY TONGUE
ALL DIMENSIONS IN MILLIMETRES
320
3x5 PINE
1 mm SHEET
6x10
3x35
2 mm
4x6
2x2
2x5 PINE
2x15
1 mm
58
WING AND STAB AIRFOILS 1/3 FULL SIZE
DIHEDRAL 75 mm
WASHOUT 2°
1100
3 mm SHEET
4x4 > 2x2 PINE
156
140
675
90
33
HOLLOW BLOCK POD WITH 3 mm PLY KEEL
KRIA-A2
RUDI LINDNER
NABERN/TECK
GERMANY
WING AREA 29.4 dm²
STAB AREA 4.45 dm²
TOTAL AREA 33.85 dm²
KHD
195

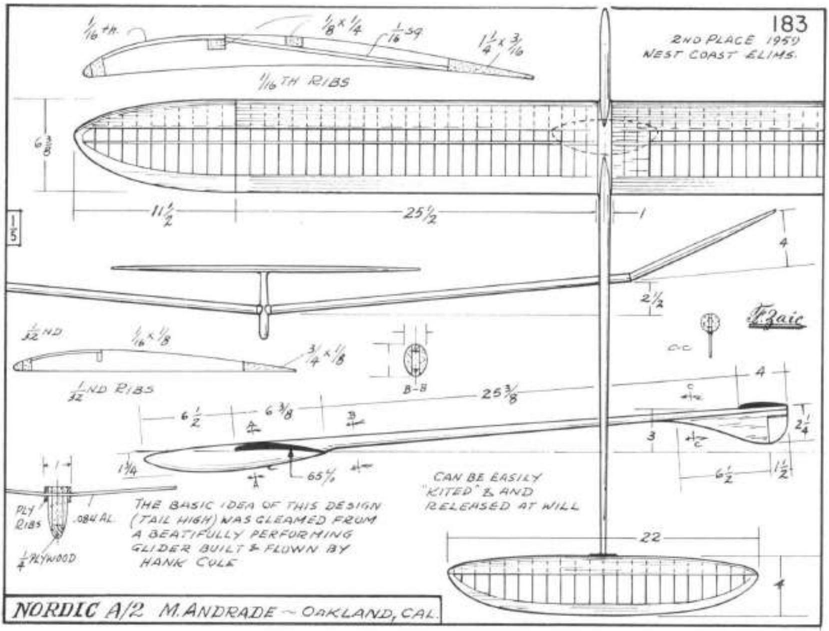
182

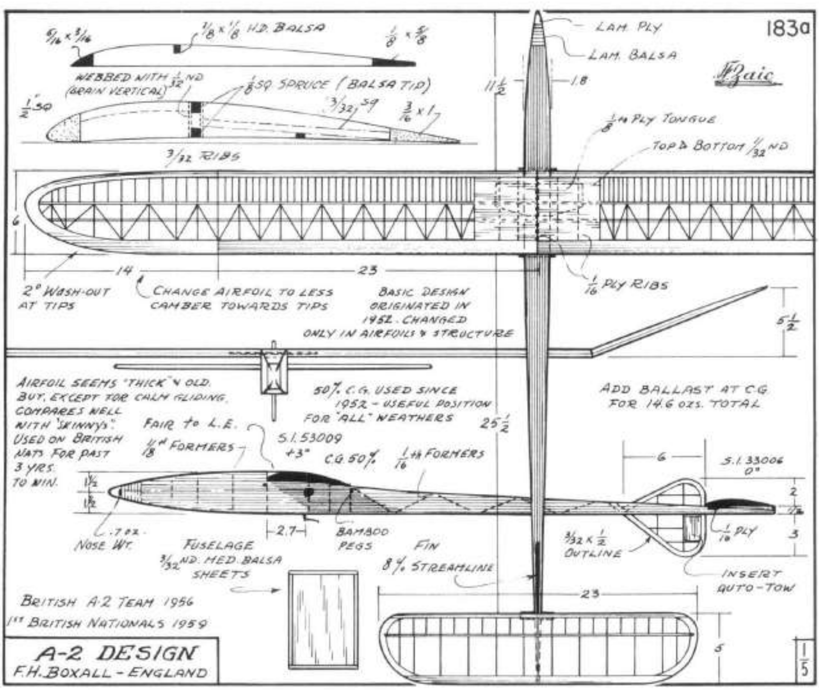


1/16th
1/8 x 1/4
1/64th Web
1/16 x 1/8
3/16 x 3/8
1/8 x 3/8
1/64th
1/16 x 1/8
1/8 O.D. Alum. Tube
Top Diagonals Are Solid - Bottom Are Shown Broken
13 3/4
23
3
6
1/16 x 1/8 Sliced Diagonals
1/16 Sq. Spars
1/8 x 1/4
1/8 Sq.
1/32 Ply Facings
Note: Wing & Stab Spars Are Webbed With Vertical Grain 1/64th Sheet.
All Ribs 1/16th Balsa Except 1/8th At Dihedral Breaks
No Warps After 4 Years of Flying
5
Wing Attached With 2 15" Lengths of 3/32 Music Wire
23
50%
3
Now In 5th Contest Season!
+5°
3
Auto-Rudder Line
+1°
2 3/4
Good All-Weather Ship Easy To Tow
3/4
Fuselage is 1/8 Sheet Balsa Box With 1/8 Sq. In Corners - Sanded oval. Boom is Triangular with Rounded Corners
7
1/16 Sq. Diagonals
NORDIC A-2
Bob Hatschek
Douglaston, N.Y.
Best Time 17m. 24 secs. At 1959 Sky-Scraper Nordic Team Challenge, Somerville, N.J.
4
20
1/5



182a
1/16 x 2 SOFT
CUT DOWN TOP OF SPAR FOR BOX
2 1/2
TO BRING C.G. TO 50% ADD CLAY (PUSHED INTO TUBE) THEN LEAD BEHIND STEEL BOLT.
1/4 SQ
1/16 TH SOFT RIBS
1/4 SQ
1/8 x 1/4
1/8 x 5/8
12 1/2
1/8 x 3/16
1/8 SQ. SPARS
1/8 x 5/8
3 1/2 x 3 1/2 TONGUE BOX FROM 1/32 PLY
15
24
6
4
GLIDER TOWS VERY GOOD PARTLY BECAUSE AL. TONGUE FLEXES & INCREASES DIHEDRAL
ALL PARTS BONDED TO FUSELAGE WITH WELDWOOD CONTACT CEMENT
6 1/2
HAS TAKEN SEVERAL 1st's LOCALY
25 1/2
NOSE: TURN FROM 1/2 ø STEEL BOLT
+5°
50%
0°
SET SCREW
1 1/4
3
1/32 PLY
4-3/32 DOWELS
1/16 x 2 x 6 1/2 HD. AL
3
1 3/4
1
BALSA CORE
3/4
1/32 PLY SIDES
22
1/2 ø HD. AL. TUBE
4
"ROSE-BUD" A-2
VIC LICHTENBERG TACOMA, WASH
1/5

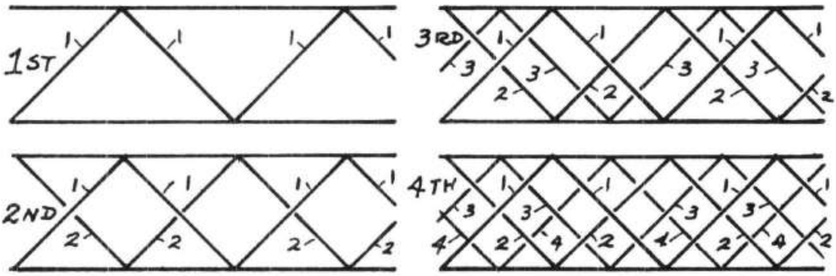

183
2ND PLACE 1959
WEST COAST ELIMS.
1/16 TH RIBS
1/32 ND RIBS
THE BASIC IDEA OF THIS DESIGN (TAIL HIGH) WAS GLEAMED FROM A BEATIFULLY PERFORMING GLIDER BUILT & FLOWN BY HANK COLE
CAN BE EASILY "KITED" & AND RELEASED AT WILL
NORDIC A/2 M. ANDRADE ~ OAKLAND, CAL.


183a
LAM. PLY
LAM. BALSA
1/8 H.D. BALSA
WEBBED WITH 1/32 ND (GRAIN VERTICAL)
1/8 SQ SPRUCE (BALSA TIP)
3/32 RIBS
1/8 th PLY TONGUE
TOP & BOTTOM 1/32 ND
1/16 PLY RIBS
2° WASH-OUT AT TIPS
CHANGE AIRFOIL TO LESS CAMBER TOWARDS TIPS
BASIC DESIGN ORIGINATED IN 1952. CHANGED ONLY IN AIRFOILS & STRUCTURE
AIRFOIL SEEMS "THICK" & OLD. BUT, EXCEPT FOR CALM GLIDING, COMPARES WELL WITH "SKINNYS". USED ON BRITISH NATS FOR PAST 3 YRS. TO WIN.
50% C.G. USED SINCE 1952 - USEFUL POSITION FOR "ALL" WEATHERS
ADD BALLAST AT C.G. FOR 14.6 OZS. TOTAL
FAIR to L.E.
S.I. 53009 +3°
C.G. 50%
S.I. 33006 0°
.7 OZ. NOSE WT.
FUSELAGE 3/32 ND. MED. BALSA SHEETS
BAMBOO PEGS
FIN 8% STREAMLINE
3/32 x 1/2 OUTLINE
INSERT AUTO-TOW
BRITISH A-2 TEAM 1956
1ST BRITISH NATIONALS 1959
A-2 DESIGN
F.H. BOXALL - ENGLAND

GOEDETIC NORDIC WINGS

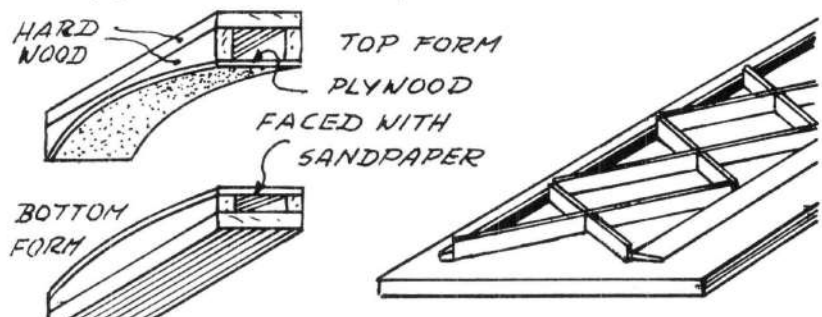
Paolo Soave, Italy

The ribs are made of medium hard balsa 1.5 mm thick. The following system is used: From a sheet of balsa, which is covered on both sides with modelspan, cut strips 1 meter long and 15 mm. wide. Pin the leading and trailing edges (which should be already shaped) to the mounting board. Following the numbered steps as shown assemble the geodetic structure in four different stages. Note that the ribs are not outlined or shaped.

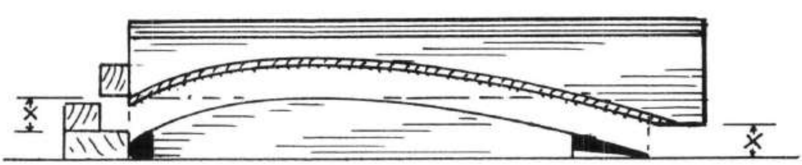


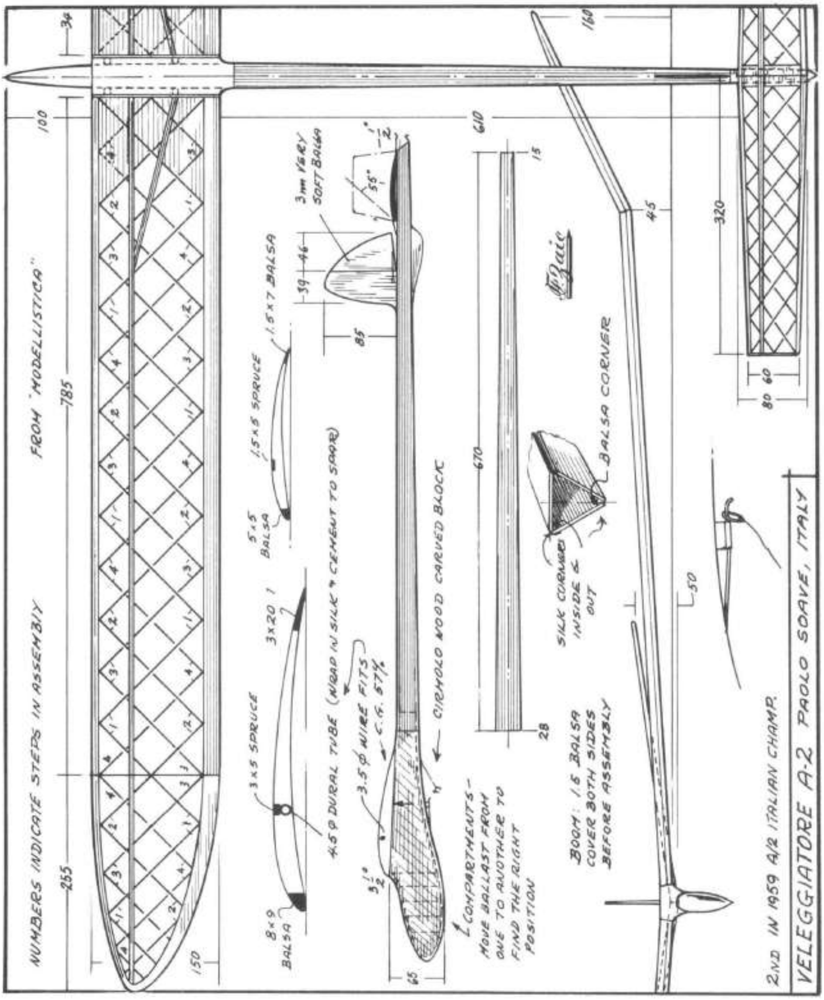
At this point prepare two sanding blocks, one for the top airfoil curce and another for the bottom curve. Glue sandpaper to the blocks with rubber cement. Begin to sand the structure, moving the blocks only in lengthwise direction. Start with rough sandpaper at first and then change to fine sandpaper when the blocks begin to approach the final outline. Finish the top of the wing first and then the bottom in order not to flattenthe airfoil.

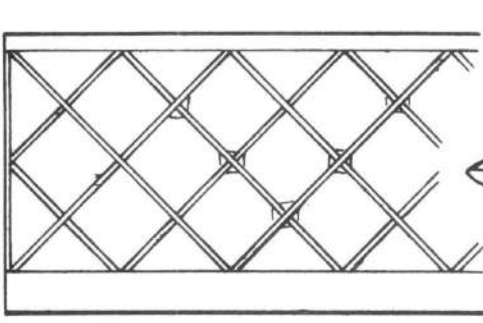
To avoid sanding the airfoil thinner than desired, place one hardwood strip besides the leading edge so that the sanding process will end when thesandpaper block touches the strip.

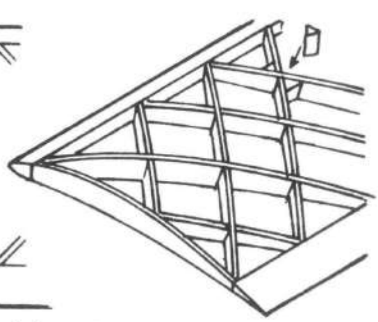


SANDING BLOCKS





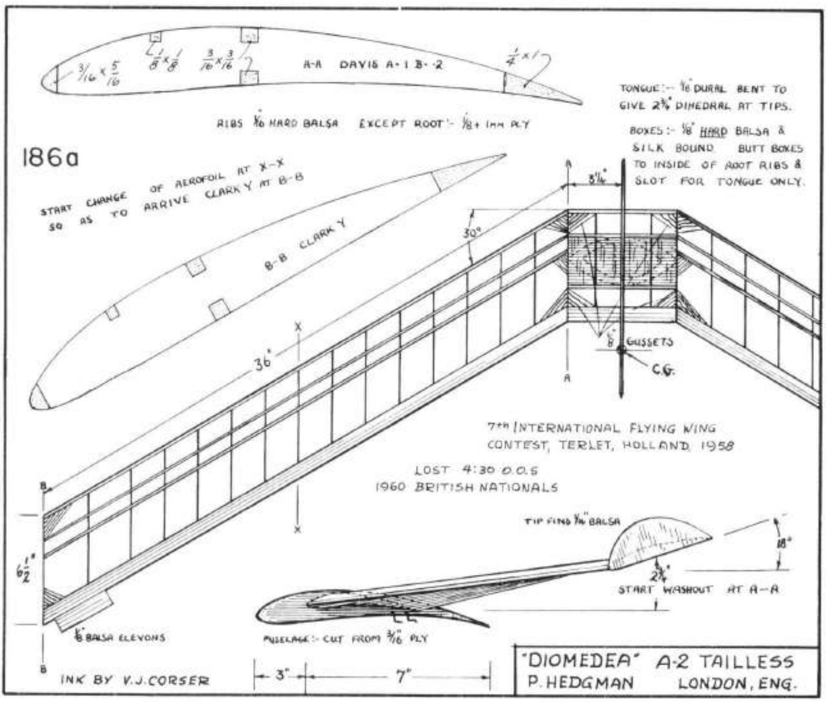


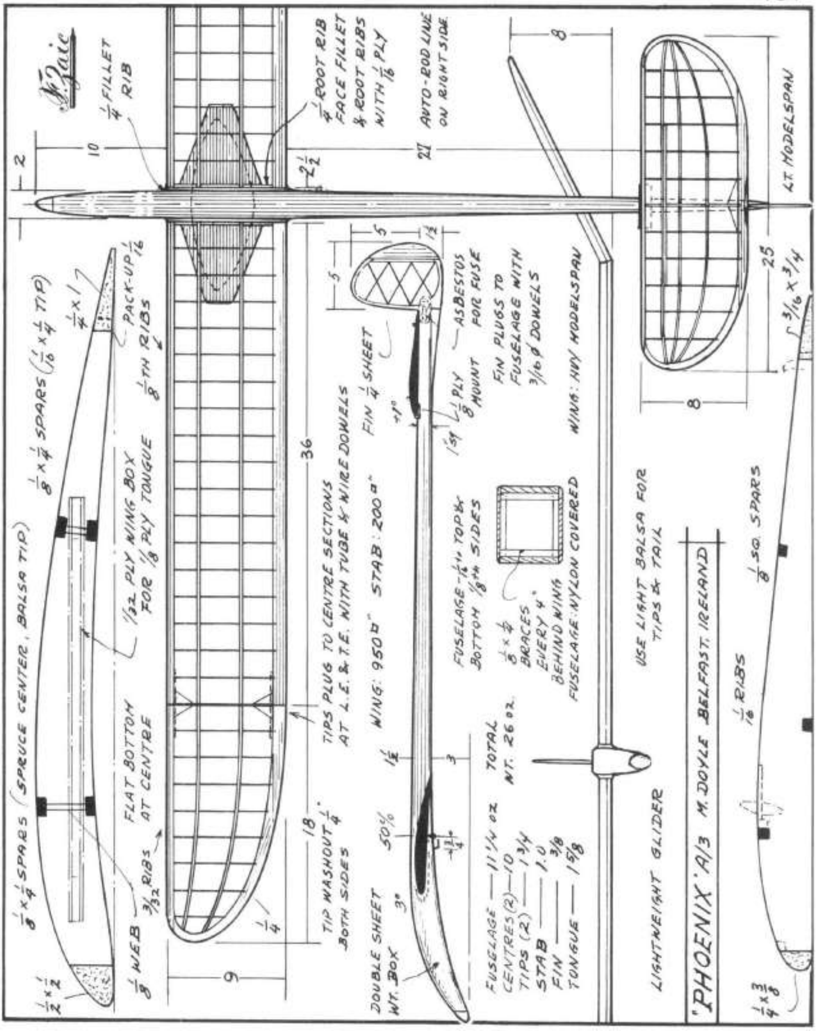


Strengthen the cross or intersection joints with soft balsa triangular fillets. Cut one long triangúlar strip and chop short lengths. When all this is done, mark the spar location and notch the ribs to size with sharp razor.

FLYING WING NOTES——Bill Kincheloe, Glendora, Cal.

On the A/2 flying wings, there isn't much to report as yet. I have gotten consisent 1-2 minute flights from the A/1 prototype in all weather, and exceptional flights of 5 min. and over on California days. Adjusted correctly, the wing doesn't seem to have any problems in the glide that would make it inferior to conventional models. The problems are in the tow! (Seems like that was the song in '38, too.) Good tows come along like winning horses at Santa Anita—not every time. A tomahawk is almost a necessity if the model is to get maximum altitude on every tow. Without that help, the tower (that looks silly!) or puller really gets a workout making Ritz turns to keep the blasted thing on the end of the line. The propensity for hunting and turning equally well to right or left in flight seems to be an advantage once off the tow. The model will start the flight with an open right turn, say, a small lift will boost it for half a minute or so, and it will drop out. Then, sometimes, it will start turning left. Almost every time, the little lifter is over there, though weaker, and a few more seconds are added. After lengthy trials with various configurations, it is obvious to me (maybe to no one else!) that the flying wing should have simple configuration to ensure reliable success. Elaborate dihedral and sweepback may look pretty in the air (I have had them, too) but they are in a fair way to make the building job a bear, and are extremely susceptible to little, invisible, disastrous warps. I am back to 20 degree mean (30%) line sweep and ½ inch per foot of plain





vee dihedral. I use 8 - 10 degrees of washout achieved by twisting in a jig. The model is built, transported, and stored in the warping jig: Keeps troubles out of the flight pattern, and makes sure that you just have the same model each time a flight is tried (especially when it may be three weeks between flying sessions!). Tip rudders vs single center rudder doesn't seem to matter if the cla is low. In this I agree with Grant. Tip rudders are more sensitive that the center one to upsets from bad landings, and require more looking after when walking through doors, but there seems to be little difference in flight characteristics. One thing, though, keep the rudder(s) straight ahead. Turn with cg and elevons. Can be done. Eliminate hunting by shifting the cg forward a smidgin and smoothing out the glide with variable warp. Exhaust of car is fine in the field. The jig can be altered later, or left alone, that the little beast returns to normal after experiment.

BALANCED WING CONSTRUCTION

David Andrew,—————————— Canada

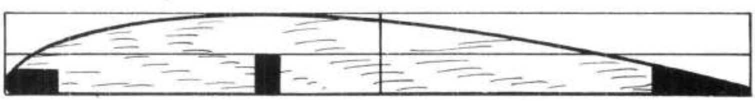
About the only development work I have done on models has been in towline gliders of the A-1 class. The final development was published in Sept., 1958 issue of the "Aeromodeller." The following points may be of interest.

The wing of this model features what I like to call, "Balanced Construction." The covering has been liberally doped, and the model is now almost three years old (Dec. 1959). Although the wing has never been pinned down, it has remained as true as it was the day it was built. I tried to distribute the spar members evenly between the upper and the lower surfaces of the wing, so that these surfaces would resist equally the shrinking stresses of the tissue covering.

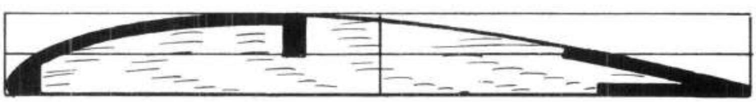
In detail: Take a symmetrical airfoiled wing, with just the L.E. and T.E., and one spar on the bottom. We know from experience that this wing, when covered and doped, will warp naturally upward, because, while the covering on the upper surface exerts a stress equal to the covering on the lower surface, the upper surface has no spar, while the lower surface has. The same reasoning is applicable to flat bottom and undercambered airfoil wings which do not have any spars on top. We have all noticed how a wing having no spar on the top near the T.E., will invariably warp upward at the T.E.

In designing, the L.E. and T.E. members on a flat or undercamber wing can usually be considered to be on the bottom surface. To "balance" their strength, the remaining spars should be concentrated on the top. See airfoil structure used and suggested method used to determine spar location for span control.

1

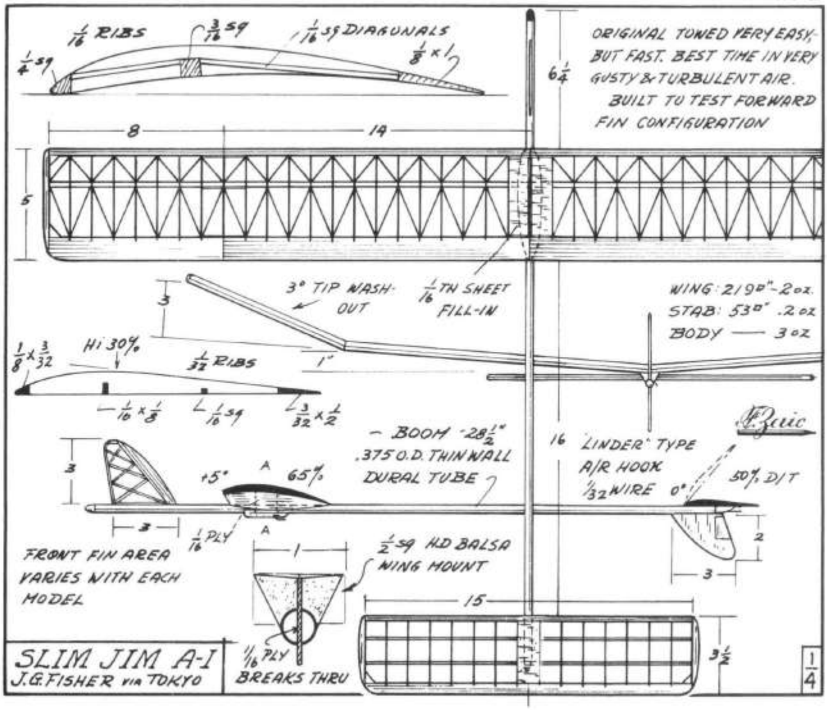


2



3

1. Rectangle is drawn around the Airfoil.
2. Divide this rectangle into four segments. segments.
3. Structural members should be divided equally among the four
4. In Fig. 1, the upper segments contain no (spanwise) structural members. Therefore the tissue stress will warp the wing upward.
5. Fig. 2 and 3. The structural members are (roughly) equally divided among the segments. Such surface should resist tissue shrinkage stresses well.



Slim Sim A-1 was built to test the feasability of a forward fin. Test showed it towed and flew very well in the wind but settled badly in calm air. Could be needing turbulence, or just higher Reynolds number via the higher effective air speed.

Glide trim tab needs more severe adjustment than normal types. The forward fin needs much experimentation for each different model. Never use turn trim in forward fin as a fugoid will be the result.

Test glide in 5-10 mph wind—not gusty—but fast. Watch each flight carefully and adjust accordingly. Don't be afraid to experiment—it is a rugged model.

DAVID ANDREW

An auto rudder is a must for straight tows on any glider. But an auto rudder by itself, unless the flying surfaces of a model are dead true, does not answer the questions of straight tows completely. I believe some sort of trim tab should be used in conjunction with the auto rudder. In hand launching the model during initial testing flights, the auto rudder should be pinned in a neutral (towing) position, and the trim tab adjusted to achieve a dead straight glide. Thus, although minor warps may be present in a model, this method will insure straight tows.

From sad experience, I have found that a fixed difference in incidence between wing and stab. (about 3 degrees) should be designed in a towliner, and under no circumstances should this be altered. Any trimming should be made in the way of addition or removal of ballast from the nose of the model. Leave the wing and stab. alone!

BALSA SHEET WING——————Ed Slobod, Los Angeles, Cal.

While on the subject of gliders, I'd like to tell you more about the A/1 glider. I built the model mainly to check out a method of wing fabrication and in the process learned a few other things. The wing was made as follows:

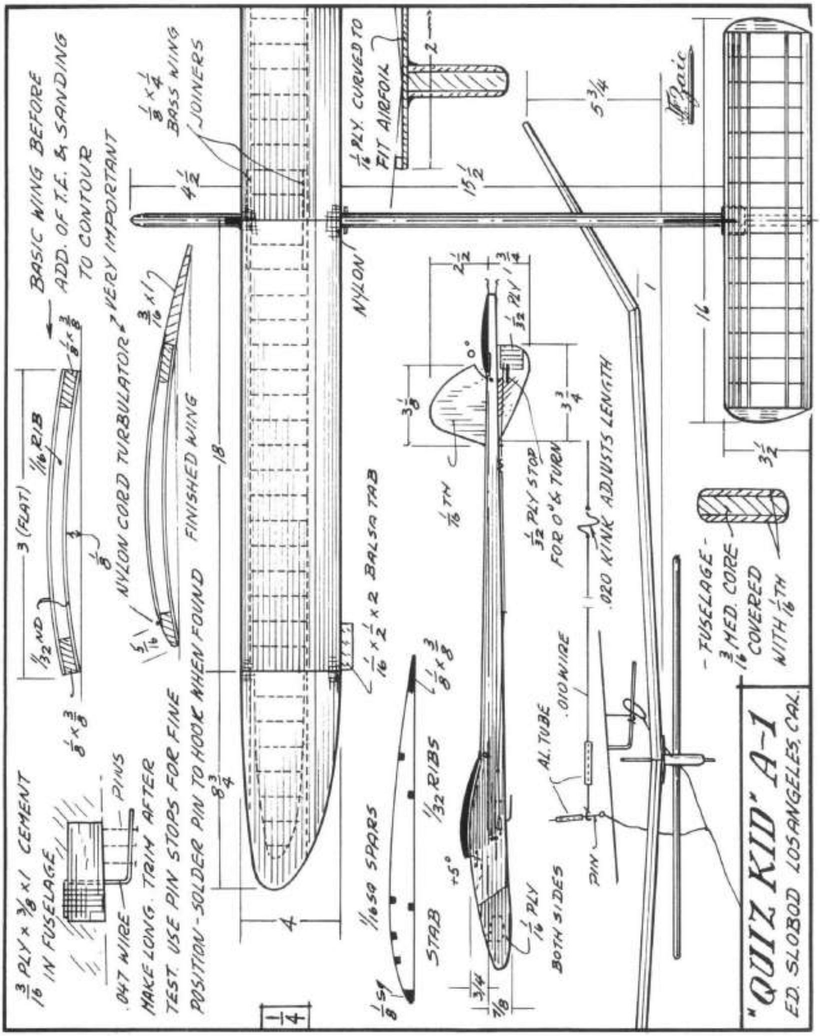
Two pieces of 1/8 x 3/8 were cemented to a flat sheet of 1/32 x 3 sheet.

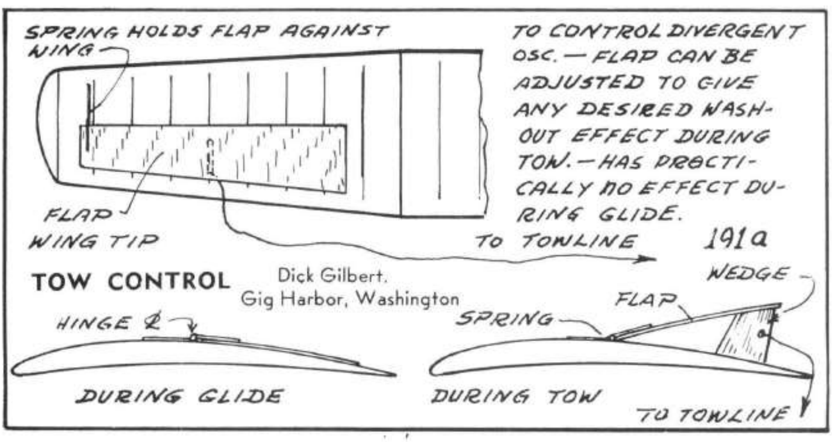
The wing was then propped up to form a curved surface and sliced ribs were installed diagonally

when dry, 1/32 x 3 was cemented to it. Then a piece of 3/16 x 3/4 was cemented to the edge and the wing, shaped as shown below to produce, in essence, a double sheeted wing.

There were other operations for the wing tips and dihedral joints but they are unimportant at this time. My finished wing had a 3 3/4 chord and a 3/16 max. thickness with about 1/4 in. underchamber.

Now the big moment was at hand. How would it perform? Wing was set at about 3 degrees, stab at 0 degrees C.G. about 70% chord aft of L.E. This was further back than I wanted it to be, but I had a wad of modeling clay available to alter the C.G. as required. Well, to end the suspense, I will tell you that I launched the model and it virtually dove at a spot about 15 feet in front of me. Hardly the glide that I had hoped for. It should have stalled, instead it dove. Where was the lift that I was supposed to get from that big beautiful highly efficient wing? Well, to make a long story short, I taped a thread on the upper surface of the wing about 3/8 inches aft of the L.E. and with the identical settings used initially, the model was launched into a big fat beautiful stall. Oh joy! There it was, the answer. Now I knew what had happened. After adding ballast to the nose to bring the C.G. to about 55%, the model on hand launch would land 25 paces in front of me. Quite a difference. Well, I didn't know if the turbulator location was the best one (and still don't) but I was willing to settle for the glide the model now had, so the turbulator was cemented permanently in place. Subsequent tests in what appeared to be still air showed the model to have an average duration of approx. 2 min. which I considered adequate for a not completely adjusted A/1 glider. This experience leads me to pose the question. Are we building and discarding wings without experimenting to see if we are really getting the most out of them?

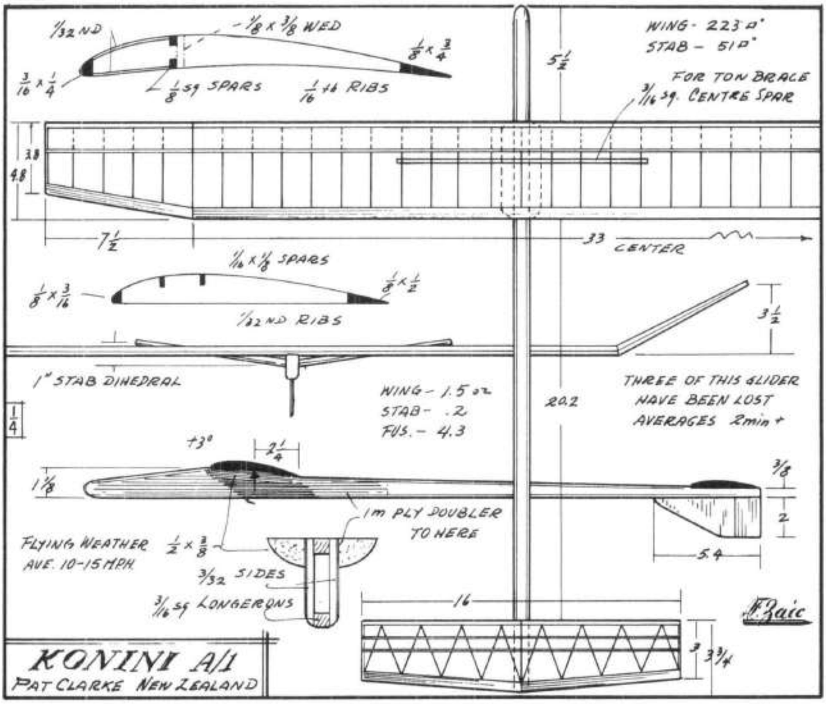




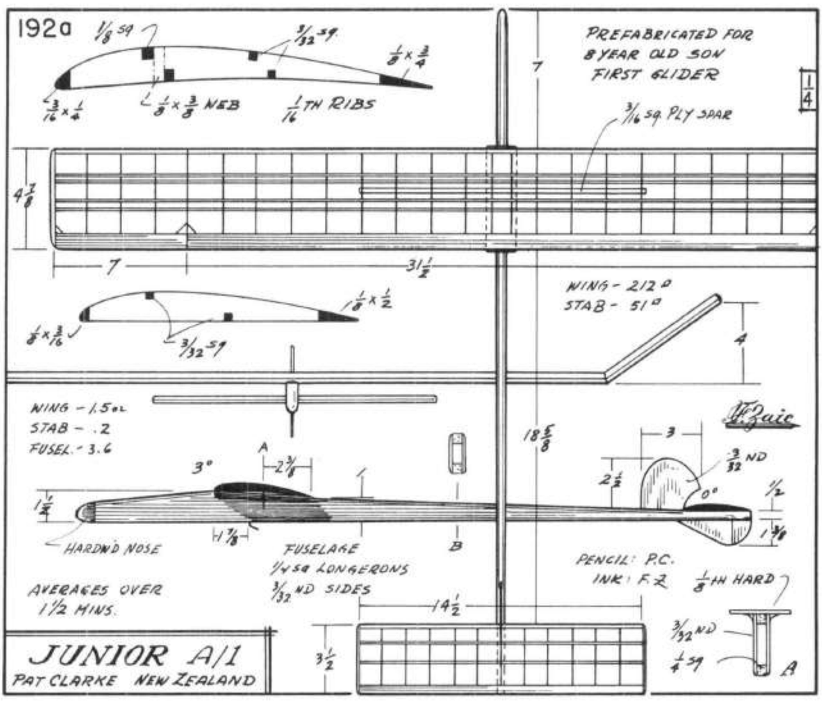
TOW CONTROL

Dick Gilbert,
Gig Harbor, Washington

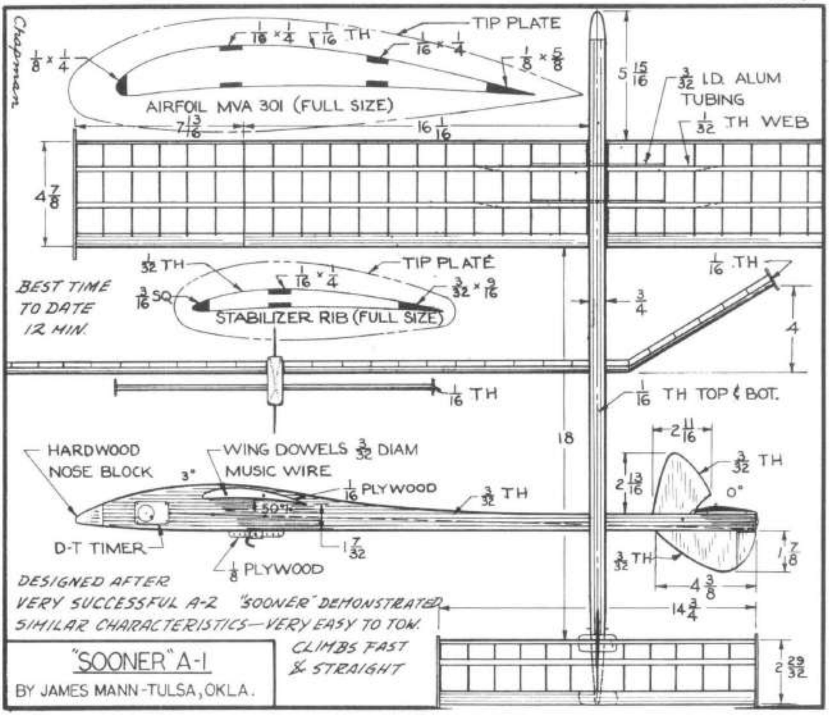
192

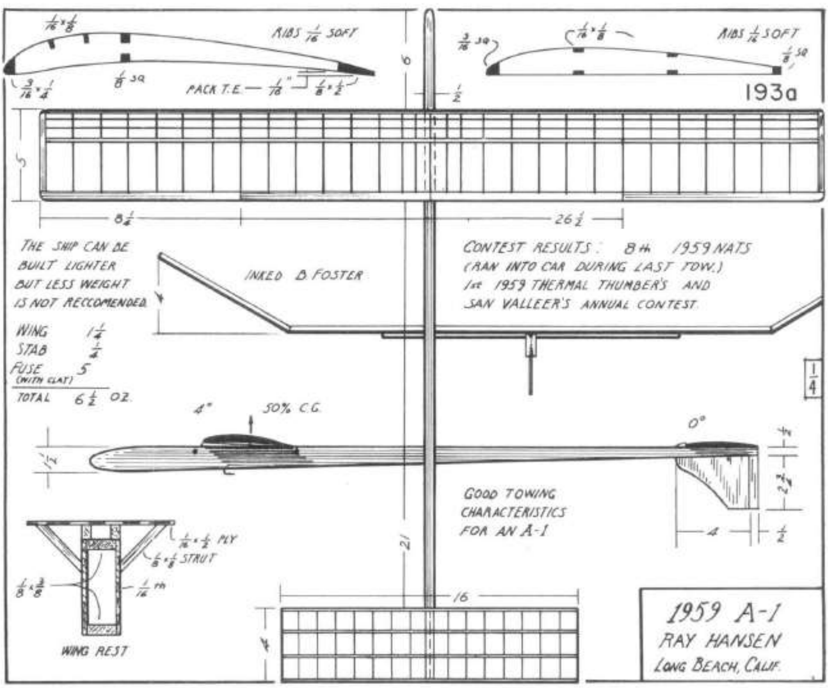


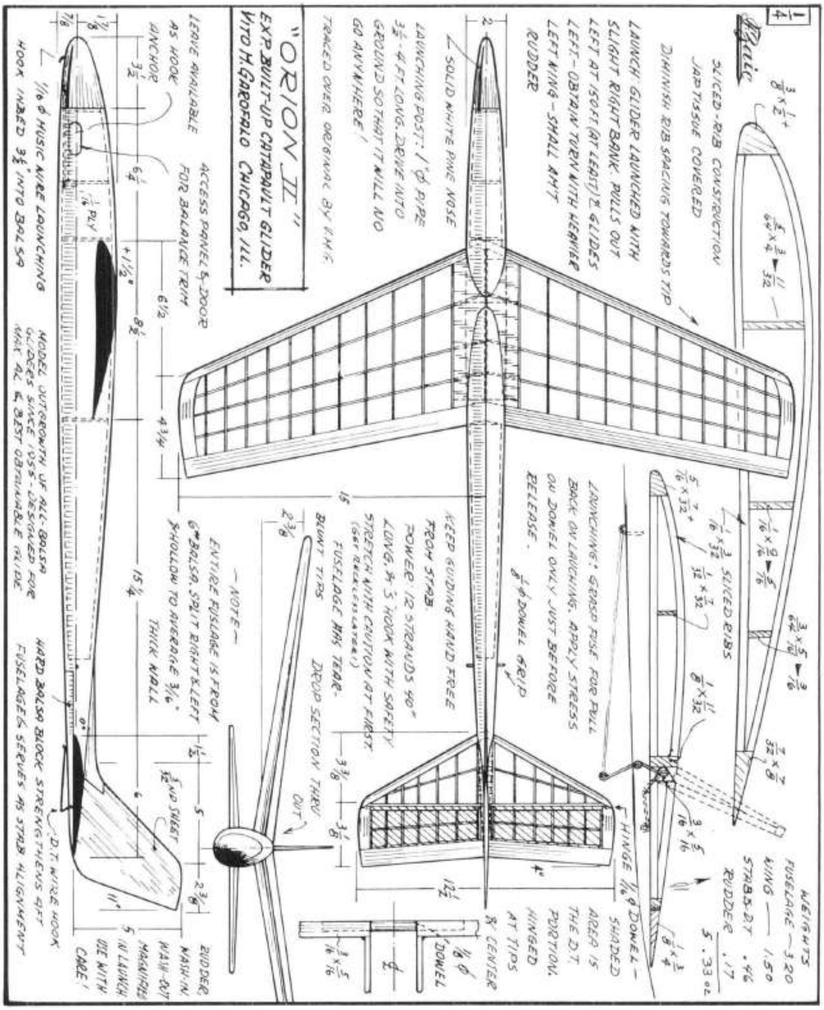
1/32 ND
1/8 x 3/8 WED
1/8 x 3/4
3/16 x 1/4
1/8 sq SPARS
1/16 th RIBS
WING - 223 □"
STAB - 51 □"
FOR TOW BRACE
3/16 sq. CENTRE SPAR
5 1/2
3.8
4.8
7 1/2
33 CENTER
1/16 x 1/8 SPARS
1/8 x 3/16
1/8 x 1/2
1/32 ND RIBS
3 1/2
1" STAB DIHEDRAL
WING - 1.5 oz
STAB - .2
FUS. - 4.3
20.2
THREE OF THIS GLIDER
HAVE BEEN LOST
AVERAGES 2min +
1/4
+3°
2 1/4
1 1/8
3/8
1m PLY DOUBLER
TO HERE
2
FLYING WEATHER
AVE. 10-15 MPH.
1/2 x 3/8
3/32 SIDES
5.4
3/16 sq LONGERONS
16
F. Zaic
3
3 3/4
KONINI A/1
PAT CLARKE NEW ZEALAND



192a
1/8 sq
3/32 sq.
1/8 x 3/4
3/16 x 1/4
1/8 x 3/8 NEB
1/16 TH RIBS
7
PREFABRICATED FOR
8 YEAR OLD SON
FIRST GLIDER
1/4
3/16 sq. PLY SPAR
4 7/8
7
31 1/2
WING - 212 □
STAB - 51 □
1/8 x 1/2
1/8 x 3/16
3/32 sq
4
WING - 1.5 oz
STAB - .2
FUSEL. - 3.6
F. Zaic
18 5/8
3
A
3°
2 3/8
3/32 ND
2 1/2
0°
1/2
1 1/2
1 7/8
1 3/8
HARDWD NOSE
FUSELAGE
1/4 sq LONGERONS
3/32 ND SIDES
B
PENCIL: P.C.
INK: F.Z.
1/8 TH HARD
AVERAGES OVER
1 1/2 MINS.
14 1/2
3/32 ND
1/4 sq
3 1/2
A
JUNIOR A/1
PAT CLARKE NEW ZEALAND


Chapman
TIP PLATE
$\frac{1}{16} \times \frac{1}{4}$
$\frac{1}{16}$ TH
$\frac{1}{16} \times \frac{1}{4}$
$\frac{1}{8} \times \frac{1}{4}$
$\frac{1}{8} \times \frac{5}{8}$
AIRFOIL MVA 301 (FULL SIZE)
$7\frac{3}{16}$
$16\frac{1}{16}$
$5\frac{15}{16}$
$\frac{3}{32}$ I.D. ALUM TUBING
$\frac{1}{32}$ TH WEB
$4\frac{7}{8}$
$\frac{1}{32}$ TH
TIP PLATE
$\frac{1}{16} \times \frac{1}{4}$
$\frac{3}{16}$ SQ
$\frac{3}{32} \times \frac{9}{16}$
STABILIZER RIB (FULL SIZE)
BEST TIME TO DATE 12 MIN.
$\frac{1}{16}$ TH
$\frac{3}{4}$
4
$\frac{1}{16}$ TH
$\frac{1}{16}$ TH TOP & BOT.
18
HARDWOOD NOSE BLOCK
3°
WING DOWELS $\frac{3}{32}$ DIAM MUSIC WIRE
$\frac{1}{16}$ PLYWOOD
50%
$\frac{3}{32}$ TH
$2\frac{11}{16}$
$\frac{3}{32}$ TH
$2\frac{13}{16}$
0°
D-T TIMER
$1\frac{7}{32}$
$\frac{1}{8}$ PLYWOOD
$\frac{3}{32}$ TH
$1\frac{7}{8}$
$4\frac{3}{8}$
$14\frac{3}{4}$
DESIGNED AFTER VERY SUCCESSFUL A-2 "SOONER" DEMONSTRATED SIMILAR CHARACTERISTICS—VERY EASY TO TOW.
CLIMBS FAST & STRAIGHT
$2\frac{29}{32}$
"SOONER" A-1
BY JAMES MANN-TULSA, OKLA.


