1955-56 MODEL AERONAUTIC YEAR BOOK

by Frank Zaic

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MODEL AERONAUTIC
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Edited by

Frank Zaic

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to "Nonno"

Free Flight

Be it so long ago, none of us can forget the wonder of our first Free Flight.—Be it only a minute ago, all of us look forward to the next flight.

How clean the mind; how weary the body after a day of thermal hunting.—How much more exciting life can be for us because of Free Flight.

Some would have us believe that the price is not worth Free Flight. Could it be that it takes a special kind of a man to do all the things that need to be done before Free Flight can become a reality?

Yet, who else but those who are willing to pay the price will know in their hearts the glory of the skies; watching their own creation Fly Free.

March, 1956
New York, N.Y.

Frank Zaic

PLAYING SEAGULLS

by Frank Bethwaite —— New Zealand

Have you watched a gull soaring a coastal ridge, and imagined all the things you could do with a model up there? Of course you have. So had I. And when a really reliable radio control unit was given me, that was the target I worked for.

It all started with the radio. This equipment was unusual in that it promised almost unlimited endurance. Then came the model. If the model was expected to fly for long periods, what sort of model would fly the longest? What would keep it up? The wind, of course. Yes, but what wind? Where from, and how hard, and how long, would it blow?

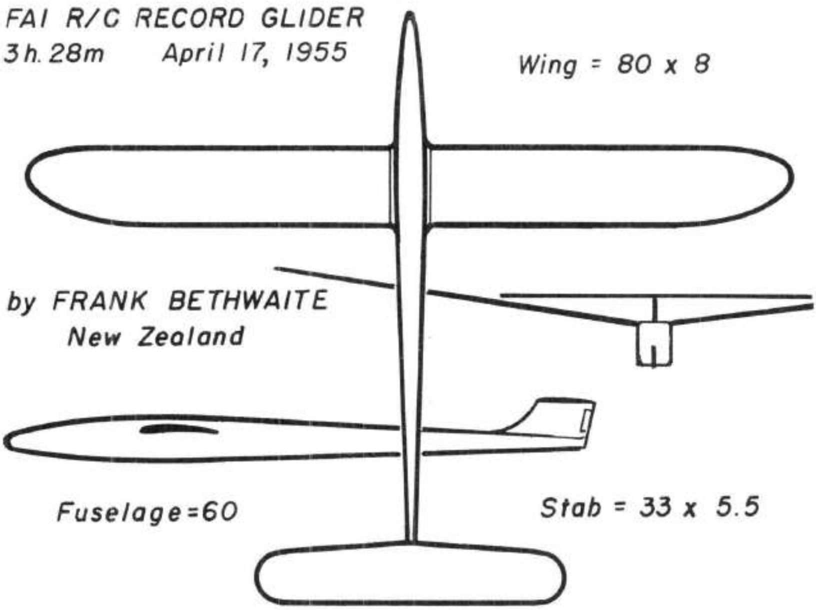
The research started in earnest in the records section of the Central Weather Office. There I found that Auckland's summer winds were not, as a rule, reliable. But a few times a year a very steady westerly would blow, always starting at least 9 mph a little after dawn, and rising to about 25 mph in the early afternoon, falling away again later. Armed with this knowledge, I then visited all the likely slopes to try to visualize the sort of lift to be expected, and the sort of turbulence to be overcome.

The result of all this was a very clean, stable glider of about 600 sq. ins., weighing about 65 ozs., and flying at 25 mph. with a sinking speed of about $2\frac{1}{2}$ to 3 ft. per sec. It was (still is) very strong, and has an escapement motor capable of storing 4000 to 5000 turns. The radio will go for longer than daylight will last. So much for hopes and ambitions.

First flights from a ridge showed up the errors and difficulties. First, of necessity the country was steep, and the model took an appalling amount of punishment simply because it flew fast and hit steep hillsides, usually flat out, downwind. Next, the region where lift is to be found is very small at ridge level, but grows much larger at some height above the crest. I had thought the model too heavy to tow up, and all launches were from hand. Thus it was soon apparent that the critical time was just after the launch—if the model could be climbed away, it could be held up almost indefinitely. But it might require five attempts before one successful launch, in even the best of conditions. Finally, the lift available was not anywhere near that which would be expected from a visualisation of a given wind blowing up a given slope. The wind does not blow up the slope, it seems. It simply slows down, and, "thickens," at lower levels. And it blows much harder over the ridge. Thus a wind which will barely lift the glider at ridge level may blow it backwards two hundred feet higher up.

After a few months of absorbing all this, I reached the stage where I could pick those conditions which would be reasonably sure of giving me sustained flight. At that time, January '52, the World Radio Control Duration Record was held by Dr. Walter Good, at about forty minutes. I awaited suitable weather, coerced timekeepers into enduring the cold, (for ridge soaring is bitterly cold even in Summer,) and flew the glider for just over one hour. This flight, ratified by F.A.I., gave me the World record I sought.

During the next few months I changed my technique in the light of the lessons mentioned above, as well as growing experience. The model was reworked, and came out lighter, at 53 ozs. It was given a towhook, and proved to be easy to tow provided there was any breeze at all. This tow solved all the woes of launching which had previously plagued me. If, for example, a flight was attempted at a time when there simply was not enough lift, then the model, instead of clouting some obstacle lower down the hill, could be easily and gently landed nearby on the ridge-top, without ever being put in the dangerous "below the ridge" position at all. It proved possible to fly from a towed launch on many occasions when I am certain it would not have been possible to climb from ridge level. Also, I found my choice of ridge altering. There are many coastal cliffs which offer perfect soaring in the right wind, but I had thought it too risky to fly them in case of mishap, for there is nothing but breaking surf below. But in all the months, there had never once been any control failure. I ought to explain that the equipment used is unorthodox in that there is no sensitive relay. The receiver works the escapement directly. Also, by its nature it is insensitive to small voltage changes; it does not need critical adjustment. The current drain is small, and there is no battery-life problem. So it seemed justifiable to fly the model out over the open sea, and I did!



It was not long before my hour was surpassed, first by an Englishman and then by a Russian. Twice during the Summer of '53/'54 did I try to do better. On each occasion a seemingly perfect wind would grow imperceptibly stronger until the model blew backward, once at 53 minutes and once at 65 minutes. This variation in strength of a seemingly unvarying sea breeze I now think is due to thermal activity. Often seagulls are flying with and around the model. When the air seems warm they all fly several hundred feet up, and there is lift over a great area. Then they all fall lower and lower, although the telltale marks of wind on water out to sea do not change, and soon all the gulls are flying a "lane," just above the cliff-top,—and that is where my model is too. After say five minutes they are on their way up again, and shortly thereafter the wind will be at its maximum strength, with the glider held poised straight into it, and only luck determining the outcome. It is interesting to note that the glider glides slightly better than a seagull. Inquisitive gulls have to give an occasional flap to keep up with it.

In May of this year another suitable day offered, and again we tried to raise that record, this time successfully. Launched just after three p.m., the glider just matched the wind-speed for about five minutes. I thought there would be no hope at that particular trim speed, but after awhile it forged ahead a little, and the game was on. Half an hour later both the model and all the accompanying gulls were much lower, but not at a critical height. At the end of an hour the model was again away up, and going backwards by inches. For perhaps ten minutes it lay perhaps one hundred yards behind the cliff-line, hardly moving. At last the wind eased a trifle, and again we were in business. But half an hour later the strength seemed to have gone out of the wind, and I was perforce flying the glider far lower than was satis-At one particular turn it so nearly did not lift again above the cliff level that I was reduced to nervous exhaustion, and hardly noticed the subsequent increase in wind strength. Which brings up another lesson,—a good model may be capable of flying for longer than a good modeller is capable of controlling it. I know that there was no pleasure in the last half hour. I was strained and tense, using far too many control movements and still controlling badly, despite that were in fact improving conditions. We flew for two hours for the sake of doing two hours, and then in the rising wind and failing light I drove the model with scant ceremony into the trees and shrubs a hundred yards behind the cliff-edge. This flight of two hours and five seconds is, at writing, the F.A.I. R/C Duration record; the second that this glider has won.

The lessons from this flight? Simply that a ridge-soaring flight such as this was the purest luck. A shade less speed, or a little more sink, and it would not have been possible. The model itself, while capable of improvement, is nevertheless very good, and simple design refinement will not help much. Future work, for our New Zealand conditions, will concentrate on two-speed models, necessarily a little different from the old ship. The radio gear, now into its fourth year, is beyond praise. Winter and Summer, in rain or dry heat, it simply works. More cannot be said. And the man? I feel that we have already gone beyond the reasonable endurance of one man, and that future attempts will all be based on a system of flying in spells. Otherwise it becomes inevitable that silly mistakes will be made due solely to fatigue.

A final word about the pleasure of all this. Despite the work and the disappointingly slow progress, I would not exchange this for any other sort of flying. For to fly a clean, fast glider, soaring gracefully up above the hills, often out over the sparkling sea, and in fitting company playing amongst soaring sea-birds, is an experience utterly unlike any other I have known.

January 13th, 1954

Thank you for your letter of October last. I apologise for the long delay in answering; over the past six months we have changed over from the flying boats to DC-6's, and there hasn't been any spare time at all. It is only now that I am beginning to pick up the threads of what used to be a very wide-spread correspondence again.

Your request for material arrived only a week after I had scratched out the enclosed, "Playing Seagulls." I only hope that it will be in time. It seems to be exactly the sort of stuff you ask for.

Now for the rest of your letter. Turns—you're not too worried about them now. We've learned that something like a glider, or a clean low-powered model, which has a C.G. position about 50% or 55%, a reasonably small stabiliser, and about 4 to 4½ degrees of decalage, will turn easily in reasonably tight circles without winding up into a spiral dive. But over the past year or two we have been chasing, primarily, speed, and a setup has been evolved which seems peculiar to New Zealand, and it certainly is fast. What could be called a "standard" model would be about 60 inches span, 9 inches chord, 45 inches long, with the motor set high over the trailing edge as sketched, and no unnecessary drag whatever. An undercarriage is not considered necessary. Weight is usually around 50 ounces, and power anything up to a hot .19, although a good 2½ c.c. diesel is the more usual choice. This sort of model is deliberately trimmed such that it only just lifts its nose at speed—any tendency to "waffle" is firmly dealt with by reducing incidence. The whole setup makes for a very fast, and highly manoevrable little machine. Normal practise is to use gross rudder, and blip all the time. On extreme power I have seen these models climb away at about thirty degrees, and do full rolls on the climb. Such power is akin to a control line stunter—whatever way the model points it goes. It is also very, very tiring to fly, due to the concentration needed, but it's fun.

During the past six months or so we have had a crop of troubles, in all of which one of this sort of model, travelling very fast, would either noose over to the vertical, or else just not bother to recover from one loop. Needless to say, there has been some head scratching to find the answer. We now think we have it in wing twist. Despite their extreme strength, these models are fairly critical due to the small decalage, and as a wing ages, and varnish and possibly heat slowly soften the dope, and the model is driven faster and faster, the point is reached finally where the washout at the tips, due to speed, results in a slightly negative longitudinal dihedral. It seems that the moment on an average wing, running at about seventy mph, would be about four foot pounds, nose down. Very roughly, the torsional stress on the wing would be about one foot pound, nose down, on each wingtip, and we have found that a normal, strongly constructed wing will twist about three to three and a half degs. under this applied load.

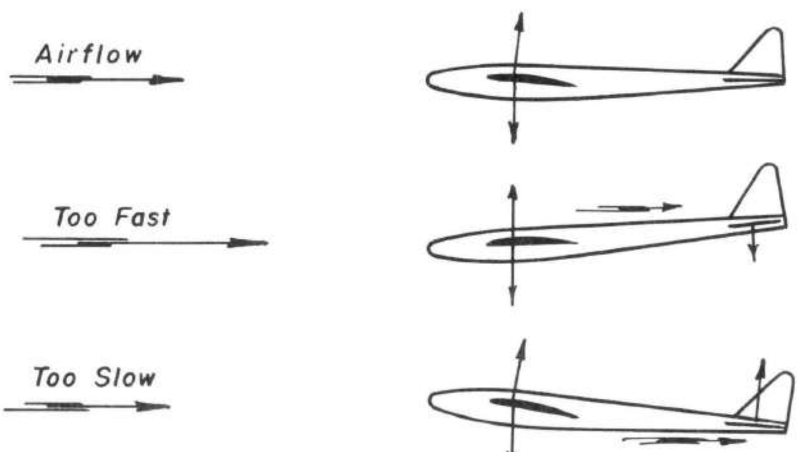
In search of an answer to this problem, we have had success with wing profiles such as NACA 2R2-12, which have a negligibly small moment. I should point out that most of the "old" wings were of about 6% camber, and thus were to be expected to have a moment coeff (Cm c/4) of about minus 0.13.

You are very welcome to publish the glider plans. I suggest that a copy of those published in "Aeromodeller" would be about the size you need, and will save me the business of sketching them out again. For your information, a Mk 2 glider has been flying around for a month or two, and it is so great an improvement on Mk 1 that it is hard to see why. The two models are identical in size. Weight of Mk 2 is 44 ozs, instead of 53. Wing is 9% thick instead of 15%, with a very sharp entry and almost a circular arc curvature on top, and only a trace of undercamber. My conception of wings on this ship was "blades," rather than three-dimensional structures. Squashy near the stall, sinking speed reduces as speed is increased until at some fairly high speed the most perfect flat, "knifing" glide results, perfect for penetration and thermal soaring provided that a sufficient initial altitude is gained for the large-radius turns to hold rising air. Speed is such that upwind flight from thermal to thermal is easy, and life is not a battle to avoid being blown downwind in the usual light breezes associated with good thermal weather.

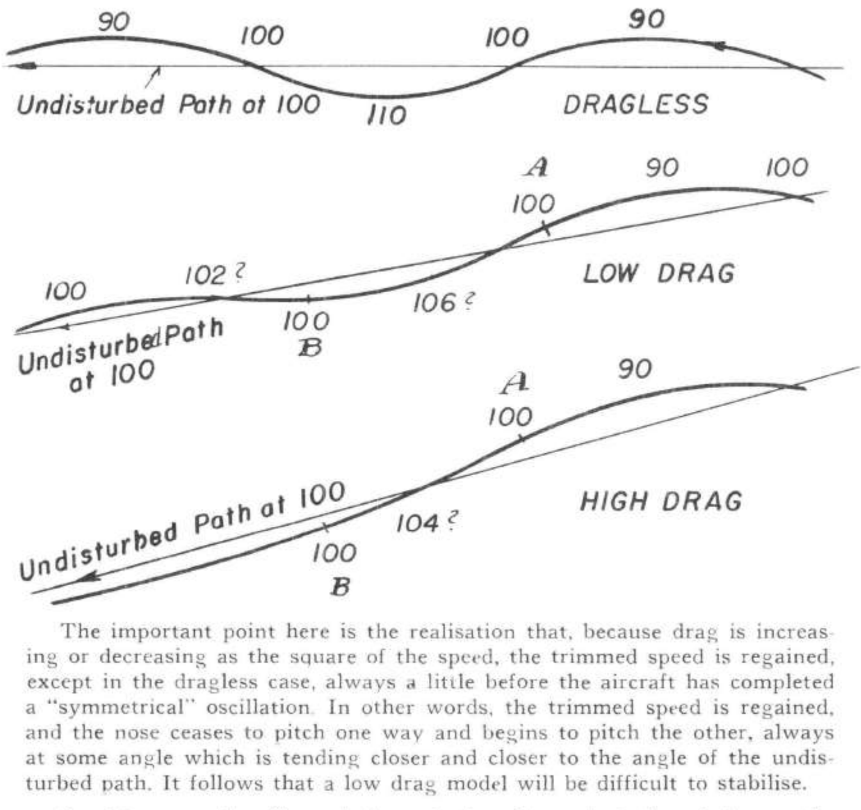
Later.

Strange behaviour has shown up on this Mk 2 glider; it goes crazy, stalling and plunging, when it gets near the ground in a breeze, despite perfect stability at all other times. It has taken some time to work out why. The reason is so interesting that I give it here in full. It is clear that we have entered a new regime of model flight, and I would be interested to know whether any other modeller has reported this trouble, and if so whether there is any easy cure.

If we consider longitudinal stability, the reason why a model trims to a particular speed is fairly plain. Fig. 1 shows a representative set-up in the trimmed speed, the too fast, and the too slow, condition, and it is clear that, given any variation from the trimmed speed condition, there will be a force tending to pitch the nose up or down to regain that trimmed speed.



The way this works out in practise is that, if upset, the model will perform the well-known phugoid, with diminishing oscillations until the trimm i speed is regained. It is vital to realise that drag is a stabilising force. A brick is completely stable—it will rapidly attain its terminal velocity and thereafter little indeed will defect it. On the other hand a dragless aircraft, were it possible to build one, could never be stabilised. Once upset it would go on phugoiding for ever. (This is not necessarily true. Theoretically, the phugoid would probably increase catastrophically.) Fig. 2 shows the phugoid paths of a dragless aircraft, a low-drag one and a high-drag one, and it will be seen how drag helps stabilise the draggy one. In each case let the trimmed speed be assumed to be 100 units, and the upset such as to cause an increae of 10 units.



The important point here is the realisation that, because drag is increasing or decreasing as the square of the speed, the trimmed speed is regained, except in the dragless case, always a little before the aircraft has completed a "symmetrical" oscillation. In other words, the trimmed speed is regained, and the nose ceases to pitch one way and begins to pitch the other, always at some angle which is tending closer and closer to the angle of the undisturbed path. It follows that a low drag model will be difficult to stabilise.

Consider now the effect of the variation of speed of the wind near the ground, due to the surface friction, on a model gliding into wind. The velocity gradient (as it is called) is sketched in Fig. 3.

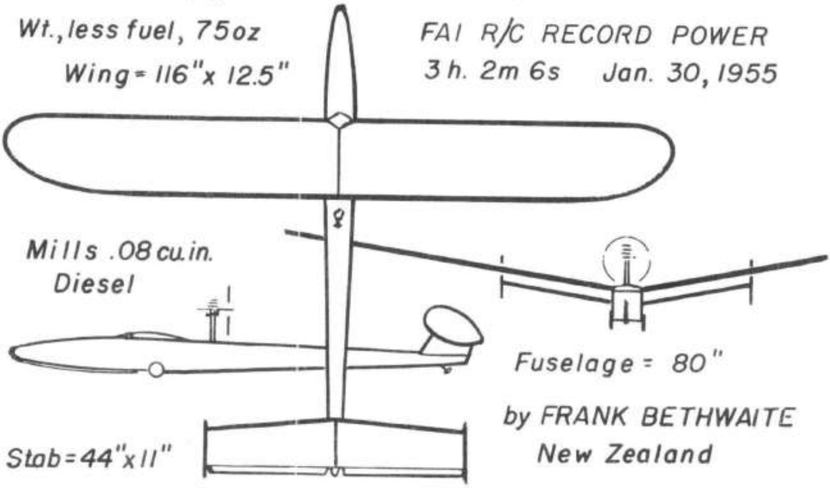
If a model is upset by turbulence, then a phugoid will commence. Now, in the case of a very clean model, it will be possible that the loss of speed due to a nose-up attitude (relative to undisturbed flight path and due to phugoid) will be less than the gain in airspeed due to the gain in height and consequently flying into a stronger wind. Now, until speed drops to the trimmed speed, the nose will continue to be pitched up. Obviously, if the gain in speed due to the velocity gradient is considerable, the nose may be pitched very far up before speed drops to the trimmed value. A nasty stall results. But the trouble has only begun. As the model plunges down, endeavouring now to regain trimmed speed—it is travelling too slowly, and the nose is still pitching down—it is traversing the velocity gradient the other way, and for every unit of speed the model accelerates due to the dive, it will lose a proportion of that unit due to the loss of headwind. The whole effect s clearly destabilising, and the dive becomes far more of a plunge than it should.

Now, to tie all this up. If the mechanism of the phugoid is thought about at the same time as the mechanism of the velocity gradient, then it becomes clear that, for every degree of stability, there will be a theoretical velocity gradient which will just destabilise it.

It seems to me that, for the first time, this new model of mine, which is clean far beyond the normal idea of "cleanliness," has proved to be of sufficiently low drag to be destabilised by the quite usual, and normally harmless, velocity gradient characteristic of the winds in which we fly. It is noticeable that it matters little whether the elevator trimmer is in the low-speed or the high-speed condition. The model still is likely to rear up about twenty feet with no apparent reason, and fall heavily. But at all times, well up, stability is excellent. And as soon as the surface wind falls to a low value—say 5 mph or less—then the model becomes a pleasure and joy to play spot landings with; the glide is so flat that a few feet miscalculation in height invites an error of the odd hundred yards.

As yet I can think of no easy cure. One could always land downwind, of course; the effect of the velocity gradient in reverse is intensely stabilising! Or I could fit a second control, and operate spoilers to increase the drag to an acceptably high value for the final approach and landing. But I want speed trim on the second control, and in any case I fight shy of second controls—they are too much work. Also, it seems already that Mark 2 can be improved by reducing drag even more. But to what point until some way of achieving stable flight is evolved?

Ten days ago I was fortunate enough to crack the R/C Duration record for the third time, this time with a power job, which flew 3h 02m 06s before we ran out of daylight. But that is another story.



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April 27, 1955

Thank you for your letter, just received. I sent my note off to you without drawing up the R6-B which has the motor set high over the trailing edge. There just was not time to sit down and draw it. I felt that you would rather have the rest, than none at all. Since writing you last, the R6-B has been described at length in the Aeromodeller, and you will be able to adapt your plan from the one published there.

Re the wing flexing troubles, Allan Rowe, the designer, has put the 2R212 (an NACA section) on his latest job. He has kept the weight low, used plenty of power, and the results are good. In particular, the model can be driven at any speed at all, right up to its TV, with the certainty (so far) that it will not change shape catastrophically. The aerobatics which can result are not as yet fully explored. Ever seen a vertical eight? Nor have I—yet—but it won't be long.

Re my Mk 11 soarer. I feel that you have read the wrong meaning into my remarks re "plunging." The action is far removed from the forced, nose-light action which we usually call "stalling" in a model (in fact, whether it is a true stall, or simply the onset of longitudinal instability depends on the model, and it is 95% probable that it is the instability, and the wing is nowhere near the stall.) In this glider of mine, the action is independent of elevator position—it will plunge in the right conditions just as much with the elevator down as with it up. The plunge seems critically dependent on a velocity gradient, plus some initially upsetting maneuvre. Without the velocity gradient, it will not plunge at all. My guess, (and I am now several months the wiser with this model) is still that it is a true phugoid action, and that as my models become cleaner and cleaner, I will get into more and more trouble with this problem. A Mk111 is being thought up, and, cleaner yet, it should prove me right or wrong, because I will improve the static functions (larger stabiliser, lighter ends etc.,) but, due solely to its lower drag, (due to thinner wings and slimmer body) the dynamic problem will be worse. We will see if it plunges as much, or worse, than Mk 11.

A photo of Mk 11 is enclosed. For your information, we flew it for 3 hrs. 24 mins. on April 16th, and for 3 hrs. 28 mins the next day. The latter flight has been claimed for as a new world record. Both flights were cliff-soaring, with the model ranging up to about 1,000 yards both ways. Both flights were terminated by mistakes, due probably to inattention or fatigue, and not by any loss or lift or other compelling cause.

Other news—about two months ago I flew a long-duration power RC job for just over 3 hours. Had word yesterday that FAI have ratified it as OK. All these bits and pieces of short flights are not what I seek, though. I'm after the open record.

Interesting point re Mk 11. I estimate it to have been airborne for about 20 to 25 hours, at a speed of close to 30 mph. How far has it flown? And how far have we come from the Moffat and Texaco jobs pre-war?

Thanks for the offer to include info on the HMV radio-control. This too has been written up in Aeromodeller, but a few words extra would not go amiss. I'll write to Les Wright, who master-minded it, and if he would like it mentioned, I'll write you again about it very shortly.

LES WRIGHT Wellington, N. Z.

I feel that you may still be interested in a short account of the radio control system that we are using in this country. In fact this letter is a belated answer to your earlier request to Frank Bethwaite for information on the receiver etc. that he uses for his various attempts on the record. But first, a general picture.

The full story is the more interesting in that it goes back directly to the 1937 year book sent out to Vern Gray (Auckland). If you recollect there was a section on R/ circuits and a direct challenge by Ross H. Hull.

I took this challenge seriously and the present equipment is developed directly from Ross's early efforts. Came a time when my firm considered there would be a measure of profit in manufacturing and marketing the complete unit, (my position as technical manager may have had some bearing on this!)

Anyway, the sales in this country alone have more than justified the project. A sample was sent to England and favourably commented on by the Aeromodeller (March last). As a result of this I have had dozens of requests for more details and have written a semi-technical article which I understand has been reproduced in the 1955-56 Aeromodeller Annual.

So far I have only dealt with English publications but letters are being received from most outlandish places, not only for information but requests for the availability of the equipment.

This of course has interesting possibilities and these are being considered.

But quite apart from the commercial angle, I believe that the system makes very interesting material for the Aeromodeller. It is another and quite different method of controlling a model. It's simplicity makes for more reliability.

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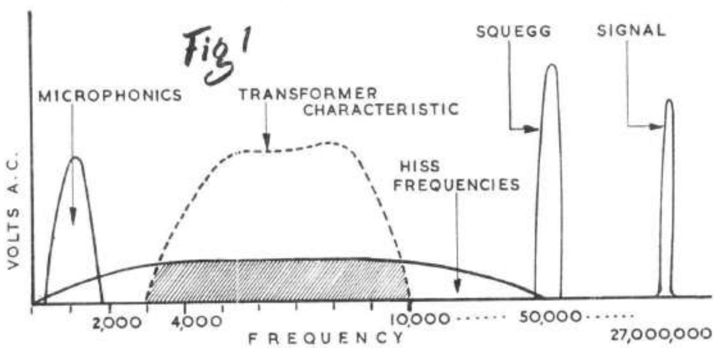


ACCEPTED PORTION OF THE HISS FREQUENCIES ARE SHOWN SHADED.

Yet another R6-B in a sized-down version built by Mort Glading seen here preparing it for flight.

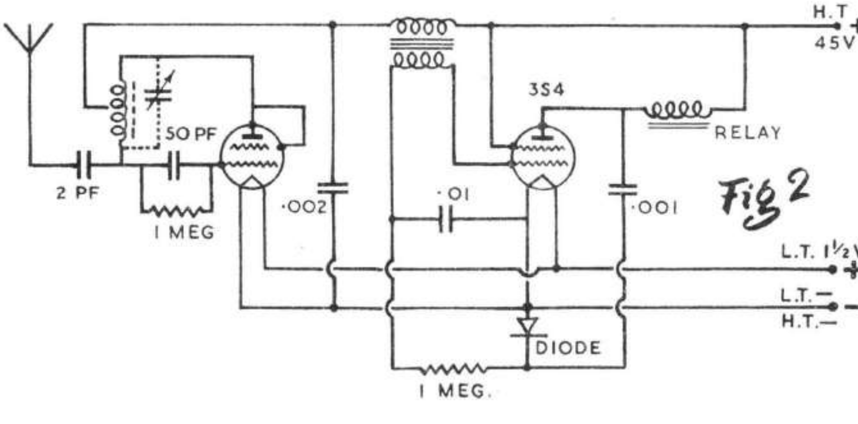
The Receiver

So there's the problem, and let us now discuss one way in which it can be solved. This is the method used in the current equipment.

Fig. 2 shows a self-quenched detector, transformer coupled to a relay valve in the plate of which is a simple reflex arrangement. It will be realised that the several frequencies already mentioned appear as small AC voltages in the plate of the detector, and it is at this point that our first separation occurs. It is well known that a condenser will pass high frequencies more easily than lower ones. The condenser between detector plate and earth will effectually pass the very high signal frequencies so that from here on they can be ignored. Unfortunately, the amplitude of the squegg frequency combined with its closeness to the wanted hiss, precludes the possibility of separation by condenser alone. Likewise, the microphonics, being lower than the wanted frequencies cannot be disposed of by a parallel condenser. A series condenser could possibly be used, but the diagram shows the only practical answer to the problem—transformer design.

This transformer, although only a small component, is the heart of the system and the key to the problem. Weighing less than one ounce it will only pass frequencies between well defined limits. Roughly resonant at 6,000 cycles, it effectively rejects all frequencies below 3,000 cycles and above 10,000 cycles per second. Moreover, this component not only separates the wanted band, but also provides a measure of voltage gain at the same time.

Returning to the circuit, these frequencies having been selected, they



are passed to the grid of the second valve and appear as amplified AC voltage across the relay in its plate circuit. This relay, being a DC operated device is not affected by the AC voltages. From the plate these voltages are now passed through a condenser to a diode where rectification takes place. The negative DC potential so produced is then fed through a resistance and the transformer secondary, to the grid of relay valve, where it controls and limits the DC current flowing through the relay. Thus the relay valve is being used to produce its own grid bias from the frequencies passed by the transformer.

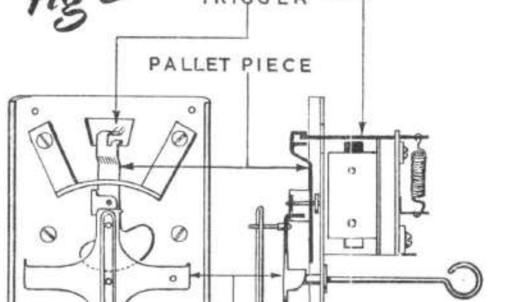
Now—when a signal is received, the hiss is eliminated and the grid bias reduced, with a corresponding rise in relay current. In actual practice, the idling plate curent is $\frac{1}{2}$ milliamp which rises to 9 milliamps on reception of a signal. This relatively large current resulted in a marked improvement in reliability against all other methods where a smaller current change was produced. No longer was any critical relay àdjustment necessary, and a sturdy relay could be rigidly mounted and the contacts more or less permanently sealed against exhaust fumes, dirt, etc.

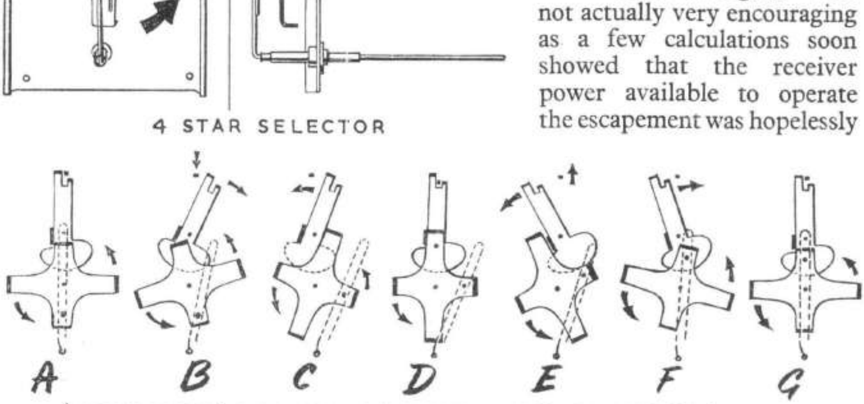
The Relaytor

So far I have spoken of the use of a normal relay in the circuit, and this was in fact used while earlier receiver experiments were being carried out. However, it soon became apparent that many of our troubles in the field were directly attributable to the relay which at best was only an intermediate step in the control process. Consideration of the healthy current change available, logically led to thoughts about the elimination of this middleman—and so after negotiating the usual pitfalls, came the Relaytor, so named because it combines the functions of relay and actuator. This operates directly from the receiver with no intermediary relay.

First thoughts were not actually very encouraging as a few calculations soon showed that the receiver power available to operate the escapement was hopelessly

Fig 3





'RELAYTOR' ACTION SHOWING HALF CIRCLE

IDEAS ON R/C MODEL DESIGN

by Harold DeBolt —————————— Williamsville, N. Y.

I have delayed answering your letter until this time so that I could do the whole thing at once. Pleased to hear that you are getting along well and that there will be a new year book. Of course, I envy your California vacation, never have been there and would love the chance!

First off, I do definitely have some ideas to pass on regarding R/C design. This past year has been lucrative in giving up answers to problems and shedding a little light in other respects. My only wish is that I could have known the answers in advance; would have some models to fly now if I had. Equipment wise very little showed up to advance the radio end which was not an improvement on some existing rig. Howard Bonner did have a new rig at that Nats and this relay-pass 2 channel receiver showed the boys that Multi-Channel equipment could be made that was light in weight. It definitely could be called new and possibly revolutionary if time proves it out. Otherwise the big change seemed to be in the actuator field. There was a strong trend towards the use of motor driven servos in place of the rubber band types. This was a logical advancement and I was more than glad to be fortunate enough to be able to offer them for use by all modelers. It would appear that these gimmicks will get better as we go along and as a result we have not seen anything yet!

Model design: Rather than go into all the details I would refer you to the Sept. '53 issue of M.A.N. for the dope on the basic design which I will use, its pretty much all there. I have looked all year for some inkling of a direction in which to head. Frankly, I was disappointed to find that what we already have seems to be proving out very well. I did think that some of the more mysterious aspects of the design came out a bit stronger through wide spread use under varying conditions. For one thing, the basic force setup seems proven, when you review the entire performance obtained with any other arrangement there always seems to be something lacking. The fact that this setup gives good power on penetration and maneuvering, and yet allows for a penetrating glide with a low sinking speed makes a mighty nice combination. One of the design points which came out a bit stronger is the use of the thick stab; using a 15% section for this gives the speed control which we need so much. It seems to be a good match for the wing so that as the speed goes up the stab lift remains very much in proportion, giving excellent longitudinal stability over a wide speed range. The only ill effect from it seems to be a bit more difficult in building elevators onto it due to their thickness. However, this proved a simple structural problem which worked itself out. I was quite surpriser to see a number of L.Ws flying this year which were greatly overpowered with .35 engines, and yet the large speed build up did not seem to effect the longitudinal stability, which seems to be a point in favor of this type stab setup.

One of the strong points of this stab which seems to be overlooked and yet proving out is the stall control when turning into the wind with a abnormal speed buildup, usually from flying down wind. As the model turns into the wind the force of the wind slows the model down quicker than it does the engine. Result is that you get an increase in slipstream effect momentarily while the craft is adjusting iself to the change. Thus just as the model starts what would be a rather sharp stall the increased slipstream flowing over the stab and under the wing causes the stab to increase its lift far more than the wing, which is an ideal situation just at that point. Result is that the model goes up alright due to the increase in total lift caused by the higher air speed, but the important thing is that the model goes up in a flat manner without the nose rising unduly. Makes for a smooth recovery from such a turn. When close to the ground a stally recovery from such a turn could prove disastrous.

Another design factor which worked out is the use of spoilers for stall control. They seemed to do the job well under all circumstances and took one headache out of the construction. We found that they did not need to be large at all, cover an area 30% of the total span and quite small in cross section. Just keep the edge sharp.

Early in the year a problem cropped up which was anything but simple. Of course it only effected models with elevators and fairly large in size but with the trend to this sort of model it was important. Frankly it cost me 9 ships before I felt that it was solved! For some unknown reason we did not seem to be able to get out of terminal velocity dives. Short dives and shallow ones were O.K., but stick the nose straight down for over 50 ft. and you had it! Experiments were made to prove the model design sound by getting a ship into such a dive with neutral elevator, in every case there was good recovery, which meant that we were not getting rid of the down elevator in these death dives. Now that it is solved we know that most of the trouble was in the equipment, but we did come up with a distinct advancement in elevator design as one result of the research. We worked out a 100% balanced elevator which has its hinge point at the 50% station. In applying it to our 15% stab, we used a 15% thick full symmetrical section for the elevator also. In as much as the L. E. of this elevator was quite sharp and fell where the stab was still quite thick we had to work out an arrangement whereby a slot was opened up when the elevator moved from neutral in order to get any effect from the balance. It really worked out good and we came up with a beautiful slot when the elevator was in a full position. The main result was that the air load on the elevator in a dive was transferred from the push rod (as it was with with a elv. hinged at the L. E.) to the hinges, and as a result there was no possibility of the air load being applied directly to the actuator and thus jamming it. One of the secondary results was far better model reaction to elevators using the new type. They seemed to smooth out the reaction to them and far less movement seemed necessary to accomplish an equal result.

We have always liked a dural gear for its simplicity of installation plus good looks. One of its drawbacks was that it lacked shock absorption in aft direction which meant that a real rough landing could cause it to come loose from its mounting or else bend up. This trouble seems to have been cured also with the help of Dick Shumacher. We have been keying the gear to its usual hardwood mounting block with a couple of headless screws so that it stays in place under normal use. We then fastened the gear to the fuselage by using dowels and wrapping rubber bands around the gear and the dowels. Now if the gear is forced backwards the rubber bands give and stop damage. In a real model rough situation the bands break and the gear flys off allowing the model to skip over the ground without digging in, this usually results in practically no damage other than broken rubber bands and a prop. It would appear that these dowels and bands could be installed so they were practically invisible by anyone who might not like the looks of them on the outside of the model.

We had hoped to do a lot of work this year on the symmetrical wing project which was started last year. Unfortunately due to the other problems which cropped up we accomplished very little over what had already been done. It is tough to fly a ship inverted when you are not sure that it will respond to full down elevator! However, as I look back, we might have been better off with the symmetrical wing. For all that would have been necessary would have been more down elevator to go around in an outside loop! Anyway I cannot recall dive troubles with the symmetrical wing. Even so the entire year was not lost as some advancements were made.

For one thing we proved out that one of two things is necessary for good performance and sufficient lift with this symmetrical wing. You either have to have a high flying speed or else an extremely low wing loading. The airfoil just does not lift much at close to zero incidence. We spent most of the year flying them fast. Now we believe the answer lies in the other direction with the low wing loading. Speed makes them tough to launch and things happen much quicker, making maneuvering a split second business. Getting the low loading is tough. It means lighter equipment at a time when it is felt that more weight is needed for reliability or else bigger ships at the same weight. There certainly will be an effort made in both directions!

Directional stability cropped up this year as a persistent problem with these designs. Finally traced it to the fact that with a zero set wing the down wash comes out higher than it did with the wing at 5 deg. Result is that the fin was thrown right into this down wash and apparently effected enough to hurt the directional stability. There seems to be two answers to it, lengthen the moment arm or twin rudders. Did not like the idea of the longer arm so tried the rudders. Lowering the area down and spreading it out seems to have helped. At least the latest version seems better so far. Another discovery along these lines also was that this type of model does not like a high angle of attack directionally. We took out a considerable amount of decalage which flattened out the flight and obtained far better turn control. Original thought was that we would loose our rate of climb, but surprisingly enough, it was increased. The model now goes up at a shallow angle but faster. Before it sort of clawed its way up and must have been working inefficiently even though the higher wing angle increased the amount of lift. Looks like the old lift-drag ratio working again.

Inverted flight improved considerably this year. Found that we could fly for considerable distances, and under good conditions actually make inverted turns.

Seems as though two things contributed towards this. Most important was an actuator development. We worked out a actuator for the elevator which was both self-neutralizing and trimmable. This was a distinct help as it removed the necessity of hunting for neutral or trim after getting inverted. All we had to do now was to return the stick to neutral and the elevator came back too, then by watching the model, trimming for level flight was easy as we already were at neutral. Another change which helped was to raise the C.G. a bit, seems the higher you can get it the better, of course. Good part is that it does not seem to effect upright flight, guess we have enough other things built in for that purpose.

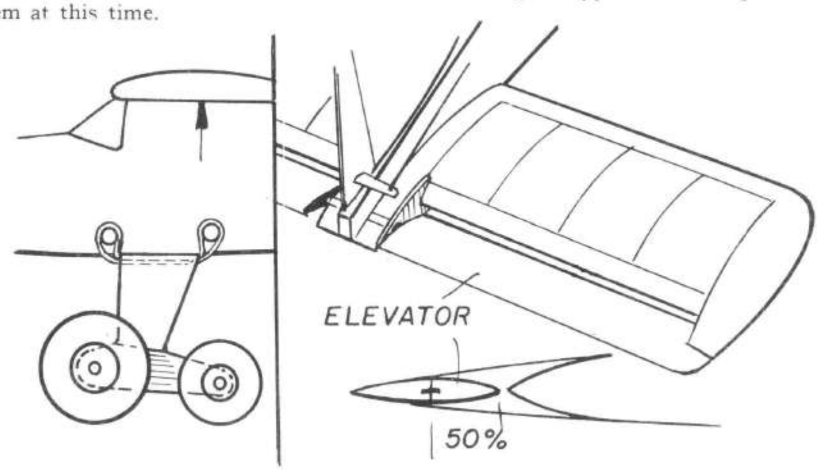
For complete dope on the basic symmetrical design see July '54 issue of A. T.

Otherwise the only progress here has been in the structural design of our models. We found that an equally rugged ship could be built, whether symmetrical or otherwise, which could carry considerably more than its own weight in equipment weight, and still maintain the same performance as before. For instance, our Nats ship weighed 4 lbs total, of this 2½ lbs was equipment leaving only 1½ lbs. for the model. Yet this 4 lbs. was equal to what we had before with only 2 lbs. of equipment. This was a big improvement for it meant a higher payload and thus multi-controls in relatively small ships. The weight reduction was accomplished rather simply now that we look back. All that was done was to reduce the number of pieces in the model and increasing the size of the remaining to carry the stress. The increase was never the equal of the two, and the resulting less cement etc. was enough to make the difference. Surprisingly enough, these new ships seem to be even more rugged than the old ones, could be the result of structural weight enertia or something?

Four wheel gear . . . Saw McCullough with one at Nats,liked it . . . Made some minor changes in design to reduce weight etc. Been using it for some time and find it very good. Model tends to run in a straight line no matter what, if diverted by a bump it just changes its heading and goes straight that way. With the steerable tail wheel its a cinch to keep straight down the runway. Have even been getting my symmetrical bombs off a grass strip with it and that takes some doing with any other type!

Secret is that you can arrange it so that the model rests on the rear wheels, which can be very close to C.G., then it can rock up onto both, and with the extra sideways resistance provided by the wider spaced bearing points, you have got what it takes. . . .

Frank, I guess this is it unless I think of something which we missed. Right off I realize I did not say a thing about scale designs, we did some work towards this end. For one thing we found strictly scale taboo, you lose too much in inherent stability. We have found however that you can take a basic R/C design such as ours, and lay many scale designs right over it. Thus, we had good luck by adapting the features of several full scale designs to our design and the end result was a darn good flying R/C job which looked very much like the full scale machine. Seems like the logical approach to the problem at this time.



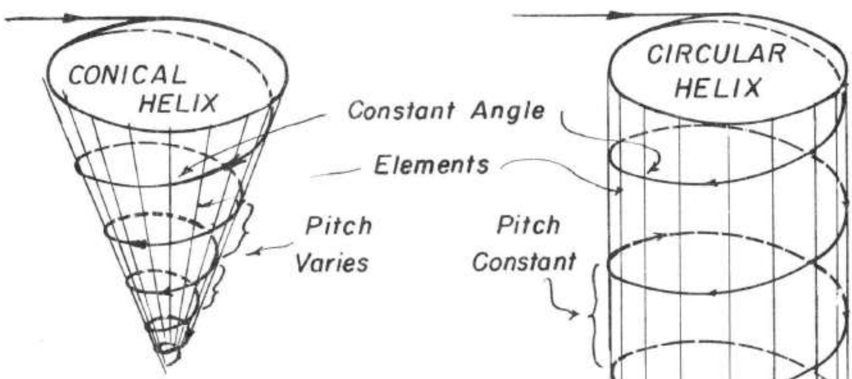
TURNS AND SPIRALS

by Lloyd M. Licher ——————— Santa Monica, Calif.

Glad the Mexico trip treated you O.K., and that you are now on the way towards writing up the next book. Also hope we can get together if you set out here again around New Year. We are taking a week vacation during the holidays. We are going skiing up near Bishop, and will watch any wave soaring attempt by the glider pilots who try for heights during that season. Dr. Kuettner has a project all lined up for later in February when he will try to soar in travelling waves in the jet stream, possible distance—1000 miles. (Winter 1954-55.)

Be sure and see Jex when you come. He has some good ideas on the aerodynamics of RC models. He wants you to write to him as a prod to send a discussion on the RC problem and the endurance ideas he has worked up. I was talking to him on the phone this morning, consulting on the spiral dive. First, some definitions:

SPIRAL is a two-dimensional plane curve such as those called Archimedes, logarithm, etc., A HELIX is a curve cutting the elements of a cylinder or cone at constant angles. A cylindrical helix is on any shaped cross-section cylinder while a circular helix is on a right, circular cylinder.



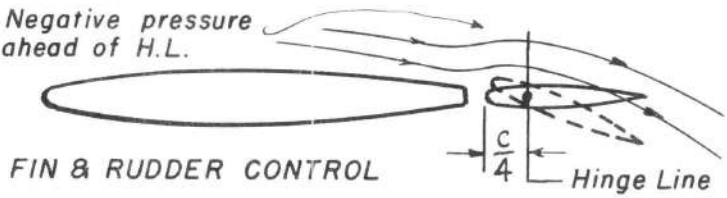
I figured the "spiral" (should be "helical") dive started out as a conical helix until the radius was that of a vertical bank after which it continued on down as a circular helix. However, Henry has investigated it more thoroughly and believes the initial helix is a horn shaped cone with a logrithmic curve until the ship reaches its stable spiral dive attitude.

Evidently a balance point is reached short of a vertical bank after which it follows down a circular helical path. It is coming down so fast, though, that it probably hits the ground before the steady state condition is reached. The angle of bank is steep though and because the path is downward any more negative in the stab (up elevator) only aggravates the situation and tightens the spiral and dive because the trimmed condition has been altered to allow it to roll over more. That is why pilots call it the graveyard spiral—on instruments all you see is the rate of climb going down and the airspeed building up; hence a hand back on the stick. And its worse before he thinks to look at the turn indicator (needle) to show he should stop turn FIRST! So the opposite bank is needed.

The thing that fools you though is that the ball indicator shows a perfectly coordinated turn (no sideslip) as indeed it is. However, opposite aileron requires some rudder to eliminate yaw during the roll. In an RC model only opposite rudder will do it which slips the ship into the turn so the dihedral can pick up the low wing, rolling it out. If the vertical tail area is large compared to the dihedral (many RC ships look that way) the ship never side skids enough when upset by a gust or control to allow the dihedral to pick up the low wing—the vertical tail "weathervanes" the ship too much.

It is called "spiral divergence" and is built into piloted aircraft where it is easy to correct. If you build in spiral stability with more dihedral it makes it very uncomfortable to fly for the pilot. (Dutch Roll) Spiral divergence becomes worse at high C_L, right where the model glides. Under power at lower C_L's it is not as bad.

RC ships fly fast and in the spiral dive they are much faster so that ordinary spring loaded power for the rudder may very well become insufficient for control at the higher "q" ($q = \frac{1}{2} \varrho V^2$). That would indicate to me that an aerodynamical balanced rudder would be a necessity. That is not static balance, which is just a weight balance about the hinge line, but would call for



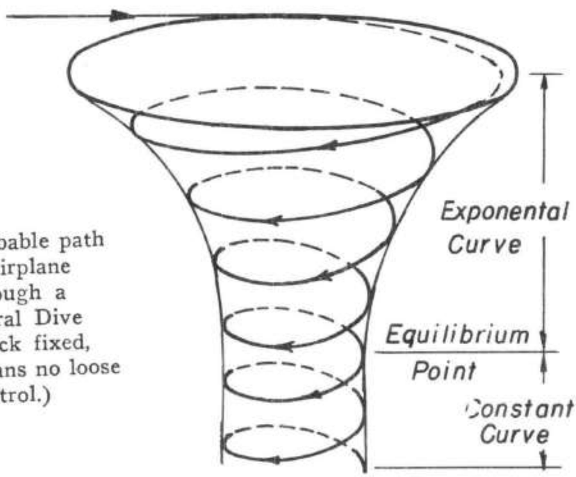
a hinge line set back from the L.E. of the rudder so that the L.E. (with nicely rounded nose) will stick out into the airstream when deflected, and cut down on the hinge moment necessary for deflection. Flutter must be watched for! This system warrants experimenting. The rudder should be statically balanced too, including the horn used for control (everything rigidly attached to the hinge line axis). The horn might even be designed to act as the static balance.

DEVELOPMENT OF SPIRAL DIVE

Considering the mechanics of entry into the spiral dive: A rudder deflection skids the model, the forward wing then picks up because of the dihedral which in turn causes a turn due to the bank. Then, if the vertical tail is too big, the model is prevented from slipping into the down wing or turn side, and since it is in a turn with the outside (up) wing going faster (therefore creating more lift) it tends to gradually roll over more, losing more lift, and diving steeper and steeper. Then, as previously mentioned, an equilibrium is probably reached before it gets to a vertical bank and it continues down.

To have prevented the initial downward motion would have taken up elevator when the bank (and resulting loss of lift) occurred to make up for the lost of C_L. For smooth, realistic RC flying I think an elevator tab linked to the rudder would be called for, although, then, how to get it down becomes a problem unless it is used for turns in one direction only.

Probable path of airplane through a Spiral Dive (stick fixed, means no loose control.)



SPIRAL DIVES IN A "CUB"

I had Henry up in the CUB one day and we tried a few spiral dives by letting the controls go free, (trimmed out) and giving the rudder a kick. It started on around all right and we did not even lose 100 feet on the first turn, but then it tightened up a bit and got increasingly worse. And contrary to my initial information, the ball was not in the center but skidded a little to the outside.

Back pressure on the stick only tightened the spiral and dive. It is quite important to realize that the turn must be stopped first, and that means opposite aileron to roll out so a straight dive results which can be pulled out of. In RC ships the only solution if there is no aileron control, is to have a rudder that will work at the spiral dive speed, and so slip the model into the turn which will pick up the low wing because of dihedral and roll it out. Aerodynamic balance on the rudder, either plain or of paddle variety seems to be the realistic solution other than more brute power to the rudder control.

Considering what goes on in the actual spiral dive in more detail, the reason it reaches some sort of equilibrium and continues down in a cylindrical helix path makes for interesting speculation. Because the ship is not in a vertical bank, there must still be some rolling moment due to yawing velocity (outer wing going faster gives more lift and so wants to roll more.) What keeps it from rolling over? The stab setting will only allow a certain radius of turn (or loop) after which any further tendency to tighten or reduce the radius causes a power, to keep the radius constant, coming from the stab. Then, too, it could be bordering on a high speed stall so that each time it tried to roll too far, thus tightening the turn and increasing the C_L, it would mush through a high speed stall and so prevent excessive bank from occuring.

RELATIVE AIRFLOW DIAMETER OF A HELIX

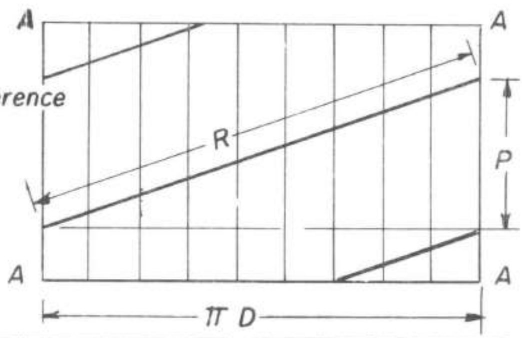
Your specific question asking for an equation expressing "relative airflow diameter of a helix" should also be dealt with. I suppose you could get an equivalent physical diameter, half of which would be the instantaneous radius of turn (not the radius of the helix). Your last sketch seemed to indicate that is what you desired. If so, the length of path travelled in one cycle or turn, "R", would equal the hypotenuse of a right triangle whose sides were pD and "P" where "D" is the helix diameter, and "P" is the helix pitch. Since helix is a curve cutting all elements of a cylinder at equal angles, if you cut the cylinder along an element and laid it out flat you would have a straight line for the helix:

$$R = \sqrt{P^2 + \pi^2 D^2}$$

R = Equivalent Circumference

Eq. Cir. $= \pi d = 2\pi r = R$

You want equivalent radius, r



$$2r\pi = R \qquad r = \frac{R}{2\pi} = \boxed{\frac{1}{\pi 2}\sqrt{P^2 + \pi^2 D^2} = r}, \quad \boxed{d = \frac{1}{\pi}\sqrt{P^2 + \pi^2 D^2}}$$

For your example of 10 ft. Helix. dia., and 10 ft. Pitch.

$$d = \frac{\sqrt{100 + 100\pi^2}}{\pi} = \frac{\sqrt{1085}}{\pi} = \frac{33}{\pi} = 10.5 \text{ ft. dia "equilvalent"}$$

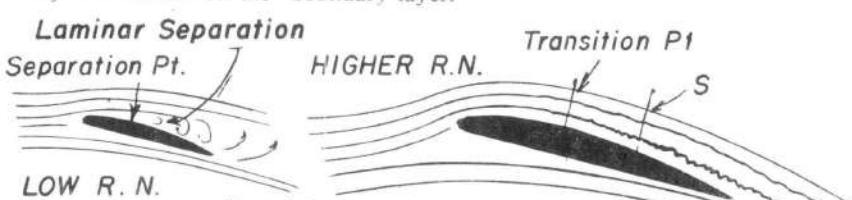
Not too much of an increase but then the usual spiral dive probably has pitch appreciably larger than helix diameter. I do not think the equivalent radius expressed above is your circular airflow radius unless the lift vector of the airplane goes through the previous flight path on the opposite side of the helix.

Hope this will be of some help.

AERODYNAMICS FOR R/C MODELS

by Henry Jex ——————— Sherman Oaks, Calif.

1. "Scale" effect is very important. A source of most trouble is effect of Reynold number on the "boundary layer."



Transition to turbulent boundary layer prevents separation.

2. Small models must have LOWER wing loading than large ones (½ A about ⅔ of Rudderbug's).

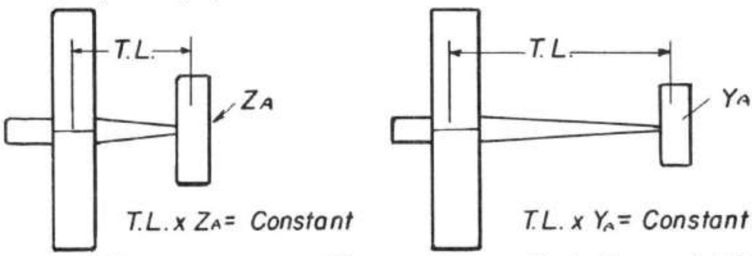
3. Small models need proportionately LARGER stabilizing and control surfaces. (½ A needs about 1.5 times area of large models such as Rudderbug.)

4 Airfoils for small models should NOT be too thick (8% Clark Y is O.K.) For larger models, use blunt noses for gentle stalls.

5. Turbulence producers such as wires, sand, etc. help on small models.

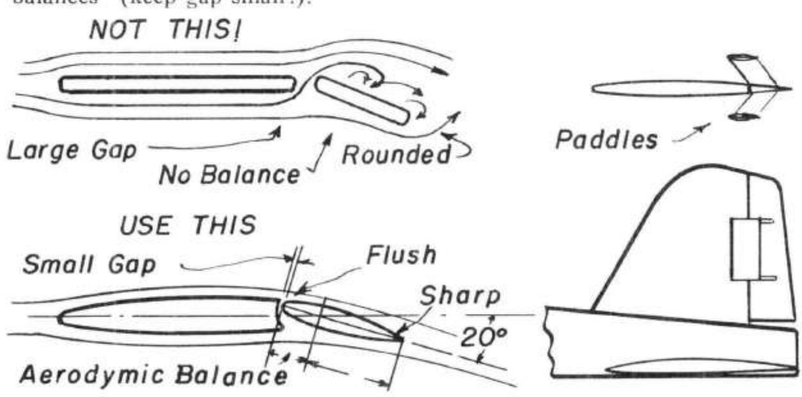
6. Zaic's "Circular Airflow" theory is useful.

7. For less violent reactions, use long tails of smaller area. Make (Tail area) x (tail length) = Constant.



8. C.G. governs recovery (like weathervane pivot). Foreward C.G. (10% to 30%) is very safe. Stalling tendency should be reduced by auto-elevator hooked to rudder. Aft C.G. (30% to 60%) is smoother but dives easily.

9. Avoid large deflections to prevent separations (rather increase size of surface). Keep hinge gaps small (leakage promotes separation). Use long narrow surfaces. To prevent jamming of actuator, use "aerodynamic or paddle balances" (keep gap small!).



Not guaranteed at low R.N. so maybe paddle balances should be used.

NOTES ON WAKEFIELD ADJUSTMENT

by J. Horton —————————————————— Baltimore, Md.

GLIDE ADJUSTMENT

For longitudinal glide trim we have three variables: 1. Stabilizer incidence; 2. Wing incidence; 3. Center of gravity location with respect to mean wing chord.

Several years of dead air testing with a stop watch proved that the center of gravity should be located on the trailing edge of the mean wing chord. As you move the center of gravity forward (holding stab incidence constant) you must increase wing incidence. This will greatly decrease glide duration as the wake drag goes up sharply, and this wing iincident will give you a slow glide which will not penetrate in a wind. Moving the center of gravity aft of the wing will result in a model with zero or little wing incidence and high sink in a wind. (You must carry wing incidence to prevent nega-dive—a dive with no recovery.

The stab setting is the key to good glide. Begin by setting the stab as close to zero degrees as possible. In calm air the model should glide flat with fair speed. If the model sinks in the glide it may be because of too much positive or too much negative incidence. If you use excess positive you will be forced to increase wing incidence to get a decent glide. Then the wing and stab will both be dragging, causing a slow sinking glide. If you use too much negative in the stab, the whole fuselage will be given an angle of attack and the model will really sink. One good indication of too much negative incidence is poor recovery from stalls caused by gusts, etc. Thus it is a good idea to test your model in windy weather. If it does not recover immediately from a stall, but oscillates several times you probably need packing under your stab leading edge—just use the minimum to get good recovery. Too much positive incidence will sometimes give you a model which will not recover from a dive at all, once it gets its nose down—the stab lifts strong and as speed increases the lift increases.

The wing incidence will thus be determined by C.G. location and stab setting. Once these two are set, carry just enough wing incidence for a clean glide

DIRECTIONAL TRIM

For contest models it is necessary to carry a good circle in the glide. A strong rudder turn makes for a more stable model. If upset it will return quickly to its original circle without floundering around and in a stall it will roll out in a turn. Your rudder tab should be high on the top rudder to keep the turn flat.

The rolling moment due to the high tab will be opposite the turn. A rudder tab on a sub-rudder will roll the model into the turn and make it unstable. On our rubber models we always use at least 30% rudder area below the model. This sub-rudder is very effective when the model has its nose up.

A good turn setting is a flat turn with nose slightly high and a fair glide speed.

While on the subject of glide, we should discuss one of the poor inherent design features of the rubber powered model. The long motor length gives the model high angular inertia as compared with a gas model or a glider. For those of us who are formula minded (formulas are bad as they are full of immeasureable variables) we can represent the motor as a thin uniform rod. Then:

$$\text{Inertia} = 1/12\ ml^2\ (m = \text{mass},\ l = \text{length}:$$

Or we can say inertia varies as the square of the length.

Further development will show the model develops high kinetic energy when it is pitched by a gust and large corrective forces are necessary.

For this reason we use a tail boom on our models equal to 50% of rubber length to increase dampening effect of the stabilizer (which goes up as the square of distance from C.G.) For example with a 35 inches long motor our model is 54 inches long.

Another little glide tip is to build your wing with a slightly drooped trailing edge. We don't know how good this is but we do know a reflex trailing edge is very bad.

For our folders we find a NACA 6409 wing section and Clark Y stab, good enough for a three minute Wakefield. High lift sections such as RAF 32 are not necessary as we are gliding faster than the old free wheeler glides.

We have also found that Poly-di-hederal is superior to other types due to the fact that when disturbed, the model will recover in a smooth rolling motion with minimum loss of altitude. We believe this is due to the fact that this type offers less resistance to roll than does single break or poly-hederal.

POWER ADJUSTMENT

Along about 1940 we were getting a 2:30 average out of our free-wheeling stick models (200 sq. inch, 3 ounces of rubber). We tried folders and found our glides very much improved. However our duration was still 2:30 average. Also our models were more unstable with folders.

We added the tail boom to increase glide stability, but still our times were too low. The only possible answer was that the free-wheeler was outclimbing the folder.

The Wakefields after the war proved further that the free-wheeler was outclimbing the folder.

The English started the theory of C.G. shift but we eliminated this theory by placing a spring behind prop—it did not help.

We found the bug one day while gliding a stick model off a high tension line pole. The model was trimmed out with a folder, then a freewheeler of the same weight was substituted. The model dove into the ground at about a 45° glide angle. The answer was simple. The free-wheeler had so much drag it slowed the model up and the wing did not develop enough lift to glide. The ship required about 2 more degrees wing incidence with the free-wheeler for decent glide.

Now to tie this in with the poor climb of the folder, we must realize that the rubber model is operating at an airspeed close to glide speed during the latter 2/3 of the power run.

Lets consider two models, one with free-wheeler and one with folder. The free-wheeler will glide most efficiently at say 5 mph and the folder at say 10 mph.

Now suppose we apply enough power to fly the models at 10 mph. The free-wheeler, since it is moving at twice glide speed will be climbing. The folder traveling at glide speed will be sinking at glide sink. (This is hypothetical to illustrate the point, several variables have been neglected.)

To get practical, our folders during the last part of the prop run actually sank at a speed greater than glide sink due to the fact that the prop was dragging and it could not develop glide speed.

To date, 19955, there are four methods of rigging a folder and getting free wheeler type climb.

I. The English method—locate the C.G. at 50% of wing chord.
Thus increasing wing incidence and giving a slower glide.
Advantages—stable, good right power, right glide performance.
Disadvantages—dead air time is lower than 100% C.G. model due to higher wing wake drag in glide.

II. California Solution—100% C.G. location with right climb and left glide.

Advantage—You can carry a tight left glide without vower spins due to the fact that you are climbing against rudder turn. The small glide circle will give you enough wing incidence for good climbs. You can adjust for steep climb without stalls when the model slows down, the rudder effect decreases and the right thrust turns model out of stalls. The glide is tops and dead air time over three minutes.