$\frac{1}{16} \times \frac{1}{8}$
RIBS $\frac{1}{16}$ SOFT
$\frac{3}{16} \times \frac{1}{4}$
$\frac{1}{8}$ SQ
PACK T.E. — $\frac{1}{16}$"
$\frac{1}{8} \times \frac{1}{2}$
6
$\frac{1}{2}$
$\frac{3}{16}$ SQ
$\frac{1}{16} \times \frac{1}{8}$
RIBS $\frac{1}{16}$ SOFT
$\frac{1}{8}$ SQ
193a
5
$8\frac{1}{4}$
$26\frac{1}{2}$
THE SHIP CAN BE BUILT LIGHTER BUT LESS WEIGHT IS NOT RECCOMENDED.
INKED B. FOSTER
CONTEST RESULTS: 8th 1959 NATS (RAN INTO CAR DURING LAST TOW.)
1st 1959 THERMAL THUMBER'S AND SAN VALLEER'S ANNUAL CONTEST.
4
WING $1\frac{1}{4}$
STAB $\frac{1}{4}$
FUSE (WITH CLAY) 5
TOTAL $6\frac{1}{2}$ OZ.
$\frac{1}{4}$
4°
50% C.G.
0°
$1\frac{1}{2}$
$\frac{1}{4}$
$2\frac{3}{4}$
GOOD TOWING CHARACTERISTICS FOR AN A-1
4
$\frac{1}{2}$
$\frac{1}{16} \times \frac{1}{2}$ PLY
$\frac{1}{8} \times \frac{1}{8}$ STRUT
$\frac{1}{8} \times \frac{3}{8}$
$\frac{1}{16}$ TH
21
16
4
WING REST
1959 A-1
RAY HANSEN
LONG BEACH, CALIF.



Catapault gliders is a wonderful sport—especially for those who do not like to work too hard—like throwing. I made some progress over the past few years with all balsa type with impressive "high altitude" and fair glide. But I just had to go through with a built-up type to gain something in the glide department. ORION II turned out to be a whole winter project. At times it became involved—how to stress it for high power catapault etc. But I feel that it was worth it by the results achieved. It is surprising how strong a built-up wing can be. And equally surprising is to find that by adding four more strands of rubber to the catapault results in some loss of altitude gained. Seems that there is a limit to the power you can use. It is a lot of fun, walking onto an open field with posts, gliders and a sledge hammer, and be fully in business, deeply immersed in the pleasure of fast "right now" climbs and beautifully gliding flites!

TIPS FOR BUILDING LIGHTER INDOOR GLIDERS —————— L. R. Hines, Torrance, Cal.

Select the wood as never before, paying special attention to weight, correct strength for job intended, and even density for width of blank. Arrange your template to miss harder areas and be sure the grain of the wood for wing and tail surfaces is not diagonal. This means that if a sheet of wood has diagonal grain never mind the edges of the sheet, cut PARALLEL relative to wing T.E.—with the grain!

Before you buy your wood, test it. This can be done by weight, flexibility and "eyeball". By holding the sheet to a strong light many revealing hidden points can be spotted such as hard and soft areas, fatigue points (avoid at all costs) and the lighter weight of two sheets. The fuselage material must not snap clean when a sample piece is breakage-tested. The break should be long enough to reglue. The grain must be parallel with the boom.

About glue, when I break a fuselage boom, I use "Wilhold" exclusively. After gluing let it set up about five hours—more or less depending on temperature. "Wilhold" will still be flexible so add a skin or smooth-applying, non-pulling glue such as "Dart Cement" or "Ambroid FAST Drying" (not the regular).

As you build gliders, become acquainted with the thickness of your surfaces such as: .030 (stab thickness for 45 ft. ceiling) .020 (stab thickness for 30 ft. ceiling). These are numbers to aim for.

When sanding, most people get tired too soon. Therefore, the surfaces are thicker than called-out and they wonder why the model needs excess nose weight, is unstable, etc. A good rule is "when you think your done sanding, keep sanding." Go easy with the heavy hand and heavy sandpaper. These gliders are delicate so use 600 paper and then worn-down-but-not-clogged 600 to get it really smooth.

Stab lift produced by an airfoil as thin as .02 - .04, which is typical of our gliders, is almost non-existent. The only reason I sand a careful stab airfoil is for structure. The wood will flex near tips under stress and not rip from fuselage. This applies to the wing, also, along with the fact that light tapering tips are a must.

As a rule, rudders are too large. Rudder size and dihedral are related; the more dihedral, the more rudder required. Sweepback of wing cuts the dihedral required to some degree. Anhedral is a debatable feature used since I flew at the Inglewood Flitemaster Indoor Meets. It should be credited for some help in: (1) lowering the wing dihedral required, (2) transition, and (3) glide stability in gusts, which are present indoors and out.

From many past models, 35-40 feet ceilings are where finger grips become required. Fair in the grip in the overall effort to streamline. Glue 320 paper to fuselage sides where thumb and middle finger grip.

The fuselage type used on my gliders has been evolved over a good period of models. I recommend it over any type I have ever used or have seen for any H.L.G. The boom shape gives even flexure to eliminate the perennial weak spot in front of the tail.

Undercamber is very tough to sand on an armory-type glider with 3/16 sheet wing. A slightly curved block (cut from balsa) with good 400 wet-or-dry (carborundum if available) cuts time and increases uniformity. Never put much undercamber near wing tips. It just creates drag. "V" dihedral seems best for low ceiling by being more forgiving in rollout and doesn't roll too soon. Glue light thread to leading edge. It offers fair protection. Use Ambroid sparingly to glue thread. Use "Wilhold" to join dihedral breaks, wing, finger grip and tail surfaces to fuselage. It's strength is unbeatable and it is non-pulling!

GENERAL TIPS FOR SWEEPETTE

If you, the reader, have built a "Sweepette" and are jumping to test it, here are some trimming points.

First, the left wing is heavier. The stab tilted, wing offset and center break skewed 1/64 to left of parallel with fuselage starts the plane gliding left. Also glue fin slightly left. Use any added adjustments in combination with other related adjustments.

If your glider climbs too high, add undercamber and cut weight. If it doesn't reach the ceiling, add some sealer—unless it is too weak to be launched higher. If this is the case—scrap it!

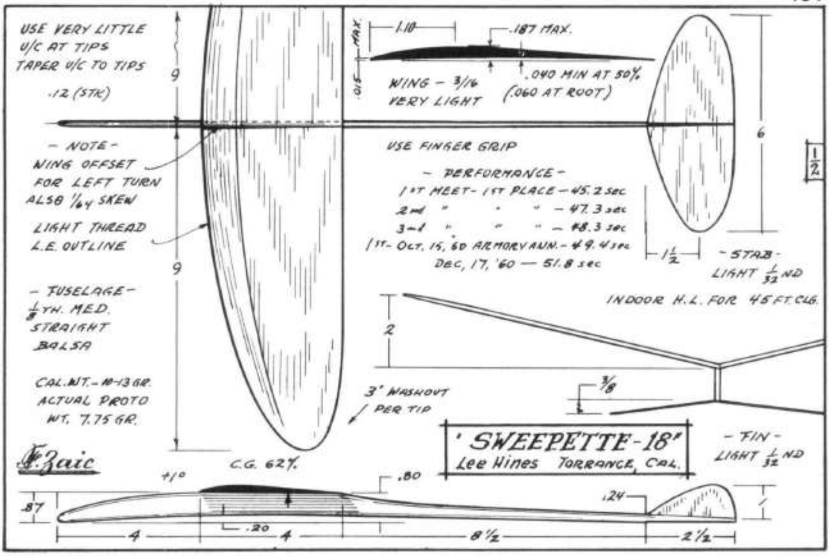
Hand glide a long time. Most testing is done here. Climb right and glide left, if warps don't interfere. If it doesn't climb right, it will invariably climb left and vice versa.

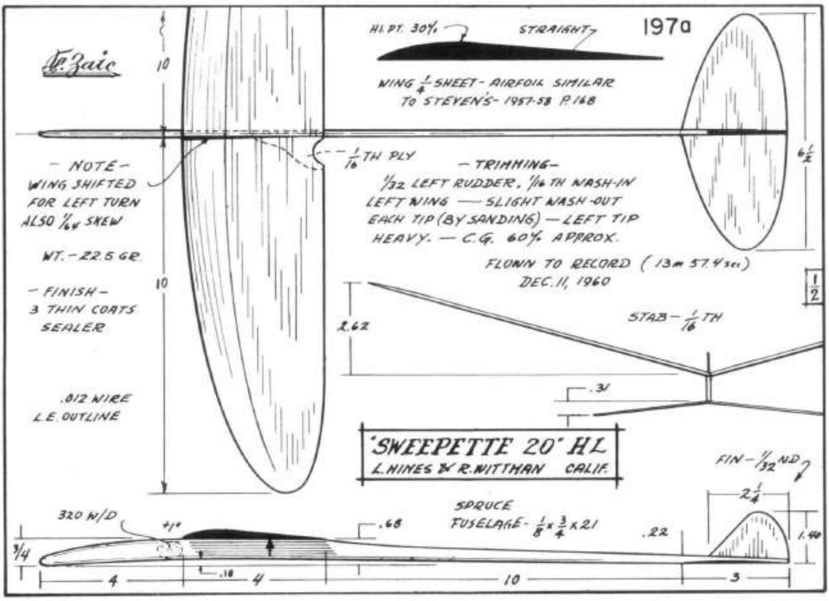
A word on sealer usage. Don't seal thin, readily warped surfaces such as stabs, fins and 1/16 sheet wings. The extra smoothness will in most cases be cancelled out by warps and the life-shortening effect sealer has on gliders. Remember, we are speaking of low-ceiling gliders here. High ceiling gliders are, or should be, sturdy enough not to be affected by several coats of sealer.

A good reason not to seal is simply that unsealed gliders last several times longer and can be trimmed to a higher degree before they get too banged up. As you may know the airfoil from L.E. to just aft of the high point is the most critical to smoothness, so a little sealer in this region might help.

If sealer is used, and the plane climbs too high, sanding is difficult at best and undercamber, for instance, will be hard to increase uniformly. You will probably have to seal again. For a one-shot deal, such as the Nats, I will always seal my surfaces for ceilings as high as the armory (45 ft.) or higher. Be very sparing on tail surfaces.

From the time you pick the wood for your wing keep in mind that the left wing must be heavier to fly properly so test it by balancing with pins to determine the heavy and light side. If the reader wonders why sweepback is predominant and what good it is, time and many gliders have shown lighter models climb higher, roll out better, glide as well or better and are more stable in turbulence which means, a swept-back glider catches thermals better if you like outdoor glider too, as I do.





To further explain the offset and the wings skew, many of us have seen gliders that didn't like to accept a definite glide turn. Other than warps, misalignment is the only thing possible that could be wrong. So, why not misalign to our advantage and start off helping the model turn? My definition of offset is: to place the center break of the wing left of the center of the fuselage generally about on the left edge of the fuselage. Now shift the left wing tip backwards (skew) so the eye can see about 1/64 in. angular change at center break from parallel to fuselage.

Please realize these notes were prepared by a right-handed person and may be reversed for anyone left-handed.

THE INDOOR HAND LAUNCH GLIDER ———

LAUNCH

Richard Miller, New York, N. Y.

I couldn't agree more with Stuart Savage that the technique of launching comes first ('56 YEAR BOOK)—although I disagree with him on finish, a point I will come to presently. During a good part of this summer I have been working on a "twirl and snap" launch with a good deal of body spin in it; one that employs the attitude position from dance (which I once studied). At the instant of launch, as well as I can analyse it, I am twirling on the ball of my left foot. At this moment my right leg breaks at the knee, all the muscles of my right side, between the shoulder and the buttocks are drawn up tight and my left arm swings around behind me as my head goes over my left shoulder. (Dig up a copy of a dance magazine and find a picture of an attitude if you don't get the picture here.) This position is a transition between the short run that preceeds it and the twirl or pirouette which follows. The way I know I'm really in the groove is when one turn is not enough and the force of the throw spins me around a second time.

I would like to make an analogy here between a reciprocating engine and a turbine. When the glider launcher stops the motion of his body and turns back to watch the glider climb it is somewhat like the energy lost by that piston going up, stopping, reversing itself, etc. The turning launch I feel is more like the turbine with its conserved rotary energy.

The low angle of the launch possible with this technique 20 to 25° from the horizontal being the most possible—might seem at first to be a disadvantage to those who favor a higher angle of launch. But consider this: The lower the angle of launch the more power can be brought to bear. In the straight out launch you use essentially the pectoral, one of the largest and strongest muscles in the body; and as the angle of the launch goes up not only does the possibility of a clean follow through decrease but you rely less on pectoral and more on deltoid muscles. In this respect compare what a man can press in the supine position as against performance in an overhead or military press.

Also consider that, granted that with the additional power we are going to get the glider up just as high with the lower angled launch, its trajectory is longer. This may add a second or so to the total flight time. And then there's rhythm! An acquaintance of mine with an interest in golfing, watching me practice one day, mentioned how Middlecoff, the golfer, uses a little rhythmic refrain, like a bit from "The Blue Danube" for example, to pace his swing an give him rhythm. As well as I have been able to apply this to date I have found it helpful. But again I think it has more possibilities where there is a full follow through.

To those interested in this launch let me caution to: 1) Use your body as much as possible, epecially when warming up; try throwing the glider only with body motion. You'll be surprised how far it will go up; 2) Avoid watching the trajectory of the glider. Look for it over your left shoulder (if, like me, you're right handed). When my right leg snaps up and my head pulls to the left I sometimes catch a quick glimpse of the sole of my right foot as I'm turning.

STRENGTH

Added to the twirl is strength. I took Curt Steven's advice (57-'58 YEAR BOOK) and worked up to 50 push ups (and am now working up to 50 again, this time on a small set of parallel bars). This added strength has improved by launch noticeably. Strength is important in itself, all other things being equal, but its vital in what might be called the strength-control quotient. Let's imagine that we are putting out X h.p. in our launch. If this constitutes around 80 to 90% of our total strength we will maintain a lot more control than if it comprises 95% or more. There's little need to note how control falls off during maximum effort. I would also recommend reverse curls, some sort of overhead press and knee bends for those interested in real physical shape for hand launch glider.

FINISH

It is hard to believe that finish is not of considerable importance. Even granting that parasitic drag is negligible at the low speeds at which indoor hand launch gliders fly, what about the launch? I don't know if anyone has ever measured hlg launch speeds but I have read that baseballs have been pitched at speeds close to 100 mph. So why not assume that a glider is going 50 mph or faster on the launch? At this speed drag does make a difference. Would the consequence of a clean ship be another 2 to 3 feet gained on the climb? Then it's worth it.

The hardest part of obtaining a good finish seems to be getting those grain marks filled in. I have suffered unsuccessfully with talcum and dope, finding it hard to get the talcum into the grain and harder to keep it there while doping. This led me to a series of experiments which included calamine lotion, milk of magnesia, zinc oxide ointment and something the druggist calls white lotion. This last is made by dissolving zinc sulphate and sulfurated potash in equal parts (and in the order listed) in distilled water. This dries hard and cakey and may turn out to be the thing, although so far I've had most success with calamine lotion. I get it thick (by evaporation or taking it from the bottom of the bottle) and apply it generously to the surface after the initial coat of sanding sealer. Getting it off proved to be a problem until I hit on fine steel wool. This I use judiciously, going any way but with the grain, till most of the lotion is off, then switch to 400 w/d. (If it clogs, which it well may, wash it out, let it dry, and use it again.)

Seal this in with a light coat of dope or sanding sealer, take off all the surface material and repeat. A photographer's loop is handy for examining the surface to check progress. The pinkish hue of the calamine makes the fill easy to see in any event and give a not unobjectionable color to the wing. As to weight, if you are careful to get off all the extraneous surface material between coats, just keeping what's in the grain marks, it is negligible.

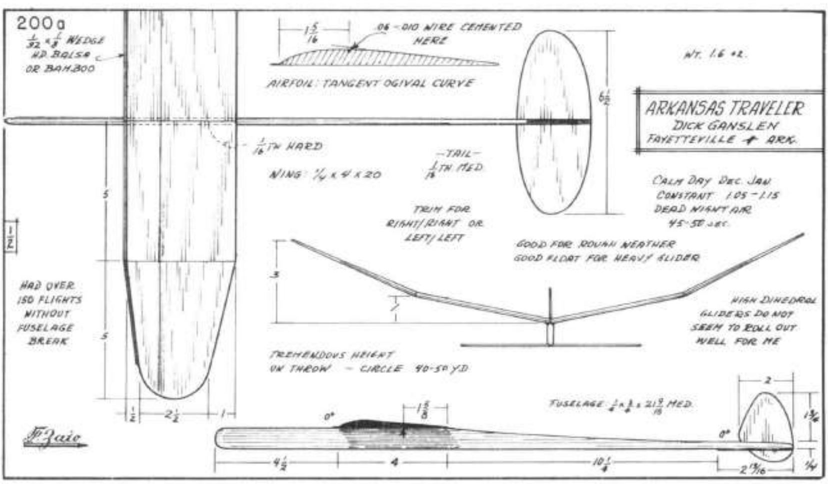
After the last coat of sanding sealer use 400, then 600 w/d. Next rubbing compound (tooth paste does very well) and finally wax. It gives a difficult finish to top."

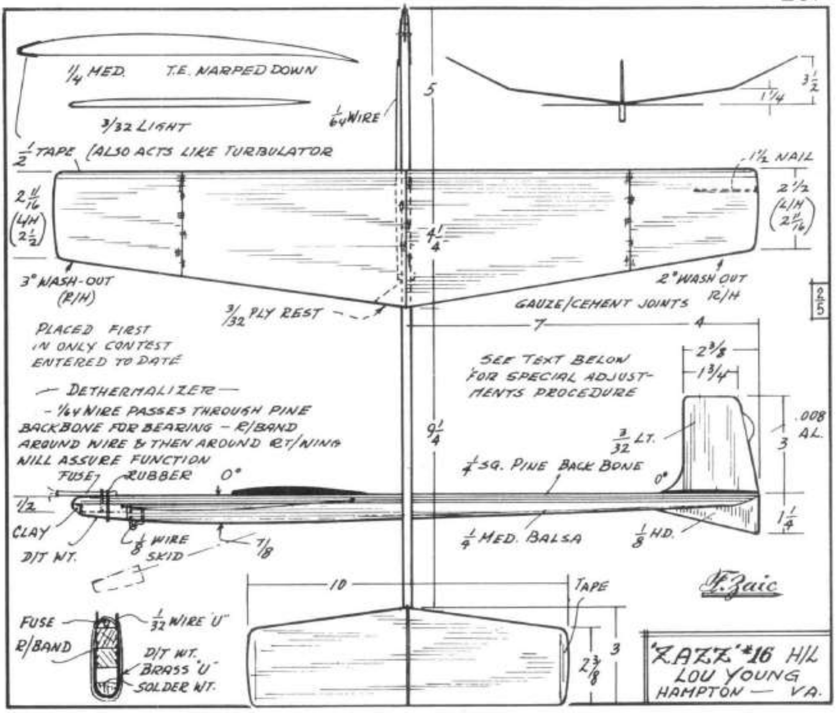
SANDING GLIDER WINGS——Dick Ganslen, Dec. 1958

I have a new idea I am using for sanding glider wings which beats anything other than sawing them to an angle. I have been very successful using trailing edge (wing) stock.

Advantages. Very rapid sanding even when the stock is not cut to taper. Simple method of controlling the camber high point. Gives good sharp edge at high point which Foster and Curt Stevens consider so important.

I glue a piece of control line wire along the top edge of the wing at the point of maximum camber. I make my sanding blocks, of varying roughness, long enough to always bridge the wire and strike my sanding table behind the future trailing edge of the wing. I nail a block of wood in from the edge of my drawing table far enough from the edge so that I can fit the wing leading edge against the block for firmness and yet far enough in from the edge of the table that I cannot sand off my trailing edge. Using Behr Manning "Lightning" 50-D-1 Openkote Cabinet Paper, I can cut a trailing edge perfectly to $\frac{1}{16}$" in 15 minutes or so with no danger of reducing my high point or losing the trailing edge by abrasion. Since the paper (and block) ride the wire on the sanding stroke, lots of pressure can be used in the sanding which one must avoid when sanding any other way. Occasionally the wire may become unglued, a minor inconvenience. Now, after this sanding, in order to keep a sharp high point. WHY NOT LEAVE THE WIRE GLUED IN PLACE! The leading edge wire (a la Savage) I always use before sanding. Now that the trailing edge can be fine sanded at your leisure, the curve can be sanded with no danger of influencing the high point or danger of rounding the high point too much. By moving the wire backward and forward before the initial sanding, the high point can be varied at will with greater accuracy.

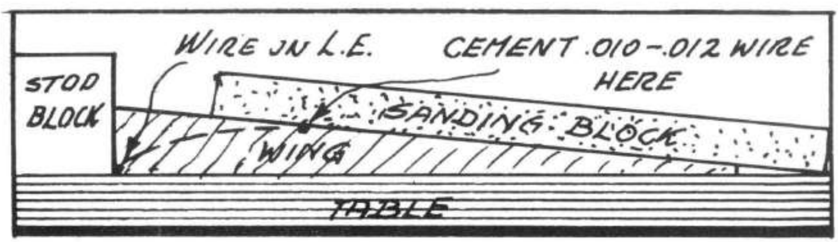




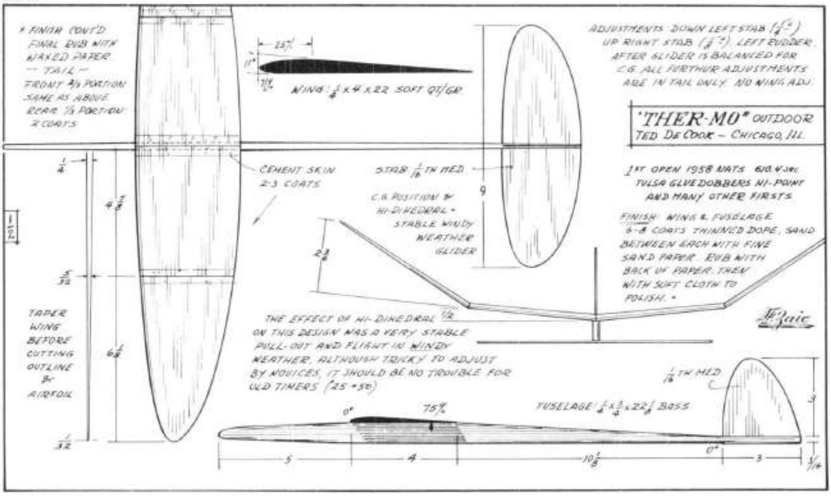
It is best to start with left wing about $\frac{1}{4}$ in. longer than shown.

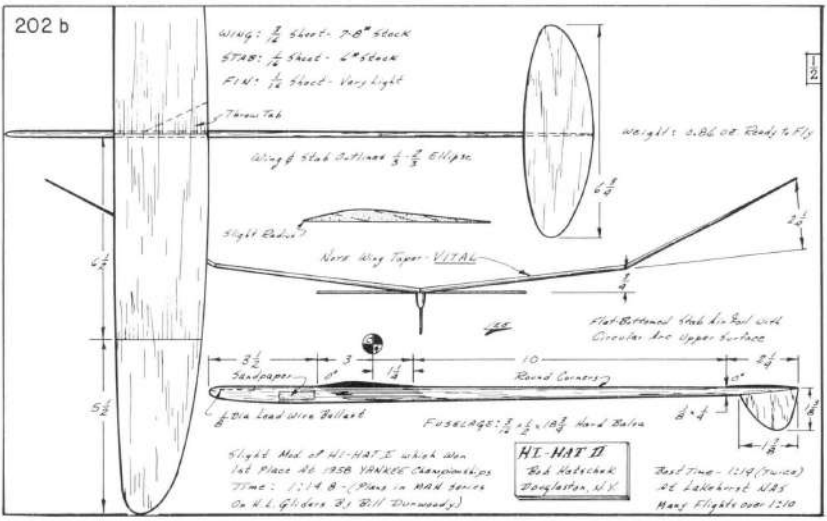
1. With rudder set straight, model will turn right, adjust for smooth, nose heavy glide.
2. Wash left wing tip slightly more than right. Model will still turn right but turns will be wider.
3. Trim left wing length down until model flies straight ahead. (If it stalls, it will turn right.)
4. Add nail to right tip.
5. Adjust rudder for left turn. You will have to remove clay from nose.
6. Solder may be filed off nose weight to balance. It is best to make it lighter than necessary so that clay, which is easier to work, can be used to make up rest of nose weight. Reverse "left" to "right" for left hand

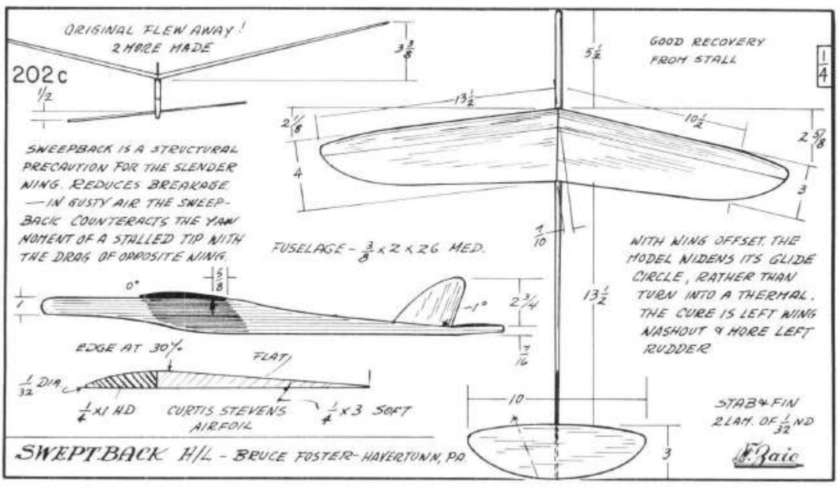
This unusual procedure results with a model which is less susceptible to spiraling in a thermal, because the right wing will stall out first. (It is at higher angle.) But the longer left wing equalizes the lift so that there is no left tendency from the twisted wing.



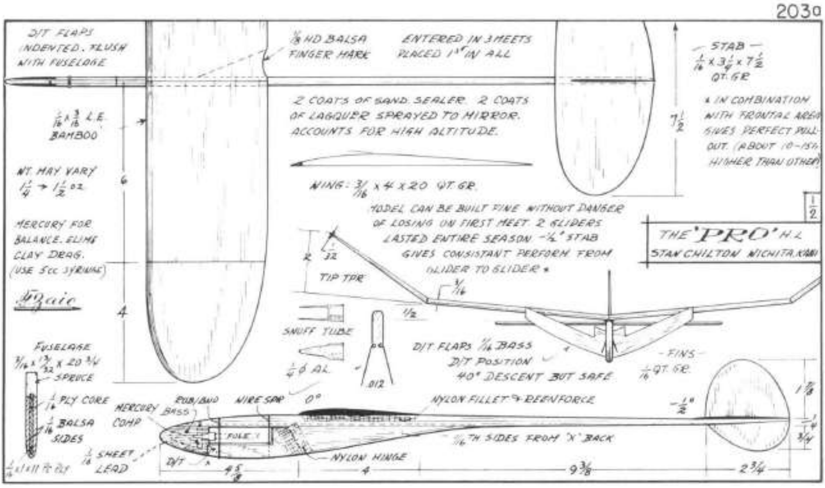
202a

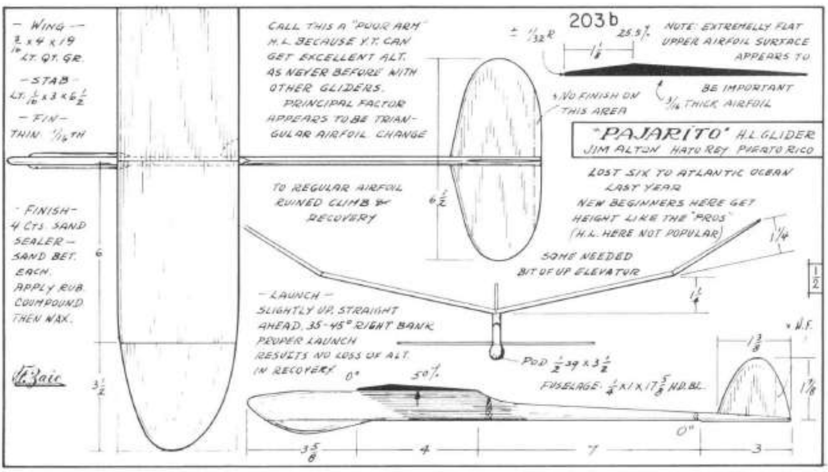

* FINISH CONT'D FINAL RUB WITH WAXED PAPER
— TAIL —
FRONT 2/3 PORTION SAME AS ABOVE
REAR 1/3 PORTION 2 COATS
WING: 1/4 x 4 x 22 SOFT QT/GR.
ADJUSTMENTS - DOWN LEFT STAB (1/4"), UP RIGHT STAB (1/8"). LEFT RUDDER. AFTER GLIDER IS BALANCED FOR C.G. ALL FURTHUR ADJUSTMENTS ARE IN TAIL ONLY. NO WING ADJ.
"THER-MO" OUTDOOR
TED DE COOK - CHICAGO, ILL.
CEMENT SKIN 2-3 COATS
STAB 1/16 TH MED.
C.G. POSITION & HI-DIHEDRAL - STABLE WINDY WEATHER GLIDER
1ST OPEN 1958 NATS 610.4 SEC
TULSA GLUE DOBBERS HI-POINT AND MANY OTHER FIRSTS
FINISH: WING & FUSELAGE 6-8 COATS THINNED DOPE, SAND BETWEEN EACH WITH FINE SAND PAPER. RUB WITH BACK OF PAPER. THEN WITH SOFT CLOTH TO POLISH. *
TAPER WING BEFORE CUTTING OUTLINE & AIRFOIL
THE EFFECT OF HI-DIHEDRAL ON THIS DESIGN WAS A VERY STABLE PULL-OUT AND FLIGHT IN WINDY WEATHER, ALTHOUGH TRICKY TO ADJUST BY NOVICES, IT SHOULD BE NO TROUBLE FOR OLD TIMERS (25 + 50)
1/16 TH MED.
FUSELAGE: 1/4 x 3/4 x 22 1/2 BASS
75%
F. Zaic

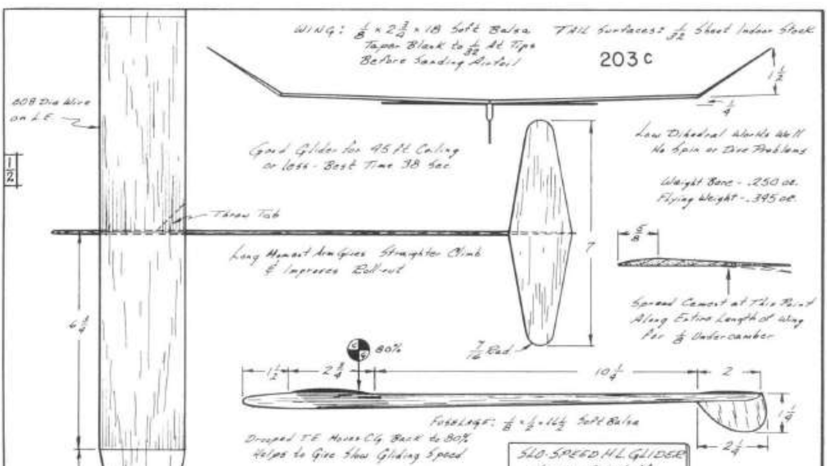

202 b
WING: 3/16 Sheet - 7-8" Stock
STAB: 1/16 Sheet - 6" Stock
FIN: 1/16 Sheet - Very light
Throw Tab
Weight: 0.86 oz. Ready to Fly
Wing & Stab Outlines 1/3 - 2/3 Ellipse
Slight Radius
Note Wing Taper - VITAL
Flat-Bottomed Stab Air Foil with Circular Arc Upper Surface
Sandpaper
Round Corners
1/8 Dia Lead Wire Ballast
FUSELAGE: 3/16 x 1/2 x 18 3/4 Hard Balsa
Slight Mod. of HI-HAT I which Won 1st Place At 1958 YANKEE Championships
Time: 1:14.8 - (Plans in MAN series On H.L. Gliders By Bill Dunwoody)
HI-HAT II
Bob Hatschek
Douglaston, N.Y.
Best Time - 1:19 (twice) At Lakehurst NAS
Many Flights over 1:10


ORIGINAL FLEW AWAY! 2 MORE MADE
202c
GOOD RECOVERY FROM STALL
SWEEPBACK IS A STRUCTURAL PRECAUTION FOR THE SLENDER WING. REDUCES BREAKAGE.
— IN GUSTY AIR THE SWEEPBACK COUNTERACTS THE YAW MOMENT OF A STALLED TIP WITH THE DRAG OF OPPOSITE WING.
FUSELAGE - 3/8 x 2 x 26 MED.
WITH WING OFFSET, THE MODEL WIDENS ITS GLIDE CIRCLE, RATHER THAN TURN INTO A THERMAL. THE CURE IS LEFT WING WASHOUT & MORE LEFT RUDDER.
EDGE AT 30%
FLAT
1/32 DIA.
1/4 x 1 HD
CURTIS STEVENS AIRFOIL
1/4 x 3 SOFT
STAB & FIN 2 LAM. OF 1/32 MED
SWEPTBACK H/L - BRUCE FOSTER - HAVERTOWN, PA.
F. Zaic

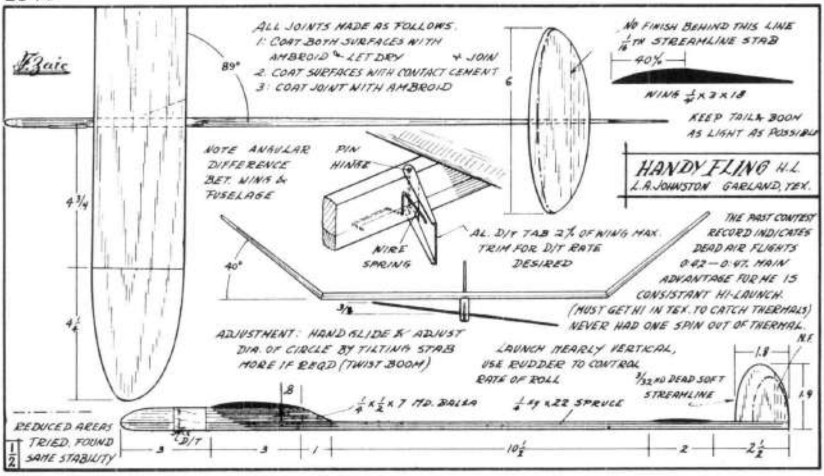
203a

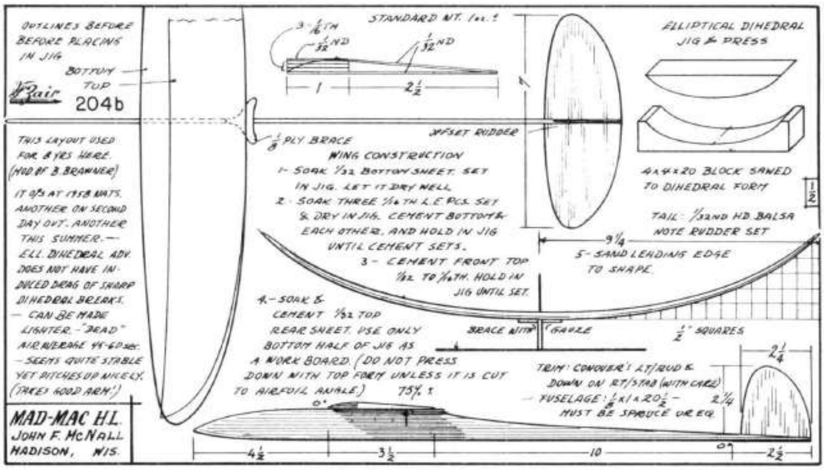

D/T FLAPS INDENTED. FLUSH WITH FUSELAGE
1/8 HD BALSA FINGER MARK
ENTERED IN 3 MEETS PLACED 1ST IN ALL
– STAB – 1/16 x 3 1/4 x 7 1/2 QT. GR.
1/16 x 3/16 L.E. BAMBOO
2 COATS OF SAND. SEALER. 2 COATS OF LAQUER SPRAYED TO MIRROR. ACCOUNTS FOR HIGH ALTITUDE.
* IN COMBINATION WITH FRONTAL AREA GIVES PERFECT PULL-OUT. (ABOUT 10-15% HIGHER THAN OTHER)
WT. MAY VARY 1 1/4 → 1 1/2 OZ
WING: 3/16 x 4 x 20 QT. GR.
MODEL CAN BE BUILT FINE WITHOUT DANGER OF LOSING ON FIRST MEET. 2 GLIDERS LASTED ENTIRE SEASON. -1/2" STAB GIVES CONSISTANT PERFORM. FROM GLIDER TO GLIDER *
MERCURY FOR BALANCE. ELIMS CLAY DRAG. (USE 5cc SYRINGE)
THE "PRO" H.L.
STAN CHILTON WICHITA, KANS
TIP TPR
SNUFF TUBE
1/4 φ AL
.012
D/T FLAPS 1/16 BASS
D/T POSITION
40° DESCENT BUT SAFE
– FINS – 1/16 QT. GR.
FUSELAGE 3/16 x 1 7/32 x 20 3/4 SPRUCE
1/16 PLY CORE
1/16 BALSA SIDES
MERCURY COMP
RUB/BND BASS
WIRE SPR
0°
NYLON FILLET & REENFORCE
POLE
1/16 TH SIDES FROM "X" BACK
NYLON HINGE
1/16 SHEET LEAD
D/T
4 5/8
4
9 3/8
2 3/4
1 7/8
1/2
6
4
7 1/2

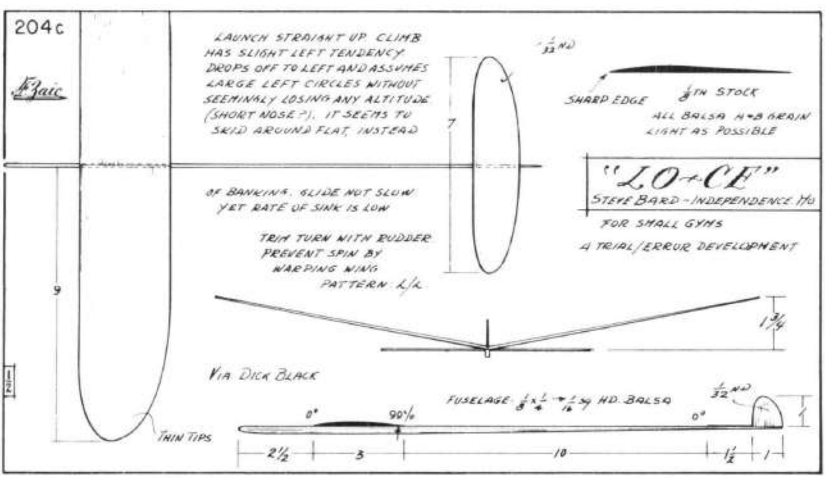

– WING – 3/16 x 4 x 19 LT. QT. GR.
– STAB – LT. 1/16 x 3 x 6 1/2
– FIN – THIN 1/16 TH
CALL THIS A "POOR ARM" H.L. BECAUSE Y.T. CAN GET EXCELLENT ALT. AS NEVER BEFORE WITH OTHER GLIDERS. PRINCIPAL FACTOR APPEARS TO BE TRIANGULAR AIRFOIL CHANGE
203 b
± 1/32 R
25.5%
1 1/8
NOTE: EXTREMELLY FLAT UPPER AIRFOIL SURFACE APPEARS TO BE IMPORTANT
3/16 THICK AIRFOIL
* NO FINISH ON THIS AREA
"PAJARITO" H.L. GLIDER
JIM ALTON HATO REY PUERTO RICO
TO REGULAR AIRFOIL RUINED CLIMB & RECOVERY
LOST SIX TO ATLANTIC OCEAN LAST YEAR
NEW BEGINNERS HERE GET HEIGHT LIKE THE "PROS" (H.L. HERE NOT POPULAR)
– FINISH – 4 CTS. SAND SEALER – SAND BET. EACH. APPLY RUB. COUMPOUND. THEN WAX.
SOME NEEDED BIT OF UP ELEVATOR
– LAUNCH – SLIGHTLY UP, STRAIGHT AHEAD, 35-45° RIGHT BANK. PROPER LAUNCH RESULTS NO LOSS OF ALT. IN RECOVERY.
POD 1/2 sq x 3 1/2
FUSELAGE 1/4 x 1 x 17 5/8 HD. BL.
0°
50%
0"
3 5/8
4
7
3
6 1/2
6
3 1/2
1 1/4
1 3/8
1 7/8


WING: 1/8 x 2 3/4 x 18 Soft Balsa Taper Blank to 1/32 At Tips Before Sanding Airfoil
Tail Surfaces: 1/32 Sheet Indoor Stock
203 c
.008 Dia Wire on L.E.
Low Dihedral Works Well No Spin or Dive Problems
Good Glider for 45 Ft. Ceiling or less - Best Time 38 Sec.
Weight Bare - .250 oz. Flying Weight - .395 oz.
Throw Tab
Long Moment Arm Gives Straighter Climb & Improves Roll-out
Spread Cement at This Point Along Entire Length of Wing For 1/8 Undercamber
80%
7/16 Rad.
1 1/2
2 3/4
10 1/4
2
6 3/4
2 1/4
7
5/8
1 1/4
FUSELAGE: 1/8 x 1/2 x 16 1/4 Soft Balsa
Drooped T.E. Moves C.G. Back to 80% Helps to Give Slow Gliding Speed
SLO-SPEED H.L. GLIDER
Norman Getzlaff
Cleveland, Ohio

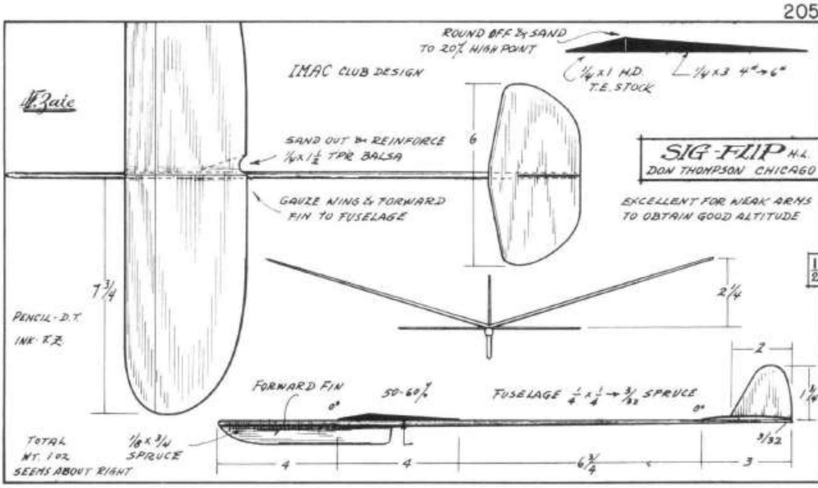
204a


ALL JOINTS MADE AS FOLLOWS.
1: COAT BOTH SURFACES WITH AMBROID & LET DRY + JOIN
2. COAT SURFACES WITH CONTACT CEMENT
3: COAT JOINT WITH AMBROID
89°
6
NO FINISH BEHIND THIS LINE
1/16 TH STREAMLINE STAB
40%
WING 1/4 X 3 X 18
KEEP TAIL & BOOM AS LIGHT AS POSSIBLE
NOTE ANGULAR DIFFERENCE BET. WING & FUSELAGE
PIN HINGE
WIRE SPRING
AL. D/T TAB 2% OF WING MAX. TRIM FOR D/T RATE DESIRED
HANDY FLING H.L.
L.A. JOHNSTON GARLAND, TEX.
4 3/4
40°
THE PAST CONTEST RECORD INDICATES DEAD AIR FLIGHTS 0:42 — 0:47. MAIN ADVANTAGE FOR ME IS CONSISTANT HI-LAUNCH. (MUST GET HI IN TEX. TO CATCH THERMALS) NEVER HAD ONE SPIN OUT OF THERMAL.
3/8
4 1/2
ADJUSTMENT: HAND GLIDE & ADJUST DIA. OF CIRCLE BY TILTING STAB MORE IF REQD (TWIST BOOM)
LAUNCH NEARLY VERTICAL, USE RUDDER TO CONTROL RATE OF ROLL
N.F.
1.8
3/32 ND DEAD SOFT STREAMLINE
1.9
.8
1/4 x 1/2 x 7 MD. BALSA
1/4 SQ x 22 SPRUCE
REDUCED AREAS TRIED. FOUND SAME STABILITY
D/T
1/2
3
3
1
10 1/2
2
2 1/2

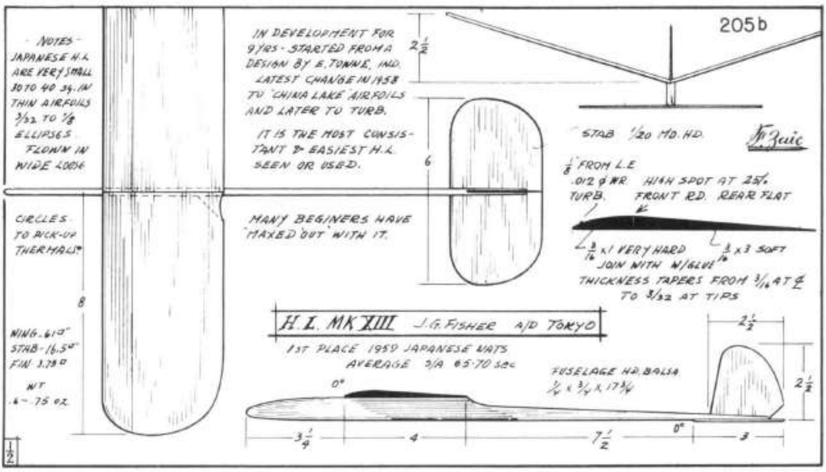

OUTLINES BEFORE BEFORE PLACING IN JIG
BOTTOM
TOP
204b
3 - 1/16 TH
1/32 ND
STANDARD WT. 1oz.
1/32 ND
1
2 1/2
ELLIPTICAL DIHEDRAL JIG & PRESS
OFFSET RUDDER
1/8 PLY. BRACE
THIS LAYOUT USED FOR 8 YRS HERE. (MOD OF B. BRANNER)
IT O/S AT 1958 NATS. ANOTHER ON SECOND DAY OUT. ANOTHER THIS SUMMER.— ELL. DIHEDRAL ADV. DOES NOT HAVE INDUCED DRAG OF SHARP DIHEDRAL BREAKS. — CAN BE MADE LIGHTER. "DEAD" AIR AVERAGE 45-60 sec. — SEEMS QUITE STABLE YET PITCHES UP NICELY. (TAKES GOOD ARM!)
WING CONSTRUCTION
1- SOAK 1/32 BOTTOM SHEET. SET IN JIG. LET IT DRY WELL.
2. SOAK THREE 1/16 TH L.E. PCS. SET & DRY IN JIG. CEMENT BOTTOM & EACH OTHER. AND HOLD IN JIG UNTIL CEMENT SETS.
3 - CEMENT FRONT TOP 1/32 TO 1/16 TH. HOLD IN JIG UNTIL SET.
4.- SOAK & CEMENT 1/32 TOP REAR SHEET. USE ONLY BOTTOM HALF OF JIG AS A WORK BOARD. (DO NOT PRESS DOWN WITH TOP FORM UNLESS IT IS CUT TO AIRFOIL ANGLE.)
4 x 4 x 20 BLOCK SAWED TO DIHEDRAL FORM
1/2
TAIL: 1/32 ND HD. BALSA
NOTE RUDDER SET
9 1/4
5- SAND LEADING EDGE TO SHAPE.
BRACE WITH GAUZE
1/2" SQUARES
2 1/4
TRIM: CONOVER'S LT/RUD & DOWN ON RT/STAB (WITH CARE)
FUSELAGE: 1/8 x 1 x 20 1/2 - MUST BE SPRUCE OR EQ.
2 1/4
75%
0°
MAD-MAC H.L.
JOHN F. McNALL
MADISON, WIS.
4 1/2
3 1/2
10
0°
2 1/2