Disadvantage—You must carry slight right wash-in on right wing to prevent power spins. In the glide you are carrying warp with the turn. If the model gets its nose down in glide it doesn't pull out of spiral dive. We found the wing must be carefully built with very little wash-in on right panel.

III. Use of gadgets—Incidence changer such as was on my model in 1951 Zaic Yearbook.

Advantage—Top performance with right power, right glide setting—good stability.

Disadvantage—Gadget must be carefully built.

IV. Use of short burst prop run. This is the reason for the popularity of single bladed folder.

Advantage—By keeping airspeed under power much higher than glide speed you keep out of trouble. You get up high in wind, etc.

Disadvantage—With a 30 second prop run you'll need a 150 second glide to do three minutes—that's a rough ratio.

The new rules have not been with us long enough to determine best power set-up.

A 70 second prop run seems too sluggish in wind. A 30 second run seems too short for consistent 3 minute performance. A good compromise is 50 seconds. We use 14 strands, 34½ inches long, ¼ inch Pierelli rubber with a 22 inches diameter—22 inches Pitch two blade folder. This type rubber seems better than Dunlop or United States brands, but it nicks very quickly. Therefore it must be broke in fast or it will develop nicks and broken strands. Also we use a new motor for each contest.

While on power adjustments we ran across one interesting thing. In calm air, right thrust or down thrust seem to give same duration. However in a wind the right thrust will pull the model out of a nose up into the wind attitude whereas the down thrust won't. Therefore we are using no down-thrust—all right thrust adjustment.

While discussing wind there is another wind effect worth noting. Theoretically a model is supposed to become a part of the air mass. That is it's airspeed downwnd is supposed to be the same as upwind. However this doesn't happen in a three minute flight. Proof of this is that our models always stall heading into the wind. Thus it is apparent that the wind increases the air-speed of the model when heading into the wind. Therefore you need a fairly tight power turn to get a decent climb in wind. With a large circle the model flies downwind hardly climbing at all.

Under the new rules your model should do three minutes in dead late evening air consistently. This is not out of line, we were doing 2:30 before 'the war with free-wheelers. However, you have to get it up to get three minutes. Last year we were doing 3 minutes on 18 turns per inch. (A good safe figure.)

We include the following list of items we have accumulated during the past years to get top performance.

1. Test your motor by making up several 1 ft. lengths with the number of strands you intend to use and blowing them up. This will give you the maximum possible turns per inch.

2. Use a short fuse equal to motor run and open the model up to check performance under full power in calm and wind.

3. Build a jig out of a plywood base and balsa horses to band your wing and stab to, so that it won't warp between contests.

4. Key your wings and nose block. A wing shift will ruin your adjustments. A nose block in upside down has proven fatal.

5. Design your model so that your motor has no slack. The geared jobs proved the extra power gotten by this trick. Also wind in slow to prevent large knots.

Use a small band to hold in lower blade for glide. A blade in the wrong position when folded will really upset your glide.

Glue in all adjustments.

Use two sets of adjustments on your model. Calm air and wind. Know exactly what you need to change for wind. Use a short fuse to test your model in wind—it might not fly at all.

Check your motor before the contest for nicks. This will prevent a broken strand right when you want it least.

Do not change your adjustments during a contest unless absolutely necessary. A downdrift will make your model look all out of adjustment while it is set up perfect.

Check your prop for track and balance—also for the same pitch in each blade after locating bearings.

Another good tip is to be sure your top and sub rudders are at 0° attack when cementing to the fuselage. To check: Put pin in the center of the nose. Then pass a thread from this point around T.E. of the rudder and back to the pin. By lining up the rudder's L.E. to be in center of two thread strands, the rudder will be at 0°. We have had some strong rolling moments under full power caused by rudders out of line, even though the glide circle (low speed) was beautiful.

We always carry washing against power turns to prevent spins. However, use just a minimum amount. Too much washin will cause this panel to stall in the glide, and the model will fall off on this side (usually with the turn). Then, after stalling, picks up speed and stalls again.

A good general tip on the shape of your model is to keep all curves as shallow as possible. Too much attention has been paid to skin drag and not enough to wake drag. A classic example of this is adding a bulge to fuselage to keep surface area down, while still meeting cross section rules. By this method it is true you reduce skin drag. But the wake drag goes way up. Air will simply not follow a sharp curve. It will break away and cause high wake drag.

Due credit must be given to the following model flyers for the role their planes played in this article—Ray Dietz, freewheeler expert—Austin Hofmeister, Wake Team '51—Ed Magam, short burst artist.

HI-POWER RUBBER SUPPLY

by Sherman W. Schultz Jr. —————— St. Paul, Minn.

Real surgical tubing has power potency that has to be felt to be believed. An excellent power supply for sling shots, and almost unbreakable motor for "rubber" powered models. Since there are no "edges" to start a fatigue tear, surgical rubber tubing can be wound to maximum with safety. It is a power supply that may prove highly dependable. Be sure to use genuine item. They have what they call red rubber. This is not the type. The type used by the writer is sold as Davol Amber. Can be had: No. 2703 1/8 x 3/64 wall, No. 2710 3/16 x 1/16 wall and No. 2706 5/16 x 1 10 wall.

Now to pass on a few hints that will be helpful in applying this type of power. The inside is easy to lube—just suck the lube up the tube and let it drain out. Outside is lubed the usual way. The big deal originally was to let the air OUT of the tubing BEFORE the loops are tied into a motor. Tried removing air by twisting the tubing with ends open, but this did not prove practical. Finally solved the problem by puncturing tubing with a common pin every 6 or 10 inches intervals, when UNWOUND. If you puncture a bubble when it is wound, you get an explosion and a split in the tube. But puncturing the limp rubber acts as a valve to let out air when it becomes the least bit compressed, with no tearing or splitting.

THOUGHTS ON THE HELICOPTER

by Parnell Schoensky ——— Kirkwood, Mo.

There must be quite a few creative modelers still with us, fo- interest in quality events such as R/C, Clipper Cargo, Wakefield and Navy Carrier continues t ogrow. There is evidence that some of these modelers are becoming intrigued by the helicopter event, now that the Hiller Competition rules have given it direction and new life. The lack of basic rotary wing know-how is naturally a deterrent to many modelers, as is the scarcity of meets offering the helicopter event. I would like to offer a few hints on the first count; the contest opportunities will come when more of us get out of the easy kit habit and do a bit more experimenting on our own.

What can you expect of a well-made helicopter, built to one of the current designs? Right now, climb and duration are plenty good—but stability and control leave much to be desired. There is plenty of challenge here, and that's what makes it so interesting. The creative modeler who isn't afraid of work can make some genuine contributions to our knowledge of model 'copter design.

Most of the gas-powered helicopters flown at the past three Nationals have utilized the Clough feathering rotor system, and employ either 3 or 4 blades in the main rotor. These models will make beautiful vertical flights in calm evening air, provided that their blades are freely pivoted and have identical hinge axes at the proper chord point, and further provided that rotor inertia is sufficiently low to permit rotor RPM of 125 to 175 to be obtained from low-torque glo engines. Try adding a pinch of clay for nose ballast; the conventional feathering-rotor 'copter will ease forward—probably start to circle, as propwash takes effect on the fuselage. The contest judges will never see that gentle forward motion on a typical breezy contest day, so let us add more clay. Up she goes . . . and forward . . . nose eases down-farther—too much! Almost every such model will nosedive or spiral dive when ballasted for a useful degree of horizontal movement. Now you know how Langley and Lilienthal, Wilbur and Orville used to feel. It's back to the shop for pliers and pencil . . . there must be a way to make model helicopters with far better longitudinal stability than the feathering rotor type.

Suppose the problem is simply to make a vertical flight, but the wind is fresh and gusty. Should turbulent air tip an underpowered model, or one with an overlarge fuselage and fin, you've had it. Either the model slips rapidly, goes into a dive as though noseheavy, or inverts completely and falls like a dead duck. What's the answer? Excess horsepower helps, as do high-speed rotors with their greater gyroscopic stability effect. Get off to a good start by keeping your mind on these painfully simple features: a) light weight, b) ample power, c) smooth-functioning, carefully balanced rotating and pivoting parts. Through neglect of such elementary requirements, half of all helicopters built are glued to the ground—and half of those that do get aloft are prone to wobble uncertainly and work themselves into a spiral dive. If your model falls into the latter class, its time to do a little thinking and a lot of experimenting. Consider the fuselage; it is working in a strong slipstream which may impinge on the top and sides in such manner as to destabilize the model. Recheck mast alignment. Move the c.g. farther foreward, then aft, so that you know for sure what its effects are. Follow with more drastic steps; rip off your original fuselage and replace it with a cleaner

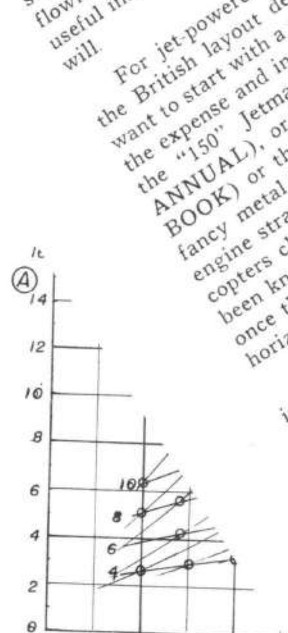
version. Consider various rotor changes, such as a change in blade pi
point, shorter and heavier tip weights, stiffer or more flexible blades, or even a different small prop. The main thing is that you experiment until you find out just what YOUR model needs to make it fly right—no one can lay down rules for trimming models when people almost invariably modify kits or published plans, or come up with original designs whose features (and construction) vary all over the map. Some of my experimental models have been flown hundreds of times, and even when they crashed they were yielding useful information—it is almost as helpful to know what won't work as what will.

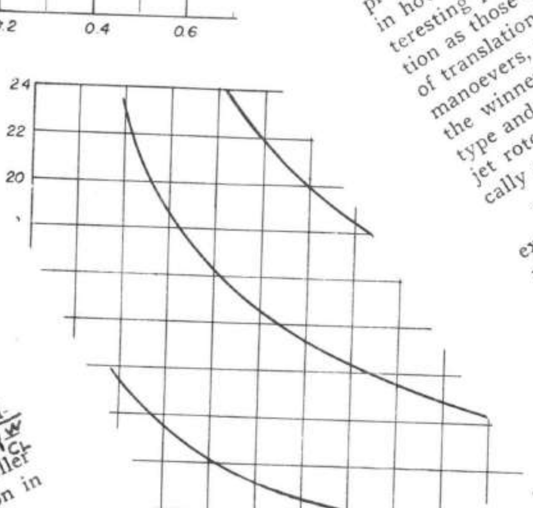
For jet-powered helicopters, the combination of Jetex power units with the British layout developed by Boreham can hardly be beat. Should you want to start with a thoroughly dependable type of whirlybird and don't mind the expense and involved loading procedures common to Jetex, get a pair of the "150" Jetmasters and make the JH-2 (1954-55 AEROMODELLER ANNUAL), or, scale down the Henderson Whirligig (1953 ZAIC YEARBOOK) or the JH-3 (AUG. 55 MAN)) to about 40 in. rotor diameter. No fancy metal parts are required, but do make the rotor blade supports and engine straps sturdy. These skewed-hinge (pitch-cone coupled, that is) helicopters climb well, are highly stable, and autorotate so well that they have been known to pick up risers and soar abit. They fly well in breezy weather, once they get started, but don't do much better than the feathering rotor in horizontal flight.

So far rubber helicopters designed for the Hiller Competition are too f
in number for any design trends to have emerged. Don't neglect this typ
power, however, for its great simplicity and cheapness allow one to co
trate on the more important stability aspects of the design. One of th
features of the Hiller event is emphasis on stability and control rathe
on duration alone, making work with rubber and Jetex power as re
as that with the glo and diesel engines.

THE WORK AHEAD. Most of all, we need to develop n
control systems that will enable our model 'copters to achiev
longitudinal flight. The designers who comes up with a goo
problem will have the Hiller Trophy nailed down for a f
in hovering flight, in climb and in autorotative descen
teresting problems, though none either so difficult
tion as those associated with stability. After we h
of translational flight and are able to put our m
manoevers, payloads, and other measures of
the winners in this event. There is a grea
type and applications of powerplants for
jet rotors, enclosed engines, Piasecki
cally controlled "flying platform" ty

The key to getting more mod
exchange of information on d
periments, read all you can
and British model mags. S
hops, sketch up your mo
fire off a letter to the neare





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Here, as you might expect, we have a very much more complex problem as there are several more variables, the principal ones being: The ratio of rubber weight to total weight, the angle of climb, and the fact that the lift coefs and speed are different in climb and glide.

You will find the magic formula in the attached calculations, and it appears rather long and cumbersome. I have had to make one assumption, which is that the thrust, velocity and angle of climb remain constant over the power run. In other words, I have taken average values. This will make a slight difference to actual calculated times, but it does not alter the relationships that give the maximum performance.

The most important result is that the maximum performance is given by having the ratio of rubber weight to structure weight 2 to 1. I.e., the rubber weight equals ⅔ of the total. This simple fact applies to any type of rubber powered model except helicopters. It even applies to them if the change over from powered flight to autorotation takes place instantaneously.

The next important point is the fact that it is worth more to save a small amount of structural weight than to cut down the drag by a similar percentage. So the moral there is never reduce drag if it means increasing the structure weight.

Now having settled for our 2 to 1 rubber to structure weight ratio, we find that the ratio of motor run to total flight time and speed on the climb to speed on the glide are both functions of lift/drag ratio and nothing else. This now establishes a definite procedure for rubber model design.

Total time is given by $$T = 0.0766\ \eta K \sqrt{\frac{C_L}{w}} \cdot P \qquad (1)$$

where C_L and w are as defined in the glider section. P is a function of t[he] lift/drag ratio plotted in Fig. 1. K = work done per ounce of rubber, and η the efficiency of transferring that energy into useful thrust.

K is about 2,000 ft.ozs/oz. of rubber and η can be taken as 50%. This [in]cludes prop efficiency, frictional losses at various bearing and the actua[l ef]ficiency of the rubber motor in its method of giving power, i.e. by untwi[sting]. This knocks our formula down to:

$$T = 76.6 \sqrt{\frac{C_L}{w}} \cdot P \qquad ($$

so that all we need to know about our aeroplane are the L/D ratio, coefficient and the wing loading. This figure for flight time only app[lies pro]viding that the motor run and climbing speed are those given in Figs.

Anyway, equation (2) gives us a still air flight time. Then, ha[ving ...] the lift/drag ratio, and knowing that the glide speed is given [...] average climb speed from Fig. 2. This gives our [...] than this to allow for the flu[...]

Now, let us have a look at the answers. First of all, the angle of climb is very steep. It is actually given by (90° minus the glide angle), so that aeroplane will have an ideal flight path like this

Secondly, reference to Fig. 2 shows that the climbing speed is of the order of 1/3 of the gliding speed. In other words, the aeroplane should helicopter up for max. duration. You can see this without being very mathematical in that the aim is to get the model to the greatest height from a given amount of work out of the motor, but you must spin the power out to a reasonable time.

Now, no matter what the flight path, the work done to get the weight of the model up to a certain height must be the same, so the residue of work, which s that required to overcome the model drag, must be a minimum. If the motor run is made very long as is the case with the long fuselage model, the climb will be shallow, the speed fairly high, (somewhere near glide speed) and the work done against the drag is high for two reasons. One that the speed is higher than the ideal case, and the other is that the work done to overcome the drag equals D.V.t, so that the longer motor run, the more work is required to pull the model along. At the other extreme is the very short motor run fast climb, which will not get very much higher, if it does get higher at all, and has taken a very much shorter time to do it.

So, to summarize, we want a fairly fine pitch prop to keep the climbing speed low, a motor run about ¼ to ⅓ of the total time to get a steep climb, and the rubber weight twice the structure weight.

Everything we have said about C_L and L/D for gliders applies equally to rubber models. I am including some specimen calcs of typical models in the sums section. The most important thing to note is that all these sums are completely general. I do not suggest that you can calculate the actual flight time by these methods, because it is obviously difficult to estimate C_L and L/D accurately, but you can at least see which way to go to get maximum performance, and see the relative importance of the various parameters.

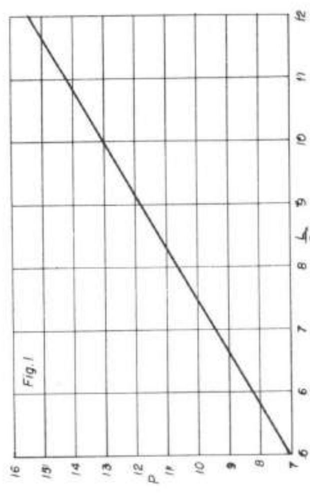


Fig. 1

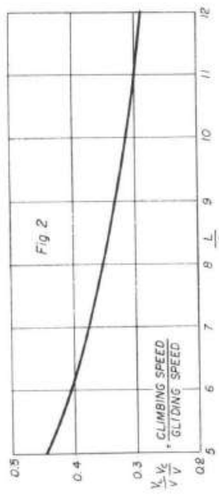


Fig. 2

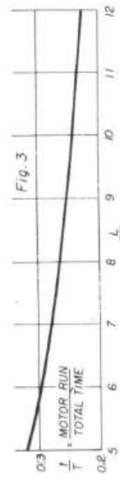


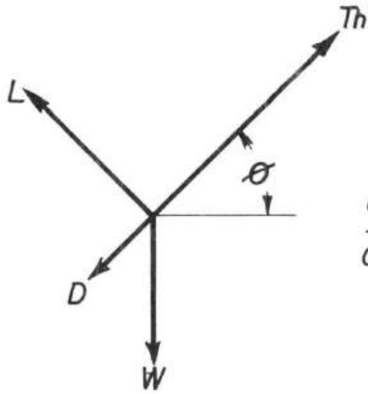
Fig. 3

TRAJECTORY STABILITY

There are now two types of stability in general. One is that associated with the layout of the aircraft and involves forces and moments. It can be broken down into longitudinal and lateral stability, and I shall define it as internal stability, as it is dependent primarily on the position of various parts of the aircraft relative to C.G. The other stability concerns the position with the various forces acting on it, considered as a point in space. This is trajectory, or what we may call external stability. It will be noted that the moments of the forces about the C.G. does not affect this stability, only the actual forces and the direction in which they act.

The first point is that the aircraft is always neutrally stable in a horizontal plane. In other words, in still air, the aircraft will follow a similar path in this plane whether you start it off facing north, south, east or west.

The same cannot be said of its path in the vertical plane, because the direction of the weight force varies with the angle of the flight path. We shall define, for present convenience, thrust to be along the flight path. Drag, of course, defined in the opposite direction to the thrust and the lift is perpendicular to these two. Then, if Ø is climb angle:



$$Th = D + W\sin\varnothing$$

$$D = Th - W\sin\varnothing$$

$$L = W\cos\varnothing$$

$$\frac{L}{D} = \frac{W\cos\varnothing}{Th - W\sin\varnothing} = \frac{\cos\varnothing}{\frac{Th}{W} - \sin\varnothing}$$

$$\frac{d\frac{L}{D}}{d\varnothing} = \frac{\left(\frac{Th}{W} - \sin\varnothing\right) - \sin\varnothing + \cos^2\varnothing}{\left(\frac{Th}{W} - \sin\varnothing\right)^2}$$

$$= \frac{\frac{Th}{W}\sin\varnothing + 1}{\left(\frac{Th}{W} - \sin\varnothing\right)^2} = 0 \quad \text{For neutral stability}$$

That is $\frac{Th}{W} = \frac{1}{\sin\varnothing}$ For neutral stability

$$\frac{L}{D} = \frac{\cos\varnothing}{\frac{1}{\sin\varnothing} - \sin\varnothing} = \frac{\cos\varnothing\cdot\sin\varnothing}{\cos^2\varnothing} = \tan\varnothing$$

First of all, consider the model climbing at a small angle. Then imagine it displaced so that Ø is increased. Note that this does not involve changing L and D as for internal stability, as we imagine moving the whole block of air in which the model is flying. Then the only effect is to swing the weight backward through a small angle, (now shown dotted). The principle effect is to increase the component of force in the drag direction, without altering the force in the lift direction (as W is moving almost perpendicular to the lift). This tends to slow the model down, so its nose drops and it returns to its original attitude. This condition is therefore stable.

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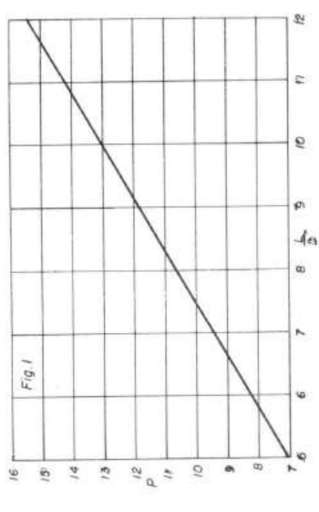

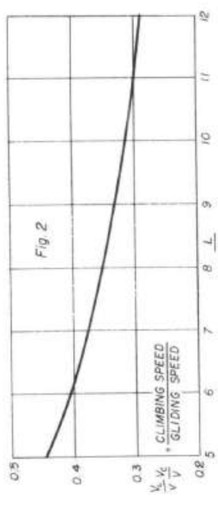

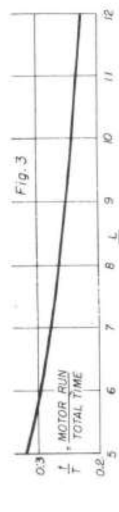

TRAJECTORY STABILITY

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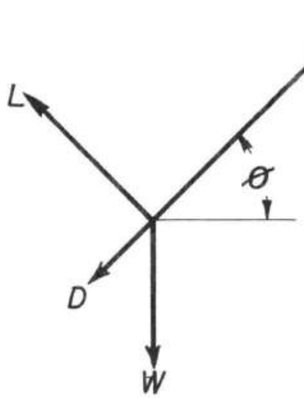

$$Th = D + W\sin\theta$$

$$D = Th - W\sin\theta$$

$$L = W\cos\theta$$

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$$\frac{d\frac{L}{D}}{d\theta} = \frac{\left(\frac{Th}{W} - \sin\theta\right) - \sin\theta + \cos^2\theta}{\left(\frac{Th}{W} - \sin\theta\right)^2}$$

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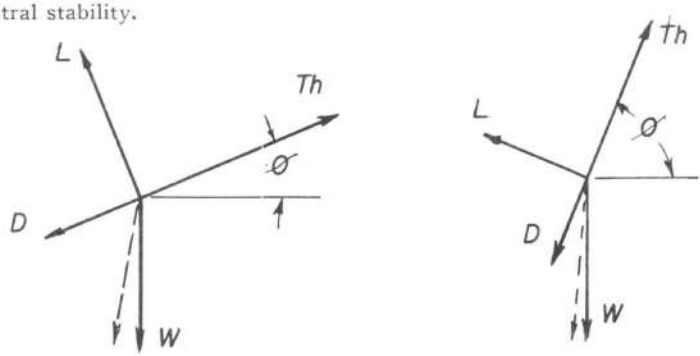
First of all, consider the model climbing at a small angle. Then imagine it displaced so that θ is increased. Note that this does not involve changing L and D as for internal stability, as we imagine moving the whole block of air in which the model is flying. Then the only effect is to swing the weight backward through a small angle, (now shown dotted). The principle effect is to increase the component of force in the drag direction, without altering the force in the lift direction (as W is moving almost perpendicular to the lift). This tends to slow the model down, so its nose drops and it returns to its original attitude. This condition is therefore stable.

The other case is a climb at a very steep angle. Here only a slight increase in Ø swings W back to dotted position, but now the force in the lift direction is noticeably increased without making much difference to the drag. More effective lift pulls the aeroplane over on its back, and so the condition is unstable. In other words, as proved mathematically, there is a condition for neutral stability.

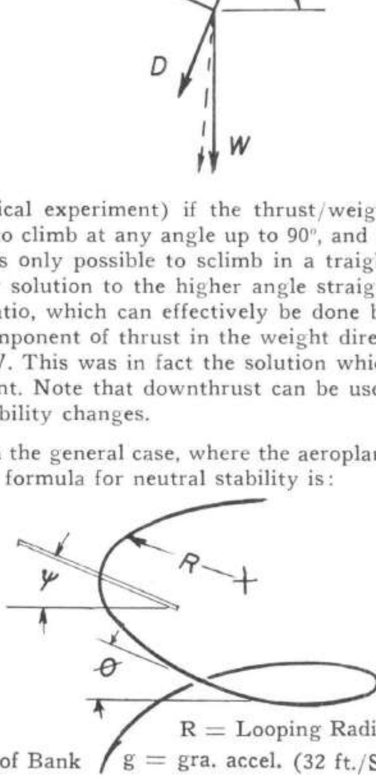


Now (reference to your own classical experiment) if the thrust/weight ratio is larger than 1 it is not possible to climb at any angle up to 90°, and in fact for a thrust/weight ratio of 2, it is only possible to sclimb in a traight line at an angle of up to 30°. The only solution to the higher angle straight climb is to reduce the thrust/weight ratio, which can effectively be done by putting downthrust on. This puts a component of thrust in the weight direction and so reduces the effective Th/W. This was in fact the solution which you yourself adopted in your experiment. Note that downthrust can be used than for both internal and external stability changes.

It can be proved quite simply that in the general case, where the aeroplane is turning and looping that the general formula for neutral stability is:

$$\frac{Th}{W}\sin\theta = \cos\psi + \frac{V^2\cos\theta}{R.g}$$

For positive stability the left hand side should be smaller than the right hand side. You can see that for a given climb angle, the stability increases as the velocity increases, and also as the looping radius decreases.



R = Looping Radius

V = Velocity (Ft. Sec.) Ψ = Angle of Bank g = gra. accel. (32 ft./Sec.)

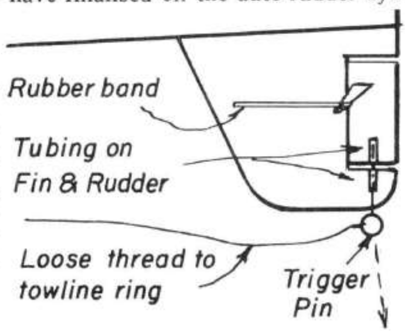
Comparing this with Th/W sinØ = 1 for straight flight, we see that an angle of bank of Ψ reduces the possible Th/W ratio for an angle of climb Ø in the ratio cos Ψ :1, so is undesirable. On the other hand for no bank, the formula becomes

$$\frac{Th}{W}\sin\theta = 1 + \frac{V^2\cos O}{R\,g}$$

Then the radius of the loop is decreased, so the possible Th/W ratio for a given angle of climb is increased. In other words, if a model is trimmed at too high a climb angle for its thrust/weight ratio, it will go into a loop which tightens until it reaches a steady state when it is once more in a stable condition. Hence the spiralling pylon climb. No power on earth will make that climb high and straight if it has a large power/weight ratio. Remember that the spiral is only a stable loop with a lump of roll thrown in to keep it going up.

ALAN C. BROWN (England) October 19, 1953

To revert to more general topics, I have finalised on the auto-rudder system, which now looks like this:

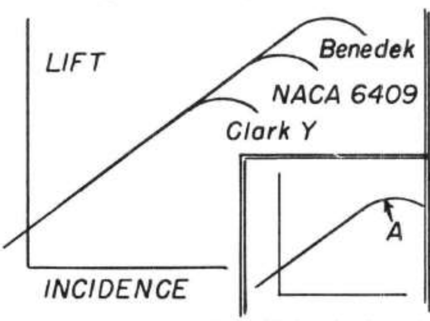


This method works very well. With overhead launches, the weight of the line pulls it off as soon as the ring comes off the tow-hook, and I have had no jamming troubles. I used it on the glider which you published in the last couple of months to win the Western Area glider eliminations for the Area Central Championship.

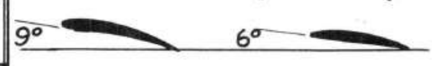
I would like to make a small comment on Pete Buskell's aerofoil tests. I see that he got very poor results from Benedek sections, which are designed to give a high $C_L^{3/2}/C_D$ ratio at high lift values. If you operate with this type of aerofoil at a lower Cl, i.e. a lower incidence, than that for which it is designed, then the drag will be greater for that given lift than a section of less camber like NACA 6409 or Pete's "Slick Stick" section. Hence its efficiency will be lower.

The reason why Pete's Benedek sections were, I think, at a low operating C_L was because he used a tailplane probably of Clark Y type section for all his tests. Now, let us suppose a few typical operating incidences, just for comparison: Clark Y at 6° — NACA 6409 at 9° — Benedek at 13°.

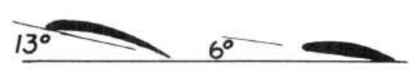
Note that, for a given Aspect Ratio, all these sections have approximately the same lift curve slope which looks like this:



We now trim our NACA 6409 model which may fly like this: a reasonable set-up for stability.



Now we put our Benedek on



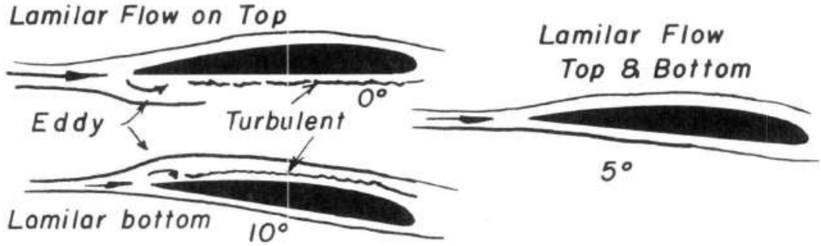
The wing is operating efficiently, but the tailplane has either to operate at 6°, which involves a very inefficient C.G. position (7° angular difference!) or alternately we increase the tailplane incidence, and now find that it is operating at a reduced local lift curve slope, point A on curve. Or it may even be stalled completely.

The tailplane efficiency depends on the lift curve slope, and so the stability suffers when trimmed at this incidence. Our next alternative is to trim it at reduced incidence, when we shall give the Benedek wing 9° or 11° incidence; in other words, another Benedek type section, although probably one of smaller camber than the wing. I am quite convinced that this set-up is an improvement on any of the conventional types that Pete Buskell has used. — Not for power models, of course, but that's another story.

TURBULENT FLOW AIRFOILS

by C. M. Christie ——————————————— Scotland

The first work done with turbulent flow wing sections was a comparison of Clark Y with the reversed section, the range of 30,000 to 80,000 RN. By visualisation tests, it was found that an eddy is formed at the nose of Clark Y reversed, the eddy creating turbulence on meeting the section. Later, this was found to be as Schmitz had predicted.



A crescent aerofoil, of same thickness as Clark Y, was next tried, and balance tests were interesting in that the lift showed a definite "surge" before the tall. The last section tested, had, again, the same thickness as Clark Y, and at the same position, 30%, but the nose was dropped and pointed, the nose angle being 45°. Here an even more curious curves, with two stalls, one at 7°, the other at 13°.

Now, it seems at present that the "nose vortes" theory seems to be the key to the understanding of turbulent flow wing sections. The crescent aerofoil has a sudden increase in lift due to the eddy changing sign and making the top surface turbulent instead of laminar.n This has two effects. 1—The flow adheres better because it is turbulent. 2—The favorable direction of the eddy increases the circulation and hence the lift of the aerofoil.

The double stall of the 30% aerofoil can be explained in the same way. The flow at 7° is leaving the back of the foil to such an extent that a stall develops; yet increases the wing incidence, and the flow becomes turbulent, clings to the back of the wing, and lift increases.

At present, these results are just being studied and it is a bit too early to give any definite conclusions, apart from the obvious one that for a flat-bottomed foil it is advantageous to have the maximum camber about half-way back, rather than in a forward position.

"AEROFOILS FOR MODEL AIRCRAFT"

Excerpts from a Thesis by C. M. Christie

Originally, it had been hoped to use the results of tests directly in the design of models, and so a similar form of construction was used for the wings. However, unknown turbulence of the tunnel, the unsatisfactory balance results, and Low Aspect Ratio (even with end plates) for test wings, all caused the idea to be abandoned.

The results, therefore, as shown on the charts, should be taken more for comparison value than for actual performance calculations of a new model. For example; the drag values include the drag of the balance arms and end plates. Of course, approximate plus or minus values can sometimes be more helpful than none at all. And the drag of the balance arm and end plates may be considered as the drag of the model parts other than the wing, if you like. The main purpose of the tests to investigate the effects of RN, however, proved of value.

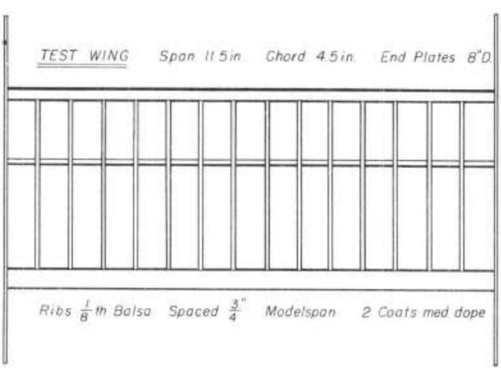
CHART 1: Clark Y tested at RN of 47,000 (20 ft./sec.) and RN 78,000 (33 ft./sec.)

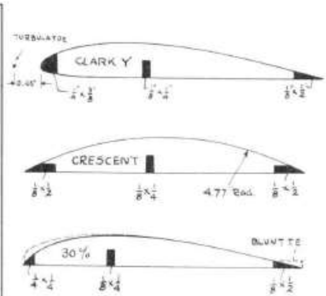
CHART 2: The effect of RN on Cl and Cd. Note how value of Cl increases without appreciable increase of Cd when RN changes from 35,000 to 45,000. This is caused by the change of airflow about the aerofoil from "laminar" to "turbulent." As you can see, it is desirable to have the aerofoil operate at the higher RN to gain extra lift without drag penalty. As luck would have it models tend to operate at the lower end of the "critical" point of the airflow change due to increase of RN values.

CHARTS 3, 4, 5, 6 and 7: How to cause "turbulent" type of airflow without necessarily going to high RN is a problem many have tried to solve. Some do so by use of turbulent type of airfoils, characterized by pointed leading edges. Others use wire or string in front of the aerofoil to cause turbulent airflow before it reaches the aerofoil itself. The result of "turbulators" are shown in the charts mentioned.

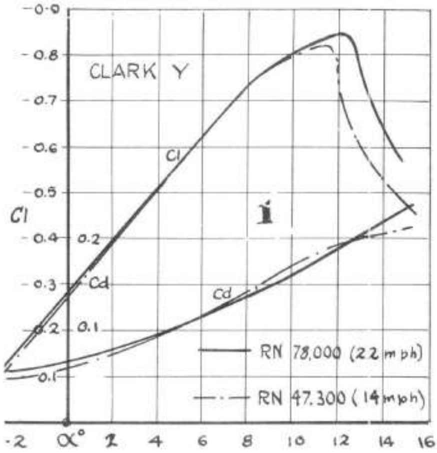
CHARTS 7 and 8: Show results of testing three "different" type of aerofoils to demonstrate the properties of the pointed leading edges. One is a similar to Clark Y from 30% back to Tr. Edge, and thinned slightly towards the Leading Edge. The second is regular Clark Y but with Trailing Edge as Leading Edge. And the third is crescent or an arc. As you can see, the sharp edges do not have a "critical" change in the Cl and Cd values with Rn changes. So that it can be taken for granted that such sharp leading edges produce turbulent flow at relatively low RN, and do not go through transition from laminar to turbulent airflow as many other aerofoils do.

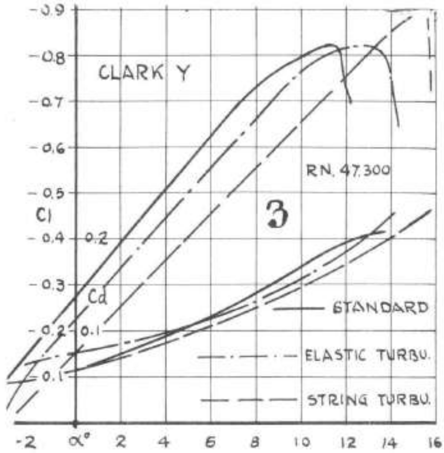
MORE INTERESTING POINTS: The thesis consisted of about 130 pages. It made very interesting reading on Mr. Christie's appreciation of model aerodynamics. — The 30% aerofoil was tested with a blunt trailing edge; rectangular instead of taper. At low angles of attack, its Cl values were lower and Cd values higher than standard 30% aerofoil. However, it had similar values at about 6 degrees. Seems to indicate that at low angles small variations cause differences. — Mr. Christie also made a run in a smoke tunnel for visual inspection of laminar and turbulent flow. — Of special interest was the study of the boundary layer by using kerosene coated test wings. By observing dry, almost dry and wet spots after a test run, an approximate airflow condition could be plotted over the wing.

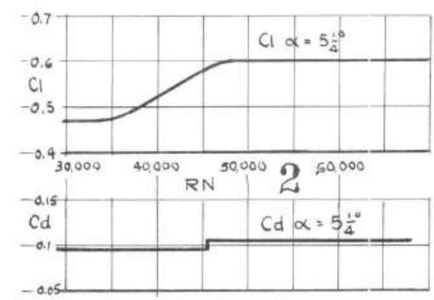


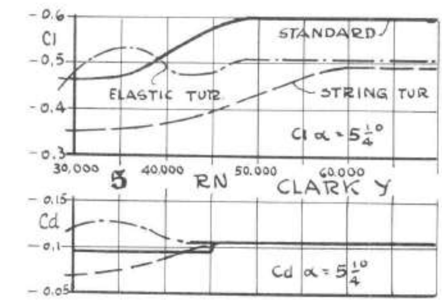


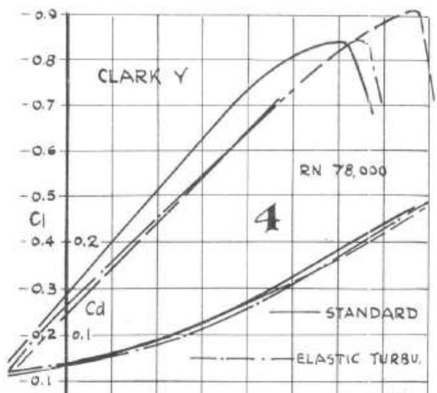
TEST AIRFOILS

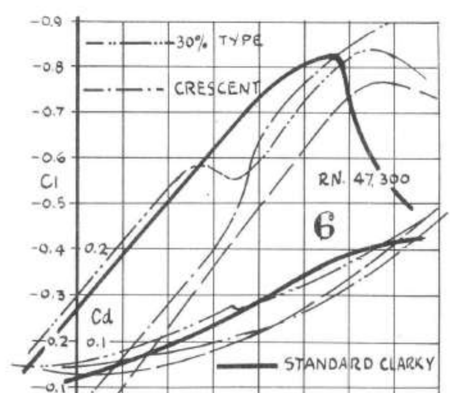

CLARK Y
1
Cl
Cd
RN 78,000 (22 mph)
RN 47.300 (14 mph)
α°

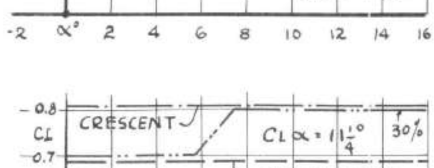

CLARK Y
3
RN. 47.300
Cl
Cd
STANDARD
ELASTIC TURBU.
STRING TURBU.
α°

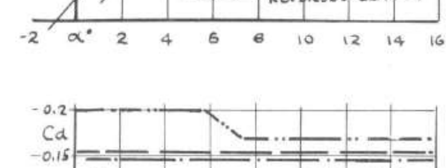

Cl α = 5¼°
Cl
RN
2
Cd
Cd α = 5¼°


Cl
STANDARD
ELASTIC TUR
STRING TUR
Cl α = 5¼°
5
RN
CLARK Y
Cd
Cd α = 5¼°


CLARK Y
RN 78,000
4
Cl
Cd
STANDARD
ELASTIC TURBU.
STRING TURBU.
α°


30% TYPE
CRESCENT
Cl
RN. 47.300
6
Cd
STANDARD CLARK Y
REVERSED CLARK Y
α°


CRESCENT
CL
CL α = 11¼°
30%
7
REV. CLARK Y
RN


Cd
8
Cd α = 11¼°
R.N.

WHIRLING ARM AIRFOIL TESTING

by S. Suzuki —— Japan

In order to test the performance of the model wings, I designed the Whirling Arm test stand and tested about 90 different sections during the period from 1948 to 1952.

The wings used for the tests were similar to those used on models with ribs spaced about 40% of Chord. Double covered with thin Japanese tissue and water sprayed. Some of the wings were covered with ¼ mm. card board or wood veneer to compare with tissue covered type. Very little difference was found between them.

The airfoils designed by me were tested on three sets of wings and the mean value taken. Wing sections for practical model work, such as Clark Y, NACA 6409, 6412, were thoroughly tested by making 7 wings for each type. The best aerodynamic performance of the lot was taken. This means that the performance of the model airfoils is very changeable according to their construction.

These tests proved that the most important conditions for improvement of duration capacity are as follows: 1st, The Airfoil Section, 2nd; Aspect Ratio 3rd; Reynolds Number.

For one test a very long time (15 hours) is required, and we must calculate the air density by always reading temp. and air density. I would like to advise those who plan to use whirling arm test stand to study the method used in windtunnel test, otherwise they cannot give credence to the value of the Whirl. tests.

By making the whirling arm tests, I could understand the aerodynamics phenomena. For instance, that the dynamic Lift and Drag are as follows:

$$L \,\&\, D \propto \rho V^2 S \qquad (1)$$

L = Dynamic Lift   D = Drag   ρ = Air Density   V = Velocity
S = Wing Area.   As dynamic pressure P is ½ ρV, therefore:

$$\text{if } L \,\&\, D \propto \rho V^2 S \qquad (2)$$

and the proportional constants are C_L and C_D, L and D of formula (1) will become as follows:

$$L = C_L \tfrac{1}{2} \rho V^2 S \quad (3) \qquad D = C_D \tfrac{1}{2} \rho V^2 S \quad (4)$$

C_L is called lift coefficient and C_D is called drag coef. I understand that formulas (3) and (4) are same as those for full size aircraft

Wings for a duration race must have a considerable large lift coef. and ratio of dynamic lift to drag (L/D). In the diagram the max. ratio of L/D is plotted for each section. The equation to satisfy the measurement of these ratios becomes as follows:

$$\frac{L}{D}\max = \left(7.9 + \frac{Rn}{10^5} - \frac{t+m}{4\cdot 3}\right)\sqrt[3]{A} \qquad (5)$$

Rn = Reynolds Number (4 to 12 x 10^4)   A = Aspect Ratio (5 to 16)
t = Wing Thickness max % Chord (0 to 15% Chord)
m = Mean Camber max % Chord (2 to 8% Chord)

This formula can be applied to wings of the present model airplanes.

I found many things that surprised me in these tests. But above all, I am surprised by the large min. drag coef. Accordingly, the max. ratio of L/D is extremely small, and the angle of attack that gives the max. ratio of L/D is extremely large, on verge of stall. As it is considered that increase of the min. drag coef. will bring falling off of the Laminar Boundary Layer, a suitable equipment for turbulent flow must be designed. It is considered that the laminar boundary layer under low RN will soon return to the former laminar flow, even if disturbed a little, and not be changed to turbulent flow so rapidly.

In Report No. 1 I made public two kinds of wing which were covered with rumpled paper and which showed the best performance in my tests of the turbulent flow equipment. By rumpled paper cover I mean that the wing was first normally finished with regular covering, and then covered again with finely rumpled and crinkled paper which was cemented to the leading and trailing edges only, with sufficient stretching to obtain airfoil shape. These wings were not good looking, but have the best performance.

The wire turbulator will injure the performance if its size and location are not correct.

Another interesting test is that of the sink and source wing. Most wings are hollow, therefore, if many small holes are bored on the surface of the wing, the sink is high at the leading edge and low at the trailing edge, and natural sink and source take place. Then the increase of the pressure becomes slow, and as a result, the laminar flow is maintained for longer time, and the min. drag decreases. The reason is that the vortical flow behind the wing becomes smaller and the drag decreases because of the removal of the point of falling off of laminar flow in the rear, but frictional drag does not decrease.

This kind of wing makes a very big hiss of sink and source during flight, and is stirring, but as the increase in ratio of dynamic lift to angle of attack $(-dC_L/d\alpha)$ decreases, it is not suitable for duration.

It is understood that the aerodynamic center of the aerofoil section is at the place of 23% to 27% of the chord. The shifting of the center of air pressure is not as large as on full size aircraft. This means that the model wing construction is easier.

It is advisable to use airfoils for duration models that have "high" mean camber, about 4-5%, and make the thickness of the wing as thin as paper.

LAMINAR FLOW

The laminar boundary layer is easy to fall off from the surface, but the turbulent boundary layer is not easy to fall off the surface because exchange of energies take place within the layer.

Therefore, if laminar flow is changed purposely to turbulent flow, the frictional drag increased a little, but the total drag is decreased. The reason why the drag of the model wing is extremely large, is that the greater part of the drag is occupied by the drag produced by the vortical flow caused by the falling off the laminar boundary layer.

They who do not understand these facts are easy to give thoughtless credence to the test value of low velocity tunnel.

The natural wind and the wind in wind tunnel are quite different. The difference is whether or not there is turbulence in the wind. The wind with turbulence has greater energy than the natural wind. Therefore, it is not easy to leave the wing surface, and accordingly shows a smaller drag value.

The influence of the turbulence under low Reynolds Number cannot be improved at all, because the shape of the air stream passing by a material object is entirely changed by existance or non-existance of the turbulence.

No turbulent flow can be produced by fitting a wing spar on the surface of the wing ribs and covered with thin paper. The spar disturbs this smooth curve on the wing surface, decreases the ratio of L/D, owing to increase of drag of the spar together with a great decrease of dynamic lift. The design of such mainplane structure must be changed immediately. I have tested with NACA 6412 as shown on the diagram.

THE TEST WITH LATTICED TURBULATOR

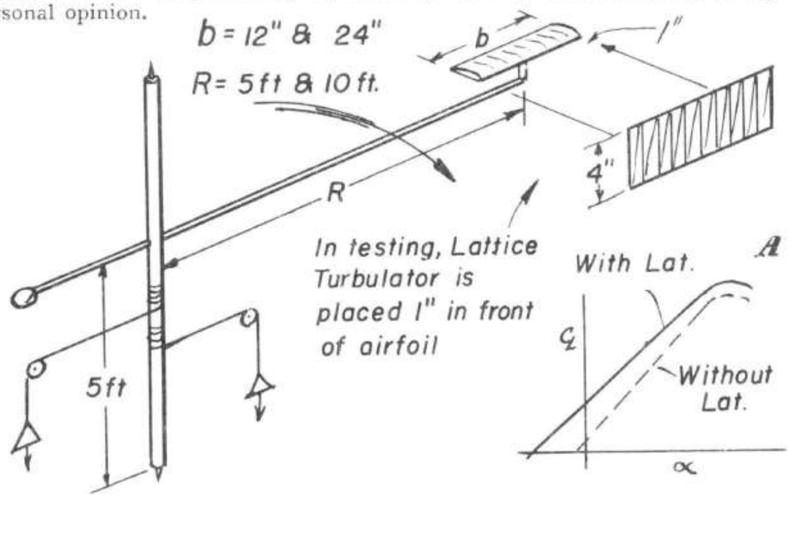
The diagram shows the latticed turbulator equipment. It is a simple equipment consisting of a frame like a picture frame, on which iron wires of appropriate thickness has been tightened vertically. The thickness of the wire was selected through test, so as to match RN of the wing.

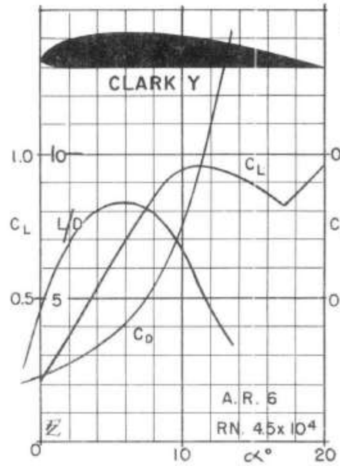
The result of the test showed, as expected, decrease of drag, increase of dynamic lift, and increase of Zero angle of lift. But it showed decrease of $dC_L/d\alpha°$, as shown in the following diagram. *A*

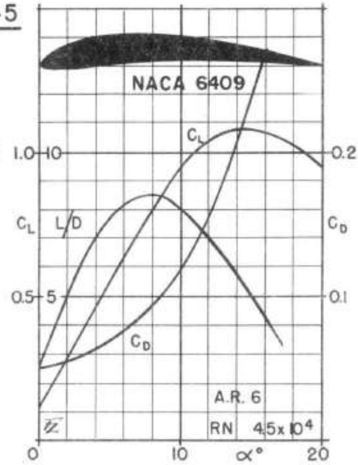
As the angle of lift zero of the wing section is extremely small in my test, there are opinions in Japan that the test might have been made erroneously but I do not think so.

As already stated, the model wing is stalling even at small angle of attack, owing to falling off of laminar flow, so I call the model wing "stalling wing."

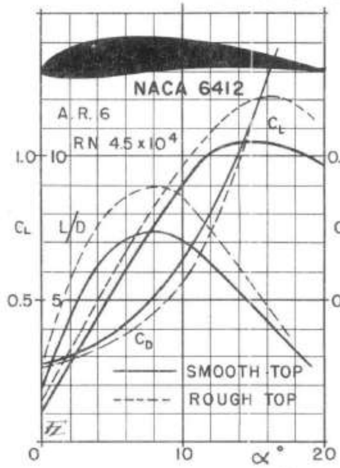
Generally, $dC_L/d\alpha°$ of model wings is larger than the value of wind tunnel test. It means that dynamic lift decreases greatly owing to decrease of the angle of attack, and the angle of zero lift decreases inevitably. The decrease of the angle of zero lift means decrease of removal of the center of air pressure, which was proved by my test. I ask you to understand this as my personal opinion.

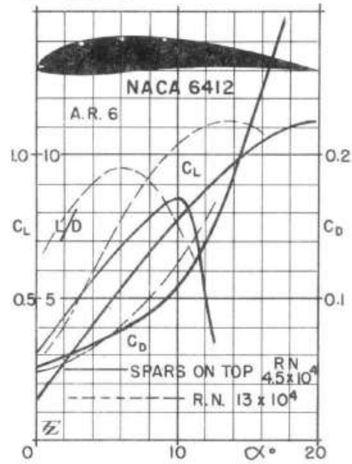




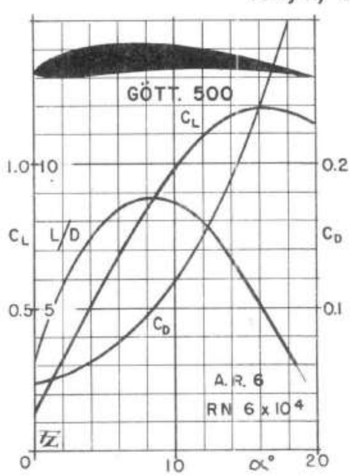


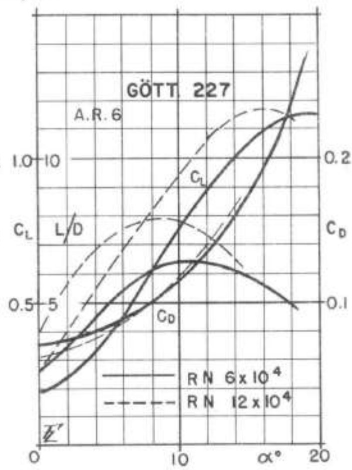
Tested by S. SUZUKI

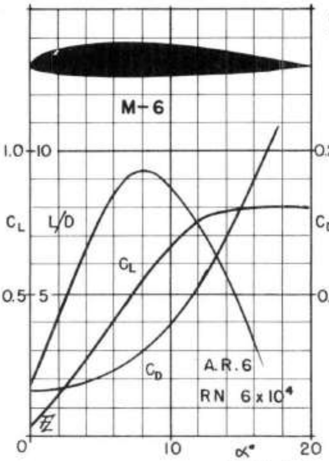


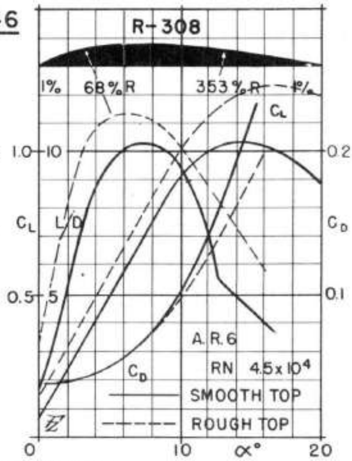


Tokyo, Japan









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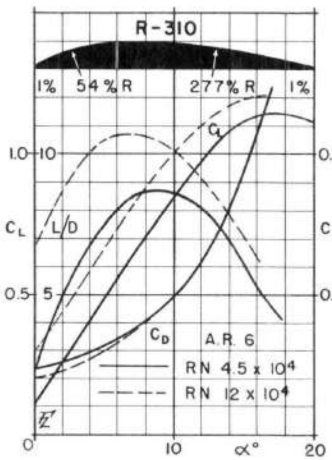

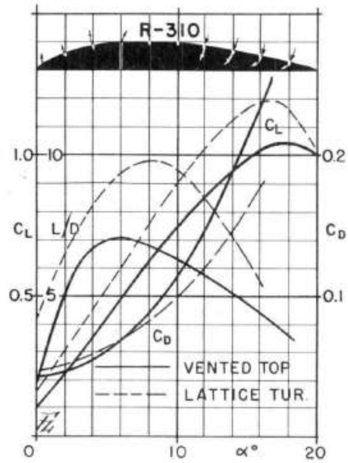

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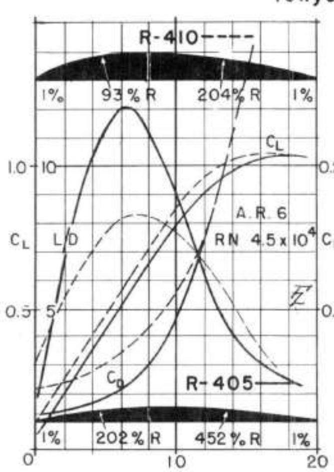

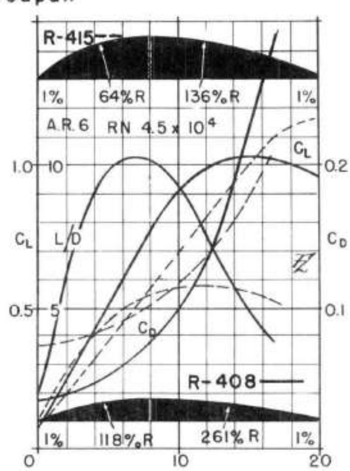

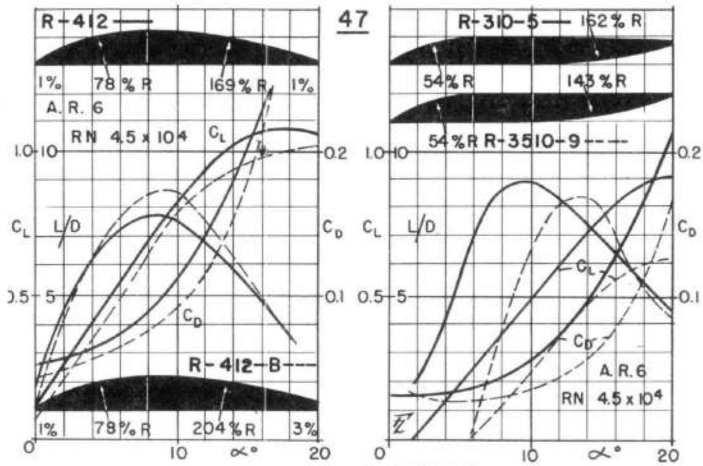

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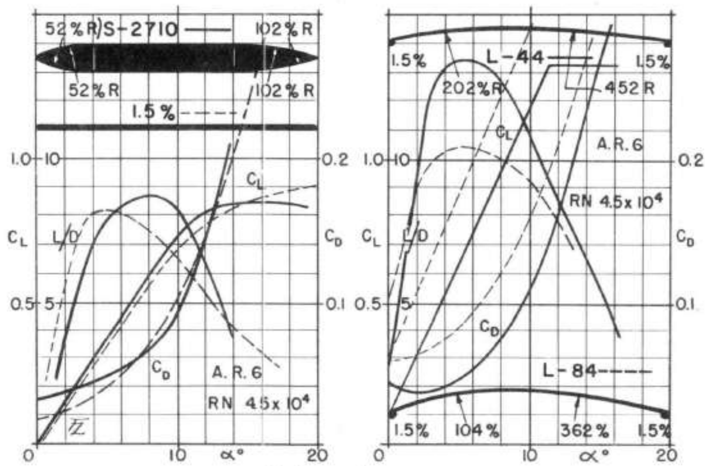

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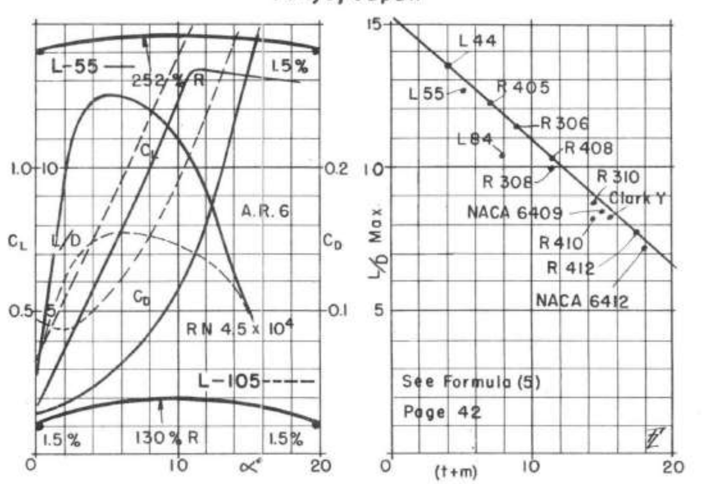


WAKEFIELD PROPS

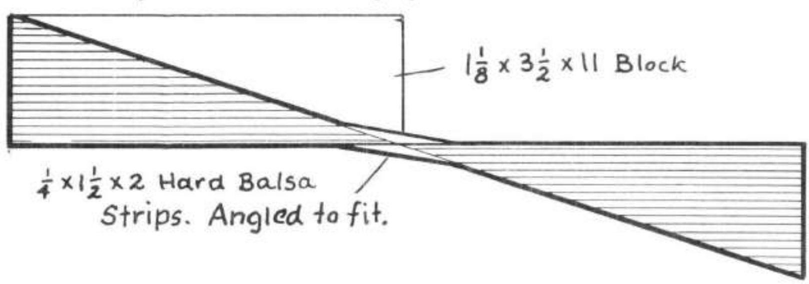
JOE BILGRI —————————— SAN JOSE, CALIF.

I don't know why you want a little background music on Wakefield props, but it all started several years ago flying indoor models and traveling around the U. S. to various Nationals; sometimes flying in a high ceiling, and sometimes in a low ceiling. Well, one year after I had developed a fairly good prop-power combination for a high ceiling cabin, and with the next large contest to be held in a low ceiling, I decided to leave the pitch the same and increase the diameter, figuring the larger prop would hold down when using the same power. But the effect was just the opposite for the mcdel climbed faster and higher.

It wasn't until the days of the early morning Wakefield flying that I thought to try the indoor style props outdoors. By indoor prop style I mean an X type blank with the front cut back to absorb some of the excess power of a tightly wound motor. While my first props were of too high a pitch they were a great improvement over what I had been using. From that point I started trying lower pitches and larger diameters up to about 26-inches bu soon decided that there was limit for practical purposes and dropped back to props that ranged from 22 to 24-inches with about a 1 = PD ratio; with the best all around prop being a 22-22 carved from a 1-1/8 by 3½ by 11-inch block cut diagonally and joined in the center to form a 22-inch prop block.

How or why my name became connected with these props I don't know, for in my magazine articles on the Duster & Drifter no details other than being carved from an X type block were given. But at the 1952 Wakefield Finals in Sweden many were curious about the props I was using, and they were examined rather carefully by many after the contest was over. At the 1953 Wakefield Finals held at Cranfield, England which was won by Joe Foster, he noticed several models props similar to his. While I'm not sure whether he or someone else put the "Bilgri" tag on the props but anyway when 3-views of the winners appeared in one of the magazines two of the top three places were noticed as having "Bilgri" type props, which was quite a surprise to me since I had never written anything about the props. One of the articles on Gustav Saaman's 1955 winner also had this notation about his prop, and one of the things that he said when I was talking to him at the Finals in Germany was that he felt that this type of prop was the only major improvement in Wakefield models in a long time.

While many who have tried this type of prop have commented that it added from 30 to 40 seconds to their models average I often wonder whether the reason so many like the X style is because of its performance or the fact that they can carve a 24-inch prop from a 12-inch block.