204c
LAUNCH STRAIGHT UP. CLIMB HAS SLIGHT LEFT TENDENCY. DROPS OFF TO LEFT AND ASSUMES LARGE LEFT CIRCLES WITHOUT SEEMINGLY LOSING ANY ALTITUDE (SHORT NOSE ?). IT SEEMS TO SKID AROUND FLAT, INSTEAD
OF BANKING. GLIDE NOT SLOW YET RATE OF SINK IS LOW
1/32 ND
7
SHARP EDGE
1/8 TH STOCK
ALL BALSA H+B GRAIN LIGHT AS POSSIBLE
"LO-CE"
STEVE BARD - INDEPENDENCE, MO
FOR SMALL GYMS
A TRIAL/ERROR DEVELOPMENT
TRIM TURN WITH RUDDER PREVENT SPIN BY WARPING WING PATTERN: L/L
9
1 3/4
1/2
VIA DICK BLACK
FUSELAGE: 1/8 x 1/4 → 1/16 sq HD. BALSA
1/32 ND
0°
90%
0°
1
THIN TIPS
2 1/2
3
10
1 1/2
1

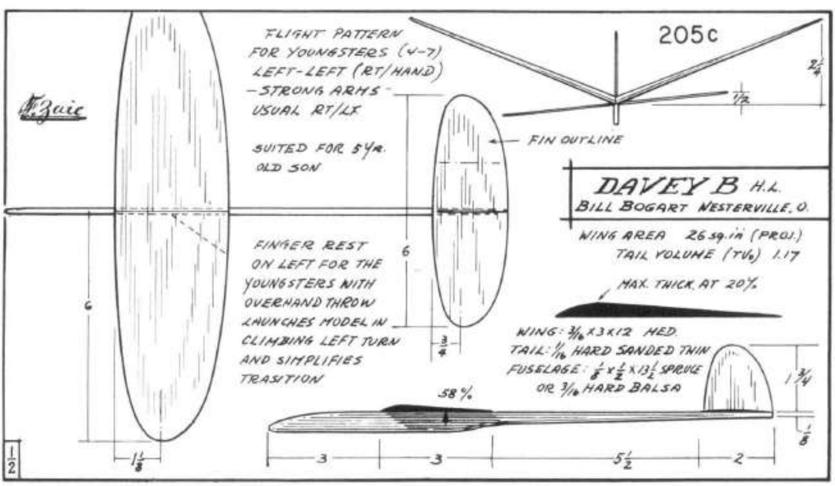
205a



W. Zaic
IMAC CLUB DESIGN
ROUND OFF & SAND TO 20% HIGH POINT
1/4 x 1 HD. T.E. STOCK
1/4 x 3 4" → 6"
SAND OUT & REINFORCE 1/4 x 1 1/2 TPR BALSA
GAUZE WING & FORWARD FIN TO FUSELAGE
SIG-FLIP H.L.
DON THOMPSON CHICAGO
EXCELLENT FOR WEAK ARMS TO OBTAIN GOOD ALTITUDE
6
7 3/4
2 1/4
1/2
PENCIL - D.T.
INK - F.Z.
FORWARD FIN
50-60%
0°
FUSELAGE 1/4 x 1/4 → 3/32 SPRUCE
0°
2
1 3/4
3/32
TOTAL WT. 1 OZ SEEMS ABOUT RIGHT
1/8 x 3/4 SPRUCE
4
4
6 3/4
3



205b
- NOTES -
JAPANESE H.L ARE VERY SMALL 30 TO 40 SQ. IN THIN AIRFOILS 3/32 TO 1/8 ELLIPSES. FLOWN IN WIDE LOOPS
CIRCLES TO PICK-UP THERMALS
IN DEVELOPMENT FOR 9 YRS - STARTED FROM A DESIGN BY E. TONNE, IND. LATEST CHANGE IN 1958 TO "CHINA LAKE" AIRFOILS AND LATER TO TURB.
IT IS THE MOST CONSISTANT & EASIEST H.L. SEEN OR USED.
MANY BEGINERS HAVE "MAXED OUT" WITH IT.
2 1/2
6
8
STAB 1/20 MD. HD.
W. Zaic
1/8 FROM L.E
.012 ø WR. TURB.
HIGH SPOT AT 25%
FRONT RD. REAR FLAT
3/16 x 1 VERY HARD
3/16 x 3 SOFT
JOIN WITH W/GLUE
THICKNESS TAPERS FROM 3/16 AT ℄ TO 3/32 AT TIPS
H.L. MK XIII J.G. FISHER A/D TOKYO
1ST PLACE 1959 JAPANESE NATS AVERAGE 3/A 65.70 sec
WING - 61□"
STAB - 16.5□"
FIN - 3.75□
WT .6 - .75 OZ.
0°
FUSELAGE HD. BALSA 1/4 x 3/4 x 17 3/4
2 1/2
2 1/2
0°
3 1/4
4
7 1/2
3
1/2



205c
W. Zaic
FLIGHT PATTERN FOR YOUNGSTERS (4-7) LEFT-LEFT (RT/HAND) - STRONG ARMS - USUAL RT/LF.
SUITED FOR 5 YR. OLD SON
2 1/4
1/2
FIN OUTLINE
DAVEY B H.L.
BILL BOGART WESTERVILLE, O.
WING AREA 26 sq. in (PROJ.)
TAIL VOLUME (TVo) 1.17
MAX. THICK. AT 20%
FINGER REST ON LEFT FOR THE YOUNGSTERS WITH OVERHAND THROW LAUNCHES MODEL IN CLIMBING LEFT TURN AND SIMPLIFIES TRASITION
6
6
3/4
WING: 3/16 x 3 x 12 HED.
TAIL: 1/16 HARD SANDED THIN
FUSELAGE: 1/8 x 1/2 x 13 1/2 SPRUCE OR 3/16 HARD BALSA
1 3/4
58%
1/8
1 1/8
3
3
5 1/2
2
1/2

"PARABOLIC" INDOOR PLANFORM — Ray Rarlan

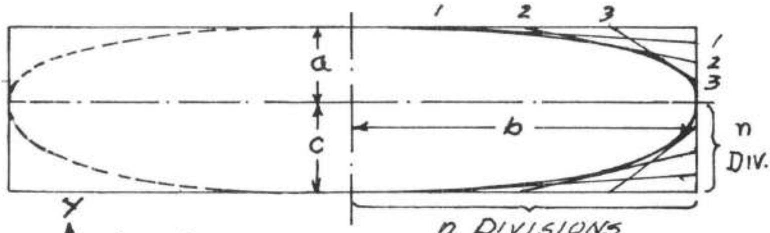
For some time, two curved planforms have been used extensively for indoor model planforms—the ellipse, and what has been called a "parabolic development." The ellipse has an area given by:

$$\underset{(ellipse)}{AREA} = \frac{\pi}{4} \times \text{MAX. CHORD} \times \text{WING SPAN} \qquad \text{WHERE } \frac{\pi}{4} = 0.7854$$

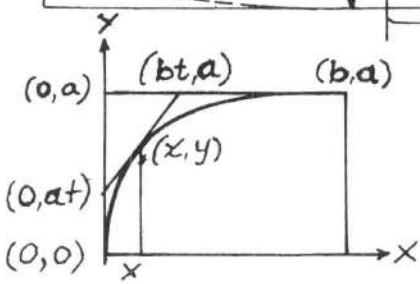
It was generally accepted practice to equate the area of the parabolic development to:

$$\underset{PAR\ DEV}{AREA} = 0.8 \times \text{MAX. CHORD} \times \text{WING SPAN}$$

Why this formula was correct always aroused by curiosity. I decided to find an analytical solution if possible. The planform is described in figure 1. It is made by fairing a curve tangent to the construction lines. The number "n" may be as large as desired; the larger, the easier it is to draw an accurate outline.



PLANFORM FIG. 1



CONSTRUCTION FIG. 2

The proceedure for finding the area is as follows. Let "t" (fig. 2) be some fraction of one. The construction line which passes through the point (O, at) also passes through the point (bt, a), as shown in the construction. Point (x, y) lies on the planform and is given by:

$$y = at + x\left[\frac{a-at}{bt}\right] \quad (1)$$

To solve "y" as a function of one variable (x), "t" must be eliminated. Note that if "x" is held constant, "y" is a minimum for that "t" which describes the construction line touching the planform at (x, y). Mathematically (with the help of calculus) this is:

$$\frac{\partial y}{\partial t} = 0 = a + x\left[\frac{ab}{(bt)^2}\right] \quad (2) \qquad \text{SOLVING FOR "}t\text{": } t = \sqrt{\frac{x}{b}}$$

PLUGGING INTO (1): $y = a\sqrt{\frac{x}{b}} + x\left[\frac{a - a\sqrt{\frac{x}{b}}}{b\sqrt{\frac{x}{b}}}\right] = 2a\sqrt{\frac{x}{b}} - \frac{ax}{b}$

The area of the planform is

$$\underset{p.d.}{\text{AREA}} = \int_0^b y\,dx = \int_0^b \left[2a\sqrt{\frac{x}{b}} - \frac{ax}{b}\right]dx = \frac{4}{3}ab - \frac{ab}{2} = \frac{5}{6}ab$$

Applying this to the complete planform:

$$\boxed{\begin{aligned}\underset{p.d.}{\text{AREA}} &= \tfrac{5}{6} \times \text{MAX. CHORD} \times \text{WING SPAN}\\ &= 0.8333 \times \text{MAX. CHORD} \times \text{WING SPAN}\end{aligned}}$$

Thus our presupposed 0.80 coefficient should be 0.8333. This makes our planforms larger than we had calculated!

As an addition to this expose, it can be noted that the planform is a geometric construction, and has the same properties in projected view as in the planform view. For a Vee-dihedral wing, the area is given by:

$$\underset{p.d.\,\text{VEE-DIH}}{\text{AREA}} = 0.8333 \times \text{MAX. CHORD} \times \text{PROJECTED SPAN}$$

However, the formula for a parabolic development planform with tip dihedral is more complicated and is found by:

$$\boxed{\begin{aligned}\underset{p.d.\,\text{tip-dih}}{\text{AREA}} &= \int_0^d y\,dx + \cos\theta \int_d^b y\,dx \; ; \quad \cos\theta = \frac{e}{b-d}\\ \underset{p.d.\,\text{tip-dih}}{\text{AREA}/2} &= \frac{5}{6}ab\cos\theta + \left[1 - \cos\theta\right]\left[\frac{4a\sqrt{d^3}}{3\sqrt{b}} - \frac{ad^2}{2b}\right]\end{aligned}}$$

a, b, c, d, e, θ ARE SHOWN IN FIG. 3

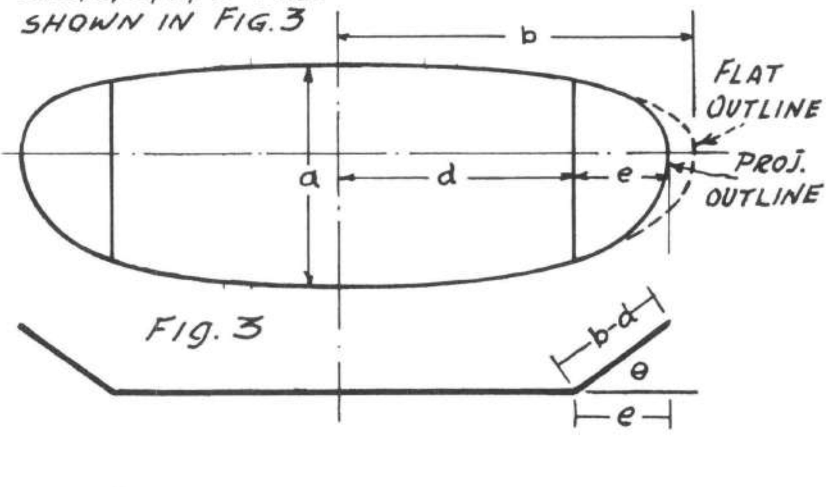
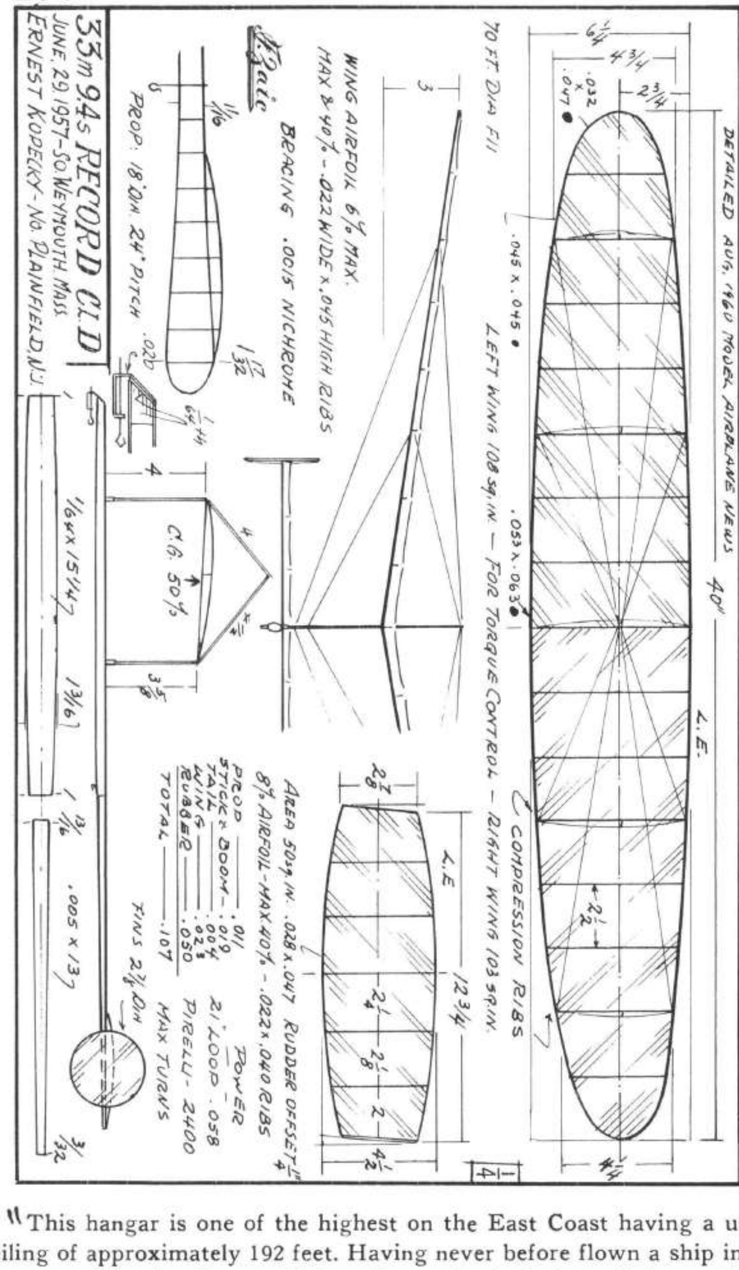
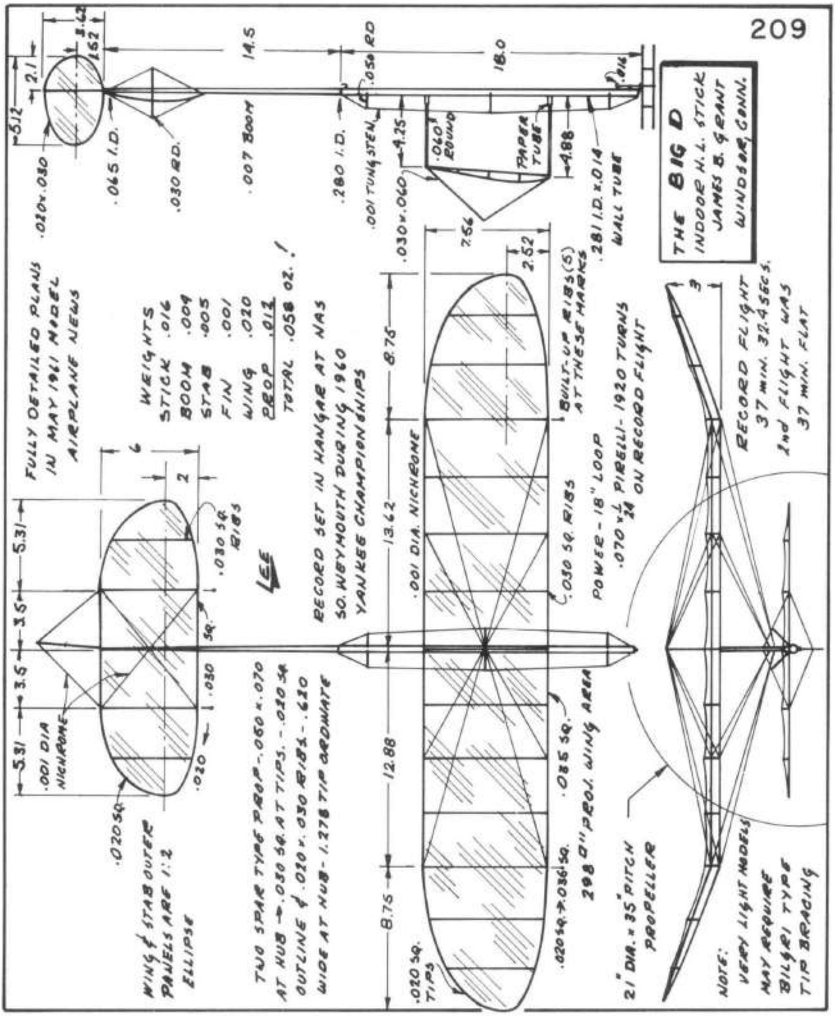


FIG. 3



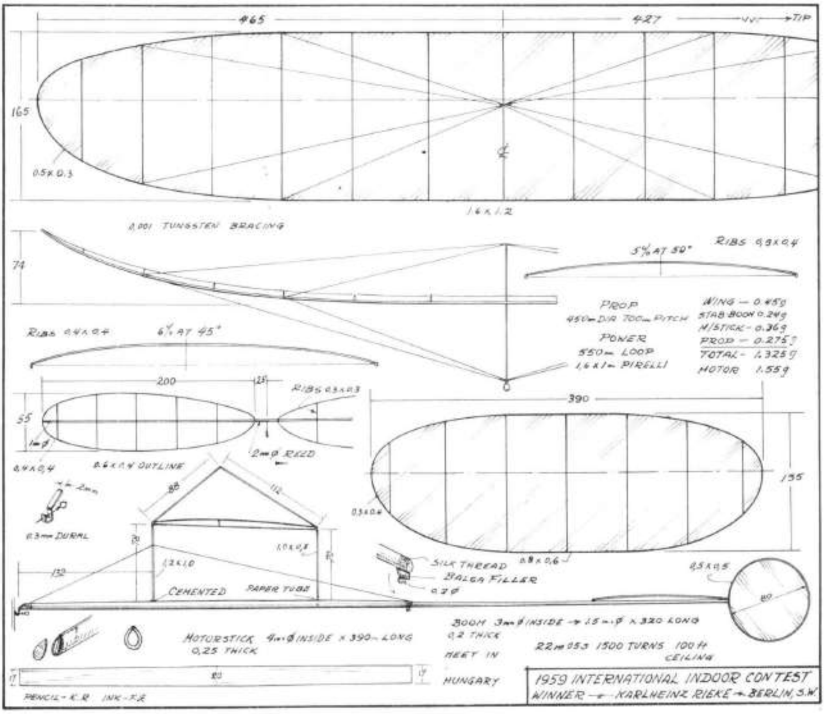
"This hangar is one of the highest on the East Coast having a usable ceiling of approximately 192 feet. Having never before flown a ship in this hangar and having been told by others who had that windy conditions usually existed, I decided to build a so called "all weather" ship, one that was strong and fairly rugged, extreme lightness being sacrificed.

This was my first Class "D" model. Experience gained from flying Class "C" ships at Lakehurst Record Trials dictated that the ship have a short body and boom (a Class D wing of 210 square inches on a normal Class C size stick and boom), a small stab, 25% wing area, twin rudders on the ends of the stab to give added efficiency, and a low pitched prop to get maximum altitude (18 diameter 24 inch pitch)."

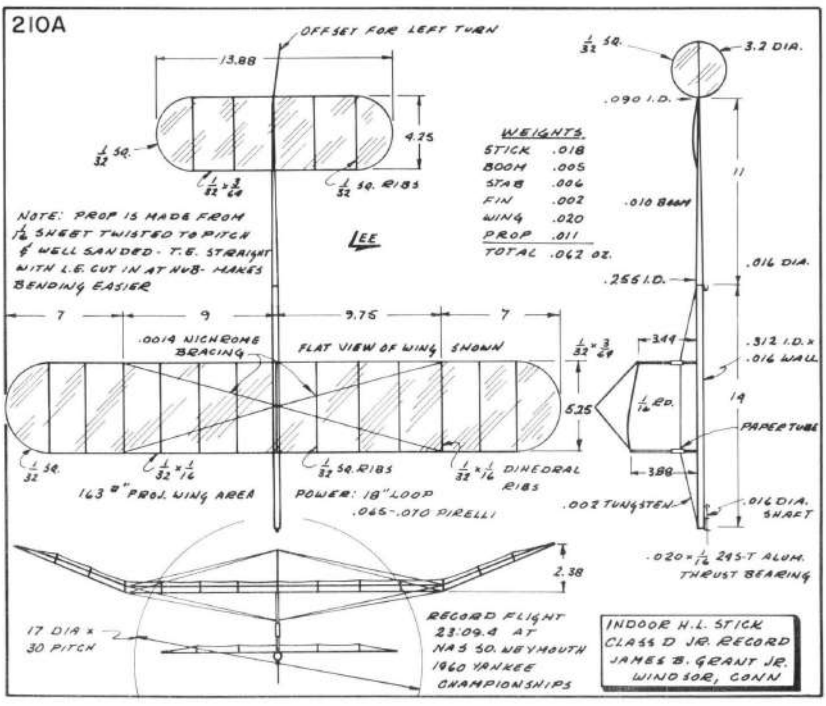


The second flight, which set the new record of 27m 32s, used a new motor, gradually broken to 1900 turns. With Dave Call on the winder, 2000 turns were cranked in and then 80 turns backed off. The model climbed steadily with no apparent early power burst and at about 15 min. mark levelled off a few feet below the center stringer of the hanger roof. Now here is where intuition, luck, or call it what you will, enters this particular phase of flying. If Dave had not decided to back off those 80 power turns, the model probably would have hit the roof and hung there. This flight approached its end with model going dead stick still 50 feet above the floor; the rubber motor hanging completely loose. A sign that the model was not flown to its best advantage. (It should have had about half row of knots still left.) Arithmetic showed that if the correct rubber motor could be selected to bring the model just under the "ceiling" and have half row of knots on landing, it could exceed 40 minutes.

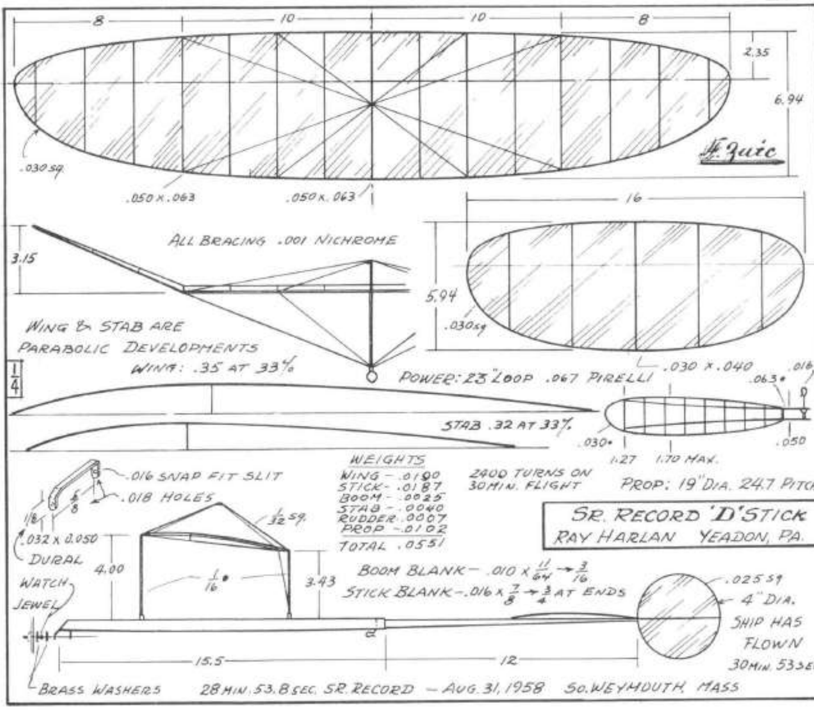
210



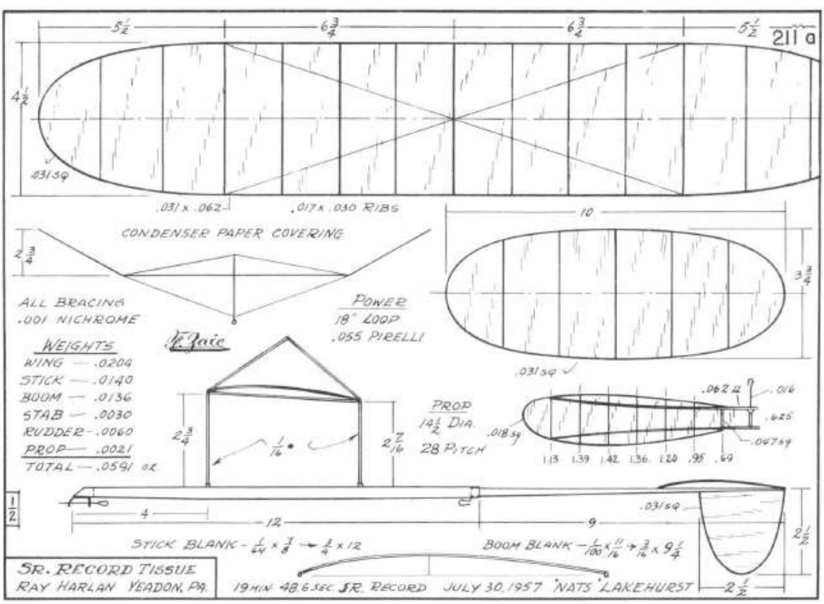
465
427
TIP
165
0.5 x 0.3
1.6 x 1.2
0.001 TUNGSTEN BRACING
74
5% AT 50°
RIBS 0.5 x 0.4
PROP
450mm DIA 700mm PITCH
POWER
550mm LOOP
1.6 x 1mm PIRELLI
WING — 0.45g
STAB BOOM 0.24g
M/STICK — 0.36g
PROP — 0.275g
TOTAL — 1.325g
MOTOR 1.55g
RIBS 0.4 x 0.4
6% AT 45°
200
25
RIBS 0.3 x 0.3
55
390
1mm ø
2mm ø REED
0.4 x 0.4
0.6 x 0.4 OUTLINE
155
88
112
0.3mm DURAL
0.3 x 0.4
1.0 x 0.8
1.2 x 1.0
SILK THREAD
BALSA FILLER
0.8 x 0.6
0.5 x 0.5
132
CEMENTED
PAPER TUBE
80
BOOM 3mm ø INSIDE → 1.5 mm ø x 320 LONG
0.2 THICK
MOTORSTICK 4mm ø INSIDE x 390mm LONG
0.25 THICK
22m 053 1500 TURNS 100 ft CEILING
MEET IN
HUNGARY
1959 INTERNATIONAL INDOOR CONTEST
WINNER — KARLHEINZ RIEKE — BERLIN, S.W.
PENCIL — K.R. INK — F.Z.



210A
OFFSET FOR LEFT TURN
13.88
1/32 SQ.
3.2 DIA.
.090 I.D.
4.25
1/32 x 3/64
1/32 SQ. RIBS
WEIGHTS
STICK .018
BOOM .005
STAB .006
FIN .002
WING .020
PROP .011
TOTAL .062 OZ.
11
.010 BOOM
NOTE: PROP IS MADE FROM 1/16 SHEET TWISTED TO PITCH & WELL SANDED - T.E. STRAIGHT WITH L.E. CUT IN AT HUB - MAKES BENDING EASIER
LEE
.016 DIA.
.256 I.D.
7
9
9.75
7
.0014 NICHROME BRACING
FLAT VIEW OF WING SHOWN
1/32 x 3/64
3.44
.312 I.D. x .016 WALL
5.25
1/16 RD.
14
PAPER TUBE
1/32 SQ.
1/32 x 1/16
1/32 SQ. RIBS
1/32 x 1/16 DIHEDRAL RIBS
3.88
163 □" PROJ. WING AREA
POWER: 18" LOOP .065-.070 PIRELLI
.002 TUNGSTEN
.016 DIA. SHAFT
2.38
.020 x 1/16 24S-T ALUM. THRUST BEARING
17 DIA x 30 PITCH
RECORD FLIGHT 23:09.4 AT NAS SO. WEYMOUTH 1960 YANKEE CHAMPIONSHIPS
INDOOR H.L. STICK
CLASS D JR. RECORD
JAMES B. GRANT JR.
WINDSOR, CONN

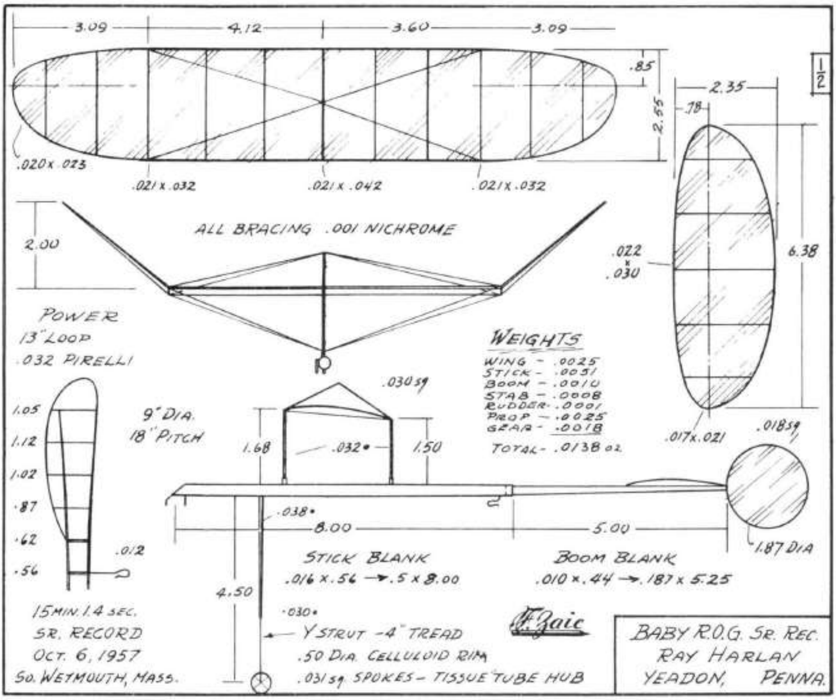


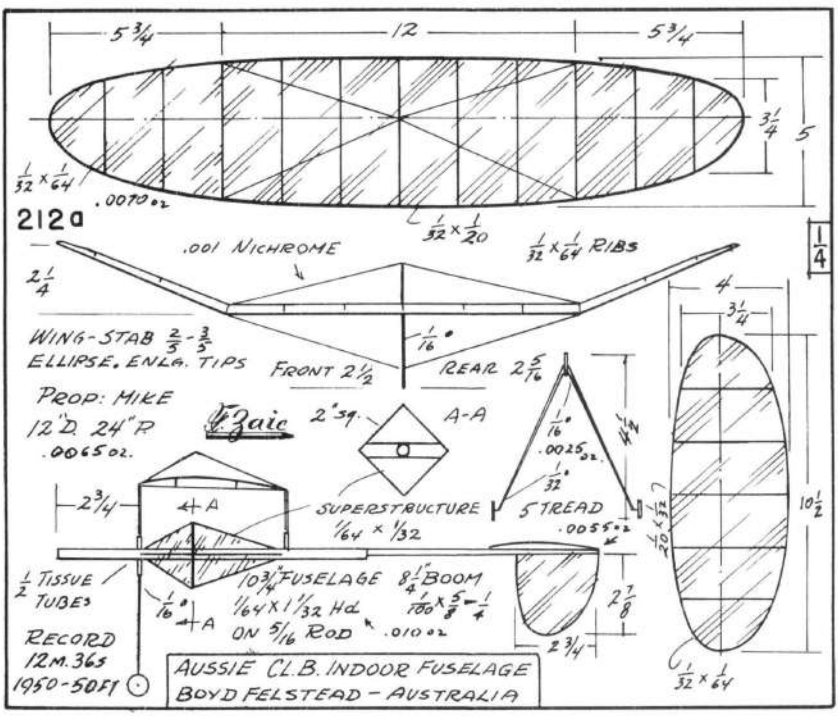
8
10
10
8
2.35
6.94
.030 sq.
.050 x .063
.050 x .063
16
ALL BRACING .001 NICHROME
3.15
5.94
.030 sq
WING & STAB ARE
PARABOLIC DEVELOPMENTS
WING: .35 AT 33%
1/4
POWER: 23" LOOP .067 PIRELLI
.030 x .040
.063
.016
STAB .32 AT 33%
.030
1.27
1.70 MAX.
.050
WEIGHTS
WING - .0190
STICK - .0187
BOOM - .0025
STAB - .0040
RUDDER .0007
PROP - .0102
TOTAL .0551
2400 TURNS ON
30 MIN. FLIGHT
PROP: 19" DIA. 24.7 PITCH
.016 SNAP FIT SLIT
.018 HOLES
1/8
5/8
1/32 SQ.
.032 x 0.050
DURAL
4.00
WATCH JEWEL
1/16
3.43
SR. RECORD 'D' STICK
RAY HARLAN YEADON, PA.
BOOM BLANK - .010 x 11/64 → 3/16
STICK BLANK - .016 x 7/8 → 3/4 AT ENDS
.025 SQ
4" DIA.
SHIP HAS FLOWN 30 MIN. 53 SEC
15.5
12
BRASS WASHERS
28 MIN. 53.8 SEC. SR. RECORD — AUG. 31, 1958 SO. WEYMOUTH, MASS

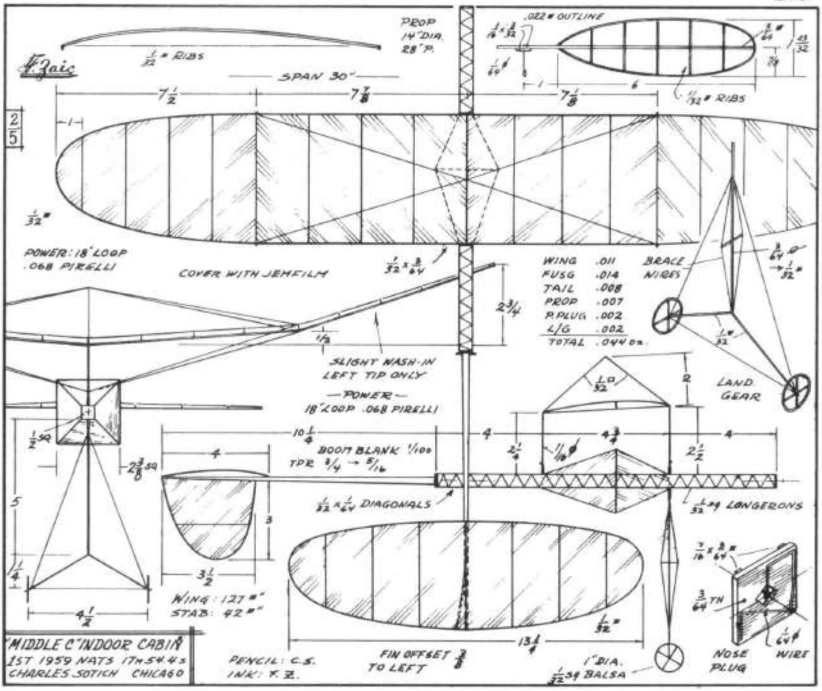


211 a
5 1/2
6 3/4
6 3/4
5 1/2
4 1/2
.031 SQ
.031 x .062
.017 x .030 RIBS
10
CONDENSER PAPER COVERING
2 3/4
3 3/4
ALL BRACING
.001 NICHROME
POWER
18" LOOP
.055 PIRELLI
WEIGHTS
WING — .0204
STICK — .0140
BOOM — .0136
STAB — .0030
RUDDER - .0060
PROP — .0021
TOTAL — .0591 oz.
.031 sq
PROP
14 1/2 DIA.
28 PITCH
.018 sq
.062
.016
.025
.047 sq
1.13 1.39 1.42 1.36 1.20 .95 .69
2 3/4
1/16
2 7/16
1/2
4
12
9
.031 SQ
2 1/2
STICK BLANK - 1/64 x 7/8 → 3/4 x 12
BOOM BLANK - 1/100 x 11/16 → 3/16 x 9 1/4
SR. RECORD TISSUE
RAY HARLAN YEADON, PA.
19 MIN 48.6 SEC. SR. RECORD JULY 30, 1957 'NATS' LAKEHURST
2 1/2

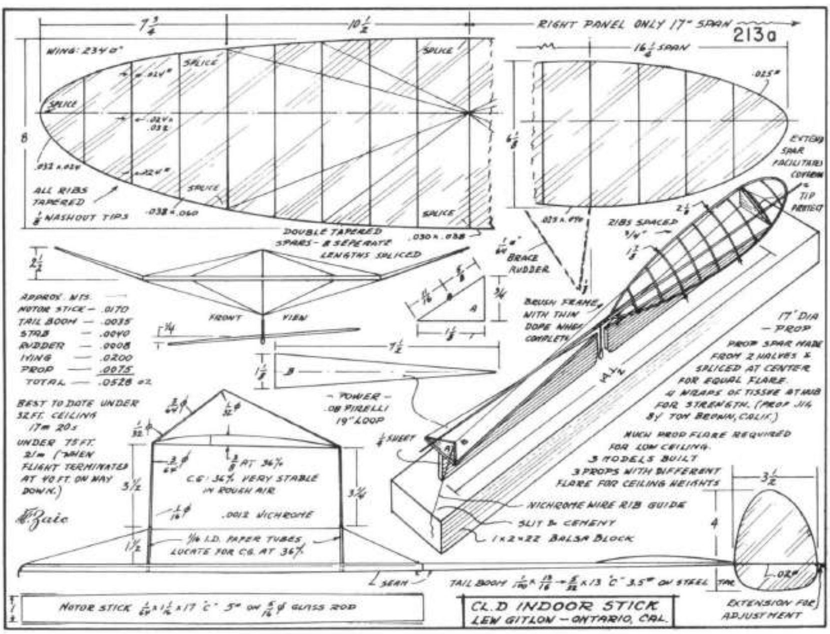
212


3.09
4.12
3.60
3.09
.85
2.55
.020 x .023
.021 x .032
.021 x .042
.021 x .032
2.35
.18
6.38
.022 x .030
.017 x .021
ALL BRACING .001 NICHROME
2.00
POWER
13" LOOP
.032 PIRELLI
WEIGHTS
WING - .0025
STICK - .0051
BOOM - .0010
STAB - .0008
RUDDER - .0001
PROP - .0025
GEAR - .0018
TOTAL - .0138 oz.
.030 sq
.018 sq
1.05
1.12
1.02
.87
.62
.56
9" DIA.
18" PITCH
1.68
.032•
1.50
.038•
8.00
5.00
1.87 DIA
.012
STICK BLANK
.016 x .56 → .5 x 8.00
BOOM BLANK
.010 x .44 → .187 x 5.25
4.50
.030•
15 MIN. 1.4 SEC.
SR. RECORD
OCT. 6, 1957
SO. WEYMOUTH, MASS.
Y STRUT - 4" TREAD
.50 DIA. CELLULOID RIM
.031 sq SPOKES - TISSUE TUBE HUB
F. Zaic
BABY R.O.G. SR. REC.
RAY HARLAN
YEADON, PENNA.
1/2

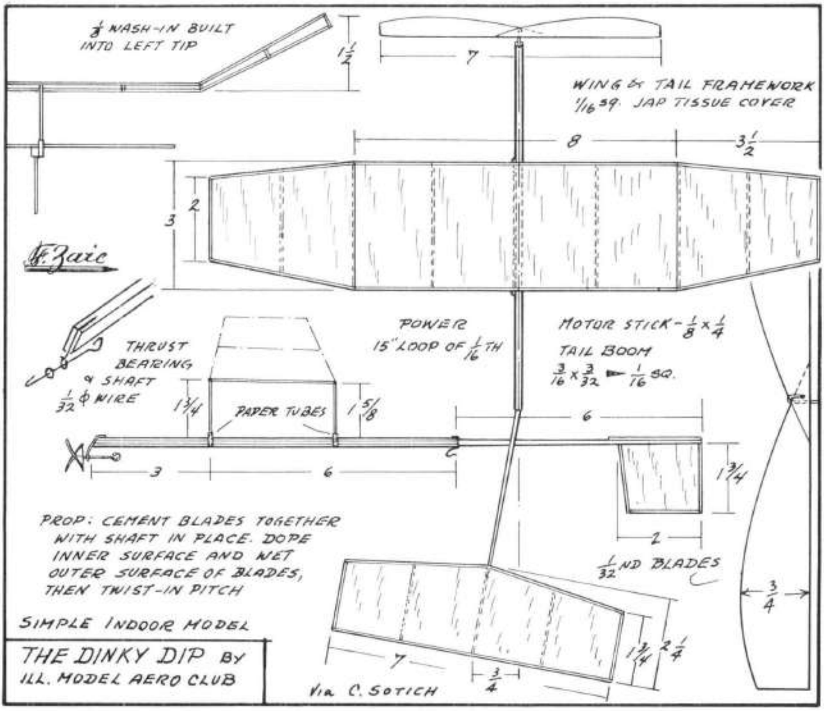

5 3/4
12
5 3/4
3 1/4
5
1/32 x 1/64
.0070 oz
212a
1/32 x 1/20
1/32 x 1/64 RIBS
.001 NICHROME
2 1/4
1/4
4
3 1/4
WING-STAB 2/3 - 3/5
ELLIPSE. ENLG. TIPS
1/16•
FRONT 2 1/2
REAR 2 5/16
PROP: MIKE
12" D. 24" P.
.0065 oz.
F. Zaic
2" sq.
A-A
1/16•
.0025 oz.
1/32•
4 1/2
2 3/4
A
SUPERSTRUCTURE
1/64 x 1/32
5 TREAD
.0055 oz.
1/20 x 1/32
10 1/2
1/2 TISSUE TUBES
1/16•
A
10 3/4" FUSELAGE
1/64 x 1 1/32 Hd
ON 5/16 ROD
8 1/4" BOOM
1/100 x 5/8 - 1/4
.010 oz
2 7/8
2 3/4
RECORD
12 M. 36 s
1950-50 F1
AUSSIE CL.B. INDOOR FUSELAGE
BOYD FELSTEAD - AUSTRALIA
1/32 x 1/64



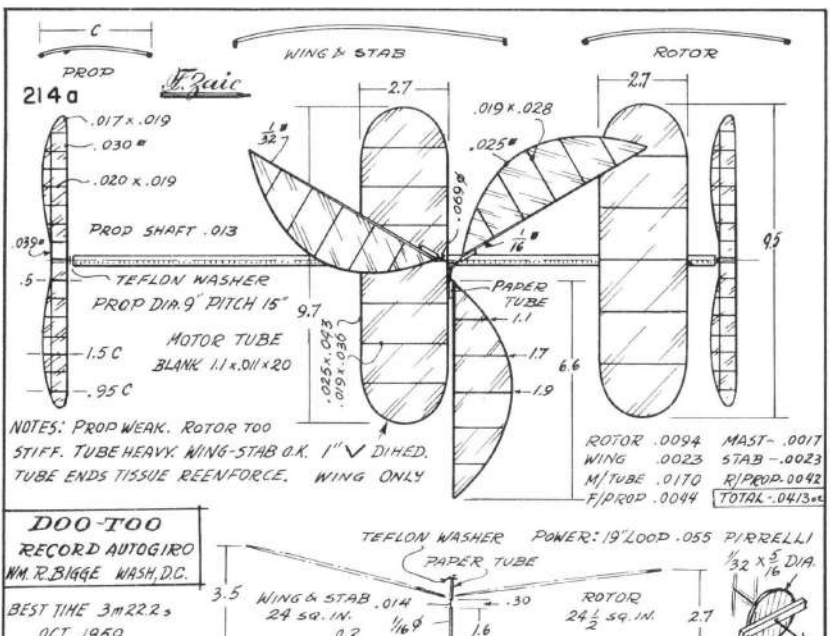
PROP
14" DIA.
28" P.
1/32" RIBS
SPAN 30"
.022" OUTLINE
1/32" RIBS
POWER: 18" LOOP
.068 PIRELLI
COVER WITH JEHFILM
WING .011
FUSG .014
TAIL .008
PROP .007
P.PLUG .002
L/G .002
TOTAL .044 oz.
BRACE
WIRES
SLIGHT WASH-IN
LEFT TIP ONLY
— POWER —
18" LOOP .068 PIRELLI
LAND.
GEAR
BOOM BLANK 1/100
TPR 3/4 → 5/16
1/32 x 1/64 DIAGONALS
1/32 sq LONGERONS
WING: 127 □"
STAB: 42 □"
NOSE
PLUG
WIRE
"MIDDLE C" INDOOR CABIN
1ST 1959 NATS 17M 54.4S
CHARLES SOTICH CHICAGO
PENCIL: C.S.
INK: F.Z.
FIN OFFSET 3/8
TO LEFT
1" DIA.
1/32 SQ BALSA



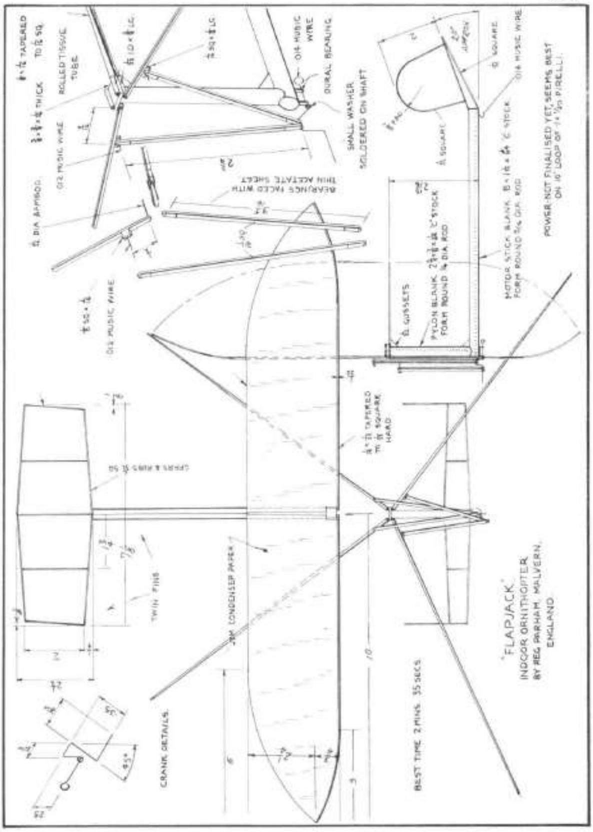
213a
RIGHT PANEL ONLY 17" SPAN
16 1/4 SPAN
WING: 234 □"
SPLICE
ALL RIBS
TAPERED
1/8 WASHOUT TIPS
DOUBLE TAPERED
SPARS - 8 SEPERATE
LENGTHS SPLICED
2 RIBS SPACED
BRACE
RUDDER
APPROX. WTS.
MOTOR STICK — .0170
TAIL BOOM — .0035
STAB — .0040
RUDDER — .0008
WING — .0200
PROP — .0075
TOTAL — .0528 oz
FRONT VIEW
BRUSH FRAME
WITH THIN
DOPE WHEN
COMPLETE
17" DIA
— PROP
PROP SPAR MADE
FROM 2 HALVES &
SPLICED AT CENTER
FOR EQUAL FLARE.
4 WRAPS OF TISSUE AT HUB
FOR STRENGTH. (PROP JIG
BY TOM BROWN, CALIF.)
— POWER —
.08 PIRELLI
19" LOOP
BEST TO DATE UNDER
32 FT. CEILING
17m 20s
UNDER 75 FT.
21m (WHEN
FLIGHT TERMINATED
AT 40 FT. ON WAY
DOWN.)
C.G: 36% VERY STABLE
IN ROUGH AIR
.0012 NICHROME
1/16 I.D. PAPER TUBES
LOCATE FOR C.G. AT 36%
MUCH PROP FLARE REQUIRED
FOR LOW CEILING.
3 MODELS BUILT
3 PROPS WITH DIFFERENT
FLARE FOR CEILING HEIGHTS
NICHROME WIRE RIB GUIDE
SLIT & CEMENT
1 x 2 x 22 BALSA BLOCK
SEAM
MOTOR STICK
EXTENSION FOR
ADJUSTMENT
CL. D INDOOR STICK
LEW GITLOW — ONTARIO, CAL.