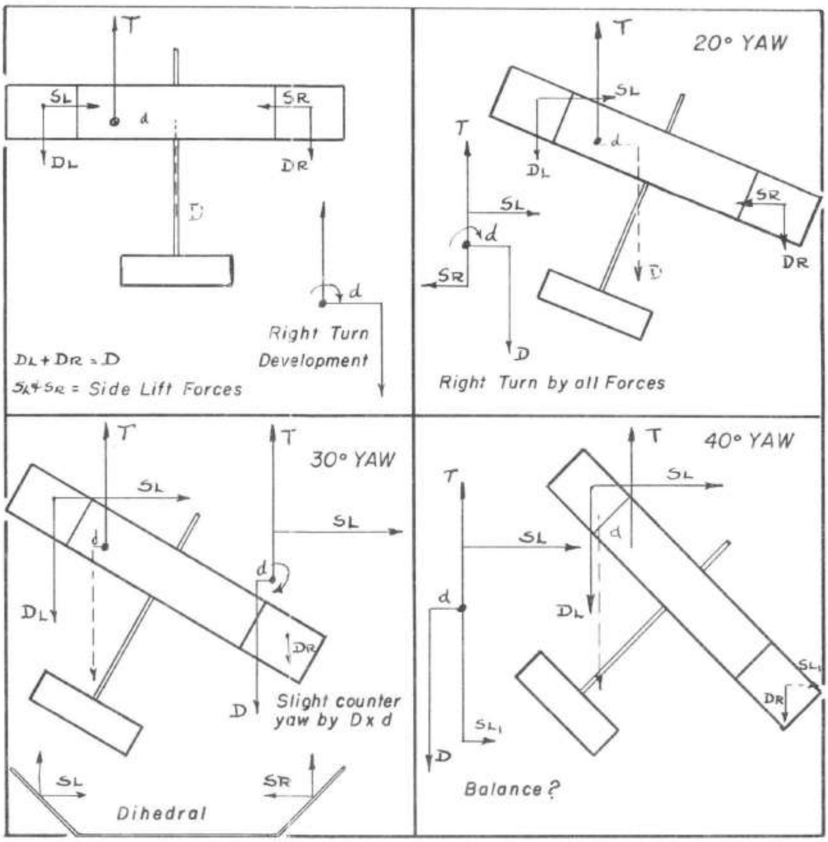


EFFECT OF SPAN-WISE SHIFT OF C.G.

by G. R. Nolan —— Fairborn, Ohio

I just cannot quite accept Test No. 11 (1951-52 Year Book) as a good test, although the information on Pages 22 and 23 seems proper. I believe that the energy in a glider can be said to be effective at the C.G., and that the thrust which is causing it to move is acting at the C.G. I also beleve that for a model to be directionally stable there must be limits on the degree of yaw (skid). If there are no limits the model will fly sideways in the direction the upsetting yawing force started it.

To me the reaction of the glider in test No. 11 looks like the series of drawings I am enclosing. I am trying to show that Test No. 11 results could be achieved by the horizontal effect of the displaced C.G. as well as by the vertical effect. Torque, of course, has no thrust effect in a horizontal plane when considered by itself. — It will be interesting to see how you handle the tilted tail business. I used the tilted stab for a couple of seasons, and find it a godsend. Eliminates a lot of sour thrust adjustments necessary to get a proper gliding circle. I have noticed that further forward the ship balances, less the tilt works. Figure the gliding up load on the stab is less with forward C.G. At increased speed the effect is similar to forward C.G., but not really too noticeable in practice.



On the prop wash effect on pylon-deep belly, fin, etc.; the easiest way for me to show what I have in mind is to send you my little test rig—R.O.G. stick with gas model prop. If you have a half hour to kill sometime you might enjoy sticking the fins in different positions and observing the results yourself. Walter Good shows in one of your books how he makes use of the idea to obtain proper power-on characteristic.

The main reason that I settled on the propwash idea is that I ran a series of tests on my contest models wherein the fin was moved back and forth while maintaining the same area moment (Area x dist. from C.G.) The right turn was less with the big fin forward than it was with the little fin far back. The only explanation I could dream up was that the larger fin, although it's moment arm was shorter, was able to make more efficient use of the prop wash. I have a notion that prop wash does not diminish in a strictly linear manner as distance from the prop increases.

January 20, 1955

Attended the Annual Indoor Meet, Jan. 3rd, in Cleveland. It was windy again—real windy! Did better this year. Won paper covered and got fourth in mike and glider. Obarski won mike. I threw 53 sec. in glider. Proudest achievement in many a year. I used a 7/8 size Foster glider from the 1953 Y. B. A GOOD GLIDER DESIGN—if kept light and thrown "West Coast Style."

Your Y. B. plans are really handy when a person needs to get "good" in a hurry. That little glider by Gordon Cain (in M.G.D.) is really a jewel—fantastic glide. Five sec. better than anything I could come up with.

I built Foster's Wakefield (1953 Y.B. & Jan. 1953 M.A.N.) last year primarily because I felt I had fallen behind current Wakefield practice and needed a proven ship in a hurry. Turned out to be the best Wakefield ever. Got me all the way up to the fourth round of the Semi-Finals where my rubber pooped out. This year I will fly a slightly modified version of the same ship.

Have not decided what to build for FAI. One thing I am sure, a big dead air "barn" does not work too well here in the Midwest. I climbed as high as anybody last year, but the rough windy weather brought the ship down in two minutes or so. The ship would do better than three minutes at night without effort.

I never had much luck with the "modern" style gas models anyway. They run high without fuss, but they just cannot stand the turbulance I guess. Many times I ran one up a mile—hopped into the car—stepped down the road a quarter of a mile,—just in time to see the ship landing. And if you do hit a thermal way up on the top of the climb, the model goes out of sight too quickly and is almost impossible to D/T down.

Now, Taibi has hit on a good thing with his "SPACER." They are really different from the "Hogan" type. Inasmuch as they carry enough angular difference to enable them to ride rough air without too much loss of height. Sort of a compromise between the "new" and the "old" style.

Incidentally, Taibi and Mahieu adjust in the manner described in my "Adjusting for Climb" bit in the 53 Book. Taibi has been doing it since the 40's or before, and the Zekes were supposed to be adjusted that way—though most are not.

I've been running a hit or miss program at the club, aimed at teaching the kids how to build indoor models, and it has been a revelation indeed. Boys that do the stunt pattern are utterly helpless when it comes to adjusting a Baby R.O.G. of a H.L. glider. Most of them did not realize that you could adjust a model. They figured that it would either fly or not. And wood—. They would use anything, and harder so much better. Some models could not be heavier if made of maple. No one seems to dare to believe that he could carve a prop, and sometimes I am not sure if they ever will.

This brings us back to the Year Books. They filled a need for model builders for almost a generation. In the thirties when you were an eager young lad you put out the best that you could dig up each year, and the early year books provided a solid foundation in model building know-how. Most of the grad model builders of today, and years past, owe a lot to you for providing them with the fundamentals.

Since the war your books have catered to the experts, for the most part men thirty or more. And now you propose to put out a yearbook for radio only. They will probably go about as before. Radio it seems, marks the end of the road for the old-timers. What do you do then?

Frank, there are about a zillion kids between 0 and 15 years old, tearing around who really NEED help. They really want to be good, and do not know how or where to start. Somebody either collars them and shows them how, or they blunder through their teens building what they do and then quit.—

Tell them about wood and weight and adjustment. Give them a few good and reliable designs. Show them how to carve props and bend wire and slice wood; how to handle rubber and throw gliders, and all the rest. Above all else, avoid giving them the "bum steer." Do this and I'll bet my shirt you will sell books like you have never sold before!

May 24, 1955

Sorry I did not write sooner, but I have been busy getting ready for the Eliminations at Columbus.—Flew them off yesterday. Won first in gas and second in Wakefield. Flew my old Wakefield (Foster Design) because my new one was not finished. The bus is getting a little limp but it is still reliable.

My FAI job seems about perfect. Aerodynamically it is virtually the same as last year's design. Shorter nose, greater concentration of weight at the C.G., higher pylon, more dihedral in center and less in the tips—were the significant changes. Structurally it is 100% new. Much neater, lighter, stiffer, cleaner etc. Mechanically I tried to make it reliable with no gimmicks. Everything 100% sure fire if possible.

All this paid off as the ship could not have been better. Perfect R.O.G., groove climb, fine rollout and nice rational glide. However, like most low angular difference jobs, it is not at its best in rough air, but I don't know what to do about it at this stage of the game. If they are stable you cannot get them up, and if you can get them up they have a slow recovery rate. So, until I investigate Taibi's set-up further I will just have to settle for the best I know now.

GLIDERS AND POWER FLIGHT CONTROL

by Hank Cole —————————————— Palo Alto, Calif.

NORDICS

Made the mistake of shipping my NORDICS back via the Panama Canal. Only advantage to this is that I will be forced to build new stuff since only one of the NORDICS arrived in flying condition. I have a lot to learn about waterproofing. I did salvage one NORDIC and took it out the other day to try my hand at some of the towing tricks which Max Hackling showed me.

I feel that the main lack of American Nordic Team was our inability to handle our gliders on the tow and to maneuver them into thermals. I can see that this is an art and something which requires continuous practice. Maneuvering the model from the launching site, or holding it on the tow to find the thermal was virtually unheard of in our contests. In fact in our elimination contests, we were held to launching our models within three minutes after obtaining a timer!

It is little wonder that we did not bring home the bacon with that kind of experience. If we can field a team which has had experience in thermal hunting with NORDICS I think we can give them a run for their money next year. I for one am going to put a lot of time on the line and hope that I am lucky enough to make the team next year.

I built three NORDICS this last year of widely varying design. This was necessary because I had no previous experience with towlines. However, my first glider turned out very well. It would average 2m 15 sec. in morning air. The long nose was necessary to balance the model since I made it on the heavy side. This long nose gave the glider some rather peculiar flight characteristics. It would tend to wander until running into a thermal, then it would tighten up to the verge of spinning. Also, it proved to be very stable in the 30 m.p.h. wind in which our semi-final contest was held for the U. S. Team. I expected calm weather in Germany so I set to work on a high aspect ratio job. Unfortunately, this model was barely finished in time to make the trip. When I left for Germany, it had only 5 flighs.

This model is definitely in the 3-minute average class. Only flew two flights in Germany (2m ls. and 2m 5s.) On the latter flight, the wind was coming up and I felt that it was getting too windy for the high AR glider, so I switched to my other job. This proved my undoing because the other glider for some reason was badly out of trim. I suspect that it was not sufficiently water proofed because it had been alright in test flights before it rained.

Live and learn. There is a noticeable increase in performance with the high Aspect Ratio, but they are too easily upset in wind. Hence, you need two types for wind or calm. Of course, if you can tow into a thermal every time, you need only one type, Lindner's.

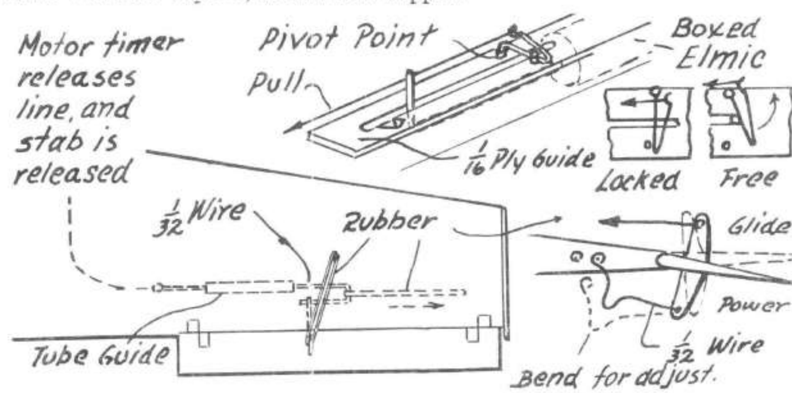
POWER FLIGHT CONTROL

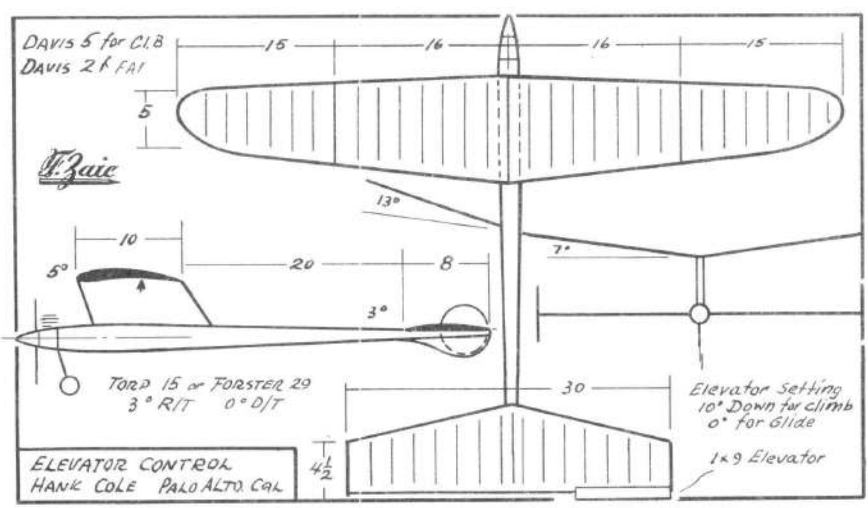
Noted your interest in the elevator control I have been using on my gas jobs. It started back in 1950 when I built a B job which had bad half-looping tendencies. Downthrust did not solve it so I installed the elevator which was down for climb, and up for glide. This gave plus-plus set-up for climb, and a tow-line glider set-up for glide. You know, lots of decalage allows tight circle in glide without spiralling in. (Circular Flow to you.)

This worked very well. Took the job to the 1951 Nationals in Dallas where it made one 10m flight, and was last seen heading North over a large mp.

One of the advantages of this system is that you adjust the glide and climb separately. Also you do not need inefficient downthrust, or those hair-trigger adjustments with the C.G. far back. The enclosed sketch shows the size of elevator and model I used. More recently I have been experimenting with this set-up of an FAI with promising results. I believe that it is important to keep the C.G. well forward for adequate stability in the climb. The elevator can be used to trim the model for climb and glide separately without resorting to the inefficien method of downthrust.

It is very important to have a mechanism which locks the elevator in position in the same position at all times or the flights will be inconsistent. Also the lock must be firm enough to prevent flexing in flight. The trigger set-up I use with the Elmic timer is shown in sketch.—1: Timer arm strikes wire arm which is pivoted in alum-tube. 2: Wire arm is carried around its pivot and so allowing the rubber band to cross the pivot point. 3: As pivot point is crossed, the rubber band is released instantaneously, and whatever action was held captive, it can now happen.





TAILLESS DEVELOPES

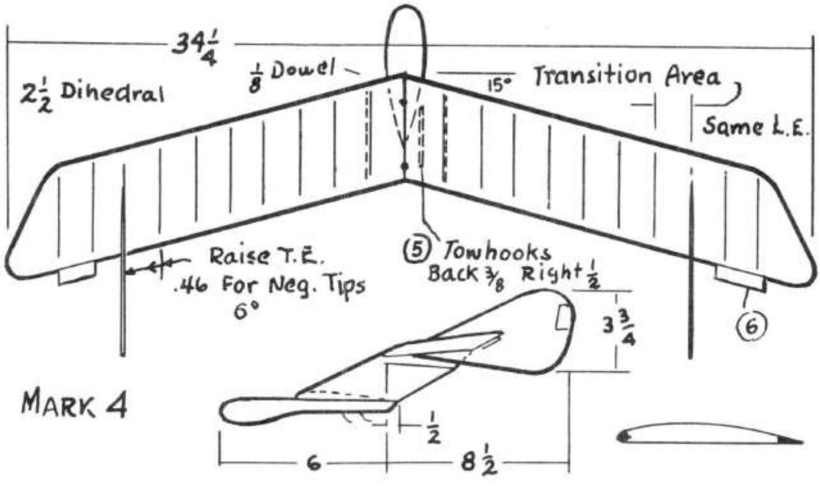
FRANK S. GUE Hamilton, Ontario

The small job described herewith was designed and built this Spring (1955) and tested extensively on our holidays just over. The preliminary design was from MODEL GLIDER DESIGN recommendations, and was made small because of lack of time and limited room available in our apartment. It was intended to indicate what might be expected from a larger job built for radio control.

We had bad troubles with side areas. We should have known better than to use sheet sub-rudders, but even after we got rid of them, we added area a second time at the rear and discarded a complete fuselage in favor of one showing about one-third of the side area of the original. Finally got a job that would tow up and did not run with the breeze. Each rudder now has about 14% of the area of the wing proper. The stages of the development are shown.

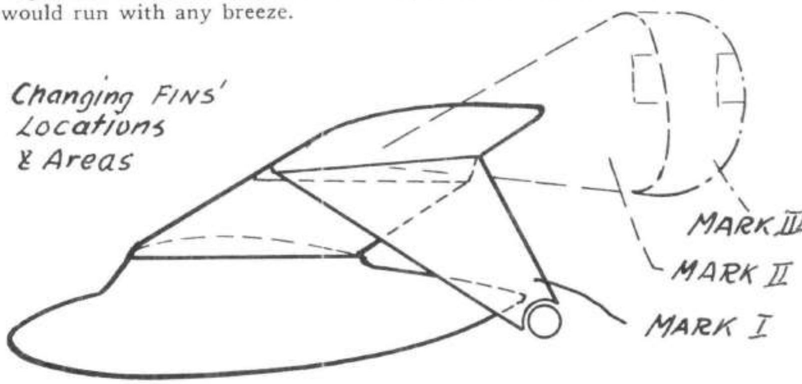
You asked about drag rudder vs. moment rudder. I used moment chiefly, although I did adjust by always starting with the rudder on the inside of the turn; then if more rudder were needed, I used the outside tab. I am very leery of the drag method, because I feel one is likely playing around with a control surface in a stalled or near-stalled condition, or worse yet at the point where a little gust or other upset will swing it from lifting to stalled. Must confess I haven't too sound grounds for such suspicions, expect that rudder stall is the only thing by which I can account for the occasional nasty spill I had while trying to use drag control.

I have set for myself a purely empirical rule; never set a trim tab at an angle higher than you would consider setting a main surface. This limits rudders etc. to about 7 or 8 degrees. I have never had occasion to regret this. If I can't get enough control this way, I enlarge the tabs. My idea is to avoid at all costs a sudden change in the model's trim, which would probably occur at the instant the model was fighting for control anyway and might make it impossible for it to get back on an even keel. Trim tabs on the little tailless, by the way, are a bit too small. Big tabs, of course, mean sensitive adjustments and a need for fairly heavy gauge hinges to hold a setting. I wound up cementing mine.



MARK 1: Full size sketch of side area distribution. Flight characteristics: poor. Sluggish response to rudders (tabs probably too mall). No directional stability except in dead calm air. Would not launch: after climbing to 25-30 feet, it would pick up a little side wind and try to turn with it. Towline would preven the turn, causing a skid until all lift was lost and model would drop like a stone. All this would happen so fast that numerous performances had to be observed to deduce what was happening.

MARK II: Numbers in circles indicate sequence in which changes were made. Flight characteristics better than Mk I but still bad. Model would start swinging on the towline part way up and would have to be released to prevent loss on control. Skid on early stage of tow cured, however. Model would run with any breeze.



MARK III: (Rudders extended to rear). Launch much better though still oscillatory in some wind and catapault conditions. Model still ran with the wind, however, and could be made to circle only with excessive rudder adjustments which in turn resulted in difficult launching and the odd brief spiral-dive when wind and rudders worked together. This version was, however, the first civilized and promising one, and was the first one giving flight durations worth timing.

MARK IV: Flight characteristics very good under most conditions. This model circled properly regardless of wind, although it slowly became evident that we had finally got more than enough rear area, as the model would occasionally nose into a strong gust and stall. Centrally located tow hooks made the model difficult to launch when adjusted for proper turn. Careful judgment of wind conditions and a little luck with the side-wind launch, however, resulted in some really exciting flights.

MARK V: Relocation of the hooks corrected all the launching problems, giving better height and a straight launch. We got the model right up over the catapault anchor every time with this arrangement. Catapault was about 28 ft. of 1/8 flat rubber and 88 ft. of thread

MARK VI: Addition of the horizontal trim tabs was a convenience intended to make possible minor changes in horizontal trim without having to fuss with the ballast in the nose, which was small gravel with cement poured in on top, and so not very handy to alter in the field.
This resulted in a very flexible arrangement which
could be adjusted rapidly and fairly predictably.

REPORT ON SOME RUBBER TESTS

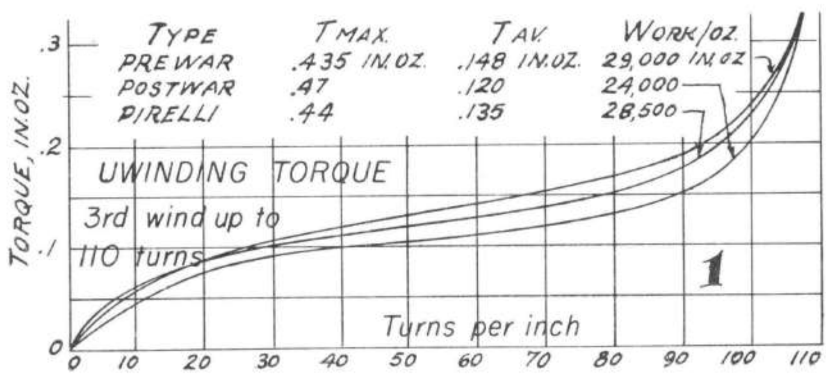
by Walter Erbach —— Lincoln, Nebr.

The item of most concern to the rubber model builder would obviously be rubber. He can modify the structural design of his ships to alleviate deficiencies in construction materials but there is nothing he can do to overcome defects in the quality of the rubber available.

The important characteristic of the rubber are the amount of unwinding torque delivered and the change in this torque as the rubber unwinds. The unwinding torque can be easily determined, at least for indoor sizes of rubber, with a simple homemade torque meter. It is probable that the average modeller has not done such testing because there seems to be no immediate practical use for the results—he will still have to use whatever rubber he can obtain for his ships. If he tries a motor of a different brand in a ship he can tell from from the flight performance whether the change is for the better. Years ago however, as a prelude to still unmade indoor flight tests, I ran an extensive set of tests on a 2 strand of 3/32 in. brown rubber (prewar). The results were interesting and conclusive. Unfortunately they are in large measure no longer useful except for comparative purposes. Since the time of the original tests further work has done for such comparison, first with post war brown rubber and more recently upon Pirelli, samples of which were kindly provided for the purpose by Ed Dolby, Reg Parham, and Phil Read.

A few of these comparisons are herewith presented together with an emphatic statement that these are not definitive or the last word by any means. Too few tests have been performed upon both post war and Pirelli for this. There are several other items that make direct, accurate comparison difficult. No control of rubber production is possible, and none of aging (although its effect has been greatly exaggerated) until the rubber reaches the experimenter's hands. Cross-sections and densities differ from brand to brand of rubber. Lastly, the turns per inch at breakage varies with the rubber (and also with the temperature although this effect will be ignored, only room temperature tests, about 65° to 70°, being cited). The last mentioned difficulty appeared in the tests made. The maximum turns per inch, with the winding technique employed, was 120 for the brown rubber but only 110 for the Pirelli. The original tests were made primarily at 20, 40, 60, 80, 100, and 120 turns per inch so the maximum turn Pirelli tests fell in a gap in the data.

Figure 1 shows the unwinding torque graphs for the third windup to 110 turns per inch of the three types of rubber, each motor being 2 strands of 3/32 in., rubber or its equivalent. The third windup was chosen because the



motors had by this windup become reasonably stabilized. These were selected graphs for motors having almost identical weights per foot, although differing slightly in cross-section and density. The superiority of the prewar brown rubber motor is even more evident than it appears because this motor was killed by holding it fully wound for ten minutes before beginning the test. (The only data available at 110 turns per inch.) The tabulation on the graph lists the maximum output torque, T-max; the average delivered torque, T-av; the total work delivered in inch-ounces per ounce of rubber for each of the three motors. These same quantities for the average of the tests run are as follows:

Data for 110 turns per inch, Third windup

Rubber	T-max, in. oz.	T-av, in. oz.	Work, in.-oz./oz.
Prewar	0.45*	0.127*	29,000*
Post war	0.46	0.115	24,000
Pirelli	0.43	0.125	28,500

*Interpolated from available data.

A glance of these figures would lead to the erroneous conclusion that prewar brown and Pirelli are about equivalent. It must be remembered, however, that the Pirelli was operating at maximum turns (maximum insofar as the first windup was concerned) while the brown rubbers were not fully wound.

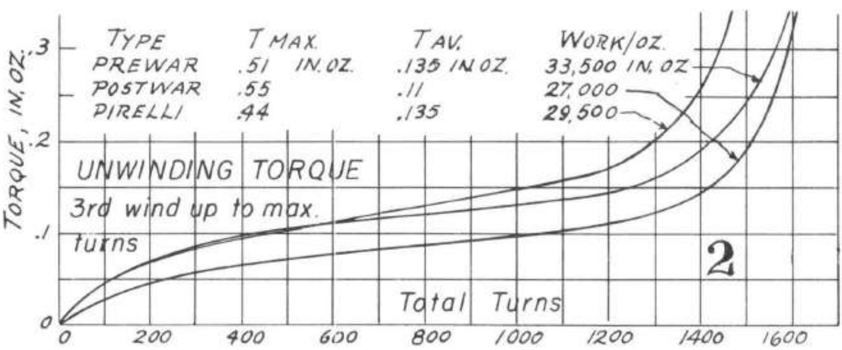


Figure 2 shows graphs of all three types of rubber fully wound and salient values for these tests. Most useful for comparison however is the following tabulation of the average values for the tests made.

Data at breaking turns per inch, Third windup

Rubber	Turns/in.	T-max, in. oz.	T-av, in.-oz.	Work, in.-oz/oz.
Prewar	120	0.48	0.132	32,500
Post war	120	0.52	0.107	26,500
Pirelli	110	0.43	0.125	28,500

Obviously some things in this glorous, new post war world could stand little improvement!

MICROFILM HINTS

by C. rtis Janke —— Sheboygan, Wis.

Much misunderstood, much maligned though it may be, it is difficult to imagine what could take the place of microfilm. Properly used, a good microfilm solution and the sheets resulting from its use are far superior to anything yet proposed for the purpose—it is quite safe to assume that as long as there are high-performance indoor rubber models, they will be covered with some form of it.

Since the advent of the really light braced models, the standard nitrate solution which had become almost traditional, is no longer satisfactory. It is intrinsically unstable dimensionally, this instability being aggravated by the addition of large amounts of plasticizer to prevent brittleness, cut down inflammability, increase flexibility, and prevent wrinkles while drying on the water. Unless some sort of trickery is used, a light model covered with the usual nitrate film is soon warped to ruin by the spontaneous shrinkage of the covering. This can be obviated to some extent by covering very loosely, by using almost no plasticizer in the solution, by aging the sheet for as long a period as possible before using, and by method discovered by Walter Erbach and myself. This consists of holding the dry sheet near a skillet containing sputtering cooking fats of some sort, which appear to pock it, loosen it to some extent, and render it dimensionally stable. This procedure is highly experimental, and is mentioned here only as a curiosity, but a light wing covered with a single nitrate sheet stabilized by this method showed no signs of warping over a period of nearly three years. No further information is available, and it is suggested that interested parties experiment with the method in the name of science. The sheet need not be held near enough to the spattering fats to become wetted by them—apparently the odor-bearing vapors of such foods as frying onions are the most effective, even at some distance from the source.

In the effort to find a more satisfactory base for an improved solution, many common plastics were tried. The various vinyls show some promise, and further test may be rewarding. Vinyl acetate, which was the base of the once popular "plastic bubbles" was tried, and outside of its original tackiness, presented no particular problem. Vinyl butyral produced permanently sticky sheets, and offered no discernable advantages. Vinyl formaldehyde—"formvar"—appeared to have excellent strength characteristics, and was sufficiently flexible without plastication, but it is relatively difficult to obtain, and no suitable solvent could be found.

The cellulosics, of which the nitrate is one,—"nitrocellulose,"—appear to be the most practical at present. Tests were made with cellulose acetate, cellulose acetate butyrate (the base of the so-called "fuel-proof"butyrate dopes which they are not!) other bi-derivatives of cellulose acetate, and ethyl cellulose. Of all these, the nitrate was the easiest to handle, and it is indeed unfortunate that it has so many other bad points. In all cases it was found that the base of highest viscosity, or polymerization number, produced the strongest and most flexible film, but at the cost of difficult spreading. All bases but cellulose nitrate presented many other difficulties also as, for example, solvency, but where these difficulties could be overcome, practical solutions where the end result and one of them is now on the market. Though not as easy to handle as the doyen, nitrate, it has been found to be non-warping after a very short curing period, is stronger and lighter, thickness for thickness, than the nitrate, and further development may result in other desirable attributes. In the meantime, research continues.

If you must use a nitrate solution, use little or no plasticizer, and use a very carefully controlled heat source if trimming by such method, to prevent the film from bursting into flame. In the trimming operation, the film is melted, not burned, and the cut is smooth and progresses evenly. Any sputtering, smoking, or jerky cutting is indicative of too high a trimming temperature.

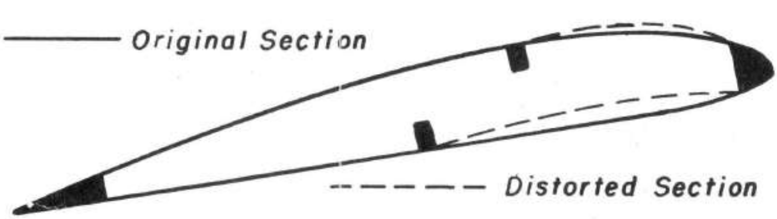
If fairly expert, use thin film, and distilled water only for the covering "adhesive." Dissolved solids once considered necessary in saliva, tap water, or other covering liquids, to "stick" the covering to the outlines, add weight, make it difficult to strip the frames for recovering, and soak into the balsa pores to remain, so that the weight continues to build with each recovering. Distilled water, used lavishly, apparently pulls film of sufficient fineness into the pores of the wood by capillary action, where it remains after the water has evaporated, with a surprisingly strong bond.

Warping may sometimes be caused while covering, by pressing a highly cambered surface against a taut sheet of film until the outline is in contact. This flattens the ribs temporarily, only to tighten the covering when they recover their shape after the pressure is released. No matter what type of film is used, it is necessary to provide enough slack in the sheet, by some method, to allow for camber. Also, if you've any doubt as to the stability of the film you are using, provide for contingencies by covering loosely. Then if the film should shrink, it is not as likely to warp the surfaces to uselessness. If you are the squeemish type, you may stick the film to the ribs with distilled water on a very soft, fine brush, but this must be very carefully done. Other than this, you need have no fear that the loose film will render the airplane less efficient—models have been flown with incredibly baggy covering with no apparent disadvantage in performance; there is must still to be learned about low-speed aerodynamics. It is this sort of thing that leads to the oft-heard, smug assertion that "indoor flying is an art, not a science!"

GENTLY STALLING CLARK-Y

by Tony Brooks — England

When testing a tissue covered CLARK-Y model wing the other day, we found CL and CD almost identical to an accurate solid wing up to the stall. The model with tissue covering stalled much more gently. Subsequent investigation showed this due to distortion of the tissue asshown on the ketch.



FREE FLIGHT FAMILY DATA

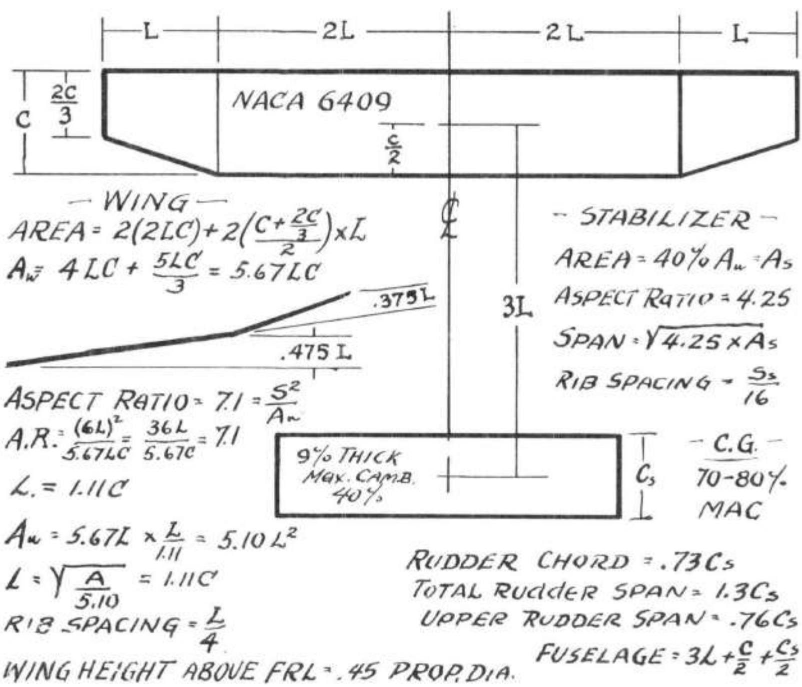
by Frank Heeb —— Connerville, Ind.

You asked about my free flight family. I worked out the enclosed data sheet few years ago. The basis for this is my 500 sq. in. Torp .19 job that was in one of your yearbooks. It was one of my best gas models, and this year I scaled it up and down—200 sq. in. ½A to 850 sq. in. .35 job.

I figured that by using this form, the only decision I would have to make would be the wing area. With this known, just crank out the answers for the dimensions and displacement. I do not think that one could make such a rule due to the difference in engines. For example: A K & B .19 certainly has more than 2/3 the power of a .29, and a .35 has more than 7/6 the power of a .29.

So I think experience and good judgment enters into the selection of the size of a model. Also, each builder knows what he wants in a plane—good climb, med. glide, slow climb, good glide etc. Also, the builder should have a weight target to try for; maybe many could not make a 500 sq. in. model weight 19 oz., and so they should go to less area and size for a lighter design.

I have just finished and test flown my new 700 sq. in. job with a .23. It came out 25 ozs., which hurts, but it is a good safe and strong airplane with an excellent glide, and, I believe, an average climb. I know now that I could build one down to .23 oz., but I can always slug this one and put a .29 in it. My main criticism of the model is that it seems too light; by that I mean it seems to bounce around a lot in the turbulence of average weather. But more flight test time will find out.



F.A.I. POWER DESIGN CHART

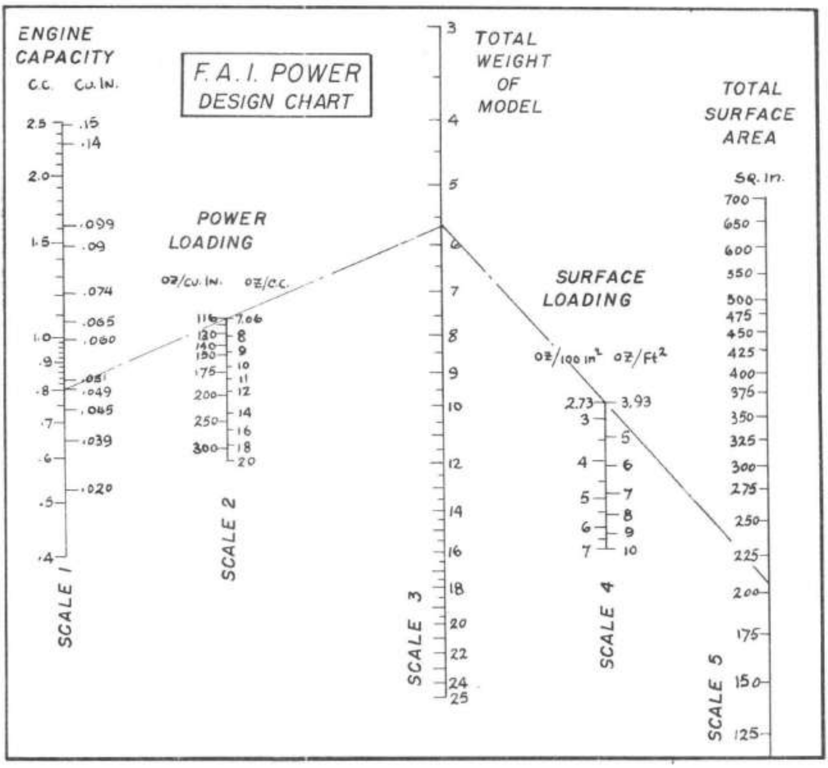
by E. G. Currington —————— Rosemere, Canada

The F.A.I. set their minimum loading (3.93 ozs./ft² or 2.73 oz./100 in².) on the surface area, which is the total area of the horizontal lifting surface. This area is not corrected for dihedral effects and is in effect the "look-down" area. In the case of a perfectly parallel chord surface with square tips, it would be the chord X the straight line distance between the tips. It also includes any portion of the surface that is enclosed by the fuselage or is on top of the fuselage.

So much for that, and now to the charts themselves. Let us imagine for instance that you are going to build the largest and lightest ship you can for that brand new "super duper" .049 that you won at the upper Gumtree contest last fall. Well the displacement is .049 cu. in. so mark that point on scale 1 of graph 1. Then, as you want the lightest ship, draw a straight line from that point through the 116 oz./cu. in. mark on scale 2, and carry it on until it cuts scale 3. We have made it cut the 116 oz./cu. in. mark as this is the minimum power loading allowed under F.A.I. Rules (7.06 oz./cc or 116 oz./cu.). The point where this line cuts scale 3 gives the minimum weight for the model i.e. in this case 5.6 ozs.

From this 5.6 oz. point on scale 3, draw another line passing through the 2.73 oz./100 sq. in. mark on scale 4, continuing it to cut scale 5. Again we had this line cut scale 4 at the 2.73 mark, as this is the minimum F.A.I. loading (3.993 oz.ft² or 2.73 oz/100 sq. in.) The point where this line cuts scale 5 is then the maximum surface area for the ship, i.e. 210 sq. in.

Summarizing, for an ½A F.A.I. job, we read a minimum weight of 5.6 ozs. and a surface area of 210 eq. in.



TAILLESS RUBBER MODELS

By G. Woolls —————————————— England

For sport flying in restricted areas, Tailless seems ideal. Stability and recovery from gusts and turbulence set up by nearby trees is excellent. I had the model shown, in a tree, about 15 feet up. It fell out nose down, but recovered within maybe 10 feet and glided in quite safely.

Tailless may be adjusted to climb very fast and steeply to a good height, and then settle in a stalled condition (as if d/t'd) after power has cut. This is done by using high power, excess downthrust, and excess negative on tips or elevons.

For duration work, keep wing loading low. Remember wing is probably only 60% effective as a lift producer. Aim to duplicate weight, size, and area of an orthodox duration model. My proceedure is as follows:

Keep span the same and add stabilizer area to chord. Alter plan to incorporate a sweep back of about 30°, and taper (Tip about 2/3 Root). If adjustable tips are decided upon, make them about 17% of total area. Build in 5° to 8° washout on main wing panels. Model will probably trim out with tips at about 20° negative, with C.G. at about 1/6 root chord forward of apex of Trailing Edge. Wing Section at root can be N.A.C.A. 6409, or similar, changing to a thin flat bottomed section at tips.

Adjustable elevons are effective and possibly simpler. These should have about 7½% main plane area, and be placed at Wing Tip Trailing Edge. Use about 7° - 10° washout, when using elevons, and be prepared to set them at about 30° negative.

C.G. remains approximately as previously stated.

Whatever type of control surfaces are used, be sure that adjustments are positive, as they are very sensitive. Slight accidental movement may ruin subsequent flights.

Don't stint dihedral. Use up to 1/10 span under each tip.

If you use a large diameter folding propeller, carry the motor as far as possible rearwards, and keep the front end as light as possible. This is to keep the distance between the front of the Wing Centre Section and propeller a long as possible, to allow room for the blade to fold.

Some form of antiwarp construction on wing is recommended. Due to the built in washout, unwanted warps (increasing or decreasing washout) are difficult to detect.

Keep rib spacing close at Leading Edge, or use sheeting, as sweep back tends to aggravate tissue sag at points of maximum curvature.

Balance with C.G. a suggested, and check washout and control surface angles. Make sure that these are the same on both wings. Hand glide, adjust angles and C.G. until dives or vicious stalling are eliminated. Then use power. My experience indicates that Tailless are safe under power, as recovery radius from stall is small.

Design shown is fifth of a series and incorporates most of the desirable points listed above. It is a little on the heavy side, but greater care in wood election should reduce weight and duration should go up in proportion.

MODEL AERODYNAMICS No. 13

The "circular airflow" theory, expounded by Frank Zaic, is an ingenious explanation as to why models tend to misbehave in circular flight—particularly to exhibit drastic signs of under-elevation or change of trim.

If we consider a model performing a symmetrical loop in still air (Fig. 1), a moment's thought will show that the *airflow path* over the model is a circle (i.e. exactly the same airflow condition is given by considering the model fixed and the air flowing in a circular path).

At any particular instance, therefore, magnifying the airflow diagram as in Fig. 2, this flow is actually curving *down* where it meets the wings and *up* where it meets the tail.

The effect is even more noticeable as we reduce the radius of the loop—Fig. 3. Wing and tailplane are rigidly spaced with a certain moment arm and there is an appreciable decrease in *effective* angle of attack over the wings and an increase in *effective* angle of attack over the tail. The magnitude of each effect is the same, which we shall call $\triangle\alpha$ (change in angle of attack)—Fig. 4. Their value can be found from basic geometry and is equal to

$$\triangle\alpha = \text{angle whose sine is } \frac{\text{moment arm}}{2 \times R}$$

Since the angles involved are quite small we can justifiably adopt the approximation that (at small angles) the sine of an angle equals the angle (in radians). And since there are π radians in 180 deg.

$$\triangle\alpha \text{ (in degrees)} = \frac{180 \times \text{moment arm}}{2\pi R}$$

The *total* effect on trim is a similar change in angle (but opposite in sign) over wings and tail. Hence the total angular change is $2 \times \triangle\alpha$ or

$$\text{effective angular change} = \frac{180 \times \text{moment arm}}{\pi R}$$

Exactly the same considerations apply with a model circling in a vertical bank—Fig. 5.

In practice, no F/F model would be deliberately trimmed for looping or vertically banked flight, hence these two cases are essentially hypothetical. Some models are trimmed to circle flat without banking—Fig. 6, when there is no circular airflow effect. But a banked turn is more common—Fig. 7—and here circular flow *is* effective, although not to the same extent as in a vertical bank. The greater the angle of bank, the more nearly "vertical bank" conditions are approached, and vice versa. The practical formula therefore becomes

$$\text{effective angular change} = \frac{180 \times \text{moment arm} \times F}{\pi R}$$

where the factor F is determined from Fig. 8. This formula can be simplified still further to

$$\text{effective angular change} = \frac{57.3 \times \text{moment arm} \times F}{R}$$

The two linear factors, moment arm and R, must be measured in the same units (e.g. feet or inches).

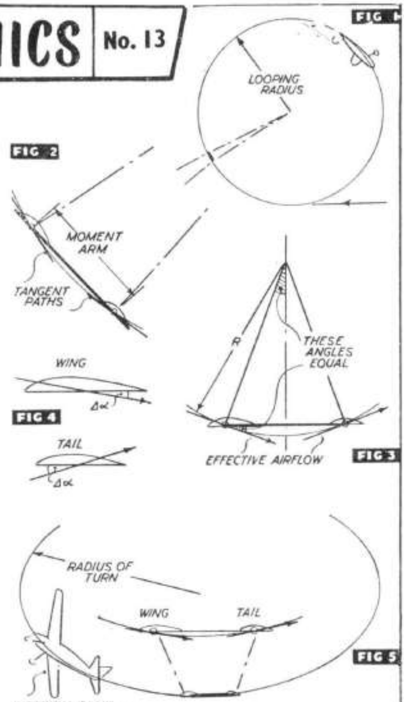
As a typical example, suppose we have a model with a 24 in. moment arm trimmed to fly a 100 ft. diameter circle with an angle of bank of 45 deg. Under such conditions

$$\text{effective angular change} = \frac{57.3 \times 2 \times 0.7}{50}$$

$$= 1.6 \text{ deg. (approx.)}$$

In terms of trimming angles, this represents 1.6 deg. *underelevation*. And if the circle tightened, the degree of underelevation would increase, e.g. with a 50 ft. dia. circle the effective angular change would be 3.2 deg.

Besides an explanation of why models do become underelevated in circling flight, the theory can be applied to assess the *degree* of turn required to stabilise a particular design layout, e.g. automatically reducing the effective wing lift to prevent stalling under power, although the complete picture as regards trim also includes downwash effect on tailplane angle of attack.



NEW AIRFOIL FAMILY

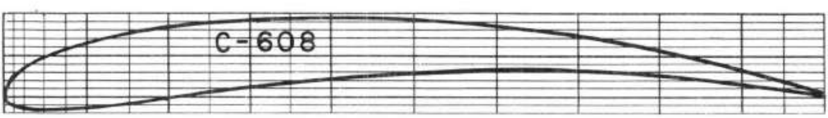
by Gail A. Cheesman —————————— Savannah, Ga

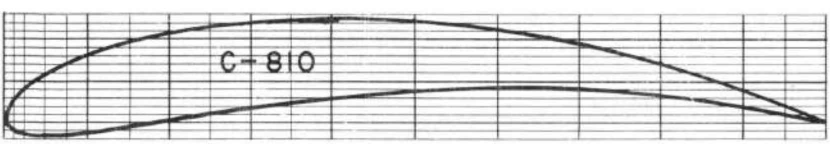
Have a new airfoil family that is giving very good results. The thicker-profiled airfoils in my earlier family (round 14 percent thick) were rather disappointing in performance, probably because of a premature stall occasioned by thickening of the boundary layer near the trailing edge. Although this could probably be remedied by using cusped airfoils such as NACA 6-Series Laminar Flow Foil, my present inclination is to favor the thinnest profile consistent with sufficient strength without excessive weight, meanwhile using blunt leading edges on such thin airfoils to prevent a premature stall resulting from laminar separation at the leading edge.

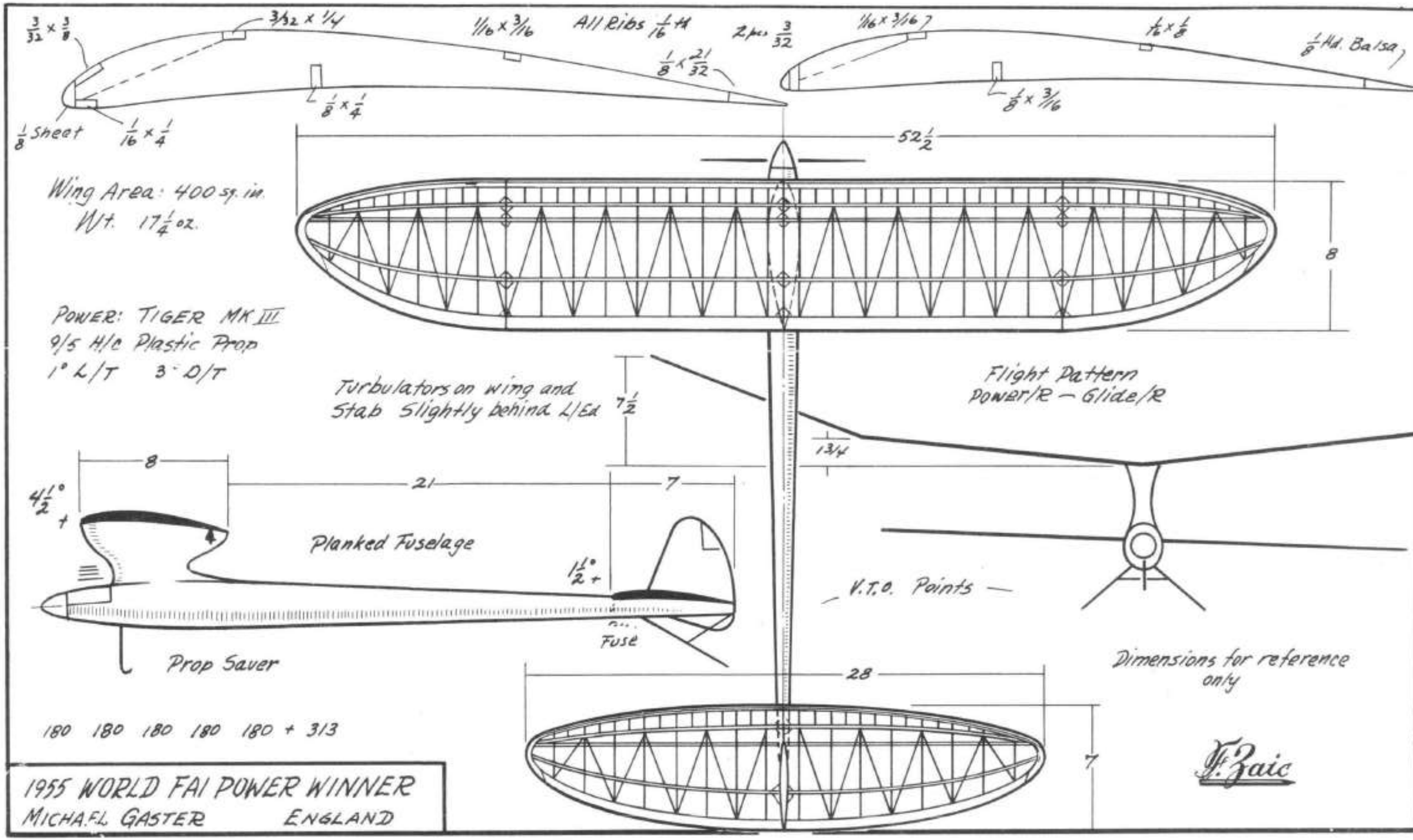
I am working on such a family of airfoils right now and will present them for publication in the magazines shortly. Here are the ordinates for two of them, the 608 for free-flight gas models and the 810 for rubber powered models and towline gliders. I am currently working on an "A" free flight model with a 608 airfoil; about 8.5 Aspect Ratio, with lower surface of the wing covered with 1/32 inch sheet balsa in an attempt to maintain laminar flow across the under surface at high angles of attack (glide condition), a possibility once suggested by Dr. Lippisch in an article.

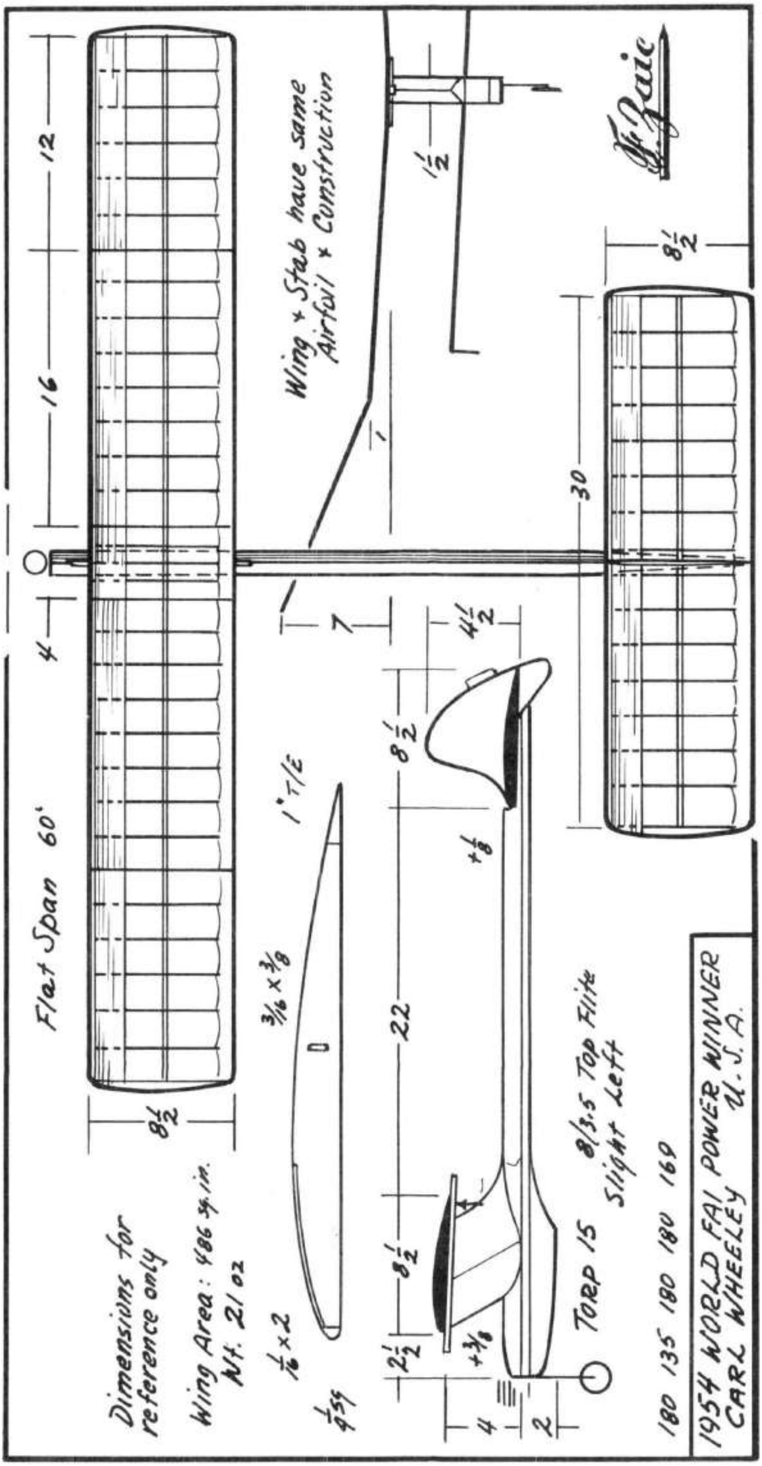
STA.	608		810	
	UPPER	LOWER	UPPER	LOWER
0.0	1.035	0.0	1.30	0.0
0.5	2.25	-1.0	2.30	-0.75
1.25	2.80	-1.35	2.90	-1.15
2.5	3.60	-1.85	4.20	-1.60
5.0	4.65	-1.90	5.50	-1.70
7.5	5.40	-1.75	6.70	-1.45
10.0	6.10	-1.45	7.65	-1.15
15.0	7.20	-0.75	9.25	-0.45
20.0	8.10	-0.10	10.45	+0.30
25.0	8.70	+0.60	11.30	1.05
30.0	9.05	1.25	11.95	1.75
35.0	9.30	1.85	12.35	2.40
40.0	9.40	2.25	12.50	3.00
50.0	9.10	2.95	12.20	3.80
60.0	8.45,	3.20	11.25	4.25
70.0	7.10	3.10	9.65	4.05
80.0	5.40	2.60	7.20	3.35
90.0	3.00	1.50	4.00	2.00
95.0	1.60	0.80	2.15	1.05
100%	00	00	00	00

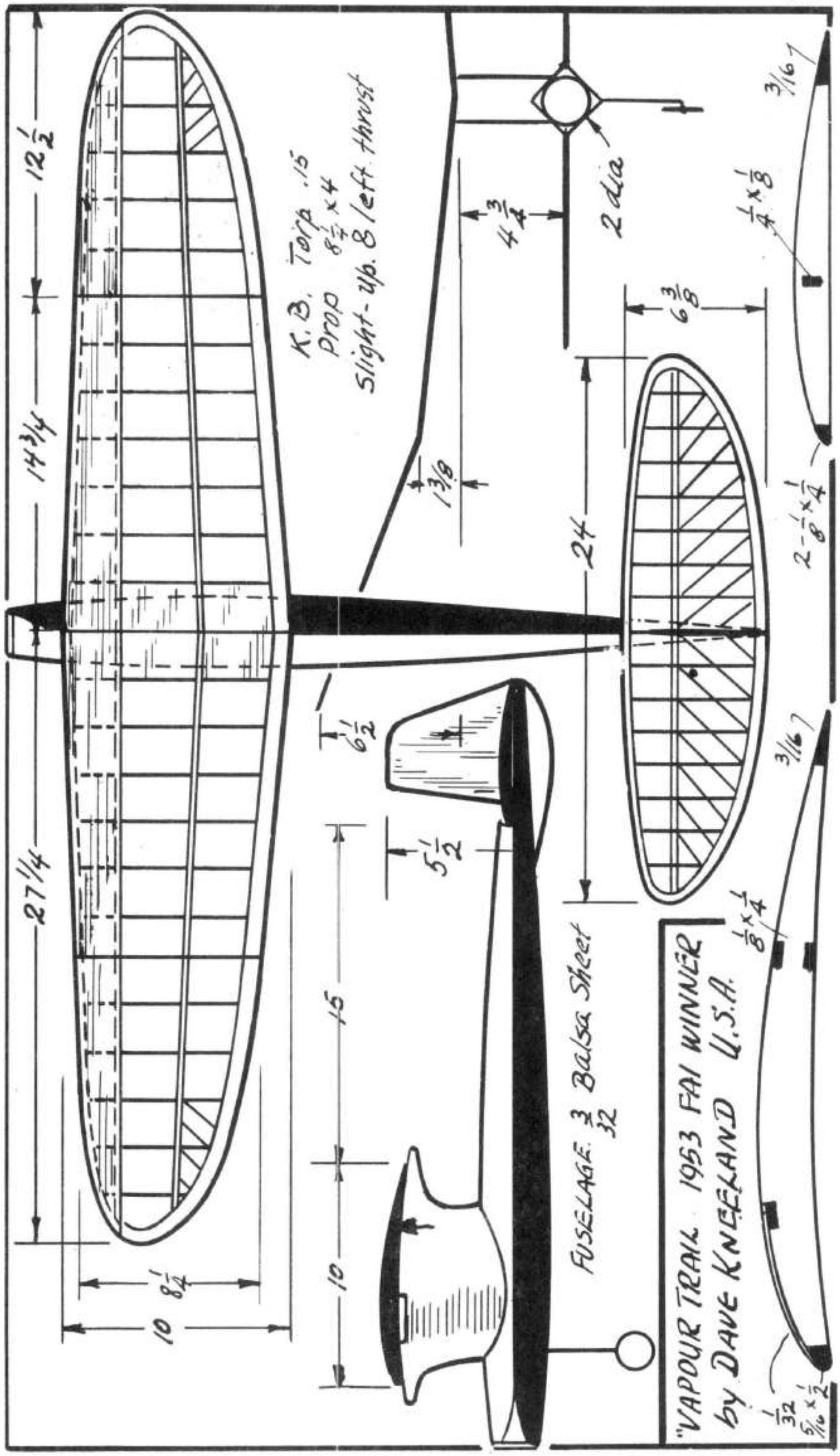
Other members of the family will lie between these two extremes, both in thickness and mean-line camber. For now, it appears that these airfoils will meet just about all present day contest model needs, but if modellers insist they can do better with 12% thick airfoils than the 8% and 10% thick sections, I will be glad to extend the family to include slightly thicker profiles.