1/8 WASH-IN BUILT INTO LEFT TIP
WING & TAIL FRAMEWORK 1/16 SQ. JAP TISSUE COVER
F. Zaic
THRUST BEARING & SHAFT 1/32 φ WIRE
POWER 15" LOOP OF 1/16 TH
MOTOR STICK - 1/8 x 1/4
TAIL BOOM 3/16 x 3/32 — 1/16 SQ.
PAPER TUBES
PROP: CEMENT BLADES TOGETHER WITH SHAFT IN PLACE. DOPE INNER SURFACE AND WET OUTER SURFACE OF BLADES, THEN TWIST-IN PITCH
1/32 ND BLADES
SIMPLE INDOOR MODEL
THE DINKY DIP BY ILL. MODEL AERO CLUB
VIA C. SOTICH



PROP
WING & STAB
ROTOR
214a
F. Zaic
.017 x .019
.030 □
.020 x .019
PROP SHAFT .013
TEFLON WASHER
PROP DIA. 9" PITCH 15"
MOTOR TUBE BLANK 1.1 x .011 x 20
.019 x .028
.025 □
.009 φ
1/16 □
PAPER TUBE
NOTES: PROP WEAK. ROTOR TOO STIFF. TUBE HEAVY. WING-STAB O.K. 1" V DIHED. TUBE ENDS TISSUE REENFORCE. WING ONLY
ROTOR .0094 MAST- .0017
WING .0023 STAB - .0023
M/TUBE .0170 R/PROP-.0042
F/PROP .0044 TOTAL - .0413 oz
DOO-TOO RECORD AUTOGIRO
WM. R. BIGGE WASH, D.C.
BEST TIME 3m 22.2 s OCT. 1959
TEFLON WASHER POWER: 19" LOOP .055 PIRRELLI
PAPER TUBE
WING & STAB 24 SQ. IN.
ROTOR 24 1/2 SQ. IN.
1/32 x 5/16 DIA.
3/32 SQ
1/3



In enclose plans of my latest ornithopter which is my best so far. It has two pairs of superimposed wings with one pair being operated by a crank displaced at 90 degrees to that driving the other pair. With this system power, normally wasted on a single wing system is used to operate the second pair of wings. The wing movement is smooth, more controlled and the model does not try to shake itself to bits. Credit for this system goes to Mr. J. S. White who developed it on an outdoor model. Whilst the motion of one pair of wings is 90 degrees behind the other, they come together at a slight dihedral angle. This coming together gives a propulsion very much like that of a primitive pulse jet. Under full power, my model has a climb only to be seen to believe. With nose pointed vertical it just goes vertical for about 30 feet before levelling a little and getting into a normal climbing circle. It has done 2½ mins. so far, but experiments with power should improve this.

RUBBER POWERED HELICOPTER ——Wm. R. Bigge

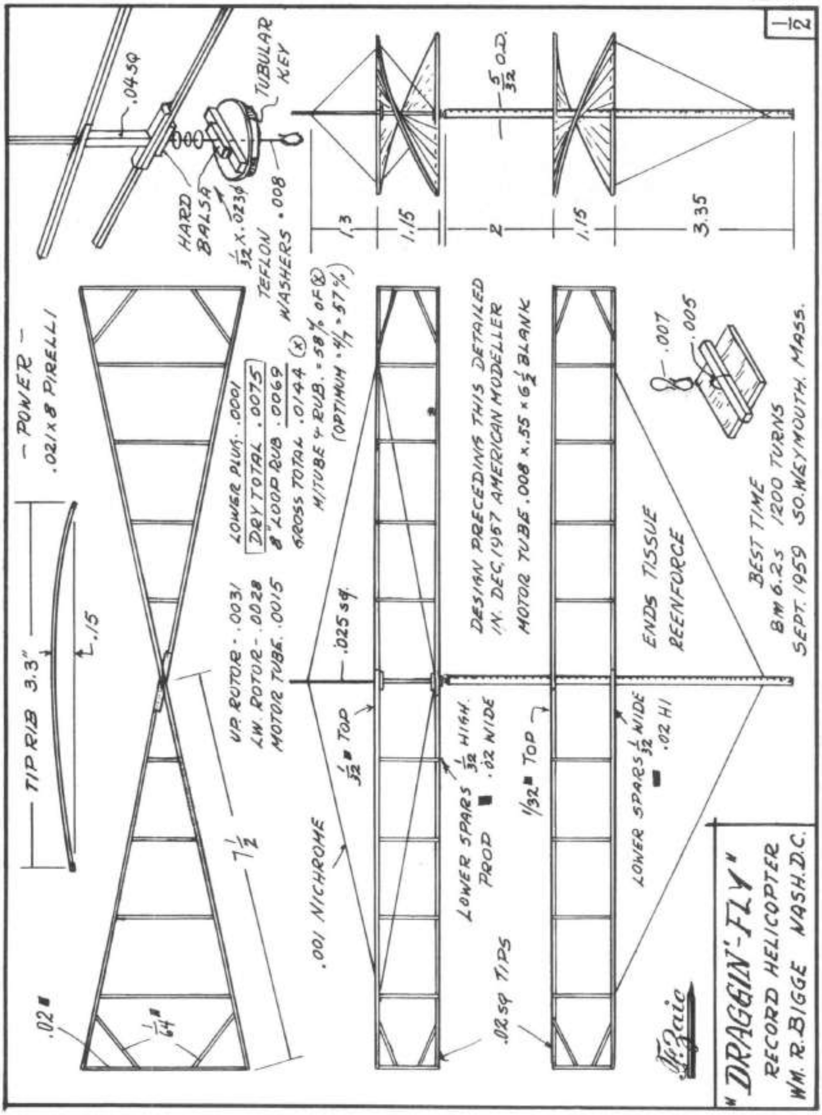
In designing a rubber-powered duration model helicopter, stability is of the greatest importance. There are several approaches.

A single-rotor model can be made stable for a given torque by adjusting the vertical position of the anti-torque vane. If the vane is too low, the model will fall over progressively (dive). If the vane is too high the model will oscillate with increasing amplitude until it falls over (divergent oscillation). A simple way to make the model stable for a large range of torque is to add weights to the blade tips. It probably helps if the blades are flexible. A large vane area improves stability. As this type depends on a gyroscopic effect, it is not practical for duration of more than about a minute. To stabilise the model with the least added weight, a three-bladed rotor should be on top, but if a two-bladed rotor is used instead it should be on the bottom. It may be that a model with a three-bladed rotor on top and a two-bladed rotor on the bottom has some advantage in stability. A three-bladed rotor can use blades of very low torsional stiffness which would make a two-bladed rotor flip the model upside down immediately.

A model with rotors at top and bottom can be made reasonably stable by adjusting the pitch. Increasing the pitch of the lower rotor is equivalent to lowering the vane of a single-rotor model. Another way to stabilise is to use a non-rotating vane, as on Parnell Schoenky's Eggbeater (1951-52 Year Book) and Richard Quermann's indoor model (1955-56 Year Book). The heavy model has the vane near the bottom, while the light model has the vane at the top. This difference may reflect the difference in weight or flexibility or both.

If one rotor is at the top and the other is close to it, the model can be stabilised with a vane of proper area free-wheeling at the bottom. To avoid diving at high power, the vane is mounted on a flexible wire shaft. With rotors close together, oscillation tends to take place in a plane and is easily distinguished from diving. This ease of diagnosis is the greatest virtue of this type. The vane is in a vulnerable position. Also, the flexibility of the wire shaft makes the vane too effective in descent and in extreme cases the model will turn over. I made a series of progressively lighter indoor models of this type about 1948 and had to keep cutting down the vane area. Finally I reduced the motor in one jump from a loop of $\frac{3}{32}$ to a loop of $\frac{1}{32}$ and the diameter from 15" to 12". As hoped, this much lighter model was stable with no vane at all. In fact it is difficult to launch such a model accurately enough upside down to make it lose six feet of altitude before recovering.

A model with one rotor on top and the other one-fourth to one-third of the way down the stick or tube will be stable if the rotors are reasonably light and flexible. The higher the pitch, the lower the bottom rotor should be. Gross weight of these highly stable models has ranged up to one and one-half ounces, but most of my outdoor helicopters are much lighter.



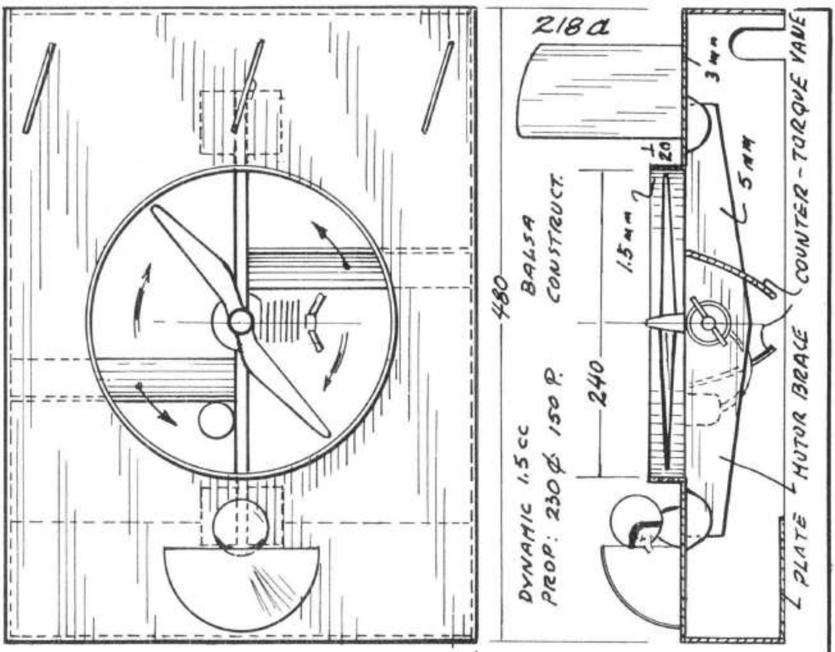
On my latest indoor model the rotors are so large and the motor tube is so short that the CG was too high for stability under high power. Rather than add a vane on top I gave it some dihedral in both rotors and its performance is now limited by the tendency of the rotors to clash at high power. Each of my latest two models will stall one lower blade, pivot on it, and use up many otherwise useless turns. If the CG is too low the model is excessively stable in the descent and falls straight down as soon as the rotors stall. A high-pitch outdoor model will "dethermalise" when completely unwound—very steady, upright, rotors stopped. A very high pitch model (P/D over five) was expected to go fast and high and be safe from thermals. When completely unwound it unexpectedly went into a flat spin and out of sight in five minutes. There is a need for variable pitch on both indoor and outdoor models, for slightly different reasons.

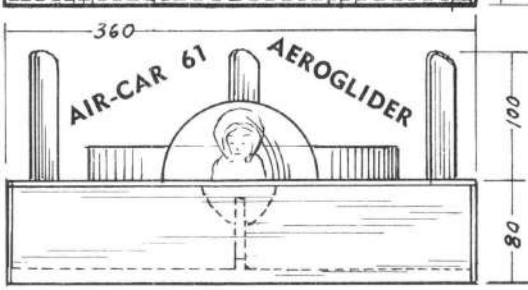
INDOOR MICROFILM GLIDERS — Harold A. Osborne

Tom Finch has two exceptional I.H.L.G. One is a Warren-Young Anti Stall Wing type. (Page 186, L957-58 Y.B.) Span approximate 10 in. The other is a conventional tailless of about 12 in. span. Gliding velocity is approximately 1 ft/sec., and sinking speed approximately ⅕ ft/sec.

The trick is to have an indoor hall that is drafty and has sunlight thru windows onto an area of the concrete floor. We have this condition at the Los Angeles Exposition Armory. Last Saturday the light over sunny concrete began to show at 10:00 A.M. and it became fierce at 12:00 Noon. I watched Tom do 5 consecutive flights of 50 to 60 seconds where normal H.L.G. were doing only 35 to 40 sec. Launch by A.M.A. rules is as high as you can reach.

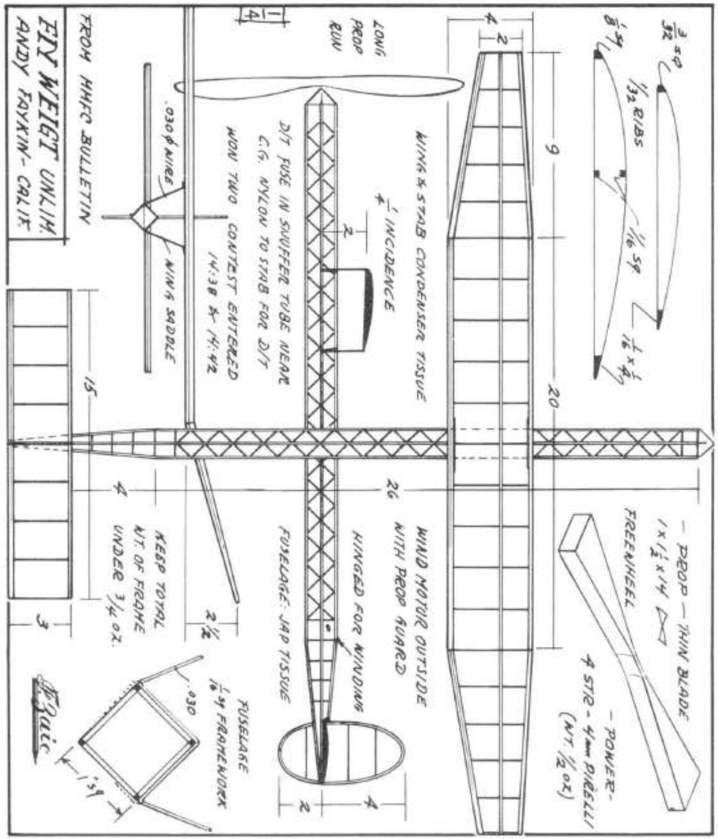
Dick Petersons record of 2 min. 20 sec. is now being processed by A.M.A. I understand the Contest Board is very upset and plans to either make two classes for H.L.G. or to put a wing loading of .3 oz./100 in² on hand launched gliders.



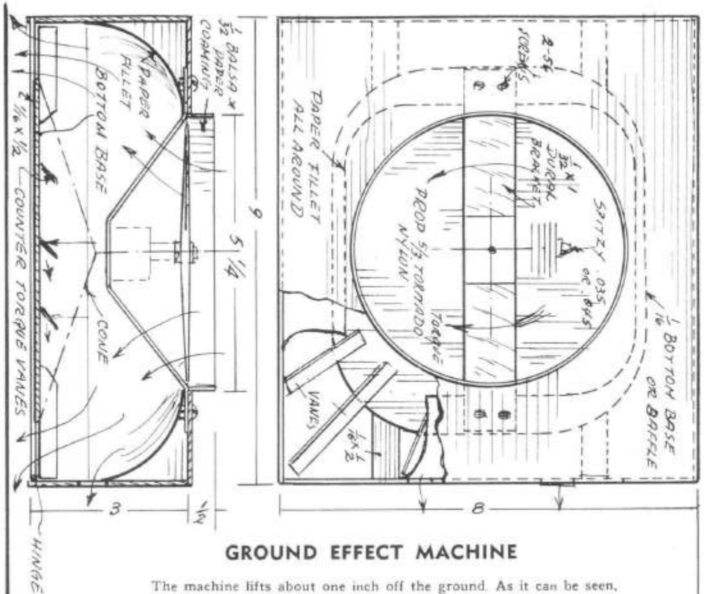


This was taken from the March 1961, issue of the "Le Modele Reduit d'Avion." Just too late to translate the article. But tried to include as much information as possible on the plans. It seems to have a forward speed of 10 km. (6.6 miles) P.H. and a rise of 5 cm. (2 in.) above ground.

G. Chaulet, France



219a



GROUND EFFECT MACHINE

The machine lifts about one inch off the ground. As it can be seen, it is of "edge skirt" variety. To guide the "prop wash" to edges, use a cone center. And to prevent dead air corner eddies, fillet the corners with paper. To counteract the prop or engine torque, cement as many vanes as are needed to balance it. The vanes are cemented to the cone and sides. Be sure to distribute them evenly around the cone. To obtain forward motion, cut out two holes on one side so that air blast will "jet" the machine above the floor. Use 3/32 balsa sheet unless otherwise specified. No effort was made to make it elaborate, and only material handy was used. You might be interested to know that I am 16 years old.

Ned Smith, West Orange, N. J.

OPTIMIZING MODEL AIRCRAFT PERFORMANCE

Don Monson, —— St. Paul, Minn.

I must apologize to you on two counts, first for being so late in sending you my report and second for going well over your 1000 word limit.

Once I started working on the equations, I saw a generalized solution for all air craft falling within the limitations of the assumptions in the report. I decided to push the analysis as far as possible to get maximum use from the equations. As a result what I thought originally would be a five week job, turned out to be a 16 week job due to the time consuming derivations and calculations involved (took up most of my spare time).

Hence I am probably too late and too long for your next issue. I feel the time was well spent though since we now have a powerful tool for analyzing aircraft performance. To my knowledge, many of the equations are presented for the first time.

I tried to make the report shorter but I feel it would lose clarity and continuity if it were cut any shorter. Even as it is some people will not be able to see how some equations were derived, hence I will give a detailed derivation for any of the equations upon request. Also the equations point out many things for which I did not have time or space to cover in the report as these will have to be left for the reader to observe.

I feel, it would be best if the report were not split up, therefore, if it cannot be squeezed in this time (perhaps by using extra small print?), it would be better to wait until such time that you can include it all.

I had to leave out much information on propellers but I think that is best at this time, since the experimental information is presently based on various propeller configurations too sketchy. I am presently building a wind tunnel which will enable me to obtain propeller performance curves. With these experimental data available and used in conjunction with the analysis in the enclosed report, we will be able to predict aircraft performance quite accurately.

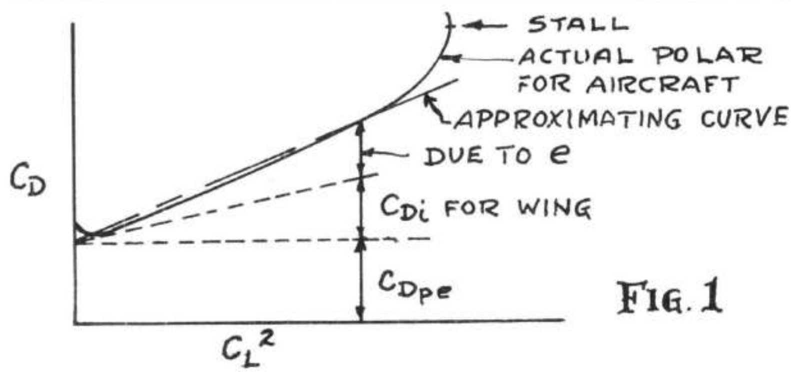


FIG. 1

A GENERALIZED METHOD OF OPTIMIZING AIRCRAFT PERFORMANCE WITH EMPHASIS ON THE CLIPPER CARGO EVENT

By DON MONSON

A method is described herein which allows a designer to estimate the performance of an aircraft in its three phases of flight, namely take-off, climb and glide.

It is most convenient to investigate these phases in their reverse order, starting with the glide.

GLIDE

The entire analysis is based upon the assumption that the actual drag polar (plot of C_D vs C_L) for the aircraft can be represented with sufficient accuracy by an approximating parabola of the form.

$$\frac{D}{qS_w} = C_D = C_{D_{pe}} + \frac{C_{L_w}^2}{\pi A_w e} \quad (1)$$

The assumption is not too bad for model aircraft since $C_{D_{pe}}$ is inherently high and discontinuities in the drag curve for individual components of the aircraft due to changes in Reynolds Number will not cause large discontinuities in the complete polar. This method has been used successfully for years in full scale aircraft design.

If the actual polar and Eq. 1 are plotted as C_D vs C_L^2, Fig. 1, we see that for an aircraft with a nonlifting tail the drag coefficient is composed of three effects; the effective parasite drag, (the drag for zero lift), the induced drag due to the wing and the increase in induced drag due to "e" which accounts for all the remaining sources of induced drag.

For best accuracy the curve should be fit to the actual polar so that it passes through the extension of the actual polar to the zero lift point and also the point corresponding to the normal glide lift coefficient.

A simple method of obtaining the actual polar for the aircraft is by means of glide tests where a measurement of the glide angle θ and the glide velocity V_g by means of a stop-watch and a transit will give values of C_D and C_L for each tail incident setting by use of the following relations:

$$C_L = \frac{W \cos\theta}{\rho/_2 V_g^2 S_w} \quad (2) \quad and \quad \frac{C_D}{C_L} = TAN\,\theta \quad (3)$$

(For the lifting tail case there will be a separate curve for each center of gravity (C.G.) setting.) This method has been used by Stewart Savage and others for several years.

It must be understood that in order to analyze a particular design either a prototype must be built and tested from which further improvements will be indicated by this analysis or $C_{D_{pe}}$ and e must be estimated. This can be done with not too much inaccuracy after a little experience is acquired.

We now turn to the problem of minimizing the sinking speed of a gliding aircraft which is one of the primary performance criteria for completion free flight models. The relation for the sinking speed of aircraft with nonlifting tails has been derived many times before, hence it will merely be restated.

$$V_s = \sqrt{\frac{2W}{\rho S_w}} \; \frac{C_D}{C_L^{3/2}} \cos\theta^{3/2} \quad (4)$$

As can be seen the sinking speed is a minimum when the wing loading $\frac{W}{S_w}$ and $C_D/C_L^{3/2}$ is a minimum.

Consider now the sinking speed for an aircraft with a lifting tail. Many modelers who fly free flight models can tell you from experience that, while gliding, his model always has a lower sinking speed while using a liting tail; on the other hand some people have referred to the lifting tail as being a swindle in that you are using a surface of lower aspect ratio and hence of lower efficiency than the wing for producing lift and therefore you are not reducing the sinking speed. Since no one has ever proved the effect of a lifting tail most modelers have relied upon the only method they know which is the "cut and try" method.

To remove further doubts, the analysis of a lifting tail follows. In the case of an aircraft with a lifting tail it must be required that

$$L = L_w + L_t = \frac{\rho}{2} V^2 S_w \left(C_{L_w} + \eta_t \frac{S_t}{S_w} C_{L_t}\right) \quad (5)$$

We divide the drag into the following parts similar to the method of Eq. 1.

$$D = D_p + \frac{1}{e}\left(D_{i_w} + D_{i_t}\right) = \frac{\rho}{2} V^2 S_w \left[C_{Dpe} + \frac{C_{L_w}^2}{\pi A_w e} + \eta_t \frac{S_t}{S_w} \frac{C_{L_t}^2}{\pi A_t e}\right] \quad (6)$$

where e plays the same role as in Eq. 1 and η_t accounts for the retardation of free stream velocity at the tail due to fuselage drag and wing wake. (Usually $0.9 \leq \eta_t \leq 1$ and can be assumed equal to unity for most cases with little error.)

Using the definitions of lift and drag given in Eq. 5 and 6 the sinking speed is derived in the same manner as used in obtaining Eq. 4 while retaining the definition W/S to mean W/S_W. The result is exactly the same as Eq. 4 if we define the lift coefficient and drag coefficient as

$$C_L = C_{L_W}\left(1 + \eta_t \frac{S_t}{S_W} \frac{C_{L_T}}{C_{L_W}}\right) \text{ AND } C_D = C_{Dpe} + \frac{C_{L_W}^2}{\pi A_W e}\left[1 + \eta_t \frac{S_t}{S_W} \frac{A_W}{A_t}\left(\frac{C_{L_t}}{C_{L_W}}\right)^2\right]$$

Notice that the ratio S_t/S_W is the percent tail area and C_{L_T}/C_{L_W} is the percent tail lift loading with respect to the wing and that for minimum sinking speed we still must have minimum W/S_W and $C_D/C_L^{3/2}$.

The effect of a lifting tail may now be compared to that of a nonlifting tail by forming a ratio of V_S to $V_{S(C_{L_T}=0)}$. If the small differences in $\cos\theta$ are neglected we obtain

$$\frac{V_S}{V_{S(C_{L_t}=0)}} = \sqrt{\frac{W S_{W_0}}{S_W W_0}} \; \frac{C_{Dpe} + \frac{C_{L_W}^2}{\pi A_W e}\left[1 + \eta_t \frac{S_t}{S_W} \frac{A_W}{A_t}\left(\frac{C_{L_t}}{C_{L_W}}\right)^2\right]}{\left(C_{Dpe}\right)_0 + \frac{C_{L_{W_0}}^2}{\pi A_{W_0} e_0}} \left[\frac{C_{L_{W_0}}}{C_{L_W}\left(1 + \eta_t \frac{S_t}{S_W} \frac{C_{L_t}}{C_{L_W}}\right)}\right]^{3/2} \quad (7)$$

where the subscript "o" indicated values for the aircraft with the nonlifting tail.

In many competition events there is no wing or wing area requirement. In this case if we compare the performance of the same airplane in the lifting and non-lifting tail case the following remain essentially constant, W/S_W, C_{Dpe}, e, C_{L_W}, A_t and A_W and Eq. 7 reduces to

$$\frac{V_S}{V_{S(C_{L_t}=0)}} = \frac{1 + \left[\frac{\eta_t \frac{S_t}{S_W}\left(\frac{C_{L_t}}{C_{L_W}}\right)^2}{\pi e A_t \frac{C_{Dpe}}{C_{L_W}^2} + \frac{A_t}{A_W}}\right]}{\left(1 + \eta_t \frac{S_t}{S_W} \frac{C_{L_t}}{C_{L_W}}\right)^{3/2}} \quad (8)$$

Notice that efficient aircraft which have low C_{Dpe} and e and high C_{L_W} and A_W do not profit as much using lifting tails compared to airplane with high C_{Dpe} and e and low C_{L_W} and A_W. Eq. 8 is plotted in Fig. 2 with typical values for an extremely efficient aircraft and one which is relatively inefficient for various tail areas S_t/S_W and tail loading (C_{L_t}/C_{L_W}). A number of things are evident, some of which are (1) For the case of no area limit a lifting tail will always reduce the sinking speed compared to the same aircraft with a nonlifting tail. (2) The low drag aircraft example can obtain maximum reductions in sinking speed from 10% to 21% for values of S_t/S_W from 20% to 50% and these occur at a definite value of C_{L_t}/C_{L_W} which corresponds to a specific amount of decalage and position of the C.G. for any given aircraft. (3) The high drag aircraft, although it may have a higher sinking speed than the low drag aircraft, is capable of greater reductions in relative sinking speed and in the given example can obtain maximum reductions from 18% to 37% for values of S_t/S_W from 20% to 50%, with the value of the tail loading being limited only by the requirements for stability. Notice also that the indoor models of medium and high drag can benefit most from lifting tails since they are able to fly closest to the limit for zero stability. (4) These curves also bring to light the reason why free flight gas models, which inherently have relatively high drag, have evolved into the large lifting tail type which most competition models presently use.

Another type of event worth analyzing is the event where either the total surface loading is limited or the total surface area is limited for a given maximum weight. The former applies to an event such as FAI. Gas for models of sufficient size to equal or exceed the "crossover" point in the loading requirements and the latter would apply to events such as Nordic Glider and Wakefield.

The question which has often been asked and discussed but never satisfactorily answered is that of how to divide the total lift and area between the wing and tail for minimum sinking speed. Under the above requirements the total surface area $S' = S_w + S_t$ so that the wing loading becomes

$$\frac{W}{S_w} = \frac{W(1+S_t/S_w)}{S'} \qquad (9)$$

Now if the sinking speed of the lifting tail case is compared to the same model with a nonlifting tail $(C_{L_t}=0)$ and a tail area of S_t/S_w of 10% and imposing Eq. 9 we find Eq. 7 becomes

$$\frac{V_S}{V_{S\left(\substack{C_{L_t}=0 \\ S_t/S_w=.1}\right)}} = \sqrt{\frac{1+S_t/S_w}{1.1}} \; \frac{1+\left[\dfrac{\eta_t \frac{S_t}{S_w}\left(\frac{C_{L_t}}{C_{L_w}}\right)^2}{\pi A_t C_{Dpe}/C_{L_w}^2 + A_t/A_w}\right]}{\left(1+\eta_t \, S_t/S_w \; C_{L_t}/C_{L_w}\right)^{3/2}} \qquad (10)$$

Also comparison of dissimilar shapes such as comparison of tandem or canard configurations to conventional configurations may be made in a similar manner using Eq. 9 and Eq. 7. Several high drag and low drag examples (using Eq. 10 or Eq. 9 and Eq. 7 for tandem and canard) are plotted in Fig. 3. The results indicate the following 1) Comparison of the low drag configurations, curves ③, ①, ⑤, and ⑥ at $C_{L_T}/C_{L_w} = 0.6$ shows that a minimum sinking speed occurs for S_t/S_w around 45%. This is seen more clearly if a cross plot is made giving

$$\frac{V_s}{V_{s\left(\substack{C_{L_t}=0 \\ S_t/S_w=.1}\right)}} \text{ vs } \frac{S_t}{S_w} \text{ for various } C_{L_t}/C_{L_w}$$

At this optimum tail loading there is only a 2% decrease in sinking speed for S_t/S_w from 0.1 to 0.5 showing little sensitivity to area proportion between wing and tail. In general it can be said that as the tail is unloaded the optimum tail area decreases.

Examining the remaining curves ④, ② and ⑦ gives at first glance the impression that best results for a high drag model would be with a canard configuration, however it must be remembered that the stability requirements for tandem and canard configurations dictate large decalage i.e. low tail loading and therefore canards with C_{L_t}/C_{L_w} much larger than 0.4 (excluding indoor models) would be unstable.

ASSUMED PARAMETERS

CURVE	A_w	A_t	C_{Dpe}	e	C_{L_w}	η_t
①	6	4	0.14	0.75	0.4	0.98
②	6	4	0.14	0.75	0.4	0.98
③	18	6	0.04	0.90	1.0	1.0
④	18	6	0.04	0.90	1.0	1.0

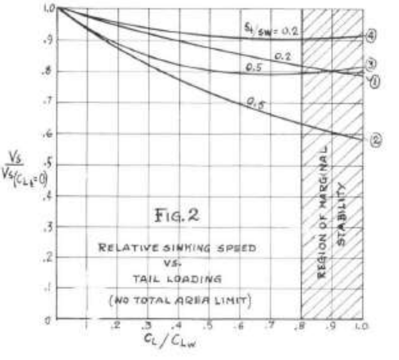


FIG. 2

RELATIVE SINKING SPEED
VS.
TAIL LOADING
(NO TOTAL AREA LIMIT)

ASSUMED PARAMETERS

	CURVE	A_w	A_t	C_{Dpe}	e	C_{L_w}	η_t	S_t/S_w
	①	18	6	.04	0.9	1.0	1.0	0.5
	②	9	4	.10	0.8	0.5	1.0	0.5
	③	18	6	.04	0.9	1.0	1.0	0.1
	④	9	4	.10	0.8	0.5	1.0	0.1
TANDEM	⑤	10	10	.04	0.9	1.0	1.0	1.0
CANARD	⑥	6	18	.04	0.9	1.0	1.0	1.5
	REF. MODEL	18	6	.04	0.9	1.0	1.0	0.1
CANARD	⑦	4	6	.10	0.8	0.5	1.0	1.5
	REF. MODEL	6	4	.10	0.8	0.5	1.0	0.1

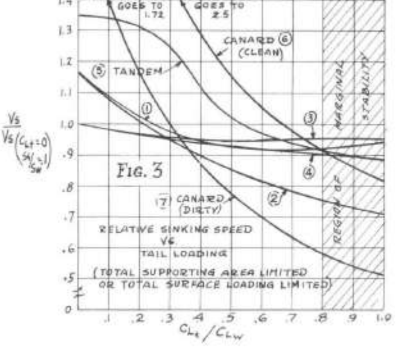


FIG. 3

RELATIVE SINKING SPEED
VS
TAIL LOADING
(TOTAL SUPPORTING AREA LIMITED
OR TOTAL SURFACE LOADING LIMITED)

In general it is seen that models with high relative drag will profit most from large tail areas and large tail loadings. Again for low tail loadings the optimum tail area decreases. Most models will have values which fall within the extremes used in the example. The trends we have seen from these extreme values indicate that FAI Gas and possible Wakefield can benefit most from large lifting tails. The recovery (stability) requirements for low drag Nordic Gliders dictate low tail loadings (large decalage) and hence low tail areas for minimum sinking speed. The sacrifice in stability using large tail areas would not be worth the small percent reduction in relative sinking speed. The optimum tail area for a particular model can be determined once the maximum tail loading for stability and values of and have been determined (by estimate or experiment).

CLIMB

We now turn to analysis of the powered portions of flight which will enable us to estimate the performance of the Clipper Cargo model. If the take-off time, sinking speed in glide and the maximum rate of climb for an aircraft are known then it is possible to determine the maximum load capability for a given aircraft flying under Clipper Cargo rules.

The maximum rate of climb is easiest to determine in terms of power required and power available and is given as

$$(RC)_{max} = \frac{(P_a - P_r)_{max}}{W} = \frac{(TV - DV)_{max}}{W} \qquad (11)$$

An explicit solution may be made if the thrust and drag are known as a function of velocity. Drag already is known from Eq. 1 and thrust may be estimated with good accuracy by assuming the thrust to vary with velocity in the following manner

$$T = T_0\left[1 - K\left(\frac{V}{V_R}\right)^2\right] \quad (12) \qquad \text{where } K = 1 - \frac{T_r}{T_0}$$

Referring to a plot of thrust vs velocity, Fig. 4, we see that K is the percent decrease from static thrust at some reference velocity V_R which for best fit of Eq. 12 to the actual curve should be measured near the take-off speed or climb speed for a given aircraft.

In many cases K may be estimated to be between 0.2 to 0.3 at the design advance ratio, however for best results an experimental value of K from wind tunnel tests of the desired propeller should be used.

Now with an explicit relation for thrust and drag the velocity for maximum rate of climb may be solved since it is known that $(P_a - P_R)_{max}$ occurs where the slope of the power required curve equals the slope of the power available curve i.e. where

$$\frac{dP_r}{dV} = \frac{dP_a}{dV} \quad \text{or where} \quad \frac{d(DV)}{dV} = \frac{d(TV)}{d(V)}$$

(T and D being functions of velocity). Solving, we find the velocity for maximum rate of climb to be

$$V_c = \left[\frac{\frac{T_0}{S_w} + \sqrt{\left(\frac{T_0}{S_w}\right)^2 + \frac{12}{\pi A_w e}\left(\frac{W}{S_w}\right)^2\left[C_{D_{pe}} + \frac{2K}{\rho V_R^2}\left(\frac{T_0}{S_w}\right)\right]}}{3\rho\left[C_{D_{pe}} + \frac{2K}{\rho V_R^2}\left(\frac{T_0}{S_w}\right)\right]}\right]^{1/2} \qquad (13)$$

and the maximum rate of climb then becomes

$$(RC)_{max} = \frac{T_0}{W} V_c\left[1 - K\left(\frac{V_c}{V_R}\right)^2\right] - \frac{\rho}{2} C_{D_{pe}} \frac{S_w}{W} V_c^3 - \frac{2}{\rho \pi A_w e V_c}\left(\frac{W}{S_w}\right) \qquad (14)$$

In the case of a lifting tail it is easy to show that Eq. 13 and Eq. 14 must be corrected by a constant (15) in the following manner

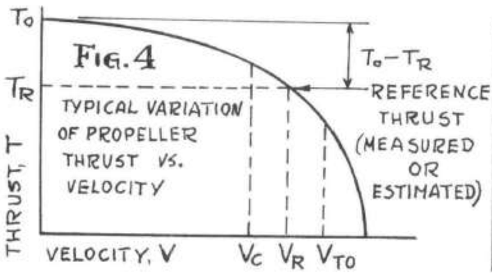
$$K_t = \frac{1 + \eta_t \, S_t/S_w \, A_w/A_t \left(C_{L_t}/C_{L_w}\right)^2}{\left(1 + \eta_t \, S_t/S_w \, C_{L_t}/C_{L_w}\right)^2} \qquad (15)$$

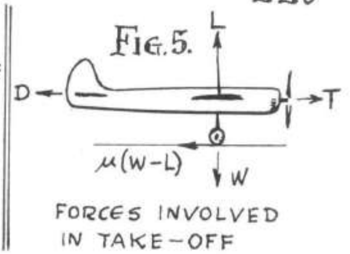
$$V_c = \left[\frac{\frac{T_0}{S_w} + \sqrt{\left(\frac{T_0}{S_w}\right)^2 + \frac{12 K_t}{\pi A_w e}\left(\frac{W}{S_w}\right)^2\left[C_{D_{pe}} + \frac{2K}{\rho V_R^2}\left(\frac{T_0}{S_w}\right)\right]}}{3\rho\left[C_{D_{pe}} + \frac{2K}{\rho V_R^2}\left(\frac{T_0}{S_w}\right)\right]}\right]^{1/2} \qquad (16)$$

and

$$(RC)_{max} = \frac{T_0}{W} V_c\left[1 - K\left(\frac{V_c}{V_r}\right)^2\right] - \frac{\rho}{2} C_{D_{pe}} \frac{S_w}{W} V_c^3 - \frac{2K_t}{\rho \pi A_w e V_c}\left(\frac{W}{S_w}\right) \qquad (17)$$

The lifting tail correction is nearly correct if the incidence remains constant throughout the entire flight and the drag increments and thrust decrements necessitated by the moments required for equilibrium in the climb are small. Eq. 13





through 17 are all derived under the assumption that the climb angle β is small so that $\cos\beta$ may be assumed equal to unity. This assumption is good for climb angles up to approximately 20 degrees which makes it valid for all loaded cargo models.

TAKE-OFF TIME

If the take-off time is known then the time remaining for climb will be known and hence a performance estimate may be made. The take-off time is given by

$$t_{TO} = \int_{V_W}^{V_{TO}} \frac{dV}{a} \quad (18)$$

Referring to Fig. 5, we see that the acceleration may be expressed by means of Newtons 2nd law as

$$a = \frac{T - D - \mu(W-L)}{W/g} \quad (19)$$

Thrust and drag have been expressed as functions of velocity in Eq. 12 and Eq. 1. Observing that

$$L = W\left(\frac{V}{V_{TO}}\right)^2 \qquad \text{where } V_{TO} = \sqrt{\frac{2W}{\rho S_W C_{L_{TO}}}} \quad (20)$$

a solution for Eq. 18 becomes

$$t_{TO} = \frac{V_{TO}}{2gER} \ln \frac{(R+E)\left(R - \frac{V_W}{V_{TO}}E\right)}{(R-E)\left(R + \frac{V_W}{V_{TO}}E\right)} \qquad \text{where } E = \sqrt{\left(\frac{C_D}{C_L}\right)_{TO} + \frac{T_0}{W}K\left(\frac{V_{TO}}{V_R}\right)^2 - \mu} \quad \text{and } R = \sqrt{\frac{T_0}{W} - \mu} \quad (21)$$

This relation is valid if the time to raise the tail and wheel axle friction are negligibly small. For rubber on concrete $\mu = .02$ and therefore can be neglected for most cases with only a small error involved.

Notice that if $V_W \geq V_{TO}$ the take-off time is zero. This is obviously the most desired condition but we have no control over the wind and cannot always meet this condition. However, many times there is some wind, usually light, and therefore an aircraft which has a low wing loading and a high C_L will have a lower take-off velocity (Refer to Eq. 20) than an aircraft which is smaller and at a lower take-off attitude for the same weight and hence will have a better chance of flying in a wind which is greater than or equal to the take-off velocity.

The worst condition which can occur is when there is no wind $(V_W = 0)$. Then Eq. 21 reduces to

$$t_{T_0} = \frac{V_{T_0}}{2gER} \ln \frac{R+E}{R-E} \quad (22)$$

Obviously this is not the best condition for making record attempts. Notice that if $E \geq R$, that is, where $T \leq$ Drag produced in level flight, the aircraft is incapable of becoming airborne.

Eq. 22 is plotted in Fig. 6 for high and low aircraft with conventional landing gear over a range of wing loadings and values of K. This curve explains graphically a point which has been observed many times while watching contestants try for higher loads during competition. The contestant will continue adding weights until a small weight addition seems to multiply the take-off time very rapidly, sometimes giving a take-off time almost equal to the engine run; this is especially evident in calm air. As seen in Fig. 6 the contestant begins operating in the region where the curve goes rapidly to infinity or the point where $E = R$. In this region the aircraft is very sensitive to added weight causing large increases in take-off time for small increases in weight.

It is desirable to design for minimum take-off time under the no wind condition to give the model greater average capability. In Ref. 1, p. 196 it is proved that the optimum C_L for minimum ground resistance in take-off is given approximately by $C_L = \frac{\mu \pi A_w}{2}$

This is approximately the value which is obtained in model aircraft using conventional landing gear, however it is seen from Eq. 20 and 22 that this value will not give minimum take-off time since take-off time is minimized when we have a maximum value of C_L at take-off. The ideal condition would be a model which would accelerate at the C_L for minimum ground resistance and then change incidence to reach a large value of C_L. Since we have no pilot to do this maneuver for us and gadgetry complicates matters, the next best method of minimizing take-off time is to use a landing gear such as the tricycle type which will hold the model at a high angle of attack during the ground run enabling a high C_L to be attained.

At this point a complete set of equations for the three phases of flight have been derived which allows one to estimate the overall performance of a cargo model. One important problem is determining what wing area should be used with a given aircraft and engine-propeller power output to give maximum load carrying capability. This problem can be solved by using Eq's 4, 17 and 21.

Under PAA Load rules we solve for the weight required to meet the condition

$$(20-t_{TO}) = 20(V_s) \text{ (where } t_{TO} \text{ is in sec) or where } (RC)_{max} = \frac{V}{1-t_{TO}/20} \quad (24)$$

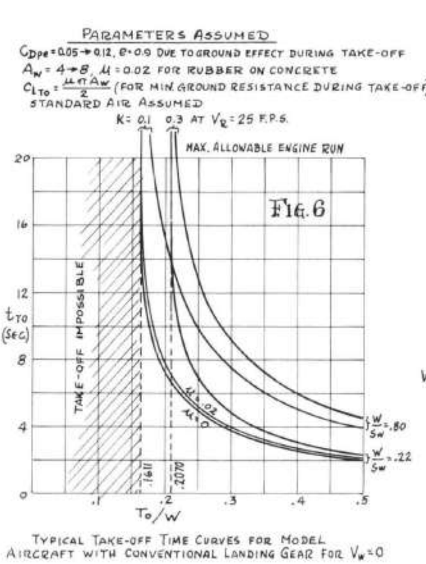
Using various wing areas. Eq. 24 applies for $0 \leq V_W < V_{TO}$

A plot is then made of W_{max} Vs. V_{TO}

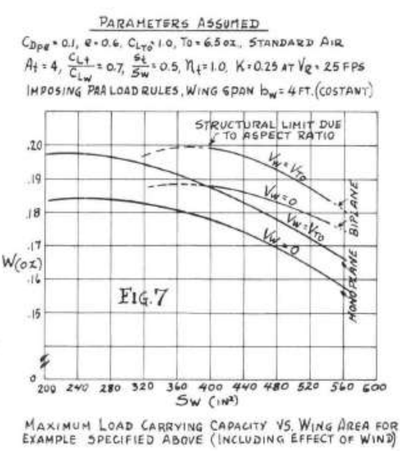
The maximum load capability will occur if $V_W \geq V_{TO}$. In this case $t_{TO} = 0$ and we solve for the weight which satisfies the condition (25).

A typical example is given in Fig. 7 where the maximum load capability for a biplane and a monoplane is presented as a function of wing area for the case of $V_W = 0$ and $V_W = V_{TO}$. This calculation was made holding the wing span constant at 4 ft. for all wing areas as per present PAA Load rules. In the case of the monoplane, the aspect ratio is then given by $A_W = 16/S_W$ where S_W is in square feet for the biplane the equivalent monoplane aspect ratio was used as computed by a method described in Ref. 2, p. 182.

It is seen that for this example the two models have nearly the same maximum load capability but the biplane has the edge on the monoplane and would be more consistant in reaching its maximum capability since V_{TO} is lower for the biplane than the monoplane when each has its optimum wing area. For this example the monoplane has an optimum wing area of 250 in.^{2} which is rather small.



TYPICAL TAKE-OFF TIME CURVES FOR MODEL AIRCRAFT WITH CONVENTIONAL LANDING GEAR FOR $V_W = 0$



MAXIMUM LOAD CARRYING CAPACITY VS. WING AREA FOR EXAMPLE SPECIFIED ABOVE (INCLUDING EFFECT OF WIND)

The reason is due to the higher aspect ratio attainable using a smaller wing area under the PAA Load rules restriction of a 4 ft. wingspan. The biplane reaches optimum load capability with a wing area of 380 in.^{2}. Structurally, the lower practical limit on wing area for this case, due to the high aspect ratio of the individual wings, is about 390 in.^{2} which is not very far from the optimum point. Notice that the value for C_{Dpe} chosen in the example is quite high, giving a conservative estimate of the load capability compared to some models which have already been flown.

· If desired this optimizing process could be carried one step further by repeating the solution using different tail areas. This would indicate not only the optimum wing area but the optimum tail area for a given tail loading consistant with stability requirements.

Since it appears that a biplane is more desirable under the present cargo rules, a few general statements on biplane design for maximum performance are in order.

1) The upper and lower wing should have equal area and equal span for minimum induced drap.
2) Negative stagger (top wing ahead of bottom wing) as much as 100% of the wing chord minimizes the interference drag and loss of lift. Positive stagger increases drag and reduces lift.
3) For maximum lift the ratio of wind gap to chord should be ≥ 1.
4) Positive decalage (lower wing at a higher angle than the upper wing) as much as 6° improves lift with only a slight decrease in stability.

For more information see NACA TR 417.

It is seen that the available thrust plays an important part in determining the performance of an aircraft. Brief mention will be made of the advantages of a pusher propeller and methods of improving thrust.

The pusher propeller configuration can improve thrust by a significant amount on cargo designs since they have large frontal area which blocks much of the propeller disc area in conventional tractor designs. Measured losses in static thrust in tractor designs due to slipstream drag on the fuselage vary from 7% for a typical ½A Free Flight model to 25% for a relatively high-drag cargo model. Additional benefits from the pusher design are directional stability under power due to plane of propeller being behind center of gravity and the practical advantage of minimizing propeller breakage. Also, the location of the engine keeps it away from the dirt which is normally picked up by engines in the tractor position. Continued tests are verifying theoretical predictions that for slow flying cargo models substantial gains in thrust are obtainable by use of shrouded propellers and single blade propellers of large disc area. Further elaboration on improving propeller thrust cannot be included in this report due to lack of space.

REFERENCES

1. Perkins, C. D. and Hage, R. E., "Airplane Performance, Stability and Control."
2. Jones, Bradley, "Elements of Practical Aerodynamics."

LIST OF SYMBOLS

A — Aspect Ratio $\left(\frac{b^2}{S}\right)$

C_L — Lift Coef. $\left(\frac{L}{qS}\right)$

C_D — Drag Coef. $\left(\frac{D}{qS}\right)$

q — Dynamic Pres. $\left(\frac{\rho}{2}V^2\right)$

η_t — Tail Efficiency $\left(\frac{q}{q_t}\right)^{-1}$

L — Lift

T — Thrust

D — Drag

t — Time

S — Area

V — Velocity

P — Power

W — Weight

b — Span of flying surface

C_{Dpe} — Effective parasite drag coef.