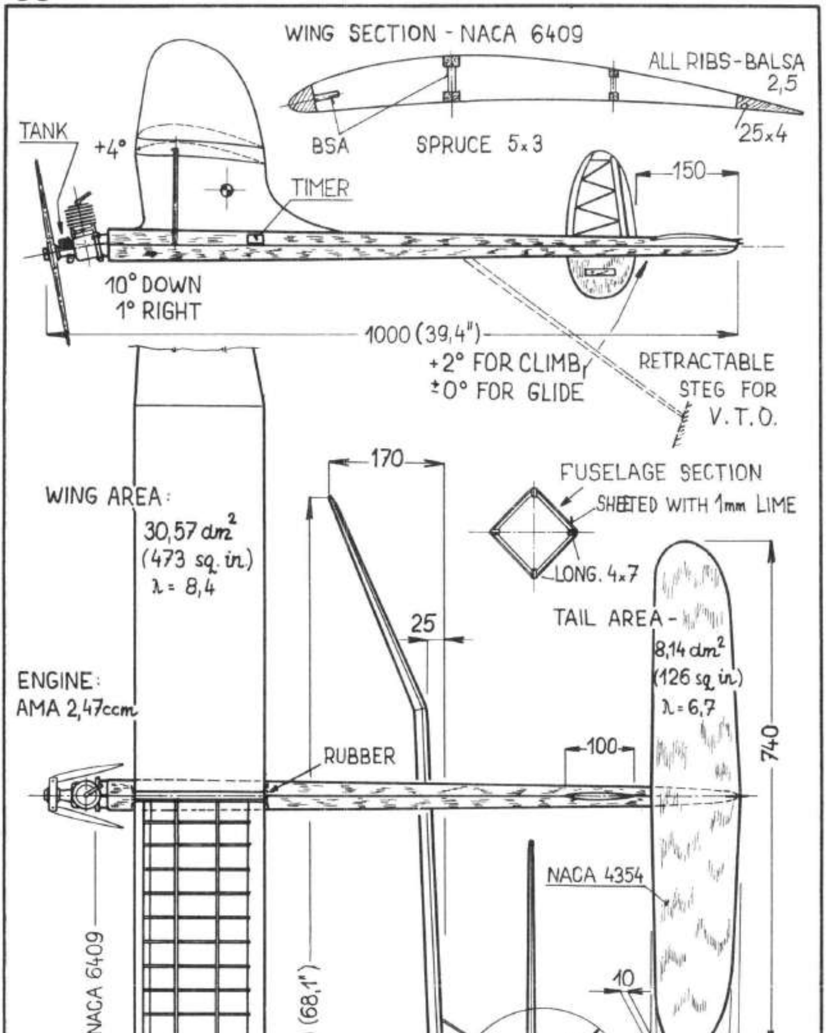


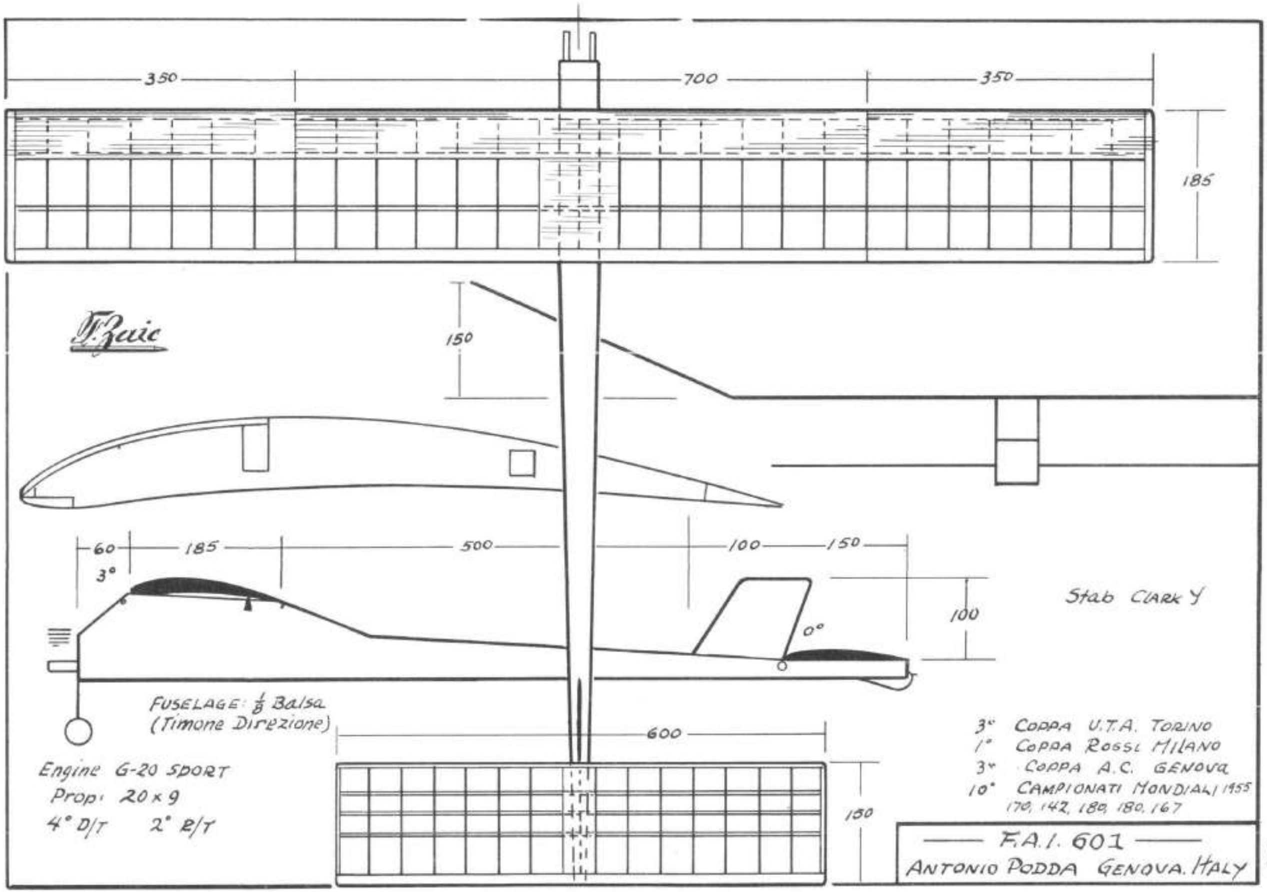



3/32 x 3/8
3/32 x 1/4
1/16 x 3/16
All Ribs 1/16 th
2 pcs 3/32
1/8 x 21/32
1/16 x 3/16
1/16 x 1/8
1/8 Hd. Balsa
1/8 Sheet
1/16 x 1/4
1/8 x 1/4
1/8 x 3/16
52 1/2
8
Wing Area: 400 sq. in.
Wt. 17 1/4 oz.
POWER: TIGER MK III
9/5 H/C Plastic Prop
1° L/T 3° D/T
Turbulators on wing and
Stab Slightly behind L/Ed
7 1/2
Flight Pattern
Power/R — Glide/R
1 3/4
8
4 1/2°
21
7
Planked Fuselage
1 1/2°
V.T.O. Points
Fuse
Prop Saver
28
Dimensions for reference only
180 180 180 180 180 + 313
7
F. Zaic
1955 WORLD FAI POWER WINNER
MICHAEL GASTER ENGLAND

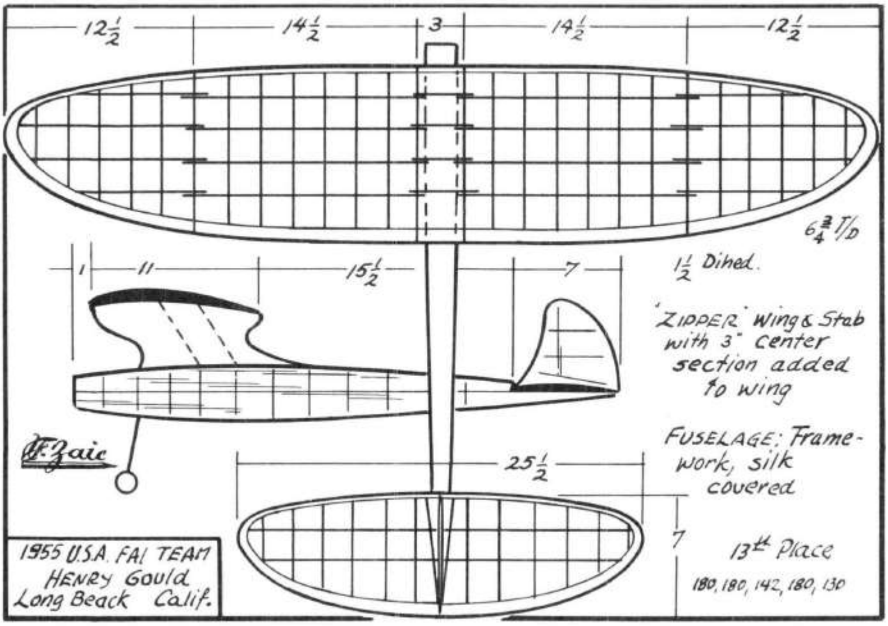

Flat Span 60'
12
16
4
8 1/2
Wing + Stab have same
Airfoil + Construction
1 1/2
1
7
30
8 1/2
4 1/2
8 1/2
22
8 1/2
+1/8
+3/8
2 1/2
4
2
Dimensions for
reference only
Wing Area: 486 sq. in.
Wt. 21 oz
1/16 x 2
1/4 sq
3/16 x 3/8
1" T/E
Torp 15
8/3.5 Top Flite
Slight Left
180 135 180 180 169
1954 WORLD FAI POWER WINNER
CARL WHEELEY U.S.A.

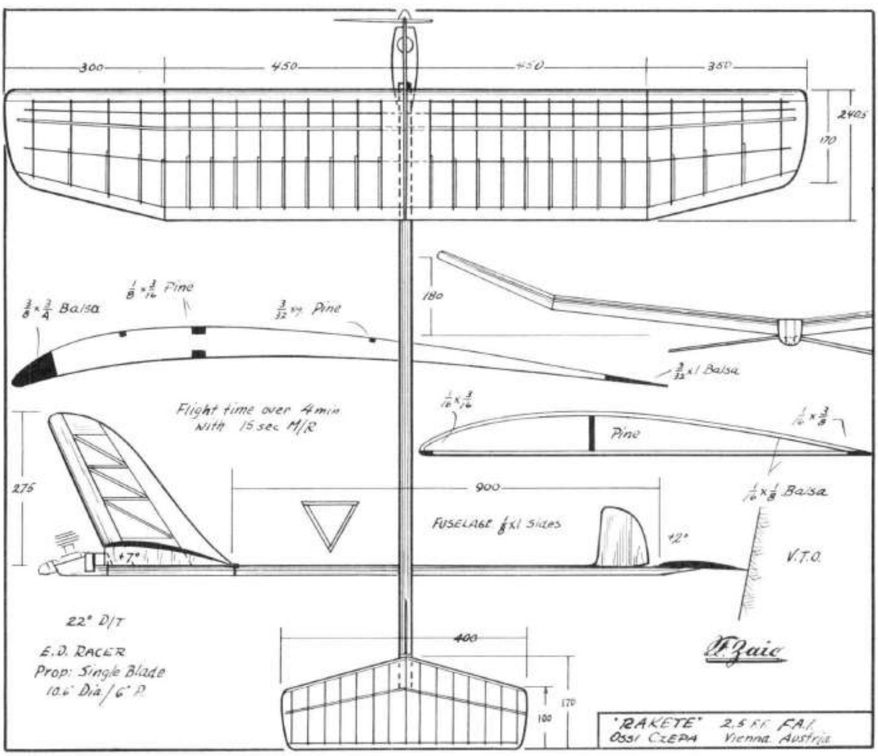

12 1/2
14 3/4
27 1/4
K.B. Torp .15
Prop 8 1/4 x 4
Slight-up. 8 left thrust
4 3/4
2 dia
6 3/8
1 3/8
24
6 1/2
5 1/2
15
10
8 1/4
10
FUSELAGE 3/32 Balsa Sheet
"VAPOUR TRAIL" 1953 FAI WINNER
by DAVE KNEELAND U.S.A.
3/16
1/4 x 1/8
2-1/8 x 1/4
3/16
1/8 x 1/4
1/32
5/16 x 1/2

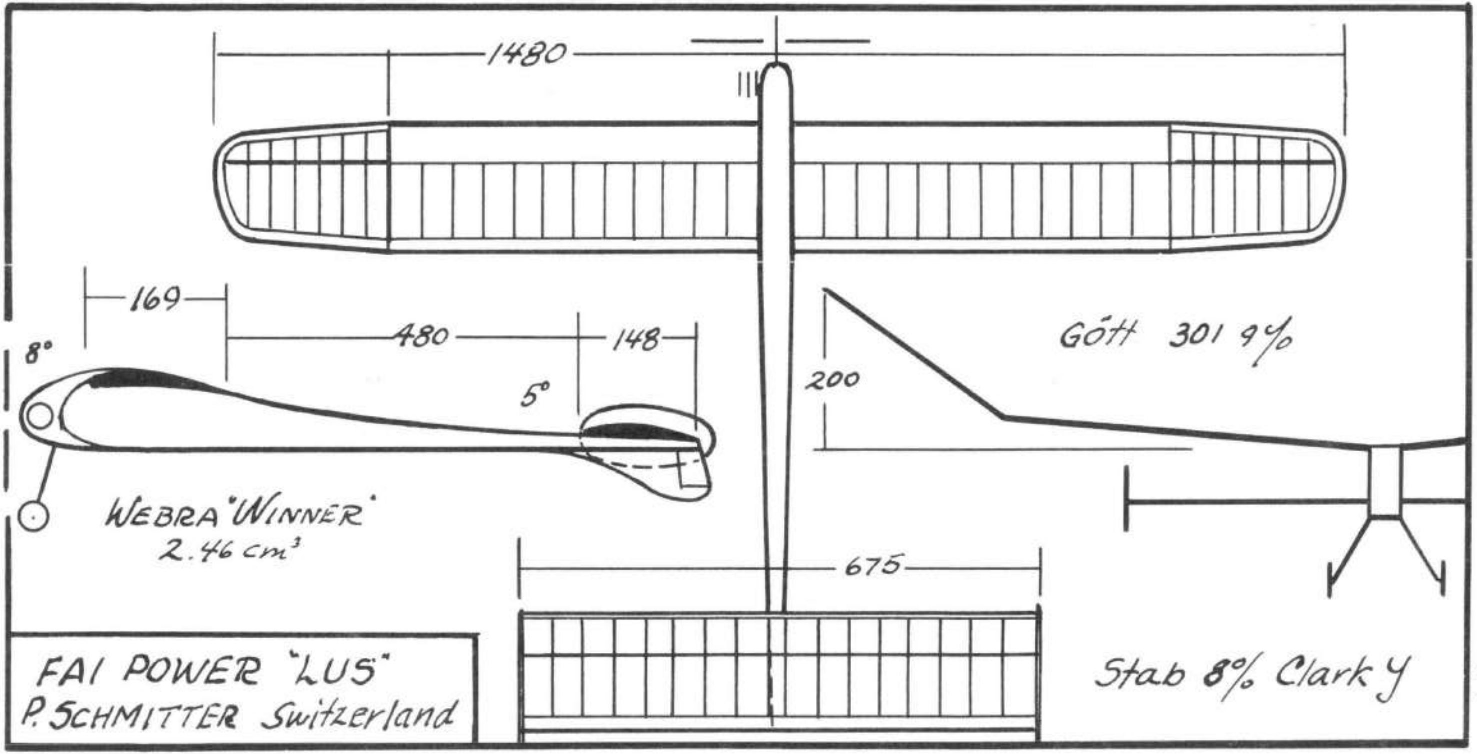

WING SECTION - NACA 6409
ALL RIBS - BALSA 2,5
BSA
SPRUCE 5x3
25x4
TANK
+4°
TIMER
150
10° DOWN
1° RIGHT
1000 (39,4")
+2° FOR CLIMB
±0° FOR GLIDE
RETRACTABLE STEG FOR V.T.O.
170
FUSELAGE SECTION
SHEETED WITH 1mm LIME
LONG. 4x7
WING AREA:
30,57 dm²
(473 sq. in.)
λ = 8,4
25
TAIL AREA -
8,14 dm²
(126 sq. in.)
λ = 6,7
ENGINE:
AMA 2,47ccm
RUBBER
100
740
NACA 4354
NACA 6409
1730 (68,1")
10
ø 260
P 120
110
130
WEIGHT - 550g
(19 1/3 oz)
WORLD CHAMPIONSHIP 1955
4th IN POWER CLASS
NACA 4409
»RAKETA-5a«
BY VLADIMÍR HÁJEK
CZECHOSLOVAKIA
10
120
191

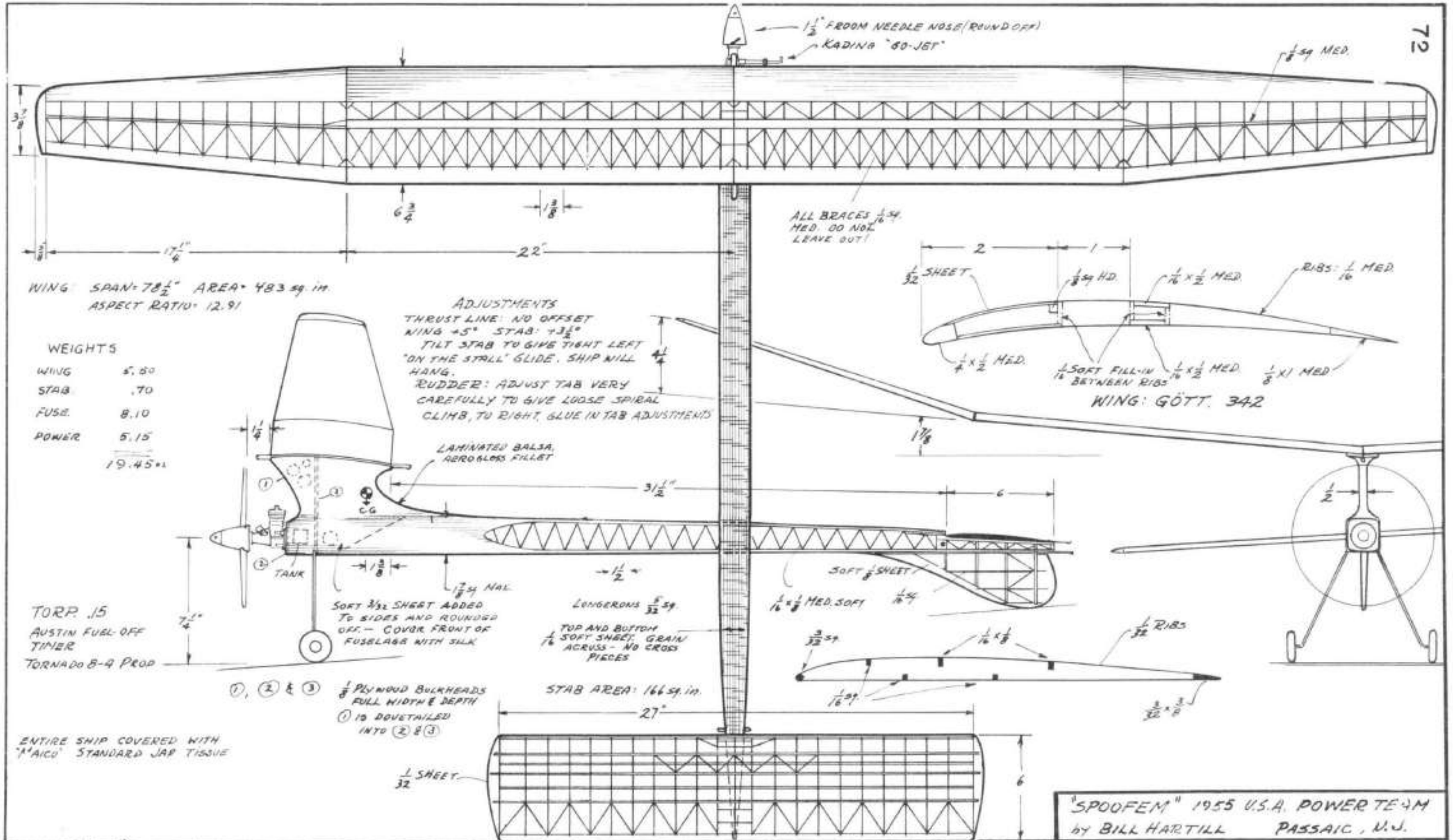


350
700
350
185
150
60
185
500
100
150
3°
0°
100
Stab Clark Y
FUSELAGE: 1/8 Balsa
(Timone Direzione)
600
150
Engine G-20 SPORT
Prop: 20 x 9
4° D/T 2° R/T
3° Coppa U.T.A. Torino
1° Coppa Rossi Milano
3° Coppa A.C. Genova
10° Campionati Mondiali 1955
170, 142, 180, 180, 167
F.A.I. 601
Antonio Podda Genova. Italy

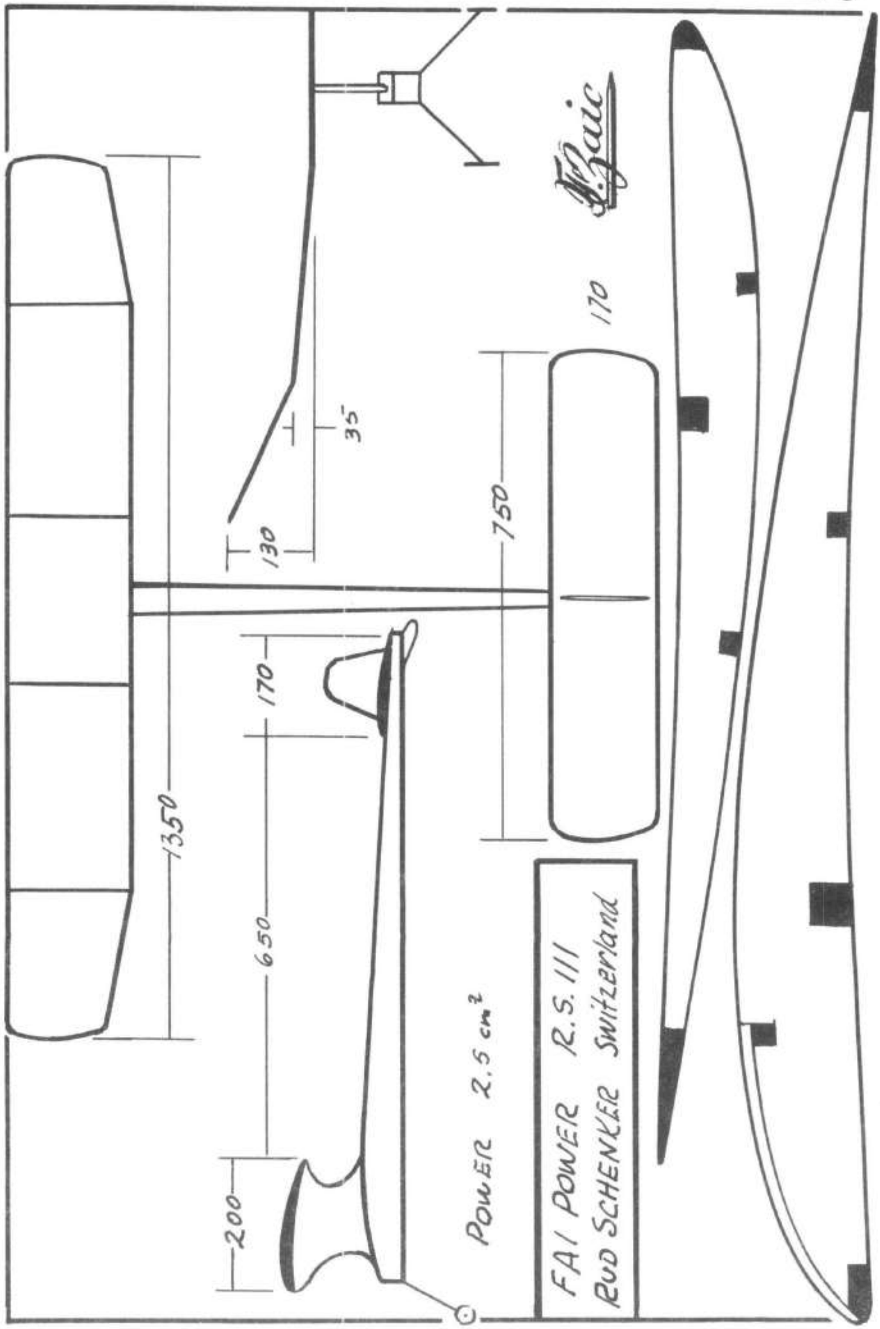

12 1/2
14 1/2
3
14 1/2
12 1/2
6 3/4 T/D
1 1/2 Dihed.
1
11
15 1/2
7
"ZIPPER" Wing & Stab with 3" center section added to wing
FUSELAGE: Frame-work, silk covered
25 1/2
7
13th Place
180, 180, 142, 180, 130
1955 U.S.A. FAI TEAM
HENRY GOULD
Long Beach Calif.
F. Zaic

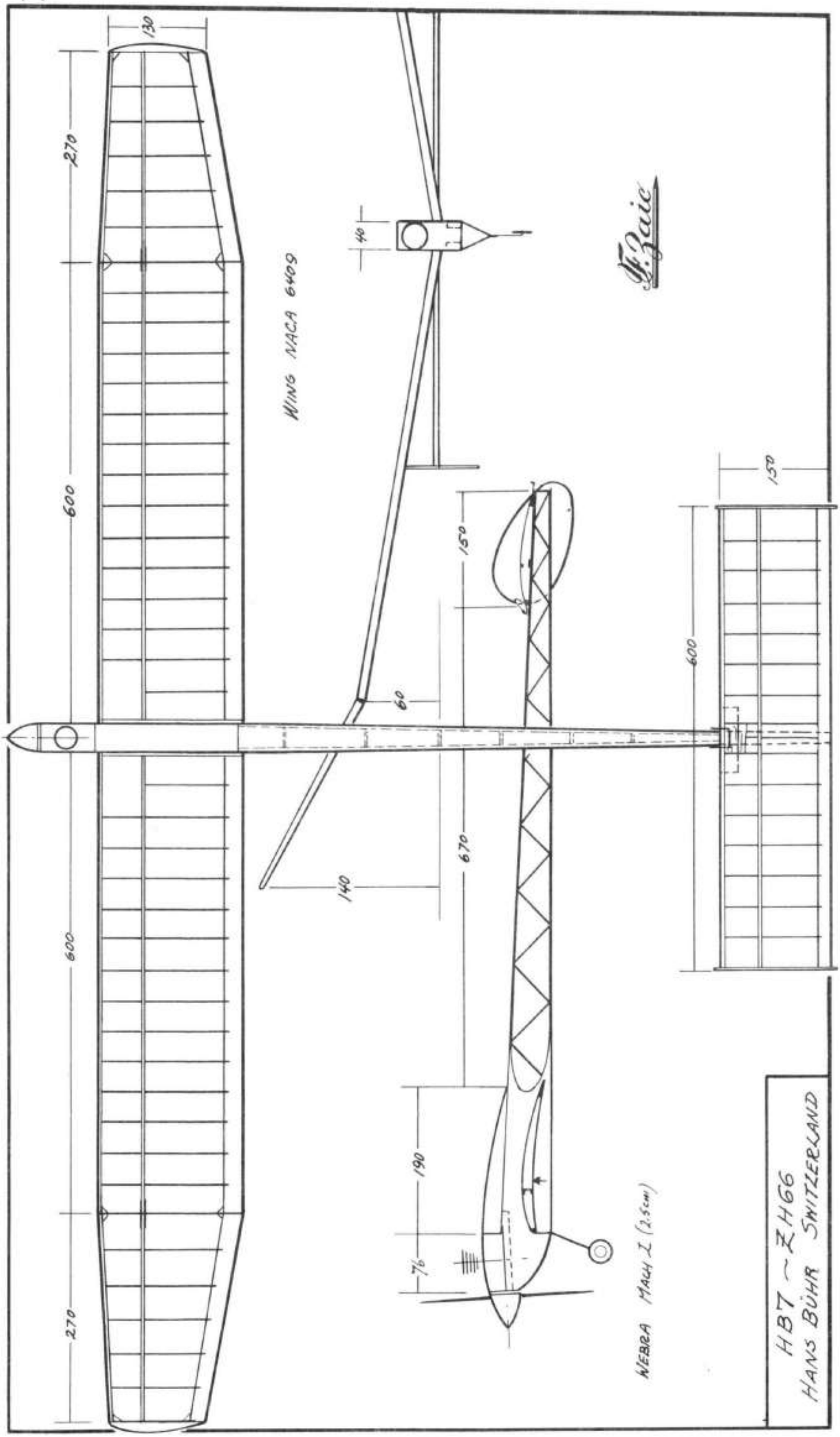

300
450
450
350
240
170
180
3/8 × 3/4 Balsa
1/8 × 3/16 Pine
3/32 sq. Pine
3/32 × 1 Balsa
Flight time over 4 min
with 15 sec M/R
1/16 × 3/16
Pine
1/16 × 3/8
1/16 × 1/8 Balsa
275
+7°
900
FUSELAGE 1/8 × 1 Sides
+2°
V.T.O.
22° D/T
E.D. RACER
Prop: Single Blade
10.6" Dia./6" P.
400
170
100
F. Zaic
"RAKETE" 2.5 F.F. F.A.I.
OSSI CZEPA Vienna Austria

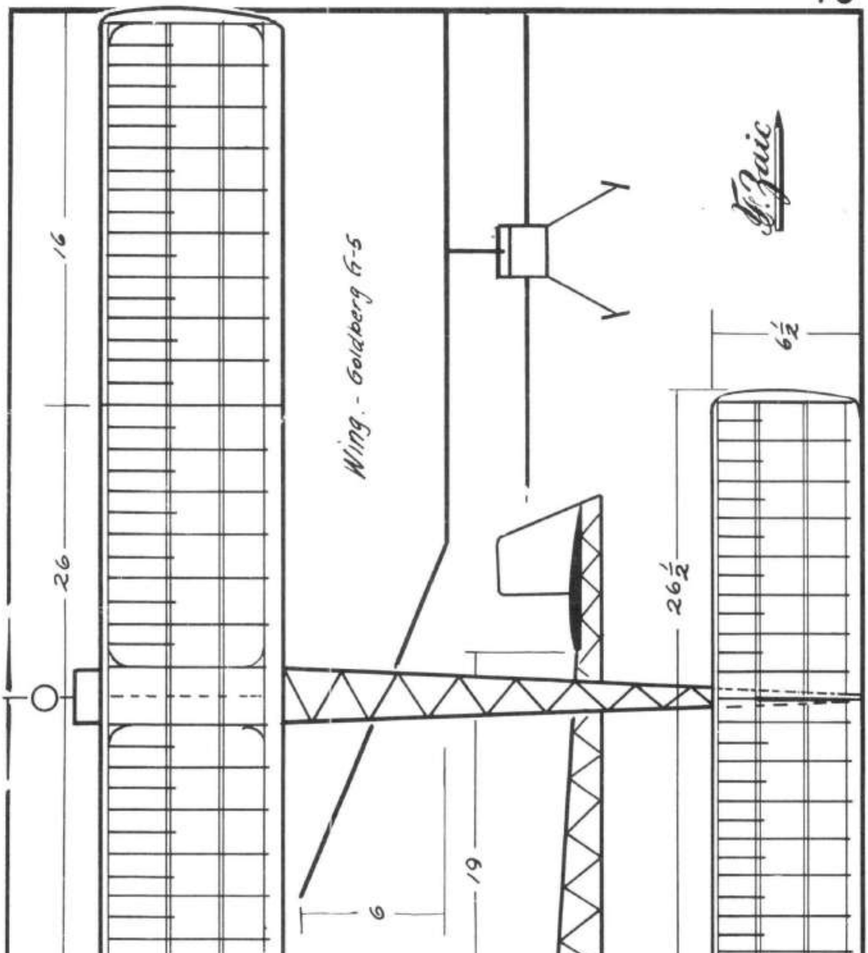

1480
169
480
148
8°
5°
200
Gött 301 9%
WEBRA "WINNER"
2.46 cm³
675
Stab 8% Clark Y
FAI POWER "LUS"
P. SCHMITTER Switzerland