E — Parameter defined in Eq. 21

e — Oswald's airplane eff. factor

g — Acceleration of gravity

K — Thrust lost factor

K_t — Correction factor for lift tail (Defined in Eq. 15)

R — Parameter defined in Eq. 21.

μ — Coef. of rolling friction

ρ — Mass density of air

a — Acceleration

RC — Rate of Climb

S' — Total Area

T_0 — Static thrust

β — Angle of climb

SUBSCRIPTS

a — Available

g — Glide velocity

i — Induced Drag

$(C_{L_t}=0)$ or 0 — Nonlift tail

$max.$ — Maximum

p — Parasite drag

R — Reference

s — Sinking speed

To — Take Off

t — Tail

w — Wing or wind vel.

c — Velocity for max. rate of climb

r — Required

QUADRUPLE LANDING GEAR ———— E. Wolfe

Here are the plans you requested. I hope they meet with your approval. I have also enclosed my views on the designing and flying of PAA-load models.

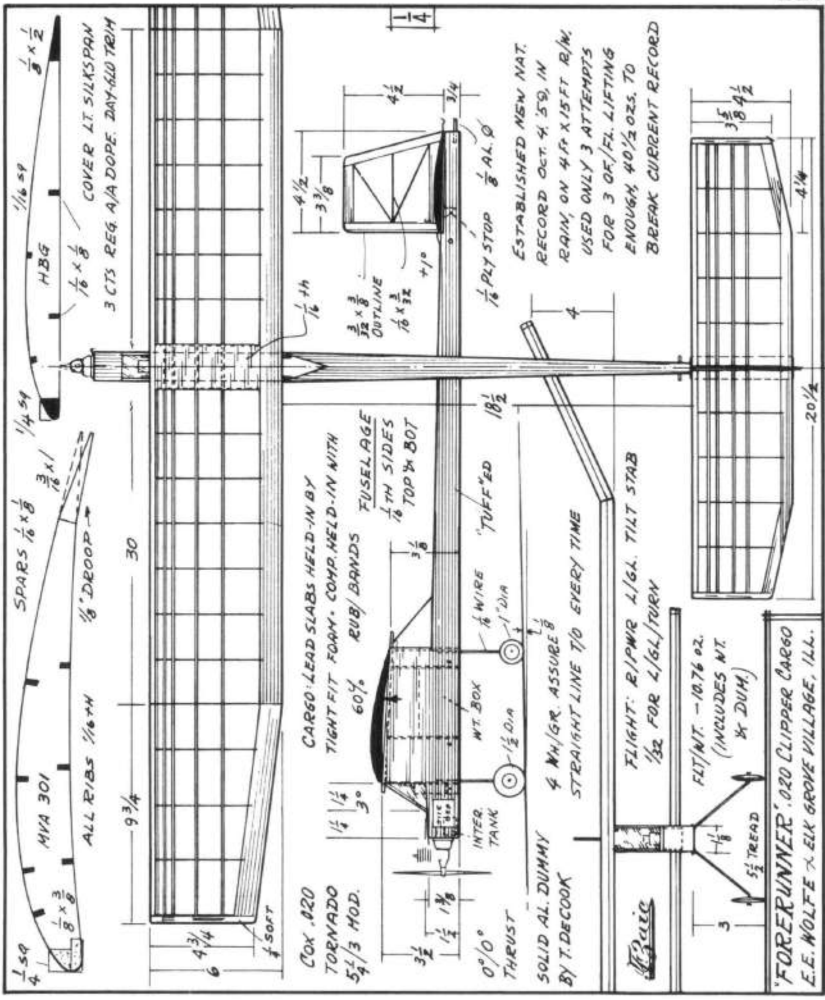
One of the most interesting types of models to fly is the PAA-load model, especially the Clipper Cargo model. This is mainly because all the flights must ROG. Most modelers can design and build a PAA-load model which flys well. Getting them off short runways such as we have in Chicago is the big problem. Our runway is a couple of boards about four feet wide and fifteen feet long. When this is surrounded by by high grass you can see why we must have a special type model.

At present I am flying all three classes of PAA-load and my planes are of the same basic design. I found that the easiest way to solve the short field take off problem was to fall back on my flying experience with the Air Force and TWA. The solution to short field take-offs, using a fixed power setting and fixed control surfaces, is to leave the ground in a flying attitude just above stall speed. A model with normal two wheel gear accelerates with the tail in the air until enough speed is attained for the wing to lift the plane into the air. If any down thrust is used on the engine, the result is a lenthy ground run. This is fine for the Nationals where you have unlimited runways but at local contests where the runways are short, the weight you can lift will be cut considerably. So, an important feature is a landing gear which will keep the plane in a flying attitude during the take off roll. The use of four wheel landing gear will do this. It also assures straight tracking after repeated hard landings. It may look a little clumsy and you will probably be in for a little good natured ribbing about your four wheels, but thats to be expected when you have something a little out of the ordinary.

Zero thrust is used, plus positive settings for both wing and stab. Thus, on the take off roll, the wing is assuming an angle of about 6 degrees and acting like a big flap. With a set-up like this for short fields, take offs will be the least of your worries when you attend the Nationals.

The most important feature on PAA-load models is, of course, the power unit. The best airplane in the world is useless without a good engine and prop.

The Cox .020 Pee Wee puts out a fantastic amount of power for its size. I would recommend having not less than four engines. They vary somewhat in power so I have built what I call a "thrust meter" to test my engines and props. Its a good way to be sure you are using your best engine and prop. I have tried all kinds of propellors and have found cut down tornado 5/3s with a narrow, thin blade to be the best so far. Be sure your props are balanced. It takes a little time to re-work and experiment with props but it will put you in the winner's circle. Filtered fuel is a necessity. A very tiny piece of dirt or lint can ruin your whole day at a contest.



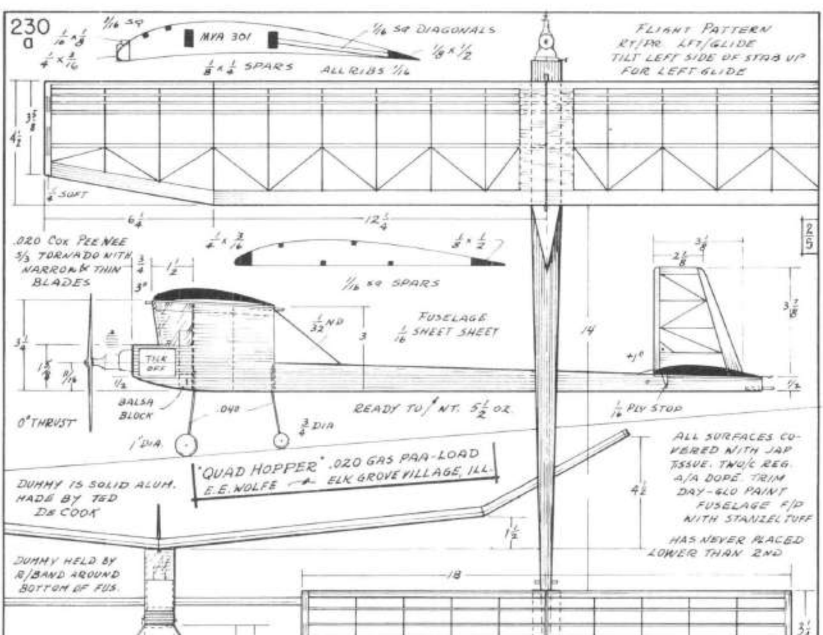
The Jetex PAA-load model is the most frustrating of the bunch due to the erratic engine operation and trouble loading the engine. Using proper procedures in loading the engine will cut down on the erratic operation somewhat. Very often, at contests, the model which manages to ROG is the eventual winner. With the new steel barrel engines and new Red Spot fuel, modelers are once more on an even par. However, these steel engines can't be treated like the old aluminum engines using the old type Red Spot fuel. They operate at a much higher temperature. With the new engines it is very important to use a new ring washer and screen for every flight. It is false economy to try to use a ring washer twice. It will usually result in a leaky engine and will cut your thrust in half, at least!

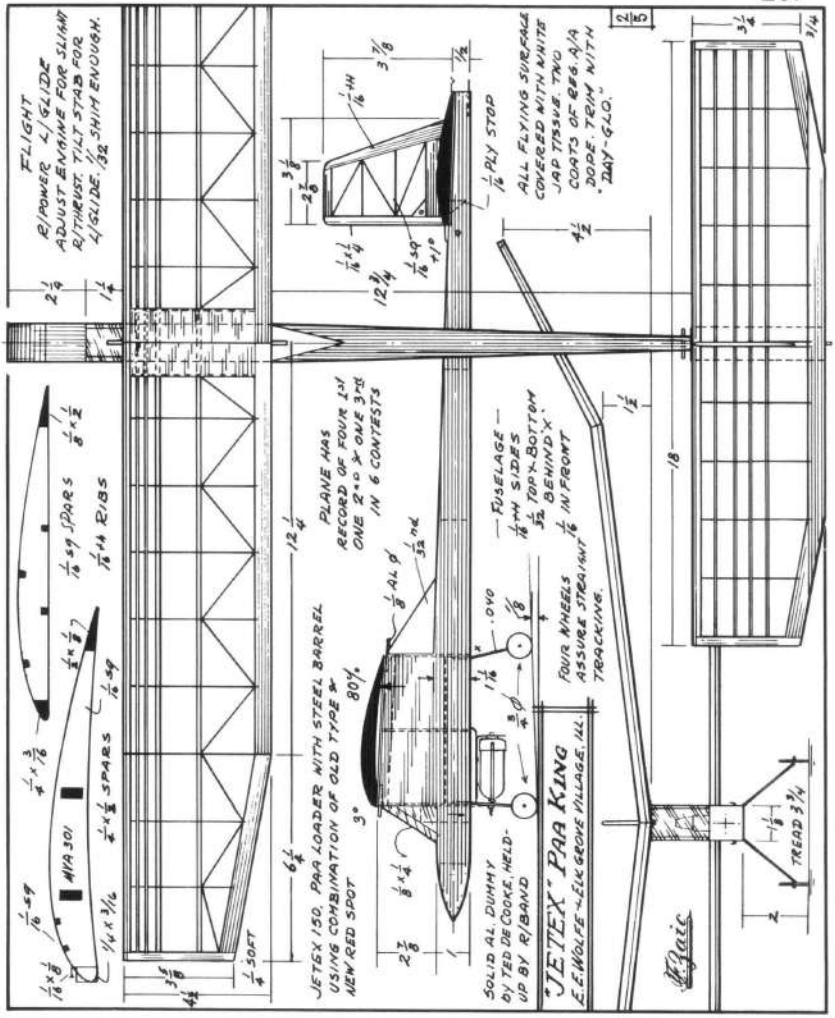
For ROG flights from our short Chicago runways it is necessary to carve on the Jetex pellets a little and use some extra wick wrapped around one of the pellets to give the extra thrust needed to take off within a short space. Remember, when you carve a pellet to increase the thrust, the duration is cut down. A little experimenting will show you how much to carve.

Engine mounting varies on Jetex models. I prefer the engine on the bottom or left side of the fuselage for easier mounting and maintenance. I also feel that it helps on the take off. Four wheel gear as on my Clipper Cargo and gas PAA load helps the plane into the air.

In case you ever have to fly during wet weather, it is important to have a good waterproof covering that will not sag or soak up water. When I set a new Clipper Cargo record on October 4, 1959, we were unfortunate enough to have rain all day long. I only used three attempts to make my three official flights, lifting only enough, 40½ ounces, to break the current record. Just before each flight, we tilted the take off boards to get rid of the water puddles and I wiped the water off my wing. I have found that using three coats of regular aircraft dope will enable you to fly all day in wet weather. A few drops of castor oil should be added to the dope. I buy my dope and thinner by the gallon at Midway airport. A little money is saved by buying in large quantities.

Thats about all I have to say on the subject of PAA-load. If you follow these hints when you build and fly your model, I promise you a season of fun flying plus some of those wonderful prizes which Pan American is good enough to provide.





CORRESPONDENCE—from C. O. Wright, Dec. 1959

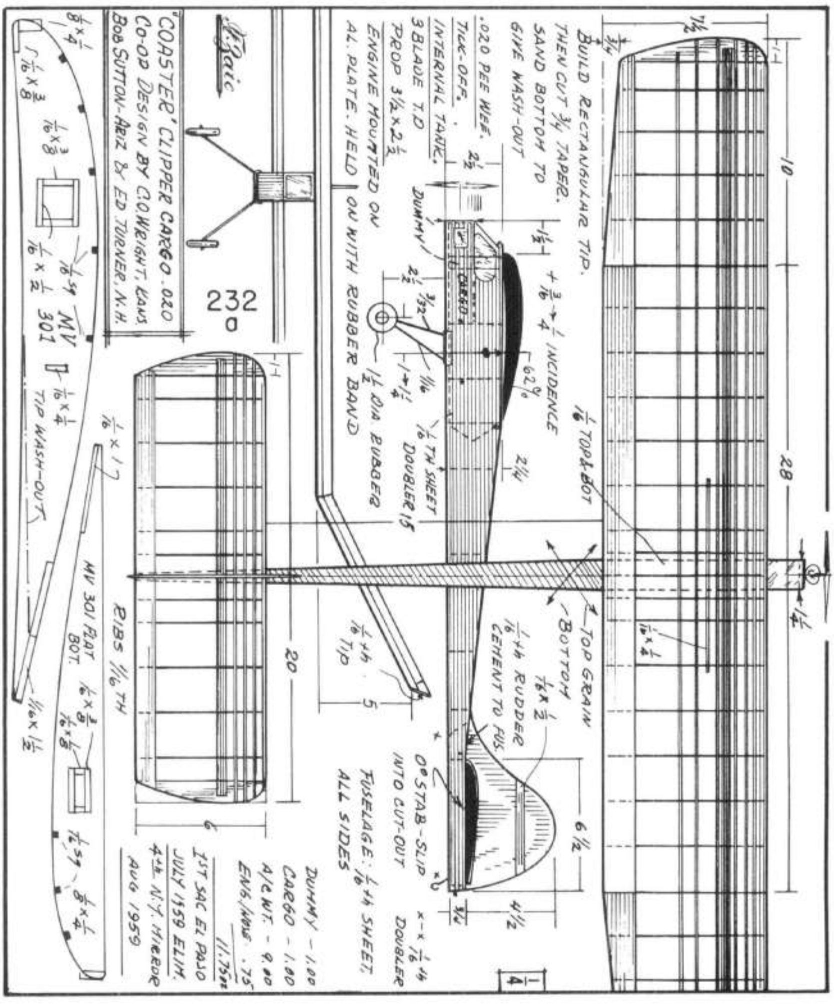
I have two possible ships that you might be interested in. The most likely would be the Cargo .02. I flew it in California last summer. The son, who is an atomic physicist, was my helper. I started off, as I remember, with 17 or 18 ounces and we carried it for over 50 seconds. I wanted to make three flights and then start up but my dear helper said the ship would carry 20. We missed it by about a second with a down wind glide. We tried it again and got a motor over-run of .2 of a second and there were three out of six attempts. The next one we carried the 17 or 18 ounces and that was the last official flight. On the next take-off a spectator ran in front of the ship and broke a wing. I patched it up and then on the last flight we got a shift in breeze on the take-off with a ground loop, so I came in third with only two flights. I think it's a good ship and I have carried 21 ounces for over 40 seconds.

The wing section on that ship is 6410½ which was the compromise you recommended years ago, between 6409 and 6412.

March 29, 1960

This relates to PAA Cargo drawings about which we have written. Bob Sutton and I, when he was visiting at Christmas a year ago, drew up the general dimensions of the Cargo ship and our ships are pretty much identical except for dihedral, wing section, etc.

Then, Ed Turner of Fairbury, Nebraska, wrote me and I drew up a rough sketch of the ship and sent it to him. Ed was here over the week-end and visited with me and I have discovered that he has his ship drawn up quite well and that he has been in communication with you. I think you could take that design and it would be close enough. Surfaces are the same and general proportions the same.

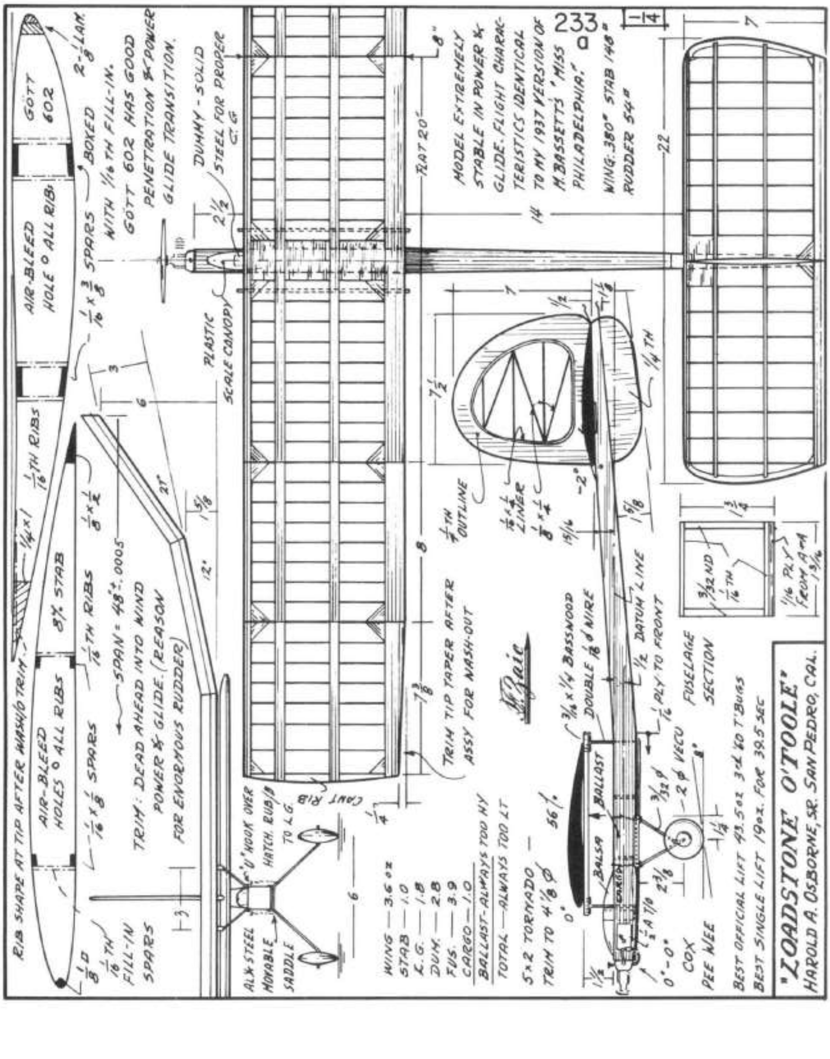


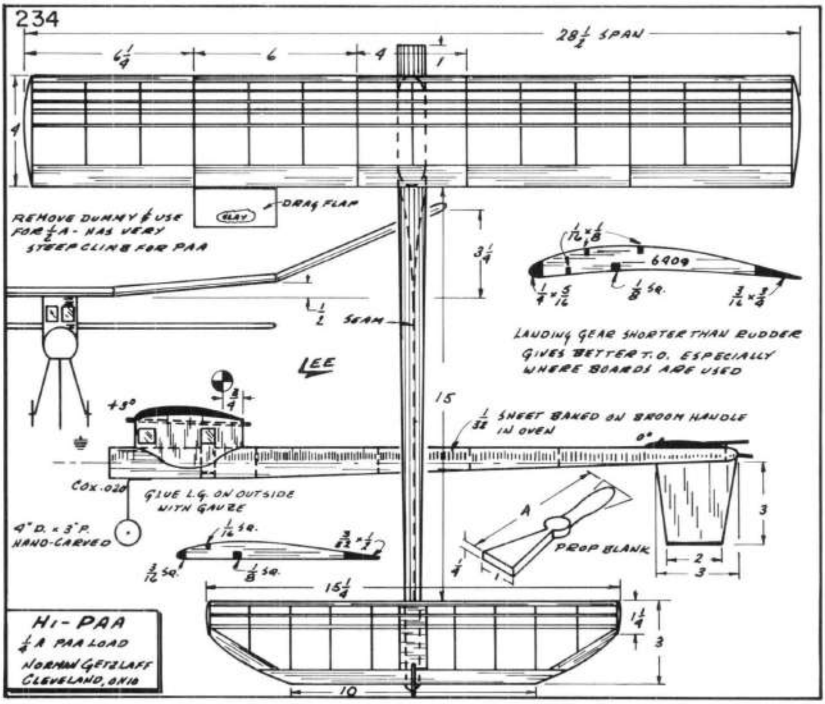
The chief difference in Sutton's ship is that he used conventional dihedral (poly) with the center dihedral and tips. Ed and I ran ours flat center panel with tip dihedral. Sutton used the thick Goldberg section G-?. I used 6410½ and Ed used the section shown on his drawings which is different still.

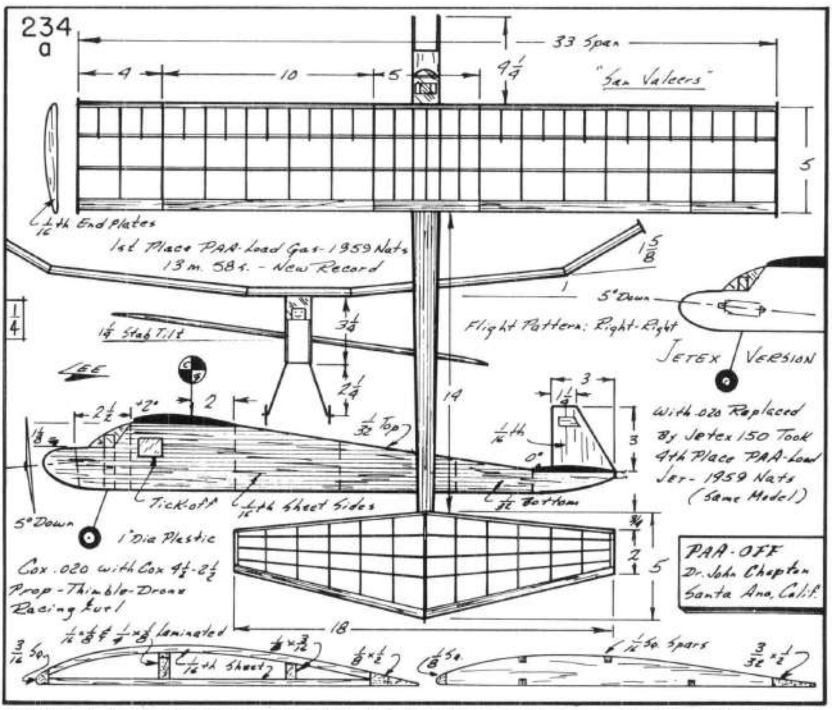
In construction, I used box spars with mortise and tendon at the dihedral joints. Ed built his solid. There is little difference on the gear. I made mine detractable to the rear, the same as the old job.

I think it would be all right for you to use the drawing Ed is going to send you.

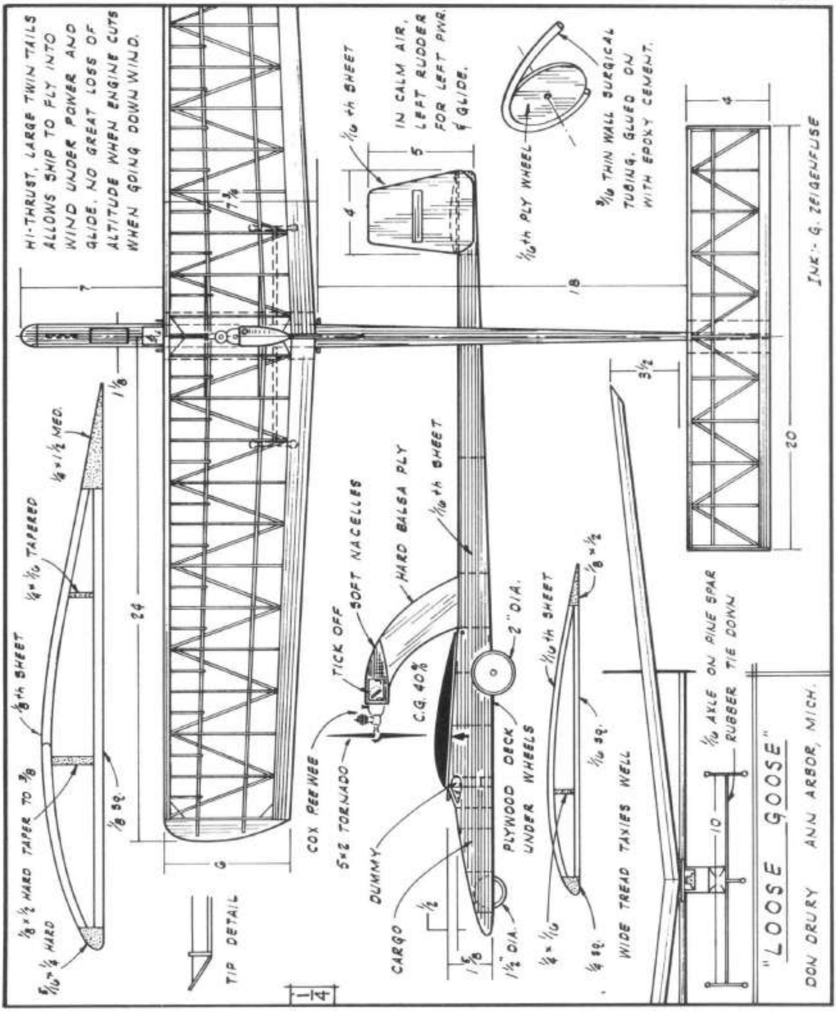
Sutton came in 2 and I was third. We each made only two official flights. With three either one of us would have been far ahead in 1st.







NOTE: Ritz's "Hot Rod" appeared in Jan. 1958 "A. M." Cunnyngham's "Space Rod" in "1961 Amer. Modeler Annual".



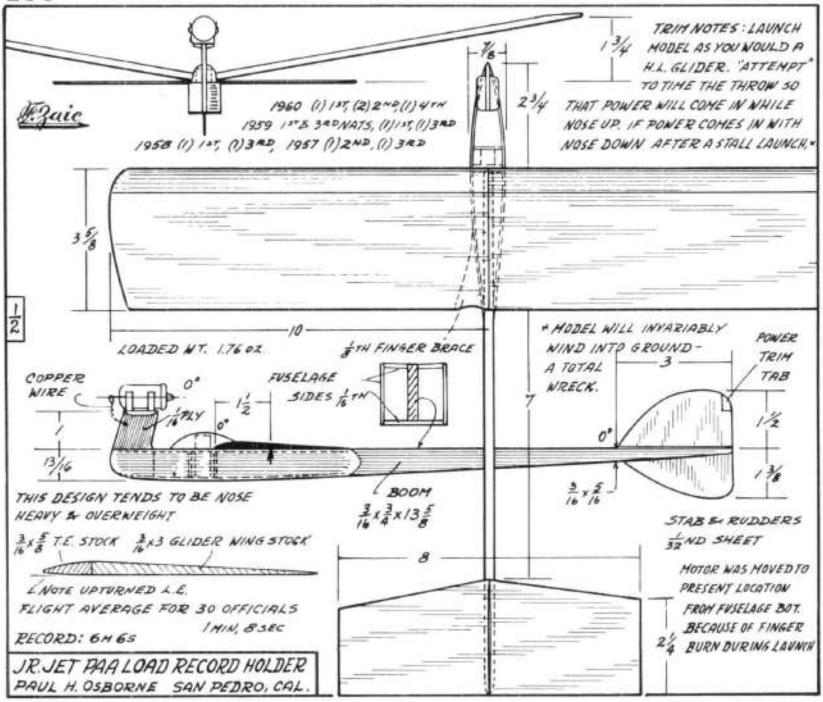
HI-THRUST CLIPPER CARGO Dan Drury, Ann Arbor, Mich.

A few years ago I had a fine Flying Clipper Cargo job, but found that if the engine cut on the down wind side of its circle on extremely windy days, the ship would lose a lot of altitude.

I built the High Thrust model with the idea that no torque to contend with and very large twin fins allow the ship to "weather vane" on windy days. In calm air, the ship is easy to adjust to Left/Left.

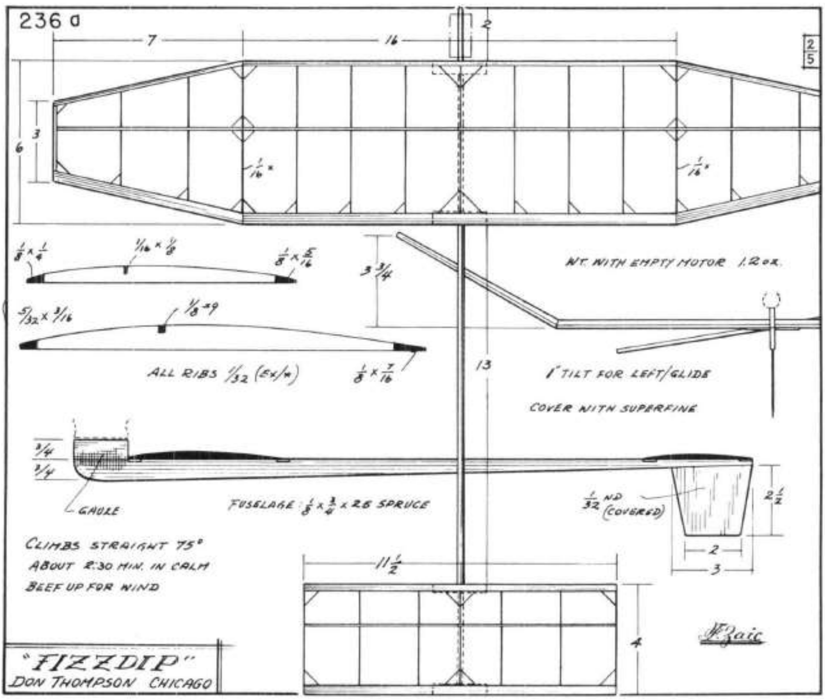
You mention that some modelers had trouble with take-off of H.T. Clipper jobs. I think this is due more to lack of incidence than H.T. 6° or more incidence in wing, O-O stab and engine and C.G. at 40% seem to work best for me in Clipper. Wide tread in center wheels allow for fast taxi and no ground looping.

236

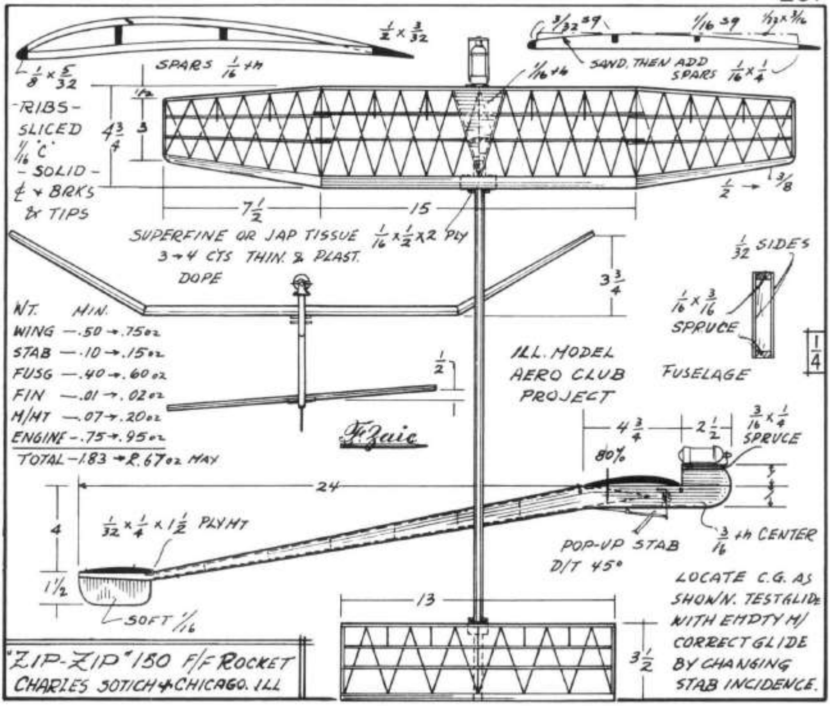


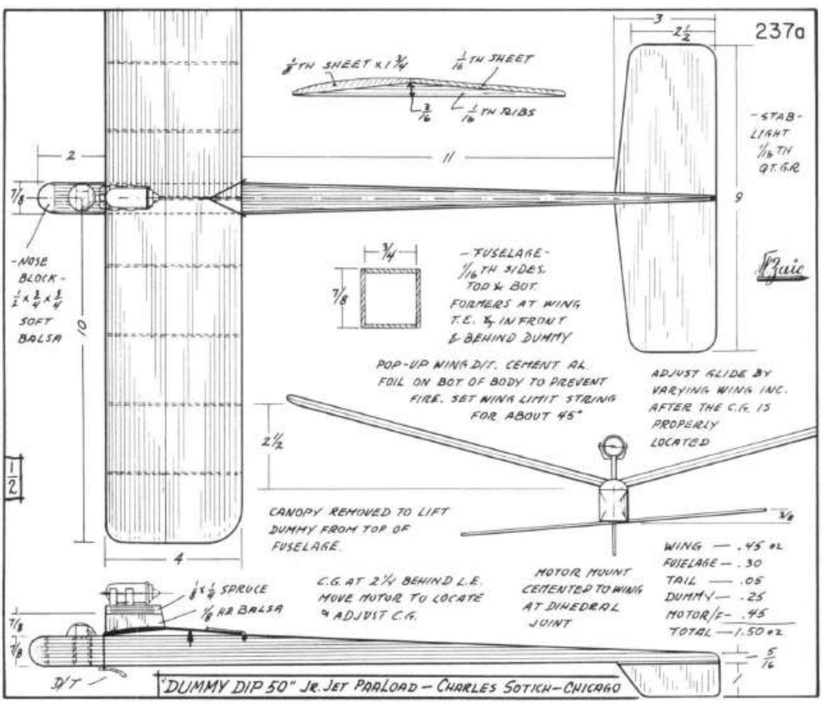
TRIM NOTES: LAUNCH MODEL AS YOU WOULD A H.L. GLIDER. "ATTEMPT" TO TIME THE THROW SO THAT POWER WILL COME IN WHILE NOSE UP. IF POWER COMES IN WITH NOSE DOWN AFTER A STALL LAUNCH, *
1960 (1) 1ST, (2) 2ND, (1) 4TH
1959 1ST & 3RD NATS, (1) 1ST, (1) 3RD
1958 (1) 1ST, (1) 3RD, 1957 (1) 2ND, (1) 3RD
1 3/4
7/8
2 3/4
3 5/8
1/2
10
LOADED WT. 1.76 OZ.
1/8TH FINGER BRACE
* MODEL WILL INVARIABLY WIND INTO GROUND - A TOTAL WRECK.
POWER TRIM TAB
3
COPPER WIRE
0°
FUSELAGE SIDES 1/16TH
1/16 PLY
1 1/2
0°
1
13/16
7
0°
1 1/2
1 3/8
BOOM 3/16 x 3/4 x 13 5/8
3/16 x 5/16
THIS DESIGN TENDS TO BE NOSE HEAVY & OVERWEIGHT
STAB & RUDDERS 1/32ND SHEET
3/16 x 5/8 T.E. STOCK
3/16 x 3 GLIDER WING STOCK
NOTE UPTURNED L.E.
8
MOTOR WAS MOVED TO PRESENT LOCATION FROM FUSELAGE BOT. BECAUSE OF FINGER BURN DURING LAUNCH
FLIGHT AVERAGE FOR 30 OFFICIALS 1 MIN, 8 SEC
RECORD: 6M 6S
2 1/4
JR. JET PAA LOAD RECORD HOLDER
PAUL H. OSBORNE SAN PEDRO, CAL.

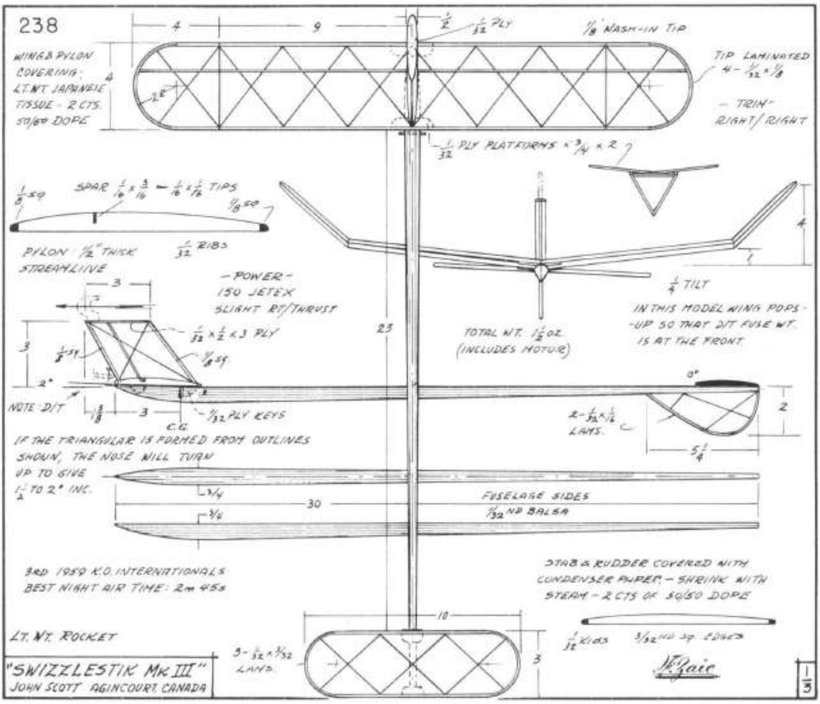
236 a

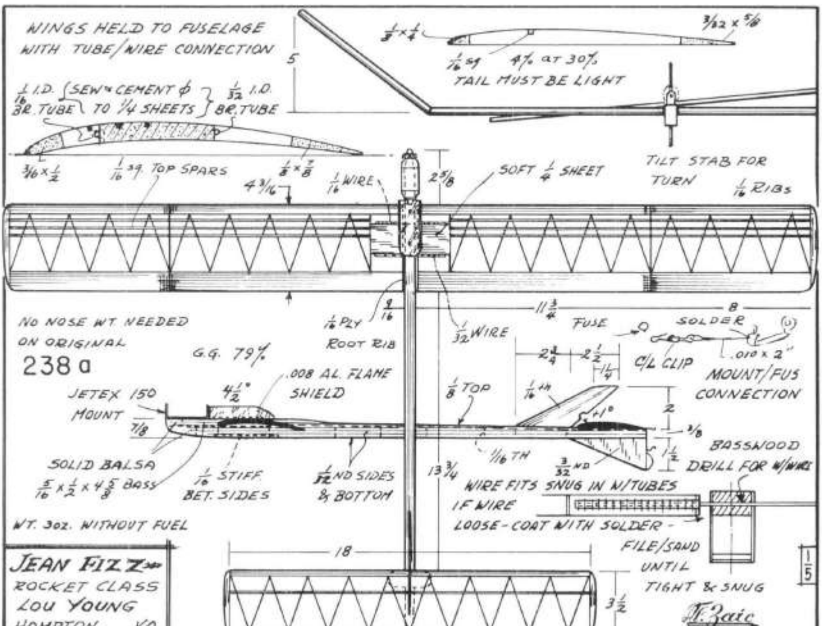


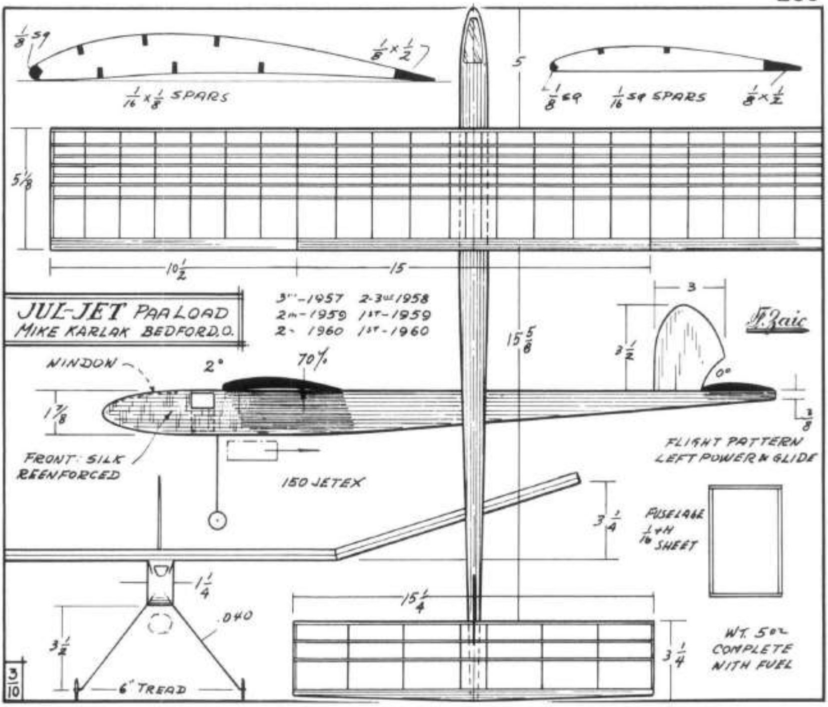
7
16
2
2/5
6
3
1/16 x
1/16 x
1/8 x 1/4
1/16 x 1/8
1/8 x 5/16
3 3/4
WT. WITH EMPTY MOTOR 1.2 OZ.
5/32 x 3/16
1/8 = 9
ALL RIBS 1/32 (EX/H)
1/8 x 7/16
13
1° TILT FOR LEFT/GLIDE
COVER WITH SUPERFINE
3/4
3/4
GAUZE
FUSELAGE: 1/8 x 3/4 x 26 SPRUCE
1/32 ND (COVERED)
2 1/2
2
3
CLIMBS STRAIGHT 75°
ABOUT 2:30 MIN. IN CALM
BEEF UP FOR WIND
11 1/2
4
"FIZZDIP"
DON THOMPSON CHICAGO


SPARS 1/16 th
-RIBS-
SLICED 1/16 "C"
- SOLID -
¢ + BRKS
& TIPS
SAND, THEN ADD SPARS 1/16 x 1/4
SUPERFINE OR JAP TISSUE
3 → 4 CTS THIN. & PLAST. DOPE
1/16 x 1/2 x 2 PLY
WT. MIN.
WING —.50 → .75 oz
STAB —.10 → .15 oz
FUSG —.40 → .60 oz
FIN —.01 → .02 oz
M/HT —.07 → .20 oz
ENGINE -.75 → .95 oz
TOTAL -1.83 → 2.67 oz MAX
ILL. MODEL AERO CLUB PROJECT
1/32 SIDES
1/16 x 3/16 SPRUCE
FUSELAGE
3/16 x 1/4 SPRUCE
80%
1/32 x 1/4 x 1 1/2 PLY HT
3/16 th CENTER
POP-UP STAB D/T 45°
SOFT 1/16
LOCATE C.G. AS SHOWN. TEST GLIDE WITH EMPTY M/ CORRECT GLIDE BY CHANGING STAB INCIDENCE.
"ZIP-ZIP" 150 F/F ROCKET
CHARLES SOTICH ✦ CHICAGO. ILL

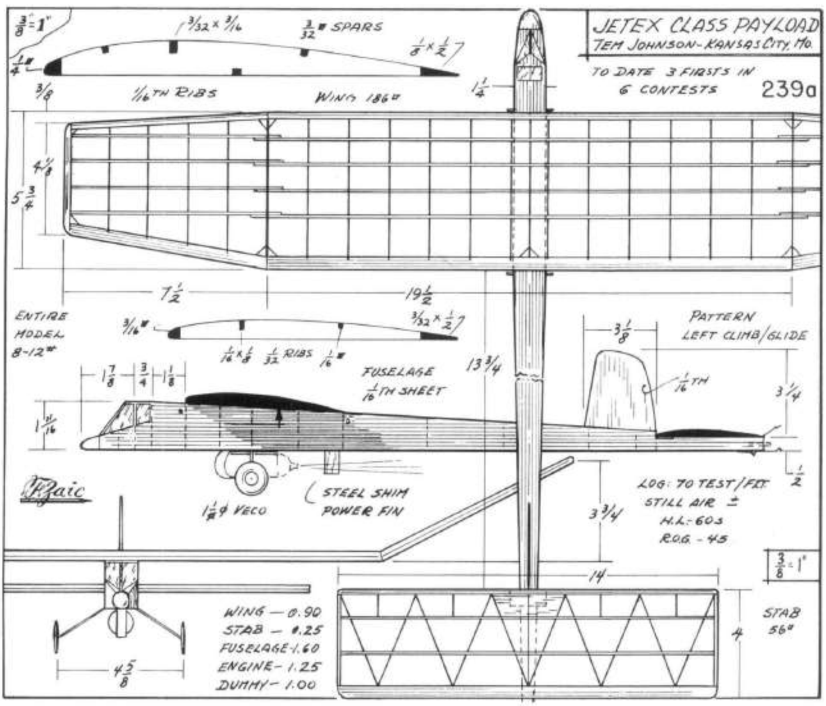

237a
1/8 TH SHEET x 1 3/4
1/16 TH SHEET
1/16 TH RIBS
-STAB- LIGHT 1/16 TH QT. GR.
-NOSE BLOCK- 1/2 x 3/4 x 3/4 SOFT BALSA
-FUSELAGE- 1/16 TH SIDES. TOP & BOT. FORMERS AT WING T.E. & IN FRONT & BEHIND DUMMY
POP-UP WING D/T. CEMENT AL. FOIL ON BOT. OF BODY TO PREVENT FIRE. SET WING LIMIT STRING FOR ABOUT 45°
ADJUST GLIDE BY VARYING WING INC. AFTER THE C.G. IS PROPERLY LOCATED
CANOPY REMOVED TO LIFT DUMMY FROM TOP OF FUSELAGE.
1/8 x 1/4 SPRUCE
1/8 HR BALSA
C.G. AT 2 1/4 BEHIND L.E. MOVE MOTOR TO LOCATE & ADJUST C.G.
MOTOR MOUNT CEMENTED TO WING AT DIHEDRAL JOINT
WING — .45 oz
FUSELAGE — .30
TAIL — .05
DUMMY — .25
MOTOR/F— .45
TOTAL — 1.50 oz
D/T
"DUMMY DIP 50" JR. JET PAYLOAD — CHARLES SOTICH—CHICAGO


238
WING & PYLON COVERING: LT. WT. JAPANESE TISSUE - 2 CTS. 50/50 DOPE
1/8 WASH-IN TIP
TIP LAMINATED 4 - 1/32 x 1/8
- TRIM - RIGHT/RIGHT
1/32 PLY PLATFORMS x 3/4 x 2
SPAR 1/16 x 3/16 - 1/16 x 1/16 TIPS
1/8 SQ
1/8 SQ
PYLON 1/2" THICK STREAMLINE
1/32 RIBS
- POWER - 150 JETEX SLIGHT RT/THRUST
1/32 x 1/2 x 3 PLY
TOTAL WT. 1 1/2 OZ. (INCLUDES MOTOR)
1/4 TILT
IN THIS MODEL WING POPS-UP SO THAT D/T FUSE WT. IS AT THE FRONT
NOTE: D/T
1/32 PLY KEYS
C.G.
2 - 1/32 x 1/16 LAMS.
IF THE TRIANGULAR IS FORMED FROM OUTLINES SHOWN, THE NOSE WILL TURN UP TO GIVE 1 1/2 TO 2" INC.
FUSELAGE SIDES 1/32 ND BALSA
3RD 1959 K.O. INTERNATIONALS BEST NIGHT AIR TIME: 2m 45s
STAB & RUDDER COVERED WITH CONDENSER PAPER. - SHRINK WITH STEAM - 2 CTS OF 50/50 DOPE
LT. WT. ROCKET
3 - 1/32 x 3/32 LAMS.
1/32 RIBS
3/32 ND SQ. EDGES
"SWIZZLESTIK MK III"
JOHN SCOTT AGINCOURT, CANADA
W. Zaic
1/3

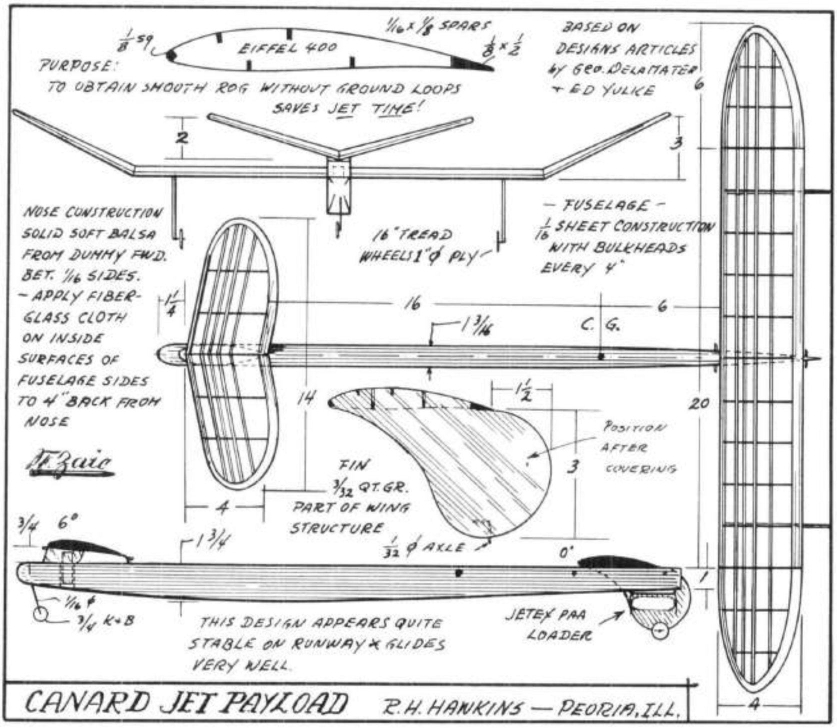

WINGS HELD TO FUSELAGE WITH TUBE/WIRE CONNECTION
1/16 I.D. BR. TUBE
SEW & CEMENT ϕ TO 1/4 SHEETS
1/32 I.D. BR. TUBE
1/8 x 1/4
3/32 x 5/8
1/16 SQ
4% AT 30%
TAIL MUST BE LIGHT
3/16 x 1/2
1/16 SQ. TOP SPARS
1/8 x 7/8
1/16 WIRE
SOFT 1/4 SHEET
TILT STAB FOR TURN
1/16 RIBS
1/16 PLY
ROOT RIB
1/32 WIRE
FUSE
SOLDER
C/L CLIP
.010 x 2"
MOUNT/FUS CONNECTION
NO NOSE WT. NEEDED ON ORIGINAL
238 a
G.G. 79%
JETEX 150 MOUNT
.008 AL. FLAME SHIELD
1/8 TOP
SOLID BALSA 5/16 x 1/2 x 4 5/8 BASS
1/16 STIFF. BET. SIDES
1/32 ND SIDES & BOTTOM
BASSWOOD DRILL FOR W/WIRE
WIRE FITS SNUG IN W/TUBES IF WIRE LOOSE - COAT WITH SOLDER - FILE/SAND UNTIL TIGHT & SNUG
WT. 3oz. WITHOUT FUEL
JEAN FIZZ
ROCKET CLASS
LOU YOUNG
HAMPTON VA.
W. Zaic
1/5

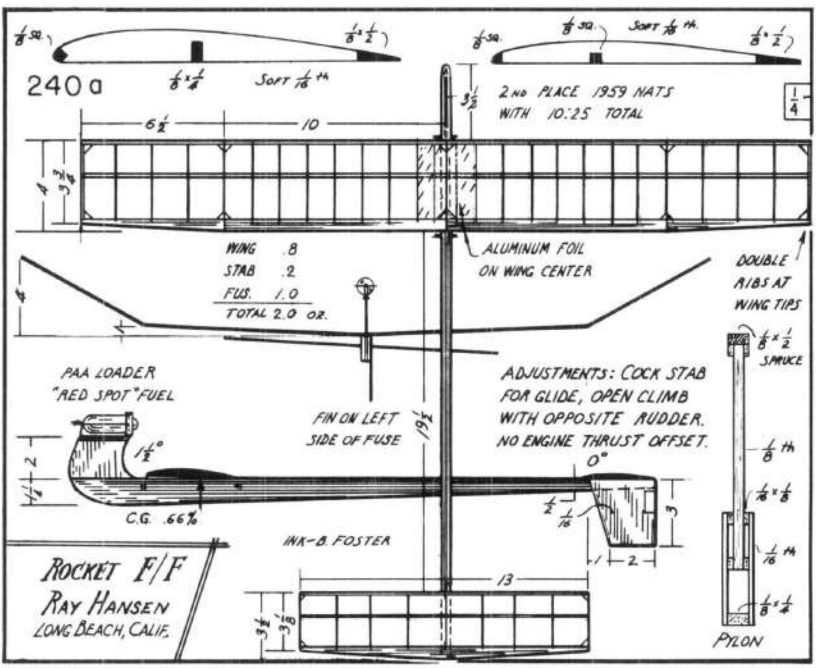


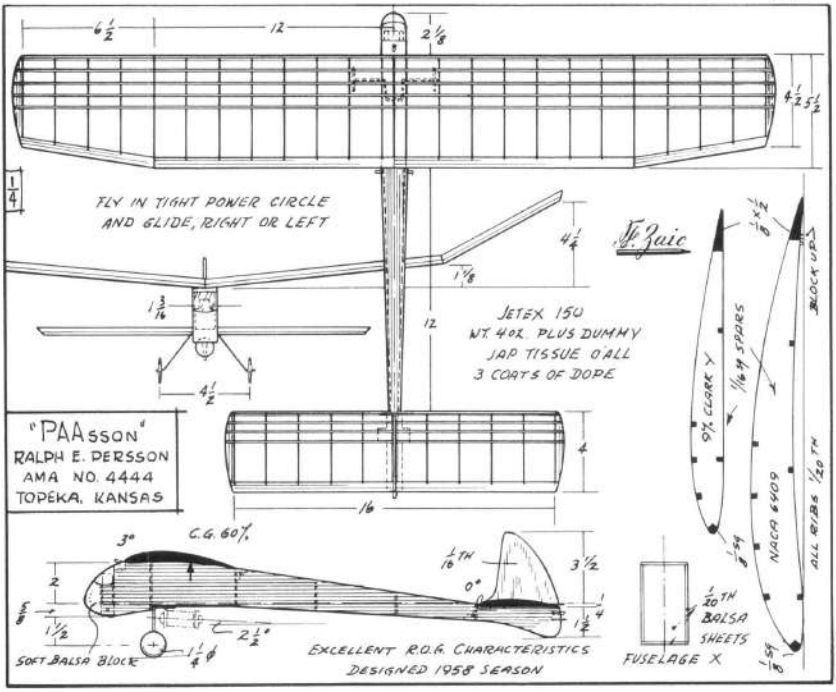
1/8 SQ
1/8 × 1/2
1/16 × 1/8 SPARS
5
1/8 SQ
1/16 SQ SPARS
1/8 × 1/2
5 1/8
10 1/2
15
JUL-JET PAA LOAD
MIKE KARLAK BEDFORD, O.
3RD-1957 2-3RD 1958
2ND-1959 1ST-1959
2- 1960 1ST-1960
3
F. Zaic
15 5/8
3 1/2
WINDOW
2°
70%
0°
1 7/8
3/8
FLIGHT PATTERN
LEFT POWER & GLIDE
FRONT: SILK
REENFORCED
150 JETEX
3 1/4
FUSELAGE
1/16 H
SHEET
1 1/4
15 1/4
.040
3 1/2
WT. 5 OZ
COMPLETE
WITH FUEL
3 1/4
3/10
6" TREAD



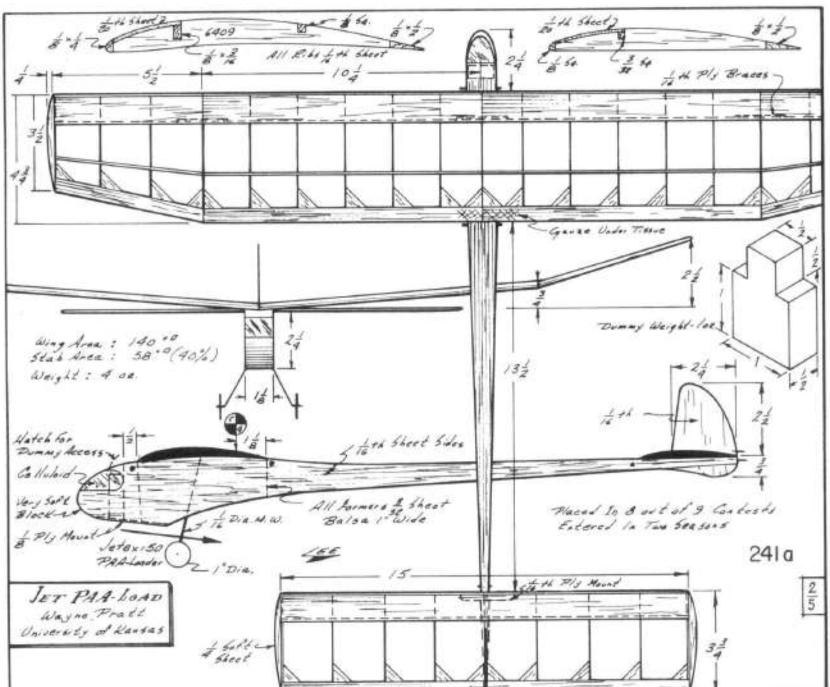
3/8 = 1"
3/32 × 3/16
3/32 ■ SPARS
JETEX CLASS PAYLOAD
TEM JOHNSON - KANSAS CITY, MO.
1/8 × 1/2
1/4 ■
3/8
1/16TH RIBS
WING 186 ■
1 1/4
TO DATE 3 FIRSTS IN
6 CONTESTS
239a
4 1/8
5 3/4
7 1/2
19 1/2
ENTIRE
MODEL
8-12 ■
3/16 ■
3/32 × 1/2
1/16 × 1/8
1/32 RIBS
1/16 ■
3 1/8
PATTERN
LEFT CLIMB/GLIDE
1 7/8
3/4
1 1/8
FUSELAGE
1/16TH SHEET
13 3/4
1/16TH
3 1/4
1 11/16
1/2
F. Zaic
STEEL SHIM
POWER FIN
1 1/8 ϕ VECO
LOG: 70 TEST/FLT
STILL AIR ±
H.L.-60s
R.O.G.-45
3 3/4
3/8 = 1"
14
WING — 0.90
STAB — 0.25
FUSELAGE - 1.60
ENGINE - 1.25
DUMMY - 1.00
4 5/8
4
STAB
56 ■


$\frac{1}{8}$ SQ
EIFFEL 400
1/16 x 1/8 SPARS
$\frac{1}{8}$ x $\frac{1}{2}$
PURPOSE:
TO OBTAIN SMOOTH ROG WITHOUT GROUND LOOPS
SAVES JET TIME!
BASED ON
DESIGNS ARTICLES
by GEO. DELAMATER
+ ED YULKE
NOSE CONSTRUCTION
SOLID SOFT BALSA
FROM DUMMY FWD.
BET. 1/16 SIDES.
- APPLY FIBER-GLASS CLOTH
ON INSIDE
SURFACES OF
FUSELAGE SIDES
TO 4" BACK FROM
NOSE
16" TREAD
WHEELS 1" ϕ PLY
- FUSELAGE -
$\frac{1}{16}$ SHEET CONSTRUCTION
WITH BULKHEADS
EVERY 4"
C. G.
FIN
3/32 QT. GR.
PART OF WING
STRUCTURE
POSITION
AFTER
COVERING
$\frac{1}{32}$ ϕ AXLE
1/16 ϕ
3/4 K+B
THIS DESIGN APPEARS QUITE
STABLE ON RUNWAY & GLIDES
VERY WELL.
JETEX PAA
LOADER
CANARD JET PAYLOAD
R.H. HAWKINS — PEORIA, ILL.


240 a
$\frac{1}{8}$ SQ.
$\frac{1}{8}$ x $\frac{1}{2}$
$\frac{1}{8}$ x $\frac{1}{4}$
SOFT $\frac{1}{16}$ th
2ND PLACE 1959 NATS
WITH 10:25 TOTAL
WING .8
STAB .2
FUS. 1.0
TOTAL 2.0 OZ.
ALUMINUM FOIL
ON WING CENTER
DOUBLE
RIBS AT
WING TIPS
PAA LOADER
"RED SPOT" FUEL
FIN ON LEFT
SIDE OF FUSE
ADJUSTMENTS: COCK STAB
FOR GLIDE, OPEN CLIMB
WITH OPPOSITE RUDDER.
NO ENGINE THRUST OFFSET.
SPRUCE
C.G. .66%
INK-B. FOSTER
ROCKET F/F
RAY HANSEN
LONG BEACH, CALIF.
PYLON



FLY IN TIGHT POWER CIRCLE
AND GLIDE, RIGHT OR LEFT
F. Zaic
JETEX 150
WT. 4 OZ. PLUS DUMMY
JAP TISSUE O'ALL
3 COATS OF DOPE
"PAAsson"
RALPH E. PERSSON
AMA NO. 4444
TOPEKA, KANSAS
C.G. 60%
SOFT BALSA BLOCK
EXCELLENT R.O.G. CHARACTERISTICS
DESIGNED 1958 SEASON
1/20 TH BALSA SHEETS
FUSELAGE X
9% CLARK Y
1/16 SQ SPARS
NACA 6409
ALL RIBS 1/20 TH
BLOCK UP



All Ribs 1/16 th Sheet
1/16 th Ply Braces
Gauze Under Tissue
Dummy Weight-lead
Wing Area : 140 sq in
Stab Area : 58 sq in (40%)
Weight : 4 oz.
Hatch for Dummy Access
Celluloid
Very Soft Block
1/8 Ply Mount
Jetex 50 PAA-Loader
1" Dia.
1/16 th Sheet Sides
All formers 3/32 sheet Balsa 1" Wide
1/16 Dia. M.W.
Placed In 8 out of 9 Contests Entered In Two Seasons
241a
1/16 th Ply Mount
1/4 Soft Sheet
JET PAA-LOAD
Wayne Pratt
University of Kansas

COMBAT WING C/L —— Art Cangialosi, Clifton, N. J.

Perhaps the best way to start this discussion is to list design criterion; a combat ship should be:

1. Maneuverable—this implies light weight, low wing loading, high lift airfoil.
2. Fast—this condition dictates on overall clean aircraft, light weight, and a minimum wing.
3. Rugged—compact aircraft not unlike a brick.
4. Expendable—simple, quick to build, and inexpensive.

The configuration which best satisfies all of these conditions is the all wing design.

The combat wing is simplicity in itself; however, there are a few points that must be watched. The first, the most obvious, and probably the most ignored, is the aerodynamic interference between the wing and elevator. The function of the elevator is to provide a pitching moment to increase the angle of attack of the wing and consequently increase the lift; in doing this, the airflow over the portion of the wing immediately in front of the elevator is altered in such a manner so as to decrease the lift in this portion of the wing. The overall effect is a decrease in the effective wing area of the model and a resulting decrease in maneuverability. These interference effects can be minimized by using a small elevator, small elevator movement and mounting the elevator a distance behind the wing with a gap between the wing trailing edge and the stabilizer. For you non-believers, try moving the elevator of your flying plank aft and decrease it's movement, then note that the ship will now fly through tight maneuvers that previously would result in stall.

A second factor that is most important on the relatively short coupled wing is the location of the center of gravity; there is only a small range of positions that will give a stable yet maneuverable ship. One procedure for finding the C.G. location and elevator area is as follows—

1. Check the performance of the model in level flight at a number of altitudes, if there is no tendency to oscillate or hunt, the C.G. is in a reasonable stable position. If level flight cannot be held, move the C.G. forward.

2. Maneuverability can best be checked by doing square maneuvers, a square horizontal eight is a good check maneuver.

A. If the corners are big and sluggish, move the C.G. as far aft as possible without inducing instability. If the corners are still not sharp add more elevator area or increase the movement.

B. If the ship turns sharp but slows down or stalls, cut down the elevator area or movement.

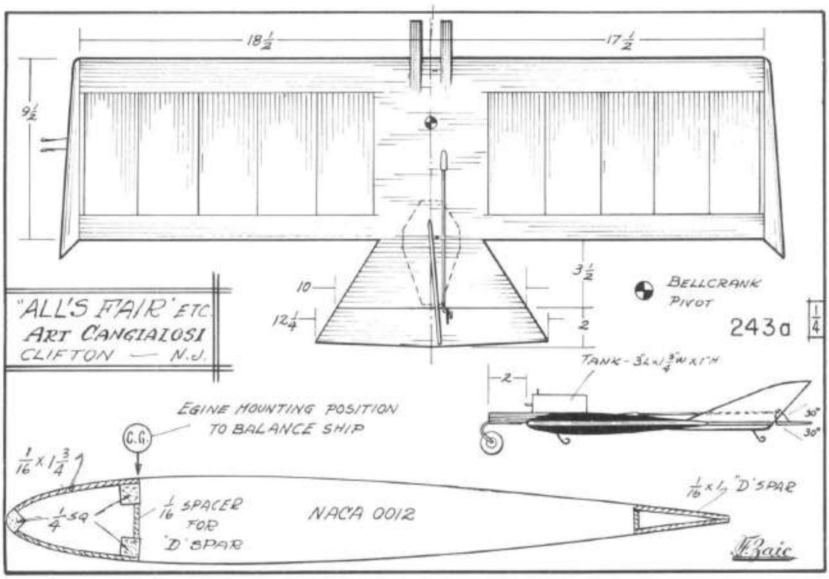
C. If the straight portion of the squares are difficult to hold or cannot be done, the controls are either too sensitive or the ship is close to being unstable; reduce control sensitivity or more C.G. forward, respectively.

A good rule to follow for determining control sensitivity is that a full wrist movement corresponds to full elevator movement.

A light wing loading and a good airfoil are essential, wing loadings of about .06 to .07 oz/in^2 and an NACA 0012 airfoil give a good balance between speed and maneuverability. Stay away from extremely thin airfoil and airfoils with sharp leading edges; the slight advantages in level flight speeds that these sections give is more than offset by the loss of maneuverability and loss of speed during maneuvers produced by their low stall angles and low lift to drag ratios at high angles of attack. Remember, the top speed of your ship in level flight is for the most part determined by the drag of that eight foot piece of crepe paper you'r towing around and you have an excellent advantage if you can maintain speed during tight maneuvers.

A good solid, vibration free engine mounting is required as it is for all high performance engine operation. Fuel tanks, pressure systems, etc., must be mounted solidly also. As for fuel tanks, a simple rectangular tank gives excellent performance with stunt type engines; a rectangular clank tank is used with engines having poor suction. External mounting of the tank provides a simple means of adjusting the fuel head by slipping sheets of 1/32 balsa under the tank.

During a combat flight no attention is paid to wind direction so the ship must be able to stay at the end of the lines even when maneuvering into the wind. A healthy amount of engine offset, 5 to 7 degrees, and good lateral trim will do the job. It is advisable to build in an aluminum trim tab on the outboard wing since warps are inevitable; the tab should be adjusted until the ship flies parallel to the lines.



CLUB TRAINER——————Probusters, Jackson Co., Mo.

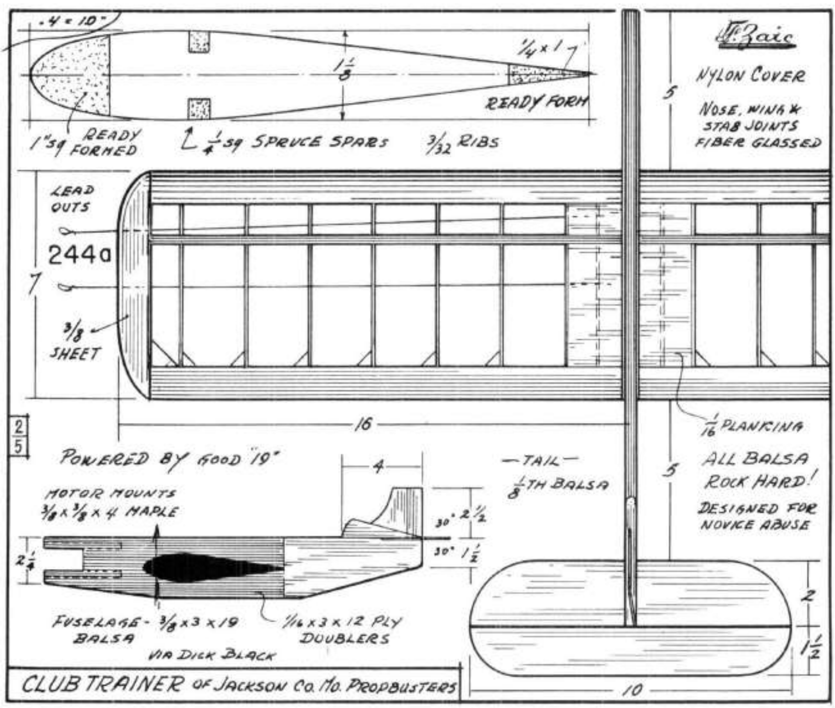
The control-line training plane is another Propbuster's club project. It was obviously not designed for beauty. But the purpose for which it was designed, namely ruggedness and stability, it served quite well.

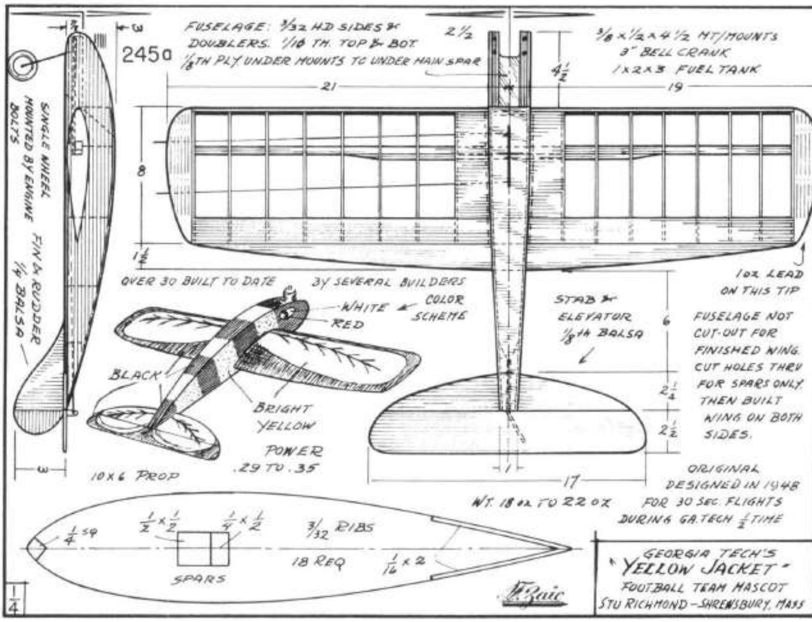
A model such as this is almost a must for any club that has an intensive program for beginners. We've found that this is a great help in preventing the kids from getting discouraged during their first attempts at flying. Regardless of the help or advice you may give (short of building the plane for him) the beginner's first model is usually poorly built. To expect him to learn to fly on such a model is asking a lot. The first time it comes in hard the plane disassembles into a pile of scrap and the kid wonders if he should go back to Tiddly-Winks.

Our training plane has been planned from almost every conceivable angle and the only damage it's received is one broken rudder and a couple of dirtied engines. This allows the novice to get right back into the air while his mistake is still fresh in mind.

Constructed of hard balsa, plywood, spruce, and fibreglass, and covered with nylon this plane is about as tough as we could make it. As for being maneuverable, the plane is capable of simple maneuvers (like large loops and lazy eights) without being a bit "touchy."

We hope that more clubs will start taking more active interest in the kids. They are the future of our hobby, and if we don't cultivate this new crop of modelers the future will be mighty dim.





GEORGIA TECH YELLOW JACKETS—Stu Richmond

The Georgia Tech Yellow Jackets are certainly an illustrious football team—and this model is their team mascot. It was designed to buzz through the sky before thousands of football fans during the half-time activities wherever the Yellow Jackets play. The model, Yellow Jacket, powered with a .29 to .35 engine has had an exciting life. It has been sprayed with DDT by rival cheerleaders. It has flown at bowl games. It was the victim of an attempted kidnapping. It has been peppered in flight with oranges by pretty U. of Florida's co-eds. And miscellaneous other incidents have occurred.

Since 1948 over twenty models of this design have been built. In the last several years the model has been a very successful and weird appearing design for contest combat flying. The basic design is taken from the model which established an AMA control-line speed record for me some fifteen years ago.

Typical construction—except the fuselage is NOT cut out to receive the finished wing structure. Holes are cut thru fuselage sides to receive ONLY the leading edge, spar and trailing edge. Then wing ribs are slipped on these pieces to form the wing. 1/8 ply goes full length under the motor mounts back to bottom of main spar to hold bell crank and assure that engine will never break loose. May sound complicated, but is simple, fast and safe construction which is well proven. Paint bright yellow; then trim black as shown. Eye is white with red pupil. I have full size templates for anyone interested.

COMBAT DESIGN C/L —— Pete Asjes, Wichita, Kansas

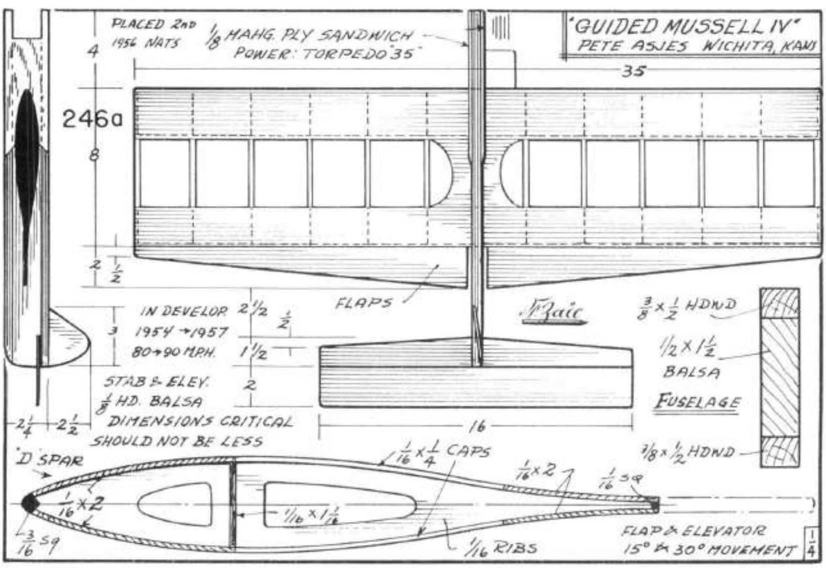
This model is the last version of a combat design started in 1954 and finished in 1957 when I retired from the combat circle.

Combat in my opinion has become a speed event with very little skill needed. I will admit that the skilled pilot has an advantage but I have seen too many contests won by pilots that were unable to complete one lap upside down. I am a firm believer that if the rules were modified to give skill in flying a greater advantage that combat would become more popular than it already is.

The design was developed over a three year period. The original airplane was without flaps. One had a box type fuse. The final design was chosen because it is easy to build, cheap, and tough to destroy. This model was as fast as any of the flying wings that it competed against, and much more stable in windy weather flying.

The first model was built in 1954 when the standard model in the combat circle was the Ring Master or something very similar. The Mussell I was much larger and had much more area and no flaps. Mussell II was reduced in size but still did not have flaps. Both I and II had box type fuselage and upright engine.

Mussell III was basically the same airplane as II except the engine was mounted on its side to minimize engine damage in crash landings and inverted landings. It was about this time that Torpedo brought out the 35 engine and combat picked up speed rapidly. As combat increased in speed the airplane fatalities picked up at at least the same rate. Since

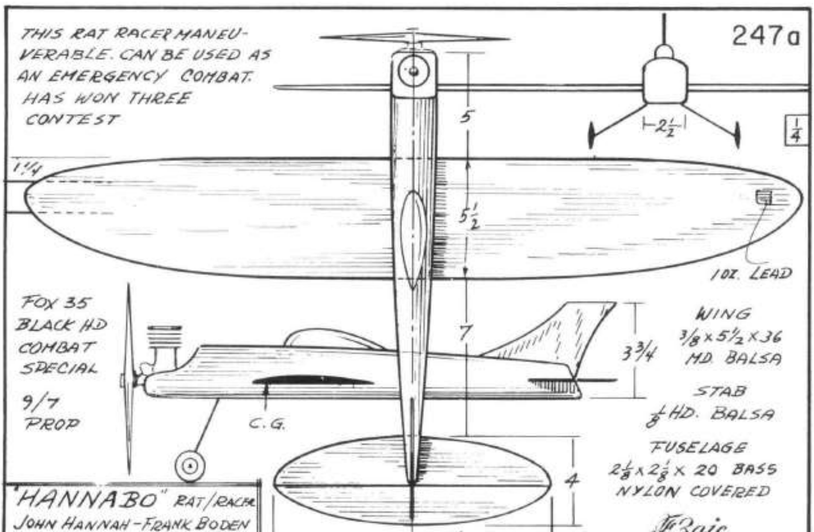


the box fuselage is more difficult to build and also takes more time Mussell IV was developed.

Mussell IV was not only designed for speed but also stability and easy flying. The first airplane exceeded my fondest hopes. The airplane flew at about 85 mph and flew like an extension of my arm. During the 1955 season I managed to place in 6 contests. The airplane so impressed the local talent that there were about 8 different modelers building them at one time. In fact some of them are still cluttering up basements in Kansas City.

During the 1956 season this airplane competed against all types of combat airplanes and did very well against all comers. With Torpedo 35 engine this airplane performed the entire stunt pattern at between 80 and 90 mph and actually do the maneuvers without jumping like a cork on the water. I took the model to the 1956 Nationals in Dallas and was doing okay until I pulled out of a dive about 6 inches under the cement runway.

In 1957 a friend, Joe Ellsworth took some of his Mussells to the Nationals and came out second best in Junior and Joe said that the airplane was capable of competing with anything flying at that time. Although this airplane has not been altered in three years I am sure that it is still able to compete in any contest against any competition. With one of the new power plants up front who knows.



DESIGNING FLOATS ——— Mel Mosher, Hopedale, Mass.

My experience with articles on floats seems to have always left me with a feeling of uncertainty on one or more vital aspect. The procedure for building a successful set of the semi-scale type for any plane can be reduce to a series of steps. These if followed faithfully will give the builder a chance to acquire know-how with a minimum of dunkings. That is our aim.

A general outline might include buoyancy, design and construction, positioning and alignment, and of course, a test phase. Under buoyancy we first decide what the approximate weight of the airplane will be with floats. Then through a simple equation the basic dimensions can be found.

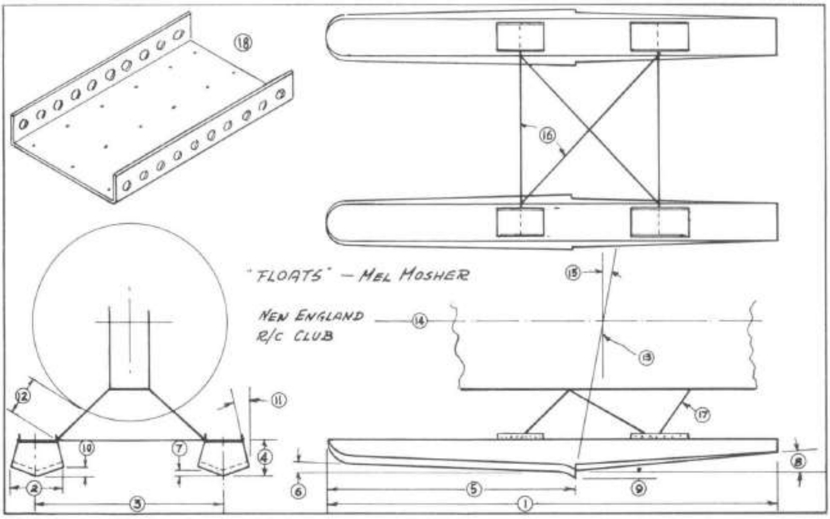
1. Float length = .7 X fuselage length
2. Float width = $\dfrac{\text{weight in ounces of plane with floats}}{\text{float length X .8}}$

From the length and width come the remaining dimensions. As these are found a full size construction drawing can be roughed out. Steps one through 18 illustrate this. A little practical philosophy may not be out of place here. Give your attention only to the step on which you are working. The job will seem easier.

3. 20% wing span.
4. 5/8 W (plus depth of hook (No. 9 in sketch). W = width of float.
5. 55% float length.
6. 2 degrees.
7. 1/8 W.
8. 5 1/2 degrees.
9. Hook depth—1/150 float length. Length = 8 times depth. This may have to be changed. Tests will bring out any weakness here.
10. 1/5 W.
11. 15 degrees.
12. Prop clearance. For most R/C models 2 inches is ample.
13. CG is found with model set up as a landplane.
14. From the CG draw a vertical line to the plane's center line. From this point at a 10 degree angle locate the step. The test phase can be started with this approximate setting.
15. 10 degrees.

For the bulkheads use 3/32 sheet. Space them 2 3/8 inches apart for the average R/C model. At crucial points such as where the struts are attached use 1/8 plywood. Balsa noseblocks and 3/32 sheet for the sides, top and bottom will be alright. Also, the bottom will be fibre glassed, the top and sides silk covered.

1/32 aluminum brackets as in No. 18 are sewed and cemented at the two points on each pontoon where the struts are attached. These permit the CG to be moved from 0 to 2 inches rearward of the step in increments of 1/4 inch. This is a quick and painless way of acquiring experience on the location of the CG relative to the step.

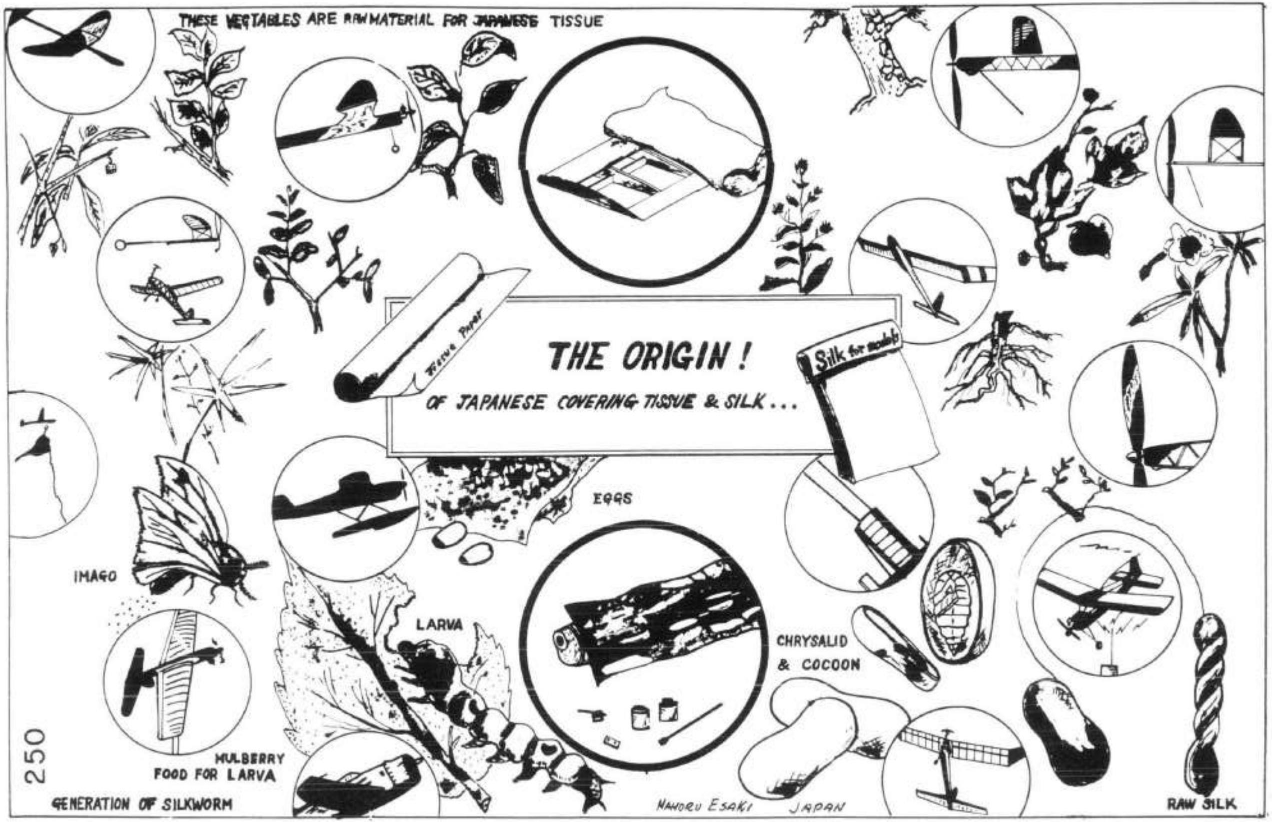


The rear struts, No. 17, from the fuselage to the pontoons are pivoted in clamps bolted to the bottom of the fuselage. This will allow the struts at the pontoon brackets to be moved from hole to hole to vary the angular setting of the floats to the fuselage center line, the stab and the wing. To avoid erratic flights, dangerous turning tendencies carefully align the long axis of the pontoons with that of the fuselage. Rigidity of the X frame No. 16 and substantial struts pays off here. The front and diagonal struts are wired and soldered to the X frame. If the music wire seems excessive, there are other ways to save weight. For instance, consider in my case of going from a receiver weighing with batteries 12 oz. to one with a total weight of 7 oz. and finally to one cutting the latter in half again.

A methodical plan for testing is as essential as when building. Test gliding on a grassy slope should show up any wild misalignments. We assume your radio is in good working order. Anything other than 3 speed on the engine will leave something to be desired. Glass smooth water is out as well as brisk winds and rough water. For test runs a light breeze and ripples are ideal. A large maneuvering area will make working conditions easier, too.

From step No. 14 we have an approximate setting of the step relative to the C.G. Start with the nose of the floats at 5 degrees negative. This probably will be too much. Work for a condition where the ship is trimmed for an easy climb. At this angle of attack, with the floats on the step and their tail ends just trailing in the water, we have a good condition. The relative setting of the floats wing and stab is most important. Extra time spent thoroughly testing different positions of the step to the CG and angular setting of the floats to the stab and wing will be rewarded with better takeoff and flying characteristics.

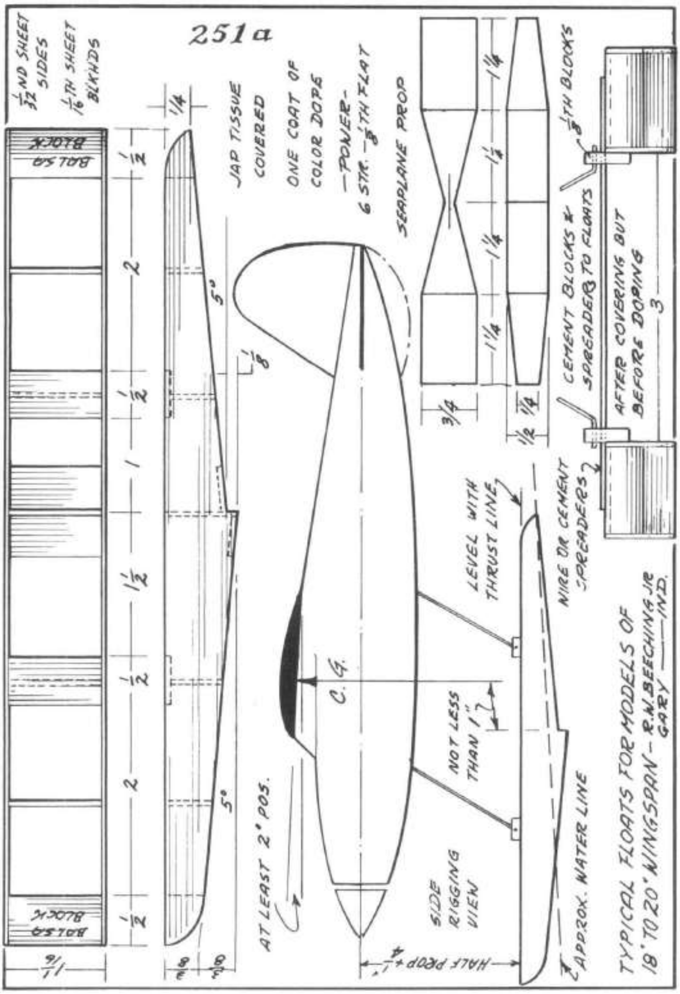
In closing we might say that here in New England, ships equipped with floats touching down on a farmer's hayfield make as pretty a sight as a skier in top form on a long jump.


THESE VEGTABLES ARE RAW MATERIAL FOR JAPANESE TISSUE
THE ORIGIN !
OF JAPANESE COVERING TISSUE & SILK . . .
Tissue Paper
Silk for models
EGGS
IMAGO
LARVA
CHRYSALID
& COCOON
MULBERRY
FOOD FOR LARVA
GENERATION OF SILKWORM
NAHORU ESAKI JAPAN
RAW SILK

MINIATURE SEAPLANES—R. W. Beeching, Jr., Gary, Ind.

Ever watch a seaplane take-off? Here is every thrill in the book for two evenings work. One for the ship and one for the floats. If you are lazy, get a Top Flite Jig-Time model. Then, all you need are the prop and floats shown above. You won't need a boat for this sea-going miniature. It will only fly a hundred feet or so, but the take-offs and landings will give you a kick no land plane ever could. If you have no pond or lake, wait for a large rain puddle. Here are some water plane hints:

Drags thru water at slow speed: Not enough power or punctured float. Travels across water with a rocking, skip action: Step too far back or wing was not positive. A sheet balsa model will take a lot of soaking and drying before it's worn. Small Flying Boats can be made using the underside of the above floats as a pattern for hull botom—make it twice as wide as the float. You are going to get your feet wet anyway; why not enjoy it!



HELICOPTER DESIGNS ——— F. G. Boreham, England

Enclosed is some model helicopter designs as promised, which I hope you will be able to use in the Year Book. I shall be always happy to exchange information etc. and help rotary wing enthusiasts.

COPTER COMMENTS

There are many model makers who are interested in development work, so I hope the following will encourage and help those modellers who may be attracted to the helicopter and rotary wing types. The model copter has a fascination of its own, and is the only type of model which can be flown in a limited space under control by testing in "tethered" flight. In fact, backyard flying is possible at long last, which is more than the control liners can do! (see sketch)

Neglecting the rubber driven model for the moment, the two main types which are mostly seen are the REACTION and JET POWERED (generally using Jetex power units).

REACTION TYPE. These have either Diesel or glow plug engines for power, and generally use the Clough feathering rotor system, though in some designs flapping hinges are fitted instead of the torsional pivoting hinge.

These models make good vertical flight in calm air, but usually come to grief when turbulence and gusts abound. This is due to the fact that the helicopter is moving slowly in the air. It is far more susceptible to "tumbling about." The rotor blades tend to flutter and stall with resulting loss of rotor R.P.M. It is, therefore, most important to have a good engine installed, in order to cope with this increase of drag.

I cannot do better than quote Parnell Schoenky, who is well known for his successful designs, and again emphasize the importance of the following:

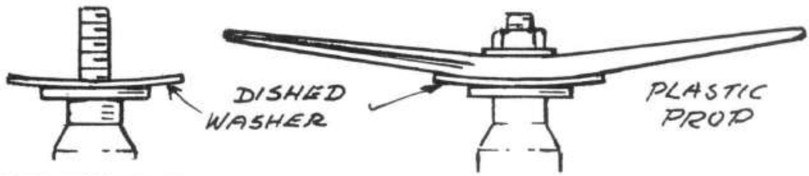
Keep weight light as possible; Well tuned engine; Blade pivoting hinge free and correctly located approx. ¼ chord; Carefully balanced and rotating pivoting parts; Correct C.G. location.

As it will be realized, to keep fuselage drag to the minimum is most important. I prefer an open type skeleton fuselage or flat silhouette made of thin sheet balsa.

A bamboo or wire landing chasis is all that is necessary for light models, and wheels, if used, can be fixed permanently as vertical T.O. requires no forward motion. The following is useful data.

Size of engine	Weight	Rotor Diam.	Prop. Diam
.5 cc	4½ - 5½ oz.	24 in.	6 x 3 OR 4 in.
.75 cc	7 - 8½ oz.	32 in.	7 x 4 in.
1.5 cc	12 - 15 oz.	42 in.	7 x 6 in. 8 x 4 in.

In order to insure some measure of stability, some of my later type models have successfully used a "coned" propeller. The flexible propeller of nylon or similar assumes a dihedral angle by using a dished washer as back plate on engine shaft. This does away with the pivoting hinge gimbal which often causes excessive vibration and rough running especially if worn and not quite true. Some loss of propeller efficiency, but weight is saved.



JET POWERED HELICOPTERS

Two Jetex units mounted on a beam driving a 2 bladed rotor system provided with skew type flapping hinges has proved a very successful and dependable type. Many successful models have been produced on my pioneer Jetticopter design and the consistent performance at helicopter events prove this.

P. Schoensky's JH2-3- and 5 are excellent examples of good jetex copter designs and have been published in British and American magazines. I would like to advocate a "wash out" in the blades, so that the outer third of the rotor forms a slight negative angle when the blades throw off pitch as they flap upward on the skewed hinge pivot. This improves the auto rotation qualities and gives slower sinking speed.

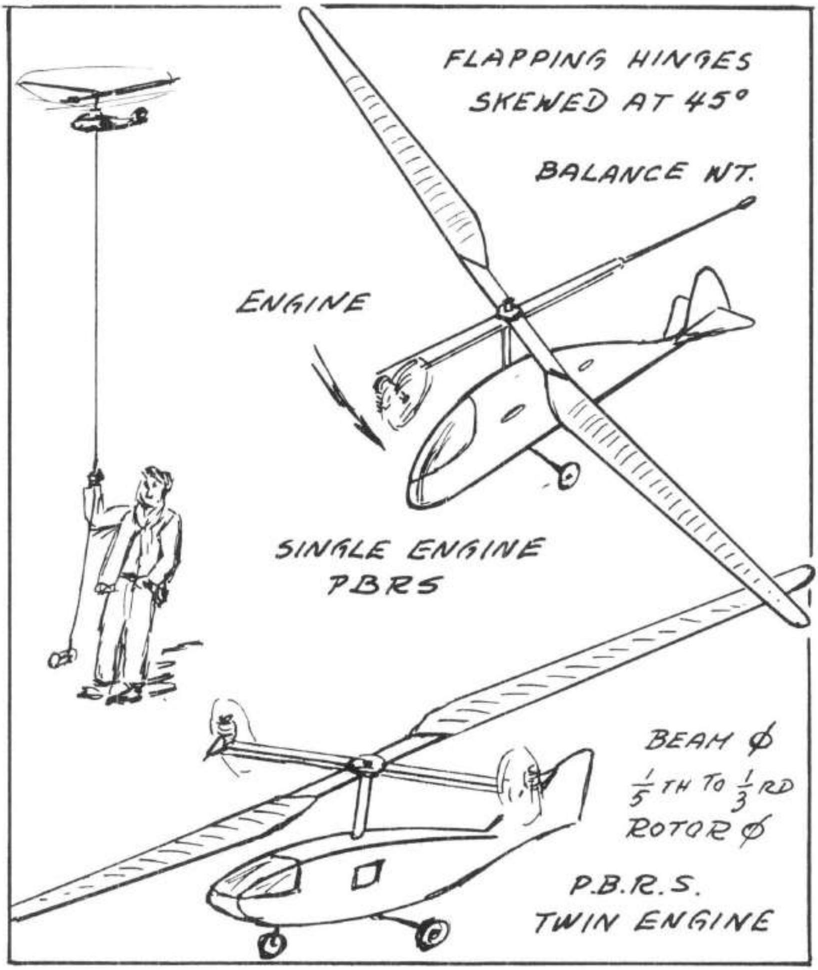
The substitution of small diesels for the Jetex units has proved successful and I have now been developing this type.

The powered beam rotor system, **PBRS**, has the advantage in giving greater lift and better auto rotation with slower sinking speed due to lower disc loading than the reaction type. Also rotor diameter is much larger as 1.5 cc engine will drive a 5 ft. diam. rotor single engine PBRS with suitable balance weight, but for best results two engines are required.

Most of my models developed on these lines have 2 bladed rotors with skew hinges, but due to the lower RPM of the engine driven beam, I find it necessary to increase the initial blade pitch setting some 5 to 10 degrees more than Jetticopter designs.

Ken Norris, a keen copter modeller from Denver, has made several successful PBRS models and I have been corresponding with him for some time. Recently I built a slightly modified version of his Hexi-Copter design which has 4 blades and beam using 2 Cox .02 engines.

This performs very well, and there is no doubt a PBRS with its superior lifting powers and stability will be the most likely layout for a radio-controlled model copter and I hear Ken is already working hard on the project.



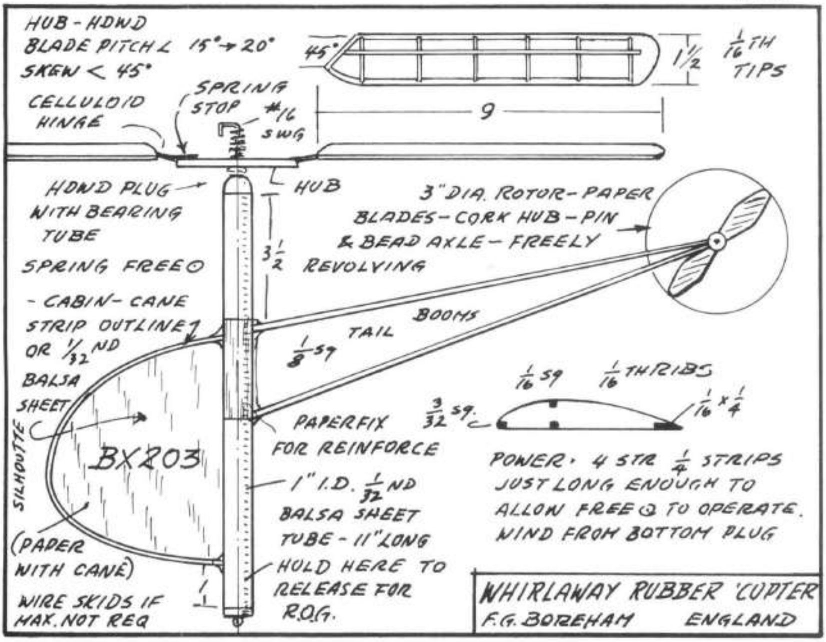
RUBBER DRIVEN

The usual rubber model has two rotors of equal diameter, connected to the same rubber motor thus rotating the rotors, in opposite directions, but unfortunately the power run is very limited. As it will be realized, the rubber runs out at approximately twice the speed, it would do driving a single rotor.

Also the stability is much to be desired as in gusty air, models of this type will tumble about and often turn over and dive in.

However, models of this type light weight and simple construction, are mostly seen, while having no appearance other than a flying rotor system, score for duration reasons.

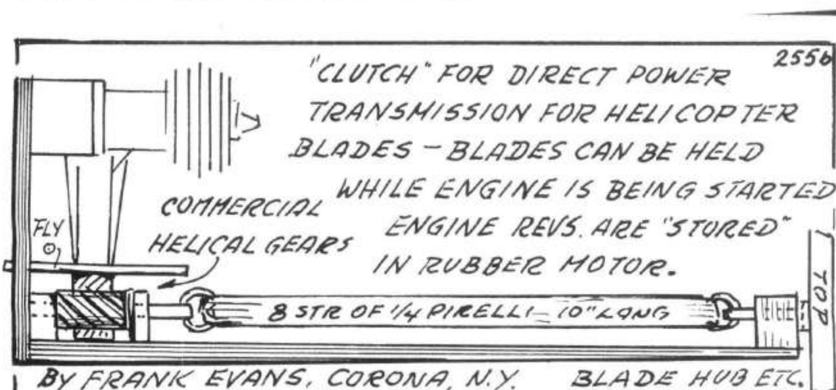
There is no doubt that rubber driven models are the cheapest, simplest and most effective means of trying out new ideas in preliminary work.



Results are obtained quickly as damage resulting from "crack ups" is easily made good without interfering with the main purpose which is of course the trying out of the idea. So try out new ideas in rotors and control systems with a rubber driven job first.

Recently, I have been trying out a single rotor rubber driven model suitable for duration flying, which appears promising and has a little better appearance and auto rotation than the usual double rotor layout. See plan. Of course, the model rotates when in flight, but the freely revolving tail rotor set at angle of attack, has a strong damping action so the fuselage turning at a slower rate than the double rotor type.

So go to it and get those rotors turning!



KIT DESIGNS FOR THE JUNIOR

Carl V. Miller, ——————————— Nashville, Tenn.

Received your inquiry as to contributions and I believe a well meant article may go a longer way than a set of plans. Though, heaven knows that many different prop designs, airfoil sections and fuselage profiles that are orbiting in my skull and that I would like to build and fly.

The point that I am mostly concerned is my dealings with so many little boys who come into my shop and who are hungry for model aviation and enthused with building. I could feel their reaching out for ideas and yet—the kits on the shelf—they shun. Of the types of kits sold, the all sheet type construction kit sold 5 to 1 over the others: The Topflite Lil Rascal, and small rubber powered Jigtime series. Carl Goldberg knew the answer and he is cashing in on the true needs. There is a gap that can be filled.

What would be wrong with an all-sheet Wing, Tail, Rudder, Fuselage and Prop in the Wakefield class? G. Perryman has used the sheet prop construction for some time, and his models climb very well with his winding. Also a small FAI—F/F model where sheet construction will automatically bring the ship's weight up to 9 oz. on a .049 or .051 without adding lead. The same can be true for a Nordic A-1.

We should not build these models just for having something different, but for the sake of helping others get into all the fun we are having ourselves. I say, and I know there will be many who will club me, Forget the Experts, and pay a little attention to the boys who are getting one year older each year. Also remember, Frank—if we help the ones who are just getting their feet wet, we will be helping ourselves and I definitely believe you will sell more of the annuals. I am really for more F/F flying gaining its rightful amount of cohorts. I wrote to Bill Winter on this matter, and he agreed that the beginner has to start somewhere. It boils down to this, the whole basic and psychological understanding of providing a kit or plan to an American boy who is in the first place lazy or who has learned to be lazy. To them, laziness means to get the utmost without dragging. Can we really help this kind of boys? I believe we can, by giving them more plans and kits with very easy construction, whereby they can enter the events approved by the AMA. Radio Control Flying owes much of its success to all sheet construction, as can be witnessed the Group from Calif. who journeyed to Miami's King Orange Meet this December 1959 and took first two places in Multi-RC with all-planked and sheeted 66" mustangs. They were built to take it.

Well, here is hoping you can have a part of your annual devoted entirely to the "New Ones" and hope some of the Top Men can have an idea or plan or two.

WORKING FOR AND WITH NEWCOMERS

Dick Kowalski, ——— Detroit, Mich.

Regarding your interest in our Monday night session, we do not try to recruit kids into the modeling game, although if a kid shows promise, we try hard to push him. By this I mean that unless the lad shows some talent and a strong interest, we will not take the time to teach him something as precise as indoor building and flying. Several years experience with the Plymouth Aero League's PAL clubs years ago showed me it was hopeless to take kids with a mild interest and try to make die hard competitive modelers out of them. Out of literally hundreds and perhaps thousands of kids that were in PAL clubs in Detroit area only one of them is still active, he is Paul Crowley. All of the others have dropped out and have never been heard of again.

Now perhaps my viewpoint is wrong, but after I think of the thousands of hours I have spent across the years with rank beginners, I think I would just as soon see them go down to the corner drug stores, buy a plastic kit, assemble it and work off the little desire they do have and forget about it. A much more successful approach is the one I have used since the PAL club deal, that is to keep my eyes open for some bright young lad who shows up flying a fair model that his own desire drove him to build. This is the boy who is worthwhile working with. I give him just as many hours of my time as is humanly possible and often subsidize him financially, if necessary. I have had two very successful proteges by this plan and only one failure and I still think he was not interested enough in the beginning.

I do not believe in starting with the rank amateur to whom I must explain what a plan is, or tell him that this is balsa wood, etc. I like the kid that has been building by himself for a year or so and needs polishing, the things like how to select balsa wood, how to plot airfoils, how to wind a rubber motor to maximum, etc. These lads do not want to go through the simplest steps of modeling, you must give them everything they can possibly absorb and all the time have them building and flying competitively. This is important, one win at a meet does more for their enthusiasm than a hundred pats on the head when they complete some simple project.

Now, we do provide and work with beginners. But these beginners are outdoor builders who have been around and are competitors already. These beginners, when we crank them up, go at indoor with a voracity that is beyond words. We have converted seven diehard outdoor men to very good indoor builders and keep working on all of the others every chance we get.

If you are still interested in this program for the year book, I would be more than happy to explain how we go about it in detail. This plan has been adopted by two Chicago area clubs and is doing well there, I understand.

NEWCOMERS' PROBLEMS Bill Hyde, Canyon City, Oreg

It has taken me quite some time to get around to writing you. I must confess that when I filled out your questionnaire there were no articles written on the subject outlined, and, I might say, there still isn't. I do want to say that you are doing a fine job with your yearbook and wish you much success in coming years.

As you know the subjects outlined were "Model Repairs" and "Tips For Beginners." After considerable thought the conclusion was reached that both subjects might well be condensed into "Tips For Beginners." There is no doubt that if we don't help the novice and there will come a day when there is only one modeler left at age one hundred and something and it is a well known fact that it takes two to compete.

So—where do you start giving tips to beginners? Do you tell them to Build Free-Flight, U-Control, Rubber, Gliders or what? Why not instruct them in all phases of the sport? It is very possible that one trouble getting beginners in is due to the fact that they are shown only one phase of the game. To turn a phrase "One man's poison is another man's meat," or anyway in modeling this is true.

So Frank, let's impress on the novice that there are many things that one can do with glue, balsa, paper and dope. You don't have to sink five to fifteen dollars into an engine to fly a model plane. But on the other hand you can have a lot of fun with the .020's to .074's in a free flight. First tip to beginner.

1. Don't put anything smaller than a .15 in a U-Control Model. Now there will be a lot of yak about this statement but never was a truer word spoken. The fellow that is building his first model has about as much chance getting anything smaller off the ground as a hog has of going to war, possible but not probable.

2. Read everything you can about whatever you are building. There are lots of good books and mags on the market that cover all angles of this sport so read them. Don't think that you can't learn from a book because what little bits this old kid learned up until I was about 24 was from a book as I live 60 miles from the nearest town and about 250 from another modeler.

Now a tip to the Industry. To do a real job of enticing the new man or boy in, each kit that is put out should have a more detailed explanation about building it. It must be assumed that every kit is going to be sold to a novice. Surely, it will make kits cost more but that's the price that you and I, the average modeler must pay to keep the great and unique sport going. So now back to the beginner.

3. Go to contests! Ask questions! this is the real way to learn. Don't be bashful, almost any guy will answer the neophytes questions

at a contest. Also don't question the fellow with the prettiest or the most models but the one with the shabbiest outfit there, for in him you will find the person who really loves to model planes, the backbone of the sport, the "Sport Flyer." From this you will learn more quicker about actually getting a plane into the air than anyone.

4. Join a club. That is it. On this there can be no if, ands, or maybe. If there isn't one to join form your own. Three guys are all you need, this too is written from experience. Just don't get mad at the other two or make one of them mad at you.

Now we come to why the guy that starts never gets off the ground.

The first thing that ruins lots of prospective modelers are those cussed small plastic jobs. You know, the ready-to-runs. How many of you have seen a kid crank all day on one of them and never even gets his finger snapped? He tries this a few times with no results and suddenly develops a sharp interest in fishing. Result—one potential modeler lost! And brother if you think that is hat talk go out someday and ask the first five kids you see if they have ever tried flying model airplanes. Also the dads that have brought them home only to see them turn into junk are legion. Result—Two potential modelers lost.

On the other hand we have the youngster or older fellow who buys a motor in the .15 or up class. He painstakingly builds a balsa model, paper covers it, then one day sneaks out to fly it. He gets the motor started and off she goes—but something went haywire and it zooms into the ground. A wing or stab is broken or maybe it is wrecked pretty badly. In either case, nine times out of ten the plane is junked. Result—one potential modeler lost.

Okay what do we do about these "Lost Modelers?" We cannot do anything, but with better explanations in the kits we might save a few. Just think what a great help it would be if each kit marketed had a sign in it but that said "Get a model builder to help you build and fly this plane." So simple but possibly so effective. Also impress on the novice the fact that to build a model you take pieces of wood and glue them together and if you smash it up you pick up the pieces and glue them back together until the derned thing flies.

Well, Frank, I guess that about winds the rubber as far as I am concerned. Hope that it will do some good in helping someone get started and that they don't hit the pits that I did. Could tell you stories all day about some of the goofball things that I did getting started. The outstanding one was when I cranked my first motor backwards for six months.

If you ever make it to Oregon drop in and see us. We will saddle up a couple of horses and chase a free flight for a while.

REQUIREMENTS OF MODEL AERO PREMISES

Colin G. Campbell, —————————— Angus, Scotland

Club workshop promotes atmosphere of planned, progressive mod elling.

I see no use of club without a permanent headquarters. Difficulties, mainly finance and availability, come in the way, but once overcome, effort is worthwhile. Diehard home builders read on; you may be converted or at least pick up a hint or have a new idea.

CLUB PROPERTY: Always had a place of some kind though not at first our own. When had to flit, we realized plant was just as important as fabric; couldn't make models in an empty room. Therefore, even if without a place meantime, begin to set up a collection of requisites especially cupboards and such which can be used right away till opportunity of housing the outfit is made. For this reason, description is in following order.

STORES: Large lockable cabinet at least four feet long required to take club stock of balsa dope, wire, etc. Shops are shut when we build, so club makes fair profit as shops give discount to club stores. Final variety of stock is amazing.

STOVE: Not only for heat but disposes of inevitable junk and litter reaching enormous proportions whenever modellers gather together.

WINDOWS: Used for light, ventilation, expectoration and observation of weather and approaching personalities. We have ours in latest steel frames so as finance improves, we can take them out of wooden building and fit into new abestos-roofed brick structure which is out long-term plan.

MODEL BOX RACKS: Made of angle iron and combined with shelves, enable boxes to be used as cupboards when not traveling.

BENCHES AND SEATING: Once thought proper building benches essential. Now of opinion any reasonable second-hand table does with a true building board placed on top. This way, if several boards per member, they have more components assembling at once as boards may be stacked against wall when joints are setting or dope drying.

Avoid accepting old upholstered furniture which harbours dirt and deteriorates rapidly. Have piled up a setee and easy chair and burnt them. Remaining upholstered chairs will be used next time we are short of firewood. Even hardwood chairs get splintered and broken, especially during fights. We have had two long bench seats for years and they can be used for building extra large or long wings on. We located our benches below the north windows for constant light. Sun is blinding on south side and rays do damage to models left in their path all day. We understand this is correct workshop procedure in N. Hemisphere.

OTHER FURNITURE: Clock, properly framed aeroplane pictures, radio, blackboard, cupboards, tool boxes, book shelves and dust proof storage "ad lib", are all things come first to mind, brushes and shovels go without saying, while bicycle trailers are easily made and can be dismounted for storage, we have two. Drawings available on request.

FITTINGS: Should include self-shutting doors with floor catch for holding them open when required, rack of coat hooks, notice board and most important a large sign-board above the outside door.

TOOLS: Had second thoughts again. Thought club should provide all and attempted to provide tool service. This worked at first but shortages and breakages were frequent. Now everyone encouraged to have own basic set of tools. I even have own saws, lather, drill and portable vice. Unforseen advantage is vastly greater variety of equipment distributed among member ship and still used on a communal basis.

SAFETY: Follows on. Insured for fire, third party, window breaks and burglary, expensive in wooden premises, yet so essential.

FIRST AID IS IMPERATIVE: Here again, we have a complete kit for all but was a full time job supplying it. Now, bandages, lint and disinfectant kept while individuals encouraged to have own personal supply of finger strip for cuts and prop. raps. Electrocutions, burns, bloodshed inevitable but common sense can minimize risks. So far we have had no fatalities.

FIRE PREVENTION: If you have no water mains, see that there is a plentiful supply of full water and sand buckets and if possible acquire a fast pump. We always have a patrol round premises before locking up for the night.

THE BUILDING ITSELF is decided by availability, nevertheless if you have the cash and/or the choice, put up a place with brick or concrete walls lined with plaster-board, steel window frames asbestos roof and a concrete floor with duckboards. Our floor is a foot above ground level set on concrete pillars. Most of our place is an airforce hut from the Great War, but plenty creosote has preserved 40 year old timbers.

LAY-OUT: We have an entrance hall or porch, a workshop and a committee room leading off it. Porch gives space for coats, bicycles and electricity meter and gives double door air lock to return heat in winter. Workshop is biggest room, ours is too large at 30 x 20 ft., but we need the space for storage. Committee room good for morale as can be tidy and used for host of purposes. Ex: Film shows, episcope illustrations, meetings, interviewing, and as a library writing room. We use ours for all these, also for an aircraft recognition room as we are peculiar in having a large number of air spotters in our midst.

SITE: is also in hands of fate. We were lucky in finding a power distributor pole across the road, also drains available if we ever need them. Flying field is literally on the door steps and we burnt down scrub to make a car-park.

ECONOMY: Surprisingly, public gladly contribute not only cash but excellent flying literature is donated, and even waste timber to heat the place. It is because we are so well known as a Club in contrast to the lone hands. At our A.G.M. last year, we were amazed to find that income from public generosity and sale of soft drinks etc. exceeded monies subscribed by members. However, we would gladly pay double, if we had to and if you are starting in own new premises, pay till it hurts, you get no end of recreation from the investment. Remember to keep a tight grip of Club affairs or you are soon on the rocks! Don't forget that there is a lot more in organizing a club than simply building models and flying comps.

GENERAL NOTES: It is interesting to note what turns up as life of Club evolves. Ceiling of our old place was festooned with complete models on wires which looked fine till rubber bands perished out and planes crashed on floor. Deterioration from dust and exposure was alarming. So we keep these in the boxes. We have never overcome the dust problem. We used to think it came off the concrete floor but we have it as bad on present wood one. Surely it doesn't all come from balsa? We just spread wet sawdust on the floor and sweep up the lot—that is sometimes, of course!

We fixed the wood worms with a standard chemical solution, starved out the mice, and are now combating nesting sparrows by filling their homes with tin cans and stones. (We never counted on sparrows.)

Subtle breaches of discipline among members is a headache. Cars get parked right across the entrance, doors are left swinging open, cigs. ground into floor, electricity wasted and engines run indoors messing up the place with fuel. Display of crude pin-ups and scribbling on walls has to be discouraged or the Club becomes a rabble. A few well behaved steady regulars turn out more work than an undisciplined mob.

In East Scotland, sister clubs up and down the coast have their own places and there is exchange of ideas between clubs just as within their own memberhip. Needless to say we hold competitions.

Latest idea is on inter-town traveling shop-window exhibition with items from all local Clubs to interest potential members.

Hope to read or hear from others on general subject of Club Organization and thrust that even if what I have written does not start new Clubs it may help those already existent and encourage those who build at home to join forces with established concerns. They have nothing to lose and everything to gain.

MODEL BUILDERS ON THE FARM

Robert E. Stuts, ——— Shelby, Ill.

Have had your note for some time, and though I am doubtful I have anything to offer for your new book, I wuld like to pass along my version of why there are not more rural mdel builders.

I have lived in this part of southwestern Iowa for all of my 37 years (with the exception of some four years in the Navy), and I know of no other active rural or small-town modeler.

Occasionally you will catch an interested young star, but through the years they all seem to follow the same pattern of a couple of models and then leaving the hobby for something else.

Now, as you point out, "with all that space you have," this does seem strange, and yet I believe there are some definite reasons why this is the case.

Every year finds fewer and fewer people occupying our farms and small towns. This trend has been going on for a long time, and it shows no signs of letting up. Moreover, most of the people that move away are the young families and the new high school graduates. This not only drains our already small potential of model builders, but creates some large and unsolved problems for our schools, churches and community as a whole. No matter what the activity, young blood is required or it will not long survive.

Now, what about getting the juniors we do have started with model building? If this is a problem in the city (and it is, I gather), it is many times so out in the country. Most boys like to do things in a group, be it building airplanes, watching a picture show or drinking a coke. When you consider that model building does not seem to appeal to a really large percentage of people in the first place, you can see it is difficult to find a group of interested individuals among such a small number. Then too, there are all sorts of activities competing for attenion: 4-H, F.F.A. (Future Farmers of America), Boy Scouts (with a Summer Camp), Junior League baseball (parents understand these activities better also), and during the school year, many, many more.

Farming itself does a pretty good job of competing with modeling. The flying season in Iowa is also the farming season, and contrary to those reports of the farmers' life becoming easier, I find the hours getting longer and longer. After a 14-16 hour day, it takes a real model builder to sit down at a work bench. The idea of taking off a couple of hours to do some flying on a nice day, works about the same as telling the boss you have to test a new free flight, it might work once or twice, but soon you will be out of a job or out of a farm.

Well, Frank, I have tried to point out some of the conditions that active modeler and try to encourage and help only one that seems interested. My best hopes at the moment rest with the four juniors right here in my own home. Three of them are girls, however, so I don't know.

If you suffer from fatigue, here's why and what you can do about it

by Dr. RICHARD V. GANSLEN

TO DEFINE *fatigue* specifically is like trying to define love or explain how the brain works.

One way the physiologist may explain it is by the "machine analogy." He does this by referring to the heart as a carburetor, the brain as a distributor, the vessels as gas lines, the muscles as the pistons of a car, and so forth. But for purposes of understanding, this convenience is very misleading.

If a machine is supplied with adequate fuel, lubrication, and spark, it can continue to run practically indefinitely. A machine does not get tired, bored or tuckered out. To a machine, "time" has no meaningfulness.

The human body, in contrast, begins to deteriorate the moment we awake in the morning and degenerates throughout life. Thus, we see that time is of some consequence. We know nothing about many degenerative changes taking place in the body and very little about the rest of them. Therefore, medicine confines its publicity and information largely to diseases, their prevention or cure, surgical removal of parts and minor repairs. Fatigue is too often ignored, because it is so poorly understood and is often not susceptible to *dramatic exploitation*. Yet, I venture to say that it is the world's leading health problem today and the one health problem most amenable to corrective therapy.

There is an increasing body of scientific evidence that many so-called degenerative conditions, particularly circulatory conditions, are traceable to chronic fatigue conditions arising out of nervous tension and often emotional complexes. Fatigue sneaks up on a person. No dramatic rashes, high temperature, or swellings precede its onset. The dangerous type of chronic fatigue is usually slowly cumulative over a period of days, weeks or even months of time. Thus the person may not be aware of its presence until physical collapse results.

Three things we do know about fatigue and which should be kept in mind: (1) our working capacity always decreases, (2) there is a generalized feeling of weariness, (3) fatigue is seldom specific in nature. That is, you can seldom localize the fatigue to the back, an arm, or a leg — it is a general state involving broad and often undefinable sensations.

But, I must disillusion the reader, fatigue is not bad for you. Fatigue is a normal occurrence in any healthy individual! It is the only way the body has of warning us that we are endangering our vital life processes! Fatigue rings many alarm bells. Acuity of vision falls off; our reaction time is slowed; the heart may beat more rapidly; on changing posture, the blood pressure may drop much lower than normal; our movements lack precision and complicated coordinations baffle us. Under severe working conditions, our muscles may develop cramps and pains. All of these observable or measurable phenomena we can trace to the intangible thing we call fatigue.

Unfortunately, modern man has been educated in the home and by society in general to ignore fatigue. Such expressions as "can't you take it?" and "don't give up: you just think you're tired" are typical remarks of this nature. We have become so convinced that this kind of bravery is the epitome of perfection that we abuse our body . . . sometimes beyond repair. Not to admit fatigue is not a sign of bravery but a sign of downright stupidity!

Another misconception many people have is that drugs and stimulants such as cigarettes, coffee, tea, alcohol, and those in pills make the fatigue go away. They do no such thing. Drugs in all forms merely allay the sensations of fatigue and cause the individual to ignore his *built-in warning system!* The drugs make an individual think the fatigue symptoms are inconsequential.

We should learn to pay attention to these fatigue symptoms, for the subjective symptoms of fatigue are much more important to us than the physical evidence we can obtain by more scientific and objective procedures.

Fatigue as such is a feeling which correlates poorly with the many biochemical changes in the body. There is no known, or as yet detected, "fatigue toxin" which causes the fatigue feeling. The discrepancy between objective evidence and subjective feeling has never been or ever will be, easily explaind.

Take students as an example of this discrepancy between the feeling of fatigue and the actual physical condition. Students gripe more about mental fatigue than any single group, followed by business-managerial personnel, and clerical office workers. Implicit in all the remarks these people make is that *something* has been taken out of their brain by mental work which will go back in again when they go home or rest. The implication is that there must be some brain starvation, suggestive of a nutritional factor, or there is vague reference to a poison (the "toxin theory" in another suit of underwear).

Bored with work?

If the mentally fatigued person is left to his own devices, he will soon come to certain conclusions: First, that he is or has been doing some monotonous work and is bored. Second, that in the course of the work, he voluntarily tensed his muscles (very often observed in examinations). The work is too difficult or too simple and does not interest the subject. Thus, there is no challenge or tension build-up before and during the work.

The fatigue of students after an examination is not a true fatigue but a physio-psychological let-down when the tension creator, the examination, has been written. Because the tension before the examination may build up over a day or week's time, the student is unaware of the build-up and soon begins to associate the build-up state with normal feelings. Then when he really drops back to normal, physiologically speaking, he has pseudo-fatigue feelings.

This is quite different from the kind of "chronic fatigue" that may be due to nutritional factors. The most common nutritional factors which lead to generalized feelings of fatigue or lack of pep and vitality are: anemia, vitamin B deficiencies, circulatory weakness, undiscovered disease, improper food intake, diabetes, overweight, and premenstrual nutritional disorders. The quantity of food a person consumes is never satisfactory evidence of efficient nutrition.

Assuming that a nutritional factor is not the source of the fatigue we are attempting to counteract, we must concentrate our attention on the psychological factors which may be at fault. Such factors may be distractions in the form of noise or poor working conditions, kind of work, unclassified worries or anxiety, or undifferentiated fears and phobias.

Some writers have likened our everyday life today to living on a social elevator. We are bombarded with advertising to buy a better car, build a bigger house, travel farther, use a special toothpaste. The intensity of the advertising is so great that we feel compelled to do just as the man says. Yet, all of our personal possessions and wants may already be satisfactorily taken care of at the moment.

Repressed and oppressed?

In our social behavior, society dictates that we must always be tactful, gentlemanly, avoid displays of displeasure or anger — in other words, repress all primitive impulses to "let off steam." The necessity of constant repression combined with the inner psychological pressure to do things according to the book, when combined with our natural motivation drive to "get ahead," induce tremendous inner tension. We are oppressed with the fear of failure. We are not so much lacking in courage but afraid that we may fail to display courage when the crisis comes.

To satisfy our need for expression, we read stories of adventure or enjoy yelling at the football team on Saturday, the basketball referee in the winter time, and the baseball umpire in the summer. As our society becomes more complicated and our attention to getting ahead is more intense, we lose real opportunities for physical expression and trigger complex biochemical changes in the body which can be disastrous.

Studies of these complex "stress reactions" by Hans Selye and others have revealed that intense stress, as might be set up under battlefield conditions, (an office can also be a battlefield and of equal importance), can so alter the biochemistry of the human body that one week of intense stress (anxiety) may kill a man. This was confirmed by the Army Surgeon General's Office from studies of the bodies of soldiers removed from the battlefield during World War II. These men did not have a single mark of battle on their bodies. These young men who displayed all the symptoms of hardening of the arteries, heart degeneration, and circulatory disorders found in men 60-70 years of age had had one week of front-line duty!

The stresses we undergo in society are compounded by worry. Everyone has worries. This is because we are human, and because we feel responsible for the welfare of others. Worries are our natural heritage and are in themselves harmless. They are as necessary as fatigue. It is only when we worry about future intangibles, events or situations that may never happen, that is, when we have unrealistic worries, we trigger these complex emotional and biochemical changes in the body which eventually lead us to a state we describe as nervous exhaustion.

Tired of living?

Thus, many of us, overburdened with the demands of society and our anxieties, may find ourselves tired of living. Can we do something about it? Yes, indeed. As a physiologist, I think the first thing is to remove the possibility of a nutritional cause, such as undiscovered disease or excessive weight, for fatigue. If the cause is due to worry and emotional strain, there are several solutions.

Realize that worry is a controllable attitude. Sit down and think of all the things you have done, are doing and will do. Rate them as to relative importance — keep your worrying up to date and in its proper pigeon-hole. Stop worrying about the future and the past so that you can enjoy the present. One worry at a time at *the* time.

When tension builds up to a maximum, get up and move around — get some exercise. For some strange reason, the brain cannot seem to give two types of stimuli equal attention. When the brain is being bombarded with muscular-sensory stimuli, the inner spontaneous stimuli arising from worry or associated conditions are pushed into the background. Apparently, the muscular-sensory stimuli are more powerful in their influence on the brain, more basic, or more primitive in nature. With chronic worriers and hypertension, I have seen the blood pressure fall as much as 25 mm. of mercury when the individual took regular exercise. This was not because his worries disappeared but because they were sublimated on a day-to-day basis to other sources of brain stimulation, which had carry-over value.

In other words, physical exercise is a powerful antidote to fatigue, because you cannot worry and work hard with the muscles at the same time. No coach can make much out of a "worry wart," and every athletic team has one. The "worry wart" never learns to sublimate his worries and concentrate his attention on the task at hand. He may be impressed by the color of the jersey or shoes his opponents wear, the condition of the field, and the reputation of his adversary — he tightens up, he runs hard, but he fails!

The Mayo Foundation reported in 1942 that *chronic fatigue* is *seldom relieved* by *rest* and sleep but *usually relieved* by physical *exercise*. This is not to say sleep is unimportant. Sleep is indispensable to life in most humans, and as I suggested earlier too many persons will not "give up" when tired and go to bed.

Robert Benchley once wrote an essay on " How Not to Catch a Cold" in which he started out by saying, "Don't breathe through your mouth or nose." I would like to paraphrase this statement with reference to the need for sleep. If you are in need of sleep therapy, the first thing you have to do is "go to bed"!

From a recuperative viewpoint, the efficiency of sleep seems to depend on a number of factors: (1) the presence of regular sleeping habits, (2) the relative depth of unconsciousness reached during sleep, (3) getting a sufficient number of hours for recovery which varies with individuals from five to nine hours daily, and (4) prompt repayment of sleep debts. We do not know the true value of sleep, but we do know that relaxed sleep is the main goal.

Many fatigue symptoms reflect only boredom or monotony. Take interest in new things. If you must work — and most of us do — vary your routine, organize your duties. If you are going to work, don't worry; if you must worry, don't work. Concentrate. Stop goading yourself on.

Too old to change?

Think you are too old to change? Age is a state of mind as much as a condition of the body! If the usual degenerative changes that now attack the body could be adequately controlled, we would, without question, live to be 150 years old. People don't just deteriorate all over at once; they die on a geographical basis. Some people have $100 brains, $60 lungs, $90 hearts, $75 livers, and $10 kidneys. The breakdown comes in the weakest and cheapest link in the chain.

A normal, healthy, adult man or woman of middle age, who maintains high levels of physical fitness and avoids situations involving great emotional crisis, has every chance of leading an extremely active life, both mentally and physically. There is no reason to suspect that normal fatigue should be any more serious in its effects on a man of 50 who is in good health than a man of 20. It is true that the older person may recover from fatigue more slowly, but he recovers just as completely.

So start today and conquer that fatigue. Any activity is better than no activity!

ARKANSAS ALUMNUS

COMMENTS & BOOKS — Dick Ganslen, Fayetteville, Ark.

I would suggest that any person interested in building ornithopters and helicopters read the famous classic discussion on bird flight in J. Bell Pettigrew's "Animal Locomotion," D. Appleton and Company, 1874. They will be astonished at the wealth of information and theorizing on aeronautics contained therein and particularly for the practical suggestions on design involved in these discussions. Considering that Pettigrew did not have motion pictures as a source of information, the authenticity and accuracy of his analyses are nothing short of amazing. Any good library should have this book in its files.

I have recently completed the mathematical analyses of the aerodynamics of javelin flight (three wind tunnel tests). It has taken something like 8 months. Modern track and field javelins are more like gliders. Their pitching moments have been materially altered by adding surface area (up to 25%) near the nose and keeping the center of gravity as far back as possible. Thus many throws become illegal because the point never strikes the ground. In a turbulent stadium you can often see the nose get kicked up at the critical moment.

The term tangent ogive, ogival is becoming more common parlance with the advent of missiles since the noses have some similar shape. That is, the curve is neither part of a circle, nor is it a tangental line nor is it truly a parabolic line. A number of studies with missiles have been aimed at evaluating the differences in drag particularly with these various shapes. Some of our airfoils (leading 3rd) approximate this shape. I have used this term in connection with my javelin studies.

A great and little known book on drag would interest you. FLUID DYNAMIC DRAG by Sighard Hoerner, 148 Bustead Drive, Midland Park, New Jersey. He publishes this himself (Ex German Messerschmidt Engineer.) This tremendous volume of 600 plus pages is extensively illustrated and summarizes all the data on the World up until 1958 on drag in ships, cars, aeroplanes, missiles, etc. The book sells right at $15, but well worth it if you are putting the best in your library.

17 November 1960

I am sending you a list of the books I like which the advanced and even some of the newer builders may have occasion to refer to, especially if they are designing their own models. Good books on low speed aerodynamics, as far as I can determine, are non-existent. This, to me, is the real future of aviation. Helicopters just seem to have too many component parts on them which can go wrong and will therefore always be expensive to obtain and maintain! The German Storch slow flying model was a step in the right direction.

The books I choose to read are often as much general theorizing as they are technical or mathematical . . . but I think they help the builders develop better insight into the problems which arise later in his models.

AERODYNAMICS. Theodore von Karman. Cornell U. Press, 1954.

AIRPLANE AERODYNAMICS. Daniel Dommasch, Sydney S. Sherby and Thomas F. Connolly. Pitman Publishing Co. 2nd ed. 1957.

FLUID DYNAMIC DRAG. Sighard F. Hoerner, 148 Bustead Drive, Midland Park, New Jersey. Nothing to compare with this.

AERODYNAMICS OF THE AIRPLANE. Clark B. Millikan. John Wiley and Sons, 1941.

FUNDAMENTALS OF FLUID DYNAMICS FOR AIRCRAFT DESIGNERS. Max M. Munk. Roland Press, 1929.

THE HELICOPTER. Jacob Shapiro. London 1957 and New York 1960. Mac Millan Company. Good history of development.

ESSENTIALS OF FLUID DYNAMICS (German originally). Ludwig Prantle. Hafner Publication Co., N. Y., 1952.

INTRODUCTION TO AERONAUTICAL DYNAMICS. Manfred Rauscher. John Wiley and Sons. Very tough, for only most advanced engineer with extensive math background. Tremendous development of theory of flight.

LONG LETTERS —— Clifford K. McBaine, La Habra, Cal.

It was rather coincidental that I received the file card from you in regard to the 1957-58 Yearbook, since I just recently purchased same from one of our local model shops. It was also coincidental that I have just recently been studying the circular airflow theory in your 1951-52 and 1953 Yearbooks. I have been attempting to correlate this theory with that given on full-scale stability. So far I have found some correlation with writings of Dommasch, Sherby and Connolly in their book "Airplane Aerodynamics". At this time I have no conclusive remarks on this as I have only been studying the problem the last couple of weeks, but it appears you have struck upon the solution to the modellers dilemma. I hope that later I might be able to write to you about this theory.

I have been working since 1942 in aircraft engineering and am currently a Senior Weight Engineer in the Advanced Engineering Dept. of North American Aviation, Missile Division in near by Downey, Calif. Incidentally I work with one of the old timers from Michigan who you may know, Michael J. Roll (Model Aeronautics Encyclopedia, Vol. 2, page 70). Mike as you know is now quite a national figure in the field of photography. He gets quite a kick out of talking about the old days in modeling.

I have read the 1957-58 Yearbook from cover to cover and have the following comments. The observations of Jim Horton in calm air testing (p. 74-75) I can verify by performances I have had with my Wakefield. In regard to turbulators, a group of us here in the Los Angeles area in about 1950 formed a section of the L. S. A. R. A. and did some experimenting on wing turbulence and boundary layer separation. We mounted the test wing sections on an automobile and used a tubular probe and throat microphone set up to determine the separation position by sonics. We found the multi-spar design (a la Korda) the best of the wing constructions we tested for delaying separation. This was better than balsa covered leading edges and even turbulator rods etc. This type of construction was employed in a wing using a Gott. 227-G section replacing a monospar RAF-32 on the Toft ship with amazing improvements. This change I feel was responsible for the major win this ship made here in 1950.

As our studies and experiments progressed we came to the point where we were using airfoils with the maximum thickness at, or aft, of the 50% chord (Note successful Russian Wakefield p. 101, 1957-58 Yearbook). This was to delay separation. We got to the hand launched glider stage with these sections and took some to the 1950 Nationals. They performed great but we did not have them fully developed enough to carry away any hardware. It might be interesting to note that when we got to using these sections it occurred to us that they resembled our conventional wings wounted on backwards. As a result we mounted some rubber job wings on backwards and found to our surprise that they performed almost as good as if the wing had been on right. It was shortly after this that the group disbanded. All of my notes on these tests as well as some airfoil tests we made in the Santa Ana dirigible hanger and L. S. A. R. A. reports were given away or lost. I wish I had them now.

As a result of my work on missiles and space vehicles I have come across some possible ideas for model airplane propulsion. One of these is the use of silicon solar cells mounted on the upper surface of the model which would power one of the lightweight miniature electric motors now on the market. The electric motor in turn would drive the propeller. I am sure this would cause quite a sensation at a model meet as the model, if properly trimmed, would essentially fly from sunrise to sunset. There is one major draw-back to this idea and that is the cost of the solar cells. They run about $1000/watt. My first thought here would be to build an extremely light weight model, possibly an indoor job using just a couple of the cells (.02 amp @ 0.4 volt each) which run about $8 a piece. This idea is just in the thinking stage but if anything comes of it I will let you know.

There are numerous other ideas on propulsion for models that would be interesting. One might be a system using a steam turbine driven prop obtaining its energy from the sun by means of reflectors or Fresnel lens. Or how about a compressed air or solid propellant turbine driving a prop. There are many other possibilities for improvement in our model propulsion systems. This brings up one of my pet complaints with our AMA model classification. There is absolutely no catagory for the creative modeler with new basic ideas. I believe there should be an open unrestricted experimental event for these type of models in national competition. Incidentally I do have one extremely new approach to Wakefield which so far I do not believe conflicts with the rules or specifications. If my idea pan's out I will be able to get maximums with no effort at all. I will keep in touch with you on this one if it is successful.

Sorry to be so late in answering your letter but it caught me in the middle of preparing a paper for presentation at a national convention.

I was quite impressed by your convictions in the scientific aspects of aeromodelling and particular to the circular airflow. I would like to make some comments which probably will not contribute anything materially to the yearbook, but are thoughts which you might mull over and might be constructive in the general philosophical aspects of the scientific approach and modelling.

First let me say that I believe we both have a common trait of being curious and inquisitive as to what makes model airplanes fly and what can be done to assure successful flight from a scientific approach. I too have been searching for the answer to this dilemma since I first started building models many years ago. It has been only in the last few years that I felt that I was gradually seeing the problem in its full prospective.

I would like to point out that the scientific approach to the solution of a problem involves theory, hypothesis, analysis and experiment. The problem may be attacked starting with any one of these. The scientific approach is usually to start with a hypothesis, evolve a theory, check with analysis and prove by experiment. The majority of the model builders are experimentalists and feel they have no need to correlate their experimental findings to a scientific approach. There is some merit to this approach in accomplishing a successful flying model. Even the most critical scientific approach taken by scienitists and engineers must be finally submitted to experimental verification.

I personally am not an aerodynamist but have discussed this problem with aerodynamists who are also model airplane flyers, and have come to some rather definite conclusions.

To completely design a model airplane utilizing all of the scientific data available, one is first confronted with the startling fact that very little useful empirical data is available. This then means that we would have to set up a tremendous program of accumulating this data from actual tests and interpreting it for design use. To approach the problem from a purely theoretical point of view is for all practical purposes impractical. This is due to the fact that to apply theory to the actual model airplane design involves a multitude of design influencing parameters, many of which cannot be conveyed into the actual model construction due to the tolerances of construction and our accuracies of measurement. Several aerodynamists who also fly model airplanes concurr with me in this thinking. One of these mentioned that he was thinking of programming such a scientific approach on automatic (IBM) computing machines but did not think it practical due to the construction tolerances and unpredictable factors that would be involved. You see in real aircraft and missiles there is a tremendous manpower capability and money behind the solution of such design problems, but to do this for the model hobbiest would be rather impractical.

So far you may be getting the impression that I am agreeing with the person you mentioned who wrote you the discouraging letter. I am afraid that what this person fails to realize that not all modelers have the same approach to the hobby. It would be a sorry fate indeed for modeling if every one followed a cut and dried set of rules. No, I can't agree that the American modeler is lazy. However I do agree that many have no desire to be scientific and researching. There are too many laymen today who think that only theoretical work is synonymous with the scientific approach or method. The modeler who progresses by the trial and error method is using a very basic part of the scientific approach. History of great discoveries will bear out this statement.

I have thus concluded, at this time, that the experimental approach is to be preferred to the theoretical. As a matter of fact I discovered within your own year books the element of a tool that can be used in such an approach. The engineer or scientist when interpreting experimental or empirical data must resort to statistical methods in many instances. This is exactly what I have done with your year book data on successful models. To see what kind of interesting things would come out of such an approach I classified the various types of models, that is FAI, Wakefield, etc. and compared them on the basis of many of their characteristics, such as type of airfoil, aspect ratio, surface declage, thrust angle, wing loading etc. I listed 22 such parameters and found to my surprise that the winning models had many things in common. For example, in the case of the FAI winners of 1950, 51, to 1956 there was a majority that used Clark Y sections. There was also close agreement on aspect ratio and declage. There was almost complete agreement on trim, that is, right power, right glide. This all indicates that there are some rather strong points of design which seem to be consistant winners.

I then decided that the design approach would be to take these design characteristics and incorporate them into a single design which statistically should produce the optimum design incorporating the best features of all of them. Even in this approach one must still use a lot of judgment based on experience. I came up with such a design for a gas model and have completed the full scale drawings. Now such an approach does not assure one of a successful flying model due to the many points I have mentioned such as construction tolerances and the many complex dynamic characteristics of free flying models. It does, however, approach the optimum design based on available empirical data which is far better than theoretical data and formulas. I should like to mention here the approach Mr. C. H. Grant takes in his book. Mr. Grant has basically the right procedure of taking results from test or observed data and fitting it to mathematical expression, but unfortunately his data is poor as is some of his mathematical expressions. I feel that his formulations for the most part are theoretical or purely guesswork. His general approach, however, is basically sound.

I suppose one must really determine what objective he has in building and flying model airplanes before he can take one approach over another in designing his models. Some modellers have as their objective just the enjoyment of building and flying without all the fuss about theory etc.; others are competitive minded and want to have a high performance model at all costs, while others are contented with trying to find the why of model flying.

Far be it from me to discourage any of these modellers for in the final analysis we all have the same goal, that is the enjoyment of the hobby. Unfortunately there are too few modellers of the last type mentioned, and I agree with you that models might be different if more tried new ideas as applying their theories to experiment.

What is the answer to all this? Well first before we can design models scientifically we must first accomplish the following.

(1) Set up a complete program for accumulating empirical data based on a complete dynamics analysis of the problam. This would require an experienced aeronautical engineer with plenty of spare time which is usually not the case.
(2) Improve our construction techniques to eliminate significant tolerance effects. This is a more important problem than may be expected and still keep our models light in weight. This is a mandatory step if tests are to be consistant and mean anything.
(3) When item (2) is accomplished satisfactorily test models and components can be constructed and the tests carried out scientifically.
(4) Formulate the test data mathematically. This again would require the services of an aeronautical engineer.
(5) The writing of a design procedure based on the empirical and analytical data. This would be a monumental task.

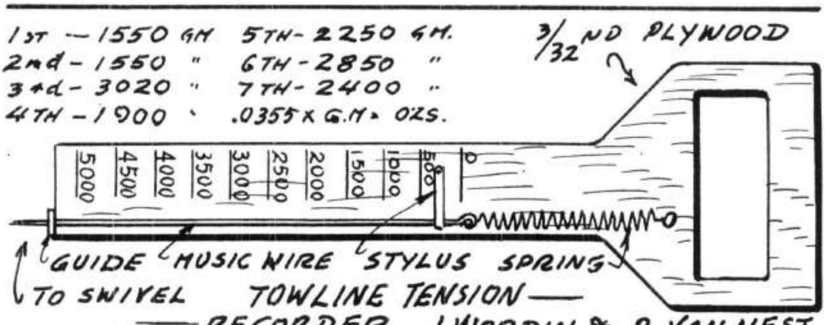
Incidentally, Frank, since you mentioned that you may use some of the material in my letters, I dug them out to see if anything had changed since I wrote them. In the letter to you dated August 25, 1959 the following corrections should be made if used:

I am now a Senior Research Engineer, specializing in fuel cell power system for the North American Aviation, Space and Information Division. The mention I made in regard to the solar cell powered airplane is now entirely feasible due to cost reduction in solar cells, and the advancements in small inexpensive electric motors. I think a small model of perhaps 30 in. span could be built completely powered by solar cells for about $10.

I think there are great possibilities in electric powered model airplanes, not just solar cells but with new improved batteries and the new fuel electric power unit. I am currently deeply engaged in the development of the fuel cell for space and other applications, and due to its high energy/weight ratio would be a natural for a model airplane. A model powered with a fuel cell coul fly for as long as 4 days continuously (100 hours) on one pound of fuel. This should really interest the duration boys!

ALLEN CHAPMAN November 27, 1960

Since last summer I've been meaning to mention to you that I spent a night with Roy Wriston in Kansas City. He was one of the kingpins in the old MAE in Tulsa back in the days of Bruce Luckett, Alvie Dague and a couple of others. (Bet you haven't seen those names in print for some time.) Roy remembered you well and wanted to be brought up to date on all the old hands-Simmers, Goldberg, the Goods and many others. We talked most of the night about models. In the old days such things as airfoils, prop block sizes and adjustments were deep dark secrets with those few who knew what it was all about. The night he laid the whole thing out, as he knew it, in the adjustment of a rubber powered model. Some things had never occurred to me. Ways of making a model speed up when in a down draft and slow up when it is in a thermal is the one thing that sticks in my mind. I came away from the visit fully convinced that the old boys knew the fundamentals of making a model fly and fly well.



TOWLINE TENSION ——— John Wordin, Burbank, Cal.

At the December 1960 C.I.A.M. meeting, Sweden pointed out that Nordic nylon towlines stretch 20%, and an increase in performance was gained by the lengthened line rather than by more legitimate means. Whether the stretch occurred while the model was on tow, or by means of an intentional stretch before each flight was not pointed out. In any case, a pull test rule was enacted to prevent future reoccurance of over-stretched lines. We investigated the effects the rule will have on lines and models. Several towlines were tested, to see if they could withstand the 5 kg. (11 lbs.) pull and not stretch. The results are as follows:

TOWLINE	REMARKS
10 lb. nylon monofiliment	This line broke after a stretch of 10 ft. under a load of 2 kg. (4.4#)
25 lb. nylon monofiliment	16 ft. stretch under 5 kg. load (11#)
30 lb. nylon monofiliment	14 ft. stretch under 5 kg. load (11#)
Shoemaker's linen thread	13 in. stretch under 5 kg. (Broke on third test pull.)
.012 dia. steel wire	Negligible stretch under 5 kg. load (Snags, snarls, electric conduct.)
.012 dia. steel wire with nylon coating (18 lb. test)	Negligible stretch 5 in. under 5 kg.

A recording spring scale was built to determine the load on the glider while on tow. The spring was calibrated by hanging gm. weights on it in 500 gm. increments (17½ oz.). Strips of paper were placed under stylus to record the deflection of the spring. A clean strip was used for each test. Seven flights were made under windy, thermal conditions. The maximum load sustained was 3020 gm. (7 lbs.), minimum load was 1550 gm. (3½ lbs.), and the average was 2217 gm. (4.95 lbs.)

From these preliminary tests it can be seen that a non-stretch type of towline will be a necessity.

It is hoped that CIAM will use this data to modify the rule to make it more useful and without loopholes. These tests show that a 5 kg. load will stretch a nylon line approximately 10%. Nylon has a permanent deformation when stretched, thus a nylon line can be stretched another 10% after the line is measured. Perhaps the line should be measured before and after each flight.

These field tests were with a "past prime" A/2, in windy conditions. No attempt was made to "baby" the tests, but towed "full-out" to simulate, as near as possible normal contest stress and srain.

(From the first issue of "The SCATTER". Published by the Southern California Aero Team. (SCAT) President: Bill Hartill. Purpose: to provide a publishing medium for free flight activities in U. S. and overseas. Available to non-members.)

CONTRIBUTIONS RECEIVED BUT NOT USED

Experiences of a come-late model builder who found the excitement of contest flying irresistible. By Cliff Webb, 32, a reporter with a family, England.

A thesis on the use of R/C models for meteorological probing of lower levels of atmosphere. Since the thesis was mainly on the circuitry (in a commercial kit design), it was thought best to leave it out as it seemed more suited for magazine presentation. By Richard Smith, Parks College.

A hard one to leave out, was a paper devoted to the study of Nordic A/2 airfoils. It is so well prepared that it won the 1960 Student Lecture Award sponsored by the Institute of Aeronautical Sciences. However, it is a collection of material on slow-speed airfoils, which most of the serious students have seen. Therefore, it would be a duplication in the Year Book. It would be a good addition to a glider book. By Willard E. Johnson, University of Texas.

THE HONORARY DRAFTSMEN

The following men should be commended for performance of service beyond the normal call of duty. They prepared, on a voluntary basis, the final drawings of models NOT their own!: Lee Renaud, Gerald D. Zeigenfuse, U. L. Corser (England), A. Rasmussen, Bruce Foster and Alan Chapman. And special thanks to Radoslav Cizek and Karl Denzin for their excellent plans.

CORRESPONDENTS

Some of my friends and correspondents who helped make this book so varied and complete by collecting material: Arnold Degen, Switzerland; Oscar Czepa, Austria; Rene Josien, France; Sandro Alinari, Italy; Urlan Wannop, Scotland; Peter Wanngard, Sweden; Sandy Pimenoff, Finland; Gunther Maibaum, Germany; Momoru Esaki, Japan; Barry Haisman, Canada; Bill Butler and Bob Risvold, United States.

Although there is no special section for the "Newcomers" in this book as there was in the 1957-58 edition, items marked (*) are meant for the "Newcomer and his Friends."

Cranfield 1958

WAKEFIELD CUP — INDIVIDUAL RESULTS

1. Baker, R. S. B. ...	Australia ...	162	158	180	180	180	**860**
2. Zurad, S. ...	Poland ...	180	116	180	180	168	**824**
3. Johansson, R. K. E.	Sweden ...	133	146	180	180	180	**819**
4. Scardicchio, V. ...	Italy ...	141	180	180	180	136	**817**
5. Benedek, G. ...	Hungary ...	180	180	180	173	100	**813**
6. Kennedy, D. R.	New Zealand	180	180	105	180	164	**809**
(*proxy* E. A. Barnacle)							
7. Fea, G.	Italy ...	161	180	140	132	180	**793**
8. **Lefever, G. J.** ...	**G. Britain**	180	98	180	180	126	**764**
9. Azor, L. ...	Hungary ...	180	131	180	98	174	**763**
10. Gordon, A. ...	Ireland ...	159	160	172	98	168	**757**
11. Niemstaedt, E. ...	Denmark ...	145	180	180	64	180	**749**
12. Popovic, K. ...	Yugoslavia ...	131	99	180	155	180	**745**
13. Heidmuller, B. ...	Germany ...	180	159	161	180	61	**741**
Widell, K. E. ...	Denmark ...	180	120	180	133	128	**741**
15. Kothe, H. H. ...	U.S.A. ...	180	76	180	166	133	**735**
16. Krizsma, G. ...	Hungary ...	180	180	180	35	153	**728**
Cizek, R. ...	Czechoslovakia	142	180	180	148	78	**728**
18. Dvorak, F. ...	Czechoslovakia	180	180	97	123	138	**718**
19. Tomkovic, M. ...	Yugoslavia ...	141	180	161	59	173	**714**
20. **Palmer, J.** ...	**G. Britain**	151	180	180	73	127	**711**
21. Perineau, M. ...	France ...	173	180	180	21	155	**709**
22. **Draper, R.** ...	**G. Britain**	180	128	180	116	100	**704**
23. Balasse, E. ...	Belgium ...	98	180	77	174	163	**692**
24. Tysklind, S. L. H.	Sweden ...	141	180	180	71	112	**684**
25. Carroll, J. J. ...	Ireland ...	125	177	159	56	166	**683**
26. Fresl, E. ...	Yugoslavia ...	135	158	180	75	125	**673**
27. Smolders, J. J. ...	Netherlands	101	180	119	180	86	**666**
28. Reich, G. A. ...	U.S.A. ...	150	161	100	180	73	**664**
29. Simerda, A. ...	Czechoslovakia	180	112	180	180	6	**658**
Hassny, K. ...	Poland ...	178	97	178	108	97	**658**
31. Licen, A. ...	Italy ...	180	180	77	103	109	**649**
32. Oswald, A. ...	Germany ...	105	163	33	180	164	**645**
Hertsch, K. ...	Germany ...	127	168	84	86	180	**645**
34. Mackenzie, D. R.	Canada ...	139	178	125	94	103	**639**
35. Grunbaum, P. ...	Austria ...	81	180	180	134	57	**632**
36. Malkin, J. ...	New Zealand	148	129	11	76	144	**614**
(*proxy* R. Baldwin)							
37. Bluhm, P. ...	France ...	180	106	94	117	105	**602**
38. Hamalainen, E.	Finland ...	162	59	104	167	105	**597**
39. Hakansson, E. ...	Sweden ...	97	180	84	52	180	**593**
40. Wong, R. ...	New Zealand	110	139	126	102	111	**589**
(*proxy* D. Greaves)							
41. Visser, P. W. ...	South Africa	180	85	60	82	180	**587**
(*proxy* R. C. Monks)							
42. Barnes, A. ...	New Zealand	88	129	125	145	92	**579**
(*proxy* D. Latter)							
43. Kekkonen, A. ...	Finland ...	180	180	74	134	—	**568**
Dormann, H. ...	Germany ...	180	135	72	69	112	**568**
45. Suter, H. ...	Switzerland	180	87	180	77	28	**552**
46. Cannizzo, S. J. ...	U.S.A. ...	180	84	116	85	74	**549**
47. Hegglin, E. ...	Switzerland	106	82	148	156	55	**547**
48. Balasse, Mme. O.	Belgium ...	180	116	180	65	—	**541**
Cheurlot, M. ...	France ...	101	153	55	175	57	**541**
50. Durhager, H. ...	Austria ...	84	180	91	83	97	**535**
51. Blomqwist, M. U.	Sweden ...	180	81	132	60	47	**500**
52. Frijyes, E. ...	Hungary ...	116	180	96	100	—	**492**
53. Chinchella, B. ...	Australia ...	163	49	84	79	106	**481**
(*proxy* A. King)							
54. Taberna, S. ...	Italy ...	63	180	46	85	105	**479**
55. Kossowski, A. ...	Poland ...	73	138	153	71	37	**472**
56. Miestoj, W. ...	Poland ...	109	113	90	73	82	**467**
57. Onishi, M. ...	Japan ...	83	129	52	63	135	**462**
(*proxy* P. Read)							
Takko, S. ...	Finland ...	65	72	118	142	65	**462**
59. Radovan, R. ...	Yugoslavia ...	80	92	12	180	90	**454**
60. Newquist, F. A.	U.S.A. ...	122	96	180	52	—	**450**
61. Hyvarinen, R. ...	Finland ...	180	87	89	83	1	**440**
62. Muzny, L. ...	Czechoslovakia	131	102	75	56	69	**433**
63. Doyle, M. ...	Ireland ...	100	47	180	95	3	**425**
64. Ranta, S. ...	Canada ...	62	78	70	78	136	**424**
65. Schnurer, H. ...	Austria ...	96	162	44	62	43	**407**
Gordon, R. C.	Canada ...	162	53	106	86	—	**407**
67. Etherington, W. C.	Canada ...	180	45	27	42	82	**376**
68. Overlaet, G. ...	Belgium ...	82	60	64	98	60	**364**
69. Nonaka, S. ...	Japan ...	62	113	—	68	86	**329**
(*proxy* F. H. Boxall)							
70. Czepa, O. ...	Austria ...	83	38	36	95	42	**294**
71. Guilloteau, R. ...	France ...	—	86	100	36	66	**288**
72. **O'Donnell, J.** ...	**G. Britain**	150	8	78	—	—	**236**
73. Meyer, J. ...	Switzerland	85	80	—	—	—	**165**

ALPHONSE PENAUD CUP — TEAM RESULTS

1. Hungary ...	2,304
2. Italy	2,259
3. Great Britain ...	2,179
4. Yugoslavia ...	2,132
5. Czechoslovakia	2,104
6. Sweden ...	2,096
7. Germany ...	2,031
8. New Zealand ...	2,012
9. Poland	1,954
10. U.S.A. ...	1,948
11. Ireland ...	1,865
12. France	1,852
13. Finland ...	1,627
14. Belgium ...	1,597
15. Austria... ...	1,574
16. Denmark ...	1,490
17. Canada ...	1,470
18. Australia ...	1,341
19. Switzerland ...	1,264
20. Japan	791
21. Netherlands ...	666
22. South Africa ...	587

VICTOR TATIN CUP — INDIVIDUAL RESULTS

1. Frigyes, E. ...	Hungary ...	180	180	170	180	180	**890**
2. Hajek, V. ...	Czechoslovakia	180	164	180	180	180	**884**
3. Baker, R. S. B. ...	Australia ...	174	150	180	180	180	**864**
4. Stabler, R. ...	Germany ...	133	180	180	180	180	**853**
5. Ordogh, L. ...	Hungary ...	126	180	180	180	180	**846**
6. Bily, J.	Czechoslovakia	180	145	157	180	180	**842**
7. Hormann, G. ...	Austria ...	147	157	177	180	180	**841**
8. **Glynn, K.** ...	**Great Britain**	125	180	172	180	180	**837**
Simonetta, A. ...	Italy ...	180	117	180	180	180	**837**
10. Tuck, H.	Canada ...	180	162	154	180	160	**836**
11. Dean, W. M. ...	U.S.A. ...	180	180	180	180	113	**833**
(*proxy* C. R. Wheeley)							
12. Hagel, R. E. ...	Sweden ...	180	141	174	157	180	**832**
13. Thompson, J. D.	Ireland ...	169	170	180	132	180	**831**
14. Meczner, A. ...	Hungary ...	180	118	172	180	180	**830**
15. Niemi, O. ...	Finland ...	180	180	180	180	105	**825**
16. Pelczarski, T. ...	Poland ...	108	180	170	180	180	**818**
17. Pecorari, V. ...	Italy ...	180	180	180	97	180	**817**
18. Piesk, L.	Germany ...	180	180	135	180	141	**816**
19. Suzuki, H. ...	Japan ...	164	180	121	169	180	**814**
(*proxy* J. H. Manville)							
20. **Collinson, A.** ...	**Great Britain**	180	180	171	91	180	**802**
21. **Jays, V.**	**Great Britain**	180	180	173	100	162	**795**
22. Schier, W. ...	Poland ...	175	127	131	180	180	**793**
23. Friis, H. O. ...	Sweden ...	180	139	161	180	132	**792**
24. Vujic, M.	Yugoslavia ...	180	180	132	180	107	**779**
25. Patterson, J. A. ...	U.S.A. ...	116	180	144	180	155	**775**
26. Malina, Z. ...	Czechoslovakia	180	131	180	103	180	**774**
27. Schenker, R. ...	Switzerland	177	68	180	180	161	**766**
28. Castegnaro, G. ...	Italy ...	180	180	140	125	139	**764**
29. Reis, F.	Austria ...	180	121	94	180	180	**755**
30. Relander, J. ...	Finland ...	121	168	104	180	180	**753**
31. Akesson, J. O. ...	Sweden ...	90	180	180	113	180	**743**
32. Woods, D. ...	Ireland ...	180	180	60	151	171	**742**
33. Cerny, R. ...	Czechoslovakia	180	30	180	180	167	**737**
34. Raulio, H. ...	Finland ...	113	74	180	180	180	**727**
35. Fontaine, J. ...	France ...	180	180	89	103	171	**723**
36. Asano, T. ...	Japan ...	180	68	171	119	180	**718**
37. Fresl, E.	Yugoslavia	100	138	160	180	139	**717**
38. Conover, L. H. ...	U.S.A. ...	—	180	158	177	180	**695**
39. Scepanovic, A. ...	Yugoslavia	52	180	144	180	130	**686**
40. Resin, F. ...	Switzerland	180	112	115	150	125	**682**
41. Morelli, A. ...	Ireland ...	180	—	137	168	180	**665**
42. Gasko, M. ...	Hungary ...	151	123	150	119	120	**663**
43. Novta, V. ...	Yugoslavia ...	122	147	88	106	180	**643**
44. Ginalski, K. ...	Poland ...	180	68	92	180	121	**641**
45. Beck, H.	Germany ...	141	117	115	180	82	**635**
46. Bulukin, B. W. ...	Norway ...	152	180	62	110	120	**624**
47. Elder, S.	Ireland ...	168	133	111	137	72	**621**
48. Czinczel, W. ...	Germany ...	180	96	64	180	84	**604**
49. Christensen, N. C.	Denmark ...	164	67	93	94	180	**598**
50. Grappi, R. ...	Switzerland	108	110	180	17	180	**595**
51. Karski, S.	Poland ...	180	76	147	180	—	**583**
52. Piazzoli, C. ...	Italy ...	137	73	151	180	27	**568**
53. Fahnrich, W. ...	Austria ...	53	178	60	180	94	**565**
54. Czepa, K. ...	Austria ...	82	74	167	80	139	**542**
55. Parry, G. E. ...	Canada ...	140	32	180	180	—	**532**
56. **Bickerstaffe, J.**	**Great Britain**	180	118	180	—	—	**478**
57. Perkins, C. C. Jnr.	U.S.A. ...	—	115	166	83	109	**473**
58. Schiltknecht, J.-P.	Switzerland	83	180	32	108	—	**403**
59. Kristensen, F. D.	Denmark ...	66	75	47	135	75	**398**
60. Skard, A. ...	Norway ...	116	26	109	15	111	**377**
61. Etherington, W. C.	Canada ...	148	180	—	—	—	**328**
62. Balasse, E. ...	Belgium ...	70	37	52	—	—	**159**
63. Verhelst, A. ...	Belgium ...	113	—	—	—	—	**113**
64. Mackenzie, D. R.	Canada ...	93	17	—	—	—	**110**
65. Karlsson, G. ...	Sweden ...	50	—	—	—	—	**50**

FRANJO KLUZ TROPHY — TEAM RESULTS

1. Hungary	2,556
2. Czecho	2,500
3. Great Britain	2,434
4. Italy ...	2,418
5. Sweden	2,367
6. Finland	2,305
7. Germany	2,304
8. U.S.A. ...	2,303
9. Poland ...	2,252
10. Ireland	2,238
11. Yugoslavia	2,182
12. Austria...	2,161
13. Switzerland	2,043
14. Canada	1,696
15. Japan ...	1,532
16. Norway	1,001
17. Denmark	996
18. Australia	864
19. France ...	723
20. Belgium	272

BRIENNE le CHATEAU 1959 FAI RUBBER

WAKEFIELD TROPHY (Individual)

1. Dvorak, F.	Czechoslovakia	180	180	180	180	180	900 +285
2. Hatschek, R.	U.S.A.	180	180	180	180	180	900 +256
3. McGillivray, J.	Canada	180	180	180	180	180	900 +245
4. Zurad, S.	Poland	180	180	180	180	180	900 +230
5. Zapachny, V.	U.S.S.R.	180	180	180	180	180	900 +198
6. Mackenzie, D.	Canada	180	180	180	180	180	900 +184
7. Tysklind, L.	Sweden	180	180	180	180	180	900 +121
8. Bilgri, J.	U.S.A.	180	180	180	180	163	883
9. Cardoro Sueno, A.	Portugal	155	180	180	180	180	875
10. Kothe, H.	U.S.A.	163	170	180	180	180	873
11. Petiot, J.	France	145	180	180	180	180	865
12. Hyvarinen, R.	Finland	180	180	180	147	160	847
13. Fea, G.	Italy	180	180	123	180	180	843
14. Meyer, J.	Switzerland	180	180	112	180	180	832
15. Schilling, H.	Germany	137	160	180	180	174	831
16. MONKS, R.	Great Britain	180	139	142	180	180	821
17. King, A.	Australia	180	180	180	180	97	817
18. Hamalainen, E.	Finland	164	180	180	110	180	814
19. Van Mellaert, J.	Belgium	143	180	130	180	180	813
20. Krizsma, G.	Hungary	180	180	180	130	138	808
21. Pla Ysas, M.	Spain	180	180	173	143	128	804
22. ROBERTS, G. L.	Great Britain	180	180	108	129	180	797
23. NORTH, R. J.	Great Britain	180	147	180	127	156	790
24. Kossowski, A.	Poland	180	180	180	88	159	787
25. Fullarton, J. (P)	Australia	180	180	83	180	158	781
26. Rupp, G.	Germany	91	180	180	148	180	779
27. Suter, H.	Switzerland	180	180	180	78	159	777
28. Benedek, G.	Hungary	136	180	180	97	180	773
29. Cooke, W. (P)	New Zealand	81	151	180	180	180	772
30. Sugden, D.	Canada	180	77	180	180	154	771
31. Taberna, S.	Italy	180	109	180	180	118	767
32. Johansson, R.	Sweden	56	180	178	180	170	764
33. Smolders, J.	Holland	180	138	76	180	180	754
34. Scardicchio, V.	Italy	180	76	180	180	132	748
35. Nimptsch, W.	Germany	150	180	105	180	132	747
36. Aalto, P.	Finland	108	180	120	180	157	745
37. Ivannikov, I.	U.S.S.R.	123	180	180	126	121	730
38. Da Fonseca e Sousa, M.	Portugal	96	118	180	180	140	714
39. Muzny, L.	Czechoslovakia	107	180	138	105	180	710
40. Carroll, J. (P)	Ireland	180	112	111	180	127	710
41. Mikkelsen, H.	Denmark	180	180	64	180	95	699
42. Kennedy, D. (P)	New Zealand	180	180	67	119	150	696
43. Terrazzoni, D.	France	109	110	140	180	151	690
44. Monturo Cavaco, M.	Portugal	78	180	106	178	144	686
45. Chabert, J.	France	105	123	106	169	180	683
46. Azor, L.	Hungary	113	180	167	111	105	676
47. Lust, P.	Holland	180	93	103	180	103	659
48. Van Mellaert, L.	Belgium	142	180	120	107	108	657
49. Matveev, V.	U.S.S.R.	103	72	131	165	180	651
50. Kaufmann, B.	Switzerland	69	180	60	154	180	643
51. Baker, B.	Australia	99	152	90	139	159	639
52. Qvarnstrom, A.	Sweden	180	71	78	152	156	637
53. Balasse, E.	Belgium	138	80	134	132	142	626
54. Cizek, R.	Czechoslovakia	118	147	110	96	139	610
55. Reuser, B.	Holland	—	180	180	137	101	598
56. Merseburger Baldy, C.	Spain	137	144	89	75	102	547
57. Christensen, N.	Denmark	121	118	133	69	85	526
58. Clarke, A. (P)	New Zealand	65	56	180	109	113	523
59. Kosihski, J.	Poland	112	97	180	—	129	518
60. Nienstaedt, E.	Denmark	107	86	27	61	119	400
61. Navarro, G.	Morocco	12	39	48	44	—	143

PENAUD CUP (Team)

1.	U.S.A.	2,656
2.	Canada	2,571
3.	Great Britain	2,408
4.	Finland	2,406
5.	Italy	2,358
6.	Germany	2,357
7.	Sweden	2,301
8.	U.S.S.R.	2,281
9.	Portugal	2,275
10.	Hungary	2,257
11.	Switzerland	2,252
12.	France	2,238
13.	Australia	2,237
14.	Czechoslovakia	2,220
15.	Poland	2,205
16.	Belgium	2,096
17.	Holland	2,011
18.	New Zealand	1,991
19.	Denmark	1,625
20.	Spain	1,351
21.	Ireland	710
22.	Morocco	143

BOURG-LEOPOLD 1959 FAI NORDIC

A/2 INDIVIDUAL RESULTS

1. Ritz, G.	U.S.A.	180	180	180	180	180	900 +401
2. Sokolov, J.	U.S.S.R.	180	180	180	180	180	900 +329
3. Habib, H. M.	Pakistan	180	180	180	180	180	900 +86
4. Tahkapaa, M.	Finland	180	180	180	180	180	900 +71
5. Kekkonen, I.	Finland	180	180	180	180	180	900 —
6. Buiter, A.	Holland	180	180	164	160	180	864
7. Janssen, R.	Sweden	180	180	180	180	140	860
8. Bulgheroni, G.	Italy	180	180	126	180	176	842
9. Wagner, H.	Austria	110	180	180	180	180	830
10. Ella, P.	Finland	180	180	101	180	180	821
11. Nilsson, G.	Sweden	180	180	92	180	180	812
12. Babic, S.	Yugoslavia	180	180	180	180	90	810
13. MONKS, R.	Great Britain	180	108	180	180	160	808
14. Michalek, J.	Czechoslovakia	180	106	180	180	159	805
15. Taverna, G.	Italy	97	180	161	180	180	798
16. Hansen, B.	Denmark	180	75	180	180	180	795
17. Thomson, W.	Canada	180	180	180	180	70	790
18. Kunz, H.	Germany	145	180	180	96	180	781
19. Kool, P.	Holland	180	108	180	180	127	775
20. Horyna, V.	Czechoslovakia	180	164	180	180	69	773
21. Schnurer, H.	Austria	85	180	141	180	180	766
22. Petit, A.	Belgium	180	180	87	180	135	762
23. Kalen, G.	Sweden	180	41	180	180	180	761
24. Frygyes, E.	Hungary	180	77	180	125	180	742
25. Krook, R.	Holland	180	145	68	180	166	739
26. Radoczi, N.	Hungary	133	164	180	180	79	736
27. Hansen, H.	Denmark	180	180	123	71	180	734
28. Soave, P.	Italy	109	180	100	180	160	729
29. Marchand, P.	Belgium	180	82	105	180	180	727
30. Wiehle, B.	U.S.A.	154	180	102	105	180	721
31. Wilson, R.	New Zealand	180	180	180	180	—	720
32. Feldleit, R.	Israel	87	180	180	180	88	715
33. BLACK, E.	Great Britain	180	147	77	125	180	711
34. Vuletic, M.	Yugoslavia	180	180	55	180	115	710
35. Braud, H.	France	180	71	180	86	180	697
36. Scheidler, —.	Austria	87	180	180	62	180	689
37. Prohacka, O.	Czechoslovakia	180	112	180	50	164	686
38. Averyanov, A.	U.S.S.R.	180	180	87	55	180	682
39. Roser, O.	Hungary	159	180	66	180	92	677
40. Sifleet, B.	U.S.A.	60	77	180	180	180	677
41. Hauenstein, W.	Switzerland	62	63	180	180	171	676
42. Dreher, V.	Yugoslavia	85	179	103	180	128	675
43. Habib, R. M.	Pakistan	180	—	180	180	121	661
44. Simonov, W.	U.S.S.R.	96	55	147	180	180	650
45. Caron, C.	France	68	49	180	180	180	657
46. Hansen, A.	Denmark	180	—	180	179	116	655
47. Tuck, H.	Canada	67	180	94	125	177	643
48. Habib, H. D.	Pakistan	31	66	180	180	180	637
49. SHIRT, E.	Great Britain	96	86	180	85	180	627
50. Scheu, G.	Switzerland	141	180	—	180	97	598
51. Foster, C.	Canada	171	70	50	142	161	594
52. Kiflawi, J.	Israel	79	51	98	180	180	588
53. Sheppard, J.	New Zealand	25	148	130	180	103	586
54. Beutler, W.	Switzerland	96	56	55	180	180	567
55. Benkert, L.	Germany	180	53	72	64	180	549
56. Ritchie, I.	New Zealand	180	50	85	166	61	542
57. Zimmerman, G.	Belgium	55	180	43	180	79	537
58. Magniette, R.	France	83	104	149	81	113	530
59. Kadmon, N.	Israel	—	180	36	180	102	498
60. Kalthoff, P.	Germany	140	27	71	175	77	490
Maximums		(33	(29)	(30)	(43)	(30)	

OFFICIAL TEAM RESULTS

1.	Finland	(14) 2,621
2.	Sweden	(12) 2,433
3.	Holland	(8) 2,378
4.	Italy	(8) 2,369
5.	U.S.A.	(10) 2,298
6.	Austria	(10) 2,285
7.	Czechoslovakia	(8) 2,264
8.	U.S.S.R.	(10) 2,240
9.	Pakistan	(11) 2,198
10.	Yugoslavia	(8) 2,195
11.	Denmark	(10) 2,184
12.	Hungary	(7) 2,155
13.	GREAT BRITAIN	(7) 2,146
14.	Canada	(5) 2,027
15.	Belgium	(8) 2,026
16.	France	(6) 1,884
17.	New Zealand	(6) 1,848
18.	Switzerland	(6) 1,841
19.	Germany	(5) 1,820
20.	Israel	(7) 1,801

Number of maximum flights per team in brackets.

CRANFIELD

1960 FAI POWER

VICTOR TATIN CUP—INDIVIDUAL PLACINGS

1.	Pimenoff, S.	Finland	180	180	180	180	180	900+12 max's
	Guerra, S.	Italy	180	180	180	180	180	900+12 max's
	Sheppard, J.	New Zealand	180	180	180	180	180	900+12 max's
	Hagel, R. E.	Sweden	180	180	180	180	180	900+12 max's
	Conover, L. H.	U.S.A.	180	180	180	180	180	900+12 max's
6.	Sulisz, Z.	Poland	180	180	180	180	180	900+ 8 max's
7.	Posner, D. S.	Great Britain	180	180	180	180	180	900+ 4 max's+156
8.	Frigyes, E.	Hungary	180	180	180	180	180	900+ 3 max's+129
9.	Bulukin, B. W.	Norway	180	180	180	180	180	900+ 2 max's+147
10.	Fontaine, J.	France	180	180	180	180	180	900+ 1 max +177
11.	Johannessen, T.	Norway	180	180	180	180	180	900+ 1 max
12.	Miller, E. W.	U.S.A.	180	180	180	180	180	900+86 sec.
13.	Winn, J. (Jays, V.)	New Zealand	180	180	180	180	180	900+ 8 sec.
14.	Grappi, R.	Switzerland	180	176	180	180	180	896
15.	Giudici, G.	France	173	180	180	180	180	893
16.	Beck, H.	Germany	180	180	173	177	180	890
17.	Czerny, J.	Czechoslovakia	168	180	180	180	180	888
18.	Meczner, A.	Hungary	180	167	180	180	180	887
19.	Bousfield, K.	Canada	180	180	175	171	180	886
20.	Simon, G.	Hungary	180	180	180	180	165	885
21.	Scott, J.	Canada	180	180	180	180	164	884
22.	Czepa, O.	Austria	180	180	180	162	180	882
23.	Schilling, H. G.	Germany	180	180	161	180	180	881
24.	Green, K. W. (West, J.)	Australia	160	180	180	180	180	880
	Padovano, E.	Italy	180	180	165	175	180	880
26.	Hagberg, M.	Sweden	180	180	180	157	180	877
27.	Thompson, J.	Ireland	178	180	180	180	152	870
28.	Eng, E.	Switzerland	157	180	180	160	180	857
	Falecki, J.	Poland	167	179	170	161	180	857
30.	Blanchard, W. S.	U.S.A.	134	180	180	180	180	854
31.	Jokinen, I.	Finland	180	180	180	180	127	847
	Simeons, J. R.	Great Britain	164	180	180	143	180	847
33.	Groves, K.	Canada	126	180	180	180	180	846
34.	Czerny, R.	Czechoslovakia	180	180	180	180	125	845
	Hajek, V.	Czechoslovakia	140	180	180	165	180	845
36.	Guilloteau, R.	France	180	180	180	121	180	841
37.	Hörmann, G.	Austria	180	180	110	180	180	830
38.	Ono, H. (Spurr, A. W.)	Japan	180	180	180	180	105	825
39.	Morelli, A. (Woodsworth, G.)	Ireland	171	180	180	180	112	823
40.	Schenker, R.	Switzerland	180	120	180	180	148	808
41.	Rizzo, S.	Italy	178	180	180	106	160	804
42.	O'Sullivan, J.	Ireland	134	180	180	122	180	796
43.	Eriksson, M.	Sweden	146	139	128	180	180	773
44.	Dalseg, G.	Norway	114	180	180	119	173	766
45.	Baker, R. S. B.	Australia	125	163	180	156	131	755
46.	Suzuki, H. (Smith, T. W.)	Japan	0	180	180	180	180	720
47.	Young, A. G.	Great Britain	169	174	179	116	76	714
48.	Hewitson, N. (Glynn, K. J.)	New Zealand	52	180	180	180	111	703
49.	Sorensen, H. S.	Denmark	127	139	180	0	180	626
50.	Schwend, T.	Germany	0	152	180	167	92	591
51.	Gerstrom, C.	Denmark	92	172	72	120	118	574
52.	Niemi, O.	Finland	5	0	115	180	180	480
53.	Niedermayr, F.	Austria	75	22	61	102	146	406
54.	Christensen, N. C.	Denmark	59	130	101	0	0	290

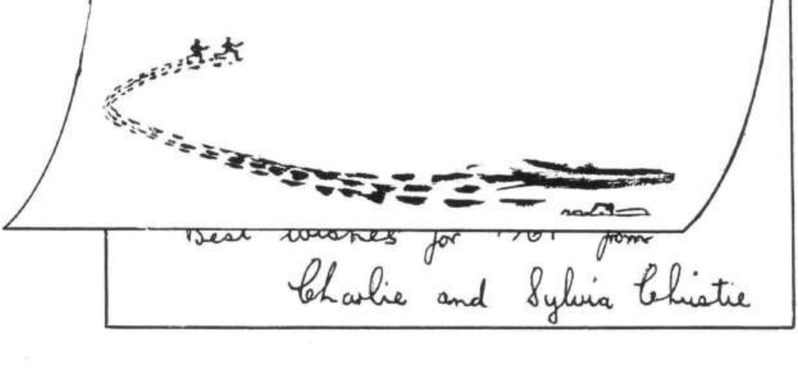
Proxy fliers in parenthesis.

FRANJO KLUZ TROPHY—TEAM AWARD

1. Hungary	2,672	10. New Zealand	2,501
2. U.S.A.	2,654	11. Ireland	2,489
3. France	2,634	12. Great Britain	2,461
4. Canada	2,616	13. Germany	2,362
5. Italy	2,584	14. Finland	2,227
6. Czechoslovakia	2,578	15. Austria	2,118
7. Norway	2,566	16. Poland	1,757
8. Switzerland	2,561	17. Australia	1,635
9. Sweden	2,550	18. Japan	1,545
19. Denmark	1,490		

ZURICH 1960 FAI R C

	NAME	1st Flt.	2nd Flt.	TOTAL
1.	Kazmirski, U.S.A.	6,275	6,183	12,458
2.	Samann, Germany	5,611	5,650	11,261
3.	Stegmaier, Germany	5,233	5,940	11,173
4.	Van den Bergh, Great Britain	5,082	5,932	11,014
5.	Olsen, Great Britain	5,317	5,327	10,644
6.	Gobeaux, Belgium	4,977	5,021	9,998
7.	De Bolt, U.S.A.	2,702	5,668	8,370
8.	Uwins, Great Britain	1,678	5,394	7,072
9.	Klauser, Switzerland	2,651	3,951	6,602
10.	Dunham, U.S.A.	4,923	385	5,308
11.	Bickel, Switzerland	610	3,844	4,454
12.	De Dobbeler, Belgium	820	1,869	2,689
13.	Maritz, Switzerland	1,151	425	1,576
14.	Hajic, Czechoslovakia	800	631	1,431
15.	Havlin, Czechoslovakia	754	336	1,090
16.	Dilot, Sweden	105	850	955
17.	Gast, Germany	632	0	632
18.	Michalovic, Czechoslovakia	514	0	514
19.	Corghi, Italy	425	0	425
20.	Eliasson, Sweden	95	0	95



WAKEFIELD. Total Surface Area (Projected): 17 to 19 sq. dm. (263.5 to 294.5 sq. in.)—Min. Total Wt.: 230 gms. (8.113 ozs.) Max. Motor Wt.: 50 gm. (1.76 ozs.)

NORDIC A-2. Total Surface Area (Projected): 32 to 34 sq. dm. (495.9 to 526.9 sq. in.) Min. Total Wt. 410 grams (14.46 ozs.)

FAI POWER. Total Min. Wt. in grams: 300 x cm. of engine. (173.4 ozs. per cu. in.) Max Displace. 2.5 cm. (0.1525 cu. in.) Max. Engine Run: 10 sec.—Min. Surf. Load: 20 gm per sq. dm. of total area. (6.55 ozs. per sq. ft.)

CONTRIBUTIONS: New contributions are always welcomed. If you are in doubt about being a potential contributor, just look over this book and other Year Books. If you have a new approach or answers to problems presented in them, you have a contribution. A development of a design always makes interesting "true confession" reading. If in doubt, write!

The Plan-Kit idea worked out fine for this edition. Most of the plans received were drawn to SCALE—only required ink tracing. Kit consists of graph paper to fit your model, instructions and mailing tube to assure flat drawing. To determine which scale you need, check the plans in this book which fit your case. Somewhere on the drawing you will find a box with a fraction in it. This fraction represents the scale to which the original book drawing was prepared. It is not essential to have the views as shown. They can be rearranged during inking. The BIG HELP is the SCALE DRAWING.

Written contributions should be as concise as possible. The ideal size is a page of written material and a page of plans or drawings. They face each other. About 1½ pages of double space typing equals a book page.

Remember, you are the only one who knows your model or experiments, and we can only print or draw what you disclose.

CONVERSION TABLES

2.54 x In. = Cm.	16.4 x Cu. In. = Cu. Cm.	.68 x Ft. Sec. = M.P.H.
.394 x Cm. = In.	.06 x Cu. Cm. = Cu. In.	1.467 x M.P.H. = Ft. Sec.
6.45 x Sq. In. = Sq. Cm.	28.35 x Ozs. = Grams	.011 x Ft. Min. = M.P.H.
.155 x Sq. Cm. = Sq. In.	.0355 x Grams = Ozs.	88 x M.P.H. = Ft. Min.

ELECTRIC F F

R C ARTICLES

POWER MODEL ARTICLES

FAI POWER

R C MODELS

GROUND EFFECT

.049 POWER

.09 PLUS

R C GLIDERS

R C DELTAS

R C CANARD

.02 POWER

R.O.W. POWER

POWER BIPLANE

CANARD POWER

POWER WING

MODEL NOTES

INDOOR MODEL CONTRIBUTIONS

INDOOR MODELS

H L GLIDERS

AUTOGIRO

HELICOPTER

ORNITHOPTER

PAA LOAD

PAA CARGO

PAA JETEX

CANARD JETEX

CONTROL LINE

PAA DESIGN ARTICLES

CONTROL LINE ARTICLES

EXPERIMENTAL ARTICLES

ARTICLES OF INTEREST

GIMMICKS

SENIORS HELP JUNIORS

Dear Friends and Readers:

This book was begun December, 1959 and finished in May, 1961. It got out of hand; it just grew and grew.

The Year Book was originated in 1933 to fill a void in the art of Free Flight by publishing plans and whatever we knew about model aerodynamics. Other publications featured Free Flight occasionally. However, this situation has changed. We have now an embarrassing wealth of Free Flight material in all model publications, here and abroad, as well as in annuals and club newsletters. This abundance of information seems to nullify the need for the Year Books. (You should remember that the Year Books are a success only from an "artistic" viewpoint.) Yet, for some reason, many of you still look forward to their publication.

It could be that the main attraction of the Year Books is the sheer quantity of plans published in them. They do make a handy and economical reference of neatly-drawn plans. But this could just as well be done by pasting published plans in a scrap book. By combining plans in one book for a particular period of time, I am not doing anything original and useful that anybody else could not do. Frankly, it is no fun re-drawing published plans. (Especially since one of my eyes is getting a bit short-sighted.) Heretofore, I felt obliged to do so to have a record of outstanding plans. But with the magazines doing the job, I no longer feel this obligation. There is just so much spare time available, and I don't feel I should spend it drawing plans already published elsewhere.

Anyone reading the above would think that this book is filled with reprints. The fact is that reprints constitute a small percentage. Still, they are reprints, and this makes me uncomfortable. Very likely because the Year Books used to feature original plans almost 100%. I would like to go back to this percentage for the following reason:

To the American readers, I would like to show all I can of the overseas activities. To the overseas readers, I would like to show what the Americans are doing. So, if I reprint for the sake of record, American modelers re-see what was published in American, and overseas modelers re-see what was published in their magazines. And as for the reader who reads all magazines...

As you can see, the next Year Book presents a problem on which I would like to have your opinion.

Frank Zaic

conversion table

inches: fractions	inches: decimals	m m
—	.0004	.01
—	.004	.10
—	.01	.25
1/64	.0156	.397
—	.0197	.50
—	.0295	.75
1/32	.03125	.794
—	.0394	1.
3/64	.0469	1.191
—	.059	1.5
1/16	.062	1.588
5/64	.0781	1.984
—	.0787	2.
3/32	.094	2.381
—	.0984	2.5
7/64	.109	2.778
—	.1181	3.
1/8	.125	3.175
—	.1378	3.5
9/64	.141	3.572
5/32	.156	3.969
—	.1575	4.
11/64	.172	4.366
—	.177	4.5
3/16	.1875	4.763
—	.1969	5.
13/64	.203	5.159
—	.2165	5.5
7/32	.219	5.556
15/64	.234	5.953
—	.2362	6.
1/4	.250	6.350
—	.2559	6.5
17/64	.2656	6.747
—	.2756	7.
9/32	.281	7.144
—	.2953	7.5
19/64	.297	7.541
5/16	.312	7.938
—	.315	8.
21/64	.328	8.334
—	.335	8.5
11/32	.344	8.731
—	.3543	9.
23/64	.359	9.128
—	.374	9.5
3/8	.375	9.525
25/64	.391	9.922
—	.3937	10.
13/32	.406	10.319
—	.413	10.5
27/64	.422	10.716
—	.4331	11.
7/16	.438	11.113
29/64	.453	11.509
15/32	.469	11.906
—	.4724	12.
31/64	.484	12.303
—	.492	12.5
1/2	.500	12.700
—	.5118	13.
33/64	.5156	13.097
17/32	.531	13.494
35/64	.547	13.891
—	.5512	14.
9/16	.563	14.288
—	.571	14.5
37/64	.578	14.684
—	.5906	15.
19/32	.594	15.081
39/64	.609	15.478
5/8	.625	15.875
—	.6299	16.
41/64	.6406	16.272
—	.6496	16.5
21/32	.656	16.669
—	.6693	17.
43/64	.672	17.066
11/16	.6875	17.463
45/64	.703	17.859
—	.7087	18.
23/32	.719	18.256
—	.7283	18.5
47/64	.734	18.653
—	.7480	19.
3/4	.750	19.050
49/64	.7656	19.447
25/32	.781	19.844
—	.7874	20.
51/64	.797	20.241
13/16	.8125	20.638
—	.8268	21.
53/64	.828	21.034
27/32	.844	21.431
55/64	.859	21.828
—	.8661	22.
7/8	.875	22.225
57/64	.8906	22.622
—	.9055	23.
29/32	.9062	23.019
59/64	.922	23.416
15/16	.9375	23.813
—	.9449	24.
61/64	.953	24.209
31/32	.969	24.606
—	.9843	25.
63/64	.9844	25.003
1	1.000	25.400
—	1.0236	26.
1-1/32	1.0312	26.194
1-1/16	1.062	26.988
—	1.063	27.
1-3/32	1.094	27.781
—	1.1024	28.
1-1/8	1.125	28.575
—	1.1417	29.

inches: fractions	inches: decimals	m m
1-5/32	1.156	29.369
—	1.1811	30.
1-3/16	1.1875	30.163
1-7/32	1.219	30.956
—	1.2205	31.
1-1/4	1.250	31.750
—	1.2598	32.
1-9/32	1.281	32.544
—	1.2992	33.
1-5/16	1.312	33.338
—	1.3386	34.
1-11/32	1.344	34.131
1-3/8	1.375	34.925
—	1.3779	35.
1-13/32	1.406	35.719
—	1.4173	36.
1-7/16	1.438	36.513
—	1.4567	37.
1-15/32	1.469	37.306
—	1.4961	38.
1-1/2	1.500	38.100
1-17/32	1.531	38.894
—	1.5354	39.
1-9/16	1.562	39.688
—	1.5748	40.
1-19/32	1.594	40.481
—	1.6142	41.
1-5/8	1.625	41.275
—	1.6535	42.
1-21/32	1.6562	42.069
1-11/16	1.6875	42.863
—	1.6929	43.
1-23/32	1.719	43.656
—	1.7323	44
1-3/4	1.750	44.450
—	1.7717	45.
1-25/32	1.781	45.244
—	1.8110	46.
1-13/16	1.8125	46.038
1-27/32	1.844	46.831
—	1.8504	47.
1-7/8	1.875	47.625
—	1.8898	48.
1-29/32	1.9062	48.419
—	1.9291	49.
1-15/16	1.9375	49.213
—	1.9685	50.
1-31/32	1.969	50.006
2	2.000	50.800
—	2.0079	51.
2-1/32	2.03125	51.594
—	2.0472	52.
2-1/16	2.062	52.388
—	2.0866	53.
2-3/32	2.094	53.181
2-1/8	2.125	53.975
—	2.126	54.
2-5/32	2.156	54.769
—	2.165	55.
2-3/16	2.1875	55.563
—	2.2047	56.
2-7/32	2.219	56.356
—	2.244	57.
2-1/4	2.250	57.150
2-9/32	2.281	57.944
—	2.2835	58.
2-5/16	2.312	58.738
—	2.3228	59.
2-11/32	2.344	59.531
—	2.3622	60.
2-3/8	2.375	60.325
—	2.4016	61.
2-13/32	2.406	61.119
2-7/16	2.438	61.913
—	2.4409	62.
2-15/32	2.469	62.706
—	2.4803	63.
2-1/2	2.500	63.500
—	2.5197	64.
2-17/32	2.531	64.294
—	2.559	65.
2-9/16	2.562	65.088
2-19/32	2.594	65.881
—	2.5984	66.
2-5/8	2.625	66.675
—	2.638	67.
2-21/32	2.656	67.469
—	2.6772	68.
2-11/16	2.6875	68.263
—	2.7165	69.
2-23/32	2.719	69.056
2-3/4	2.750	69.850
—	2.7559	70.
2-25/32	2.781	70.6439
—	2.7953	71.
2-13/16	2.8125	71.4376
—	2.8346	72.
2-27/32	2.844	72.2314
—	2.8740	73.
2-7/8	2.875	73.025
2-29/32	2.9062	73.819
—	2.9134	74.
2-15/16	2.9375	74.613
—	2.9527	75.
2-31/32	2.969	75.406
—	2.9921	76.
3	3.000	76.200
3-1/32	3.0312	76.994
—	3.0315	77.
3-1/16	3.062	77.788
—	3.0709	78.
3-3/32	3.094	78.581
—	3.1102	79.
3-1/8	3.125	79.375
—	3.1496	80.
3-5/32	3.156	80.169

inches: fractions	inches: decimals	m m
3-3/16	3.1875	80.963
—	3.1890	81.
3-7/32	3.219	81.756
—	3.2283	82.
3-1/4	3.250	82.550
—	3.2677	83.
3-9/32	3.281	83.344
—	3.3071	84.
3-5/16	3.312	84.1377
3-11/32	3.344	84.9314
—	3.3464	85.
3-3/8	3.375	85.725
—	3.3858	86.
3-13/32	3.406	86.519
—	3.4252	87.
3-7/16	3.438	87.313
—	3.4646	88.
3-15/32	3.469	88.106
3-1/2	3.500	88.900
—	3.5039	89.
3-17/32	3.531	89.694
—	3.5433	90.
3-9/16	3.562	90.4877
—	3.5827	91.
3-19/32	3.594	91.281
—	3.622	92.
3-5/8	3.625	92.075
3-21/32	3.656	92.869
—	3.6614	93.
3-11/16	3.6875	93.663
—	3.7008	94.
3-23/32	3.719	94.456
—	3.7401	95.
3-3/4	3.750	95.250
—	3.7795	96.
3-25/32	3.781	96.044
3-13/16	3.8125	96.838
—	3.8189	97.
3-27/32	3.844	97.631
—	3.8583	98.
3-7/8	3.875	98.425
—	3.8976	99.
3-29/32	3.9062	99.219
—	3.9370	100.
3-15/16	3.9375	100.013
3-31/32	3.969	100.806
—	3.9764	101.
4	4.000	101.600
4-1/16	4.062	103.188
4-1/8	4.125	104.775
—	4.1338	105.
4-3/16	4.1875	106.363
4-1/4	4.250	107.950
4-5/16	4.312	109.538
—	4.3307	110.
4-3/8	4.375	111.125
4-7/16	4.438	112.713
4-1/2	4.500	114.300
—	4.5275	115.
4-9/16	4.562	115.888
4-5/8	4.625	117.475
4-11/16	4.6875	119.063
—	4.7244	120.
4-3/4	4.750	120.650
4-13/16	4.8125	122.238
4-7/8	4.875	123.825
—	4.9212	125.
4-15/16	4.9375	125.413
5	5.000	127.000
—	5.1181	130.
5-1/4	5.250	133.350
5-1/2	5.500	139.700
—	5.5118	140.
5-3/4	5.750	146.050
—	5.9055	150.
6	6.000	152.400
6-1/4	6.250	158.750
—	6.2992	160.
6-1/2	6.500	165.100
—	6.6929	170.
6-3/4	6.750	171.450
7	7.000	177.800
—	7.0866	180.
—	7.4803	190.
7-1/2	7.500	190.500
—	7.8740	200.
8	8.000	203.200
—	8.2677	210.
8-1/2	8.500	215.900
—	8.6614	220.
9	9.000	228.600
—	9.0551	230.
—	9.4488	240.
9-1/2	9.500	241.300
—	9.8425	250.
10	10.000	254.001
—	10.2362	260.
—	10.6299	270.
11	11.000	279.401
—	11.0236	280.
—	11.4173	290.
—	11.8110	300.
12	12.000	304.801
13	13.000	330.201
—	13.7795	350.
14	14.000	355.601
15	15.00	381.001
—	15.7480	400.
16	16.000	406.401
17	17.000	431.801
—	17.7165	450.
18	18.000	457.201
19	19.000	482.601
—	19.6850	500.
20	20.000	508.001