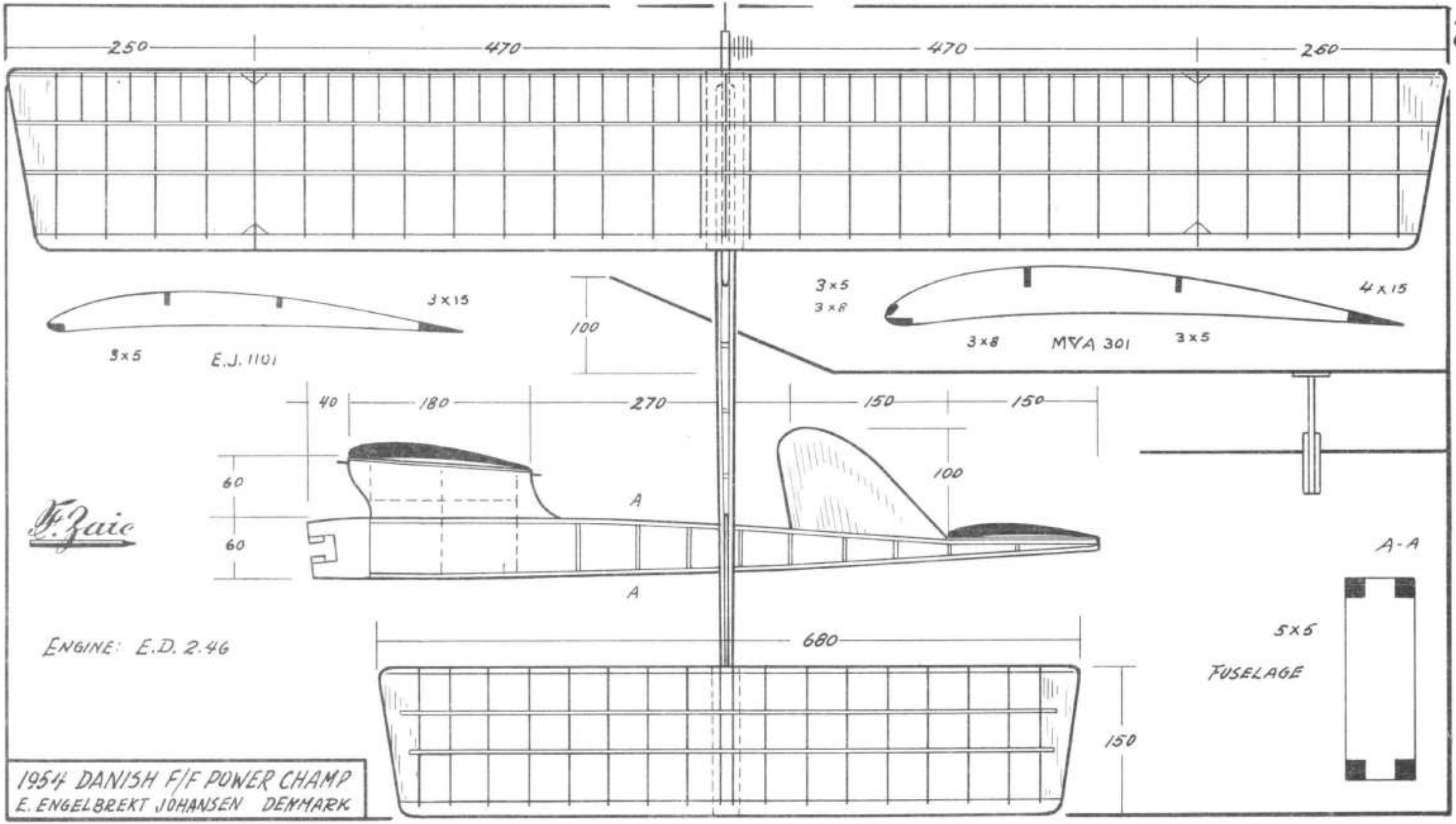


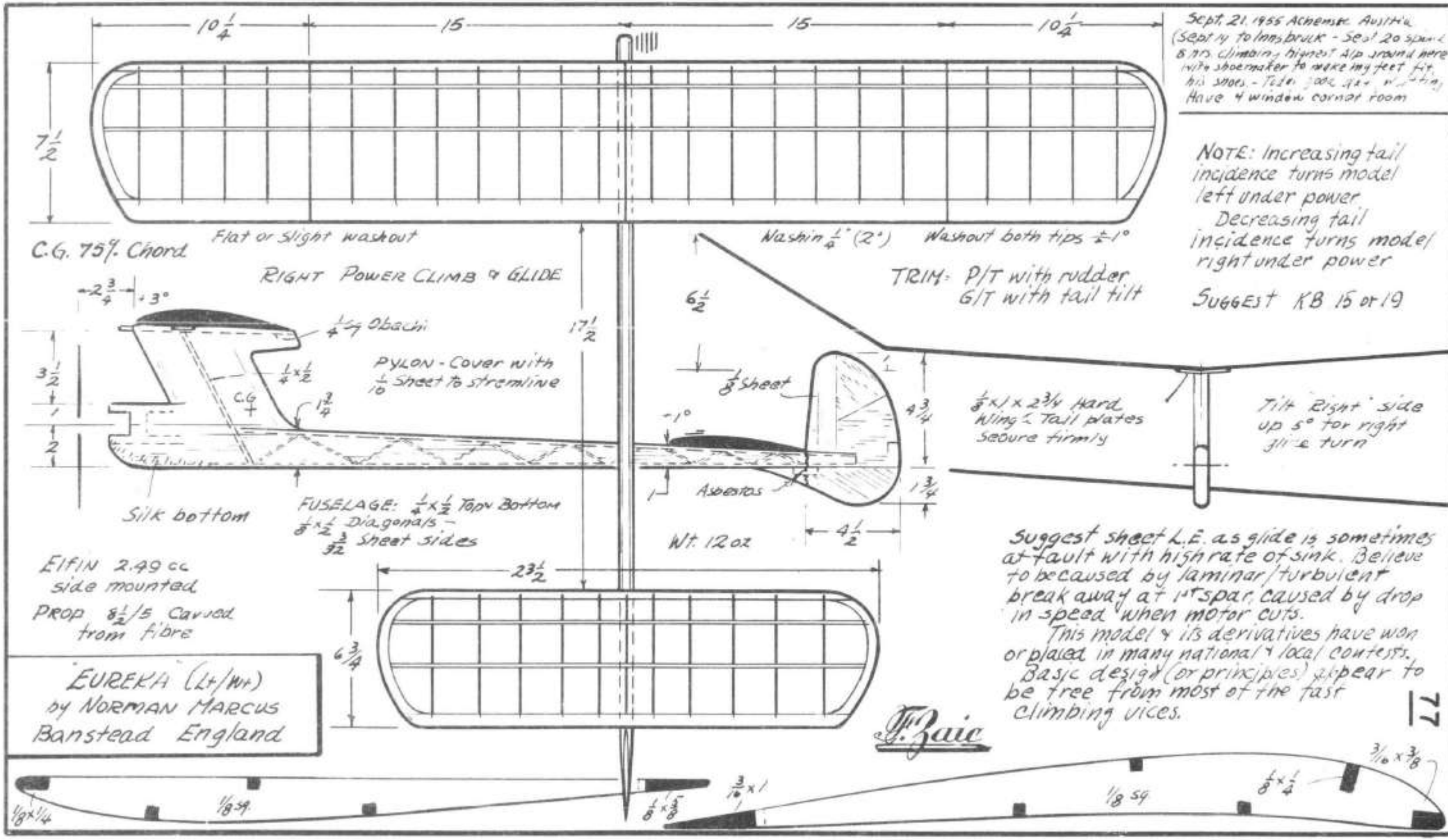
1½" FROOM NEEDLE NOSE (ROUND OFF)
KADINA "60-JET"
⅛ sq. MED.
ALL BRACES 1/16 sq. MED. DO NOT LEAVE OUT!
17¼"
22"
6¾
1⅜
WING: SPAN = 78½" AREA = 483 sq. in.
ASPECT RATIO = 12.91
WEIGHTS
WING 5.60
STAB .70
FUSE 8.10
POWER 5.15
19.45 oz.
ADJUSTMENTS
THRUST LINE: NO OFFSET
WING +5° STAB: +3½°
TILT STAB TO GIVE TIGHT LEFT "ON THE STALL" GLIDE. SHIP WILL HANG.
RUDDER: ADJUST TAB VERY CAREFULLY TO GIVE LOOSE SPIRAL CLIMB, TO RIGHT. GLUE IN TAB ADJUSTMENTS
LAMINATED BALSA, AEROGLOSS FILLET
C.G.
31½"
TANK
1⅜
1/8 sq. NAIL
½
LONGERONS 3/32 sq.
TOP AND BOTTOM 1/16 SOFT SHEET. GRAIN ACROSS - NO CROSS PIECES
SOFT 3/32 SHEET ADDED TO SIDES AND ROUNDED OFF. - COVER FRONT OF FUSELAGE WITH SILK
TORP .15
AUSTIN FUEL-OFF TIMER
TORNADO 8-4 PROP
7¼"
①, ② & ③ ⅛ PLYWOOD BULKHEADS FULL WIDTH & DEPTH
① IS DOVETAILED INTO ② & ③
ENTIRE SHIP COVERED WITH "M°AICO" STANDARD JAP TISSUE
2
1
1/32 SHEET
⅛ sq. HD.
1/16 × ½ MED.
RIBS: 1/16 MED.
¼ × ½ MED.
1/16 SOFT FILL-IN BETWEEN RIBS
1/16 × ½ MED.
⅛ × 1 MED.
WING: GÖTT. 342
1⅞
½
6
SOFT ⅛ SHEET
1/16 × ⅛ MED. SOFT
1/16 sq.
3/32 sq.
1/16 × ⅛
1/32 RIBS
1/16 sq.
3/32 × 3/8
STAB AREA: 166 sq. in.
27"
1/32 SHEET
6
"SPOOFEM" 1955 U.S.A. POWER TEAM
by BILL HARTILL PASSAIC, N.J.


FAI POWER R.S. III
RUD SCHENKER Switzerland
POWER 2.5 cm²
1350
650
200
170
750
130
35
170


130
270
600
600
270
WING NACA 6409
40
60
140
150
670
190
76
150
600
NEBRA MACH I (2.5cm)
HB7 ~ ZH66
HANS BÜHR SWITZERLAND
F. Zaic

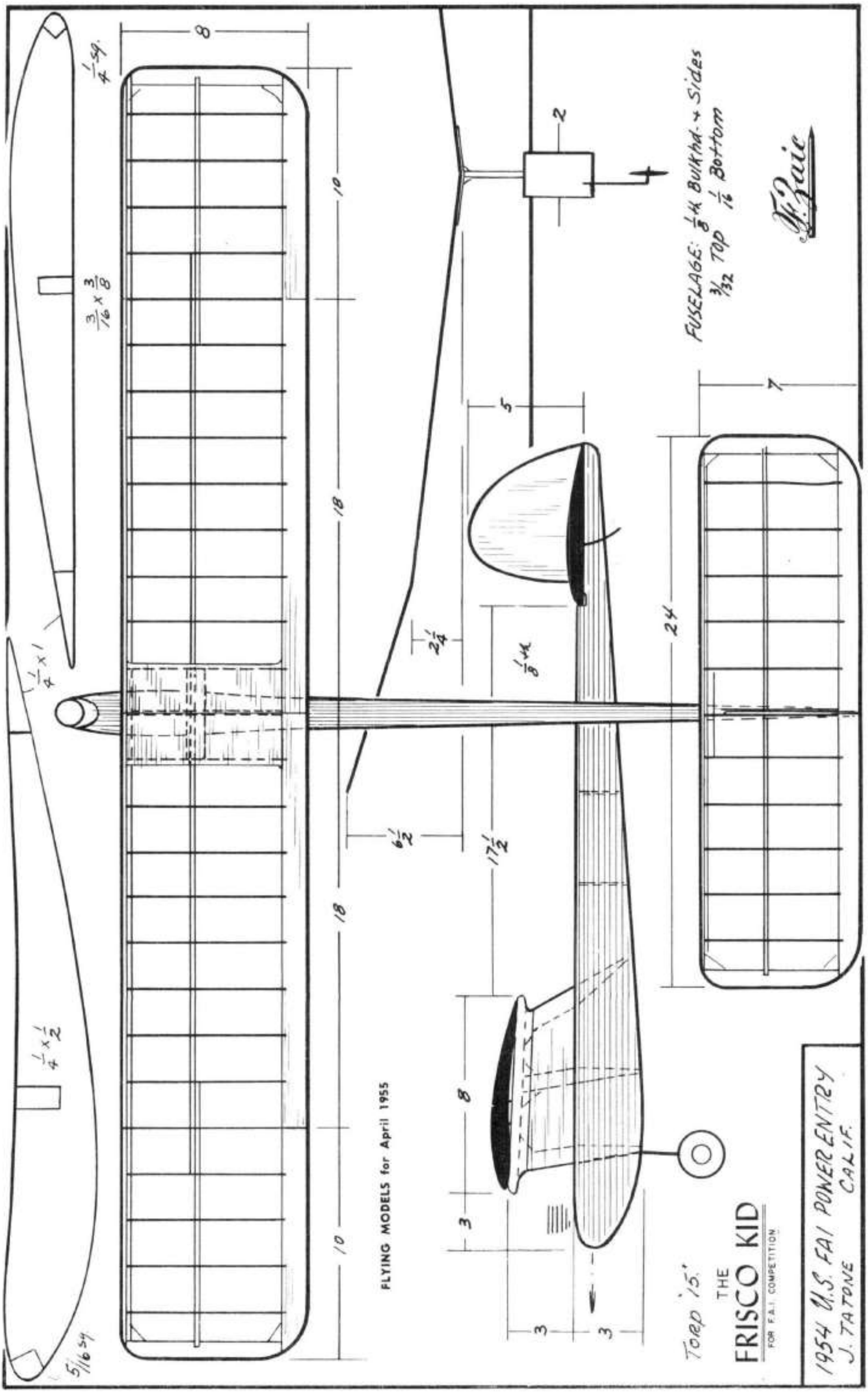

Wing. - Goldberg G-5
16
26
16
6
19
8
26½
6½
1955 U.S.A. FAI POWER TEAM
ERNIE SHAILOR - DETROIT, MICH


250
470
470
260
3×15
3×5
E.J. 1101
100
3×5
3×8
4×15
3×8
MVA 301
3×5
40
180
270
150
150
60
60
A
A
100
A-A
5×5
FUSELAGE
F. Zaic
ENGINE: E.D. 2.46
680
150
1954 DANISH F/F POWER CHAMP
E. ENGELBREKT JOHANSEN DENMARK

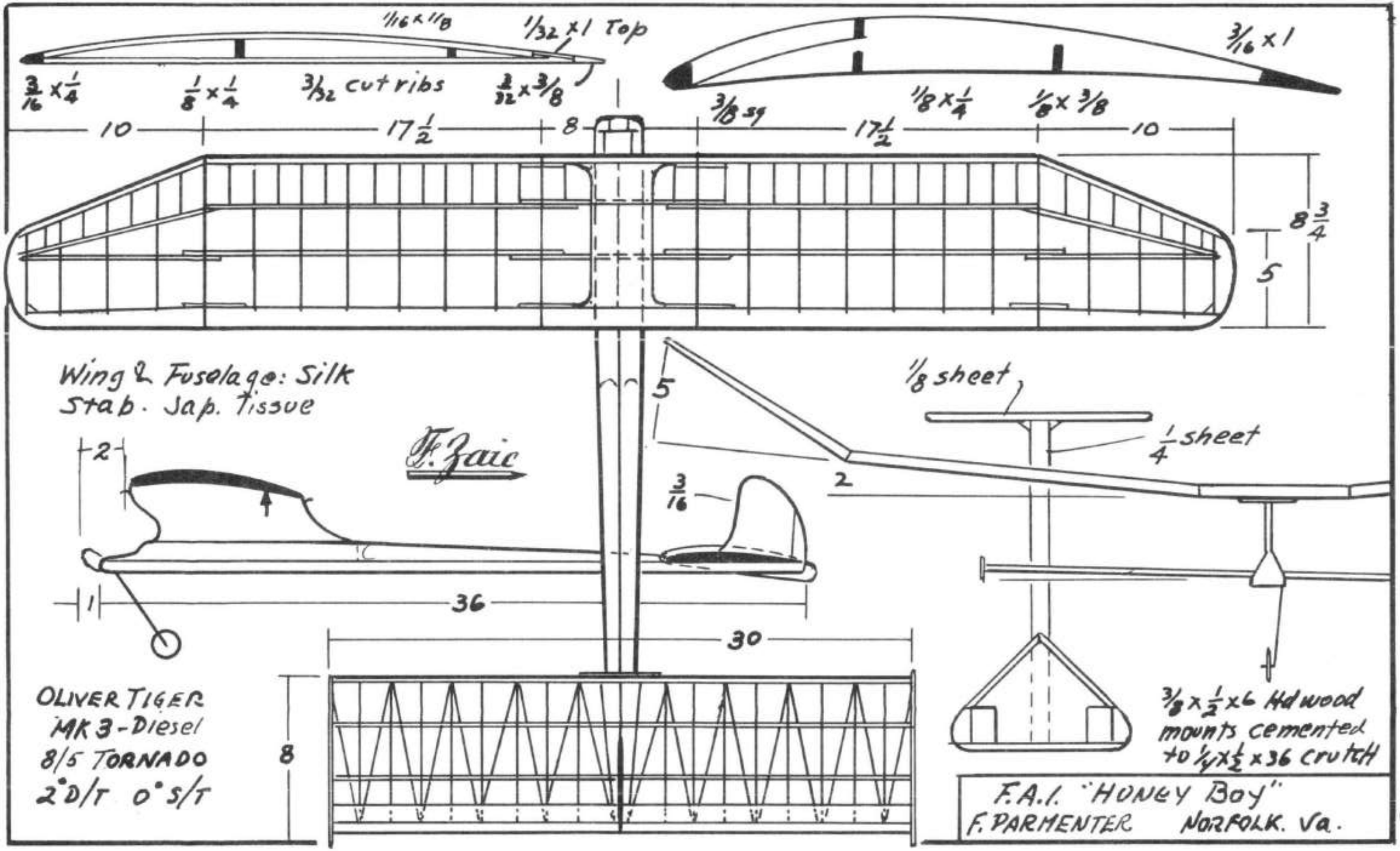


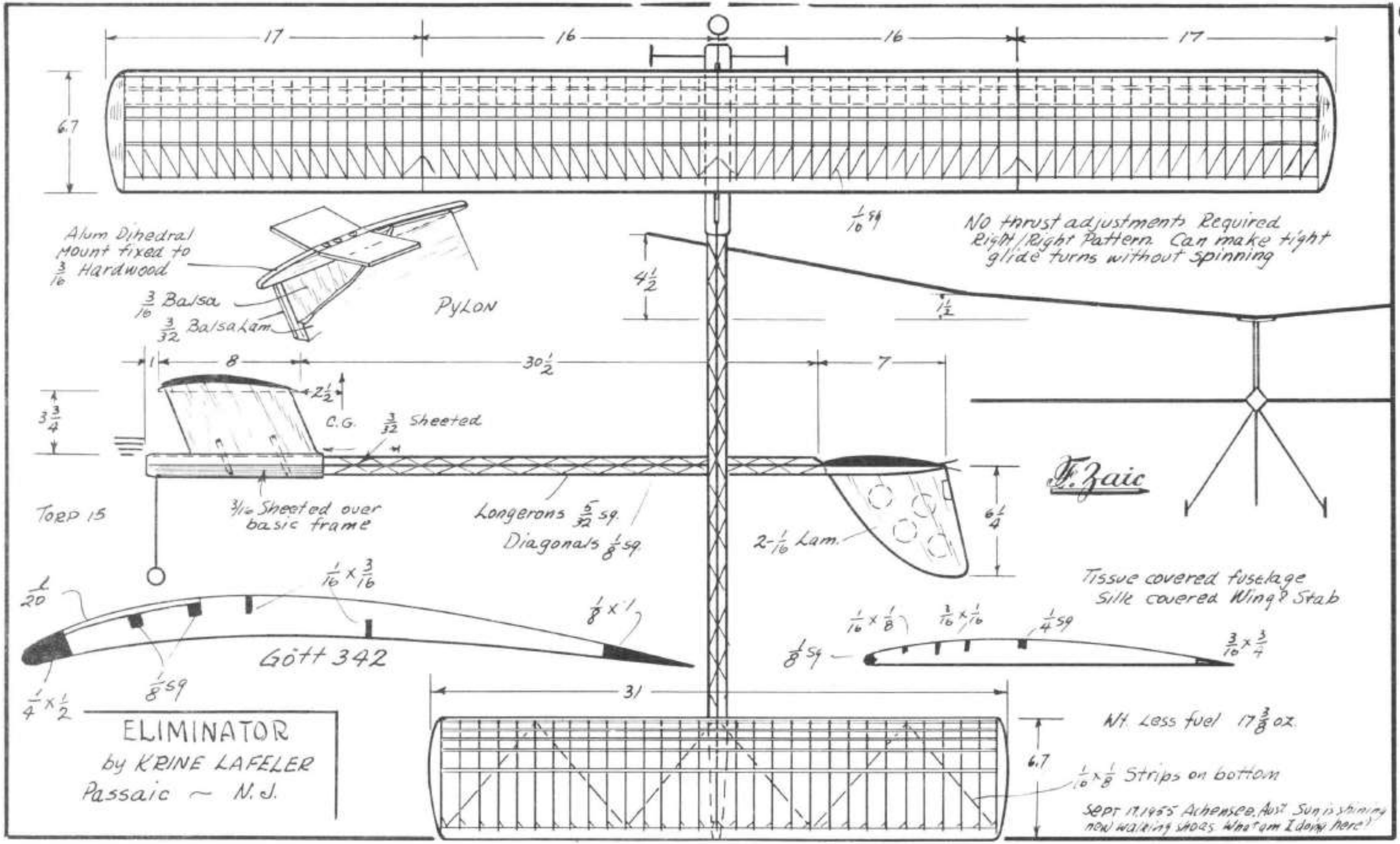
Sept. 21. 1955 Achensee Austria
(Sept 19 to Innsbruck - Sept 20 spent
8 hrs. climbing highest Alp around here
with shoemaker to make my feet fit
his shoes.
Have 4 window corner room
NOTE: Increasing tail incidence turns model left under power.
Decreasing tail incidence turns model right under power
SUGGEST KB 15 or 19
C.G. 75% Chord
Flat or slight washout
Washin 1/4" (2°)
Washout both tips 1°
RIGHT POWER CLIMB & GLIDE
TRIM: P/T with rudder
G/T with tail tilt
1/4 sq Obechi
PYLON - Cover with 1/16 Sheet to streamline
1/8 Sheet
1/8 x 1 x 2 3/4 Hard Wing & Tail plates Secure firmly
Tilt "Right" side up 5° for right glide turn
Asbestos
Silk bottom
FUSELAGE: 1/4 x 1/2 Top & Bottom
1/8 x 1/2 Diagonals -
3/32 Sheet sides
Wt. 12 oz
EIFIN 2.49 cc side mounted
PROP 8 1/2 / 5 Carved from fibre
Suggest sheet L.E. as glide is sometimes at fault with high rate of sink. Believe to be caused by laminar/turbulent break away at 1st spar, caused by drop in speed when motor cuts.
This model & its derivatives have won or placed in many national & local contests.
Basic design (or principles) appear to be free from most of the fast climbing vices.
"EUREKA" (Lt/Wt)
by NORMAN MARCUS
Banstead England
F. Zaic
1/8 x 1/4
1/8 sq
3/16 x 1
1/8 sq
1/8 x 1/4
3/16 x 3/8

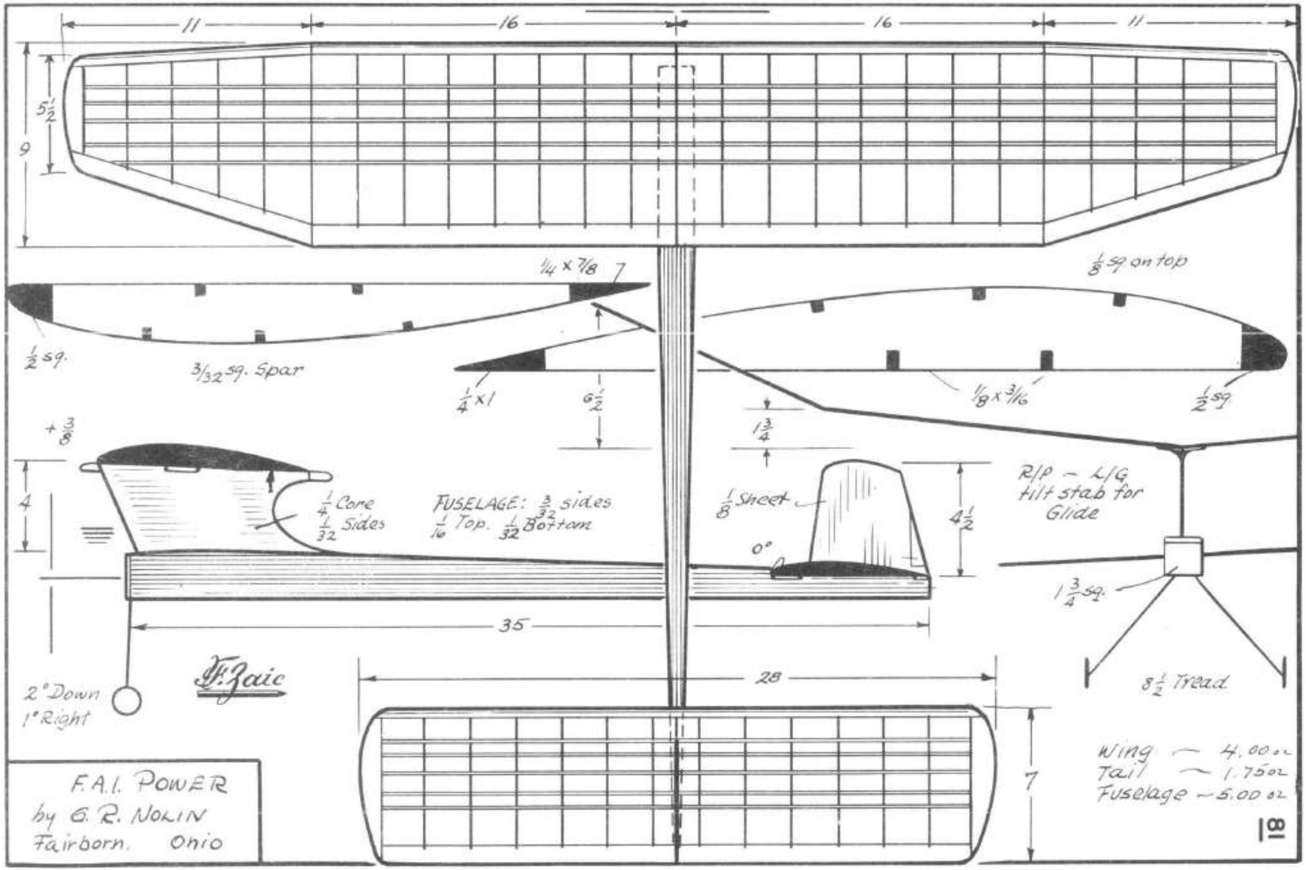
77

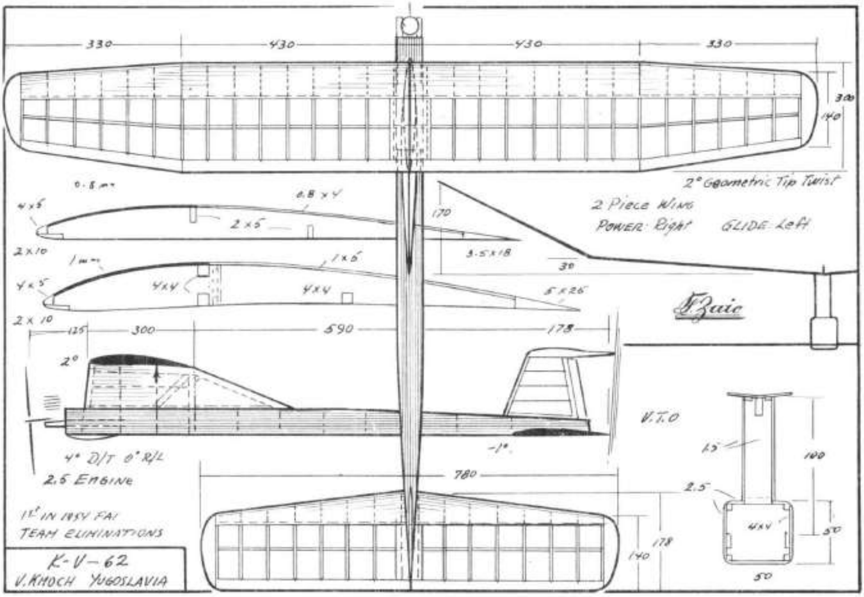


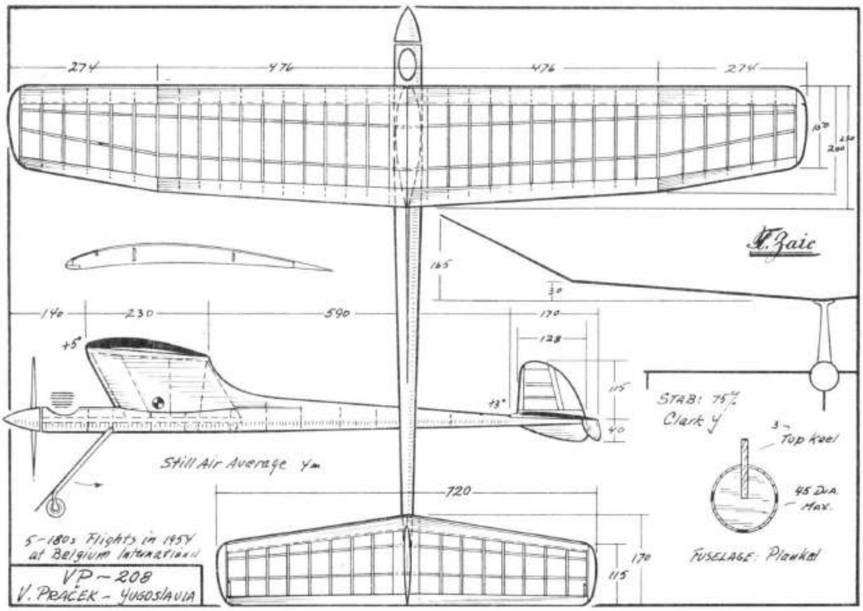
THE FRISCO KID
FOR F.A.I. COMPETITION
Torp '15'
1954 U.S. FAI POWER ENTRY
J. TATONE CALIF.
FLYING MODELS for April 1955
FUSELAGE: 1/8 H Bulkhd. + Sides
3/32 Top 1/16 Bottom
1/4 sq.
3/16 x 3/8
1/4 x 1
1/4 x 1/2
5/16 sq.
1/8 H
8
10
18
18
10
2
5
2 1/4
6 1/2
17 1/2
24
7
8
3
3
3

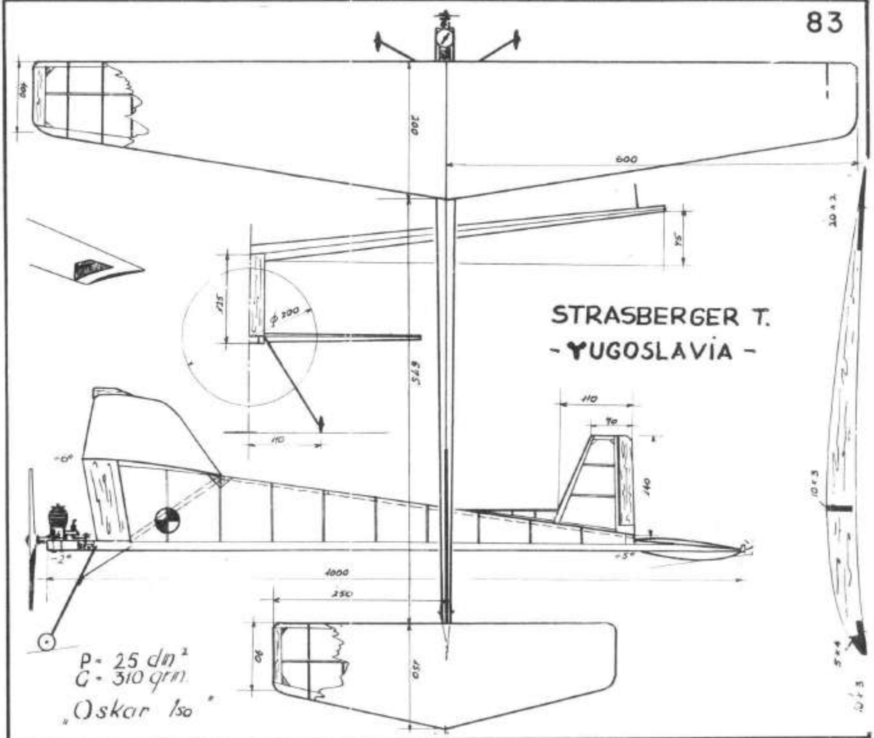

1/16 x 1/8
1/32 x 1 Top
3/16 x 1/4
1/8 x 1/4
3/32 cut ribs
1/32 x 3/8
3/16 x 1
3/8 sq
1/8 x 1/4
1/8 x 3/8
10
17 1/2
8
17 1/2
10
8 3/4
5
Wing & Fuselage: Silk
Stab. Jap. tissue
F. Zaic
2
1/8 sheet
1/4 sheet
5
2
3/16
1
36
30
8
OLIVER TIGER
MK 3-Diesel
8/5 TORNADO
2° D/T 0° S/T
3/8 x 1/2 x 6 Hdwood
mounts cemented
to 1/4 x 1/2 x 36 crutch
F.A.I. "HONEY BOY"
F. PARMENTER NORFOLK. Va.


17
16
16
17
6.7
1/16 sq
No thrust adjustments Required
Right/Right Pattern. Can make tight
glide turns without spinning
Alum Dihedral
Mount fixed to
3/16 Hardwood
3/16 Balsa
3/32 Balsa Lam.
PYLON
4 1/2
1 1/2
1
8
30 1/2
7
2 1/2
3 3/4
C.G.
3/32 Sheeted
TORP 15
3/16 Sheeted over
basic frame
Longerons 5/32 sq.
Diagonals 1/8 sq.
2-1/16 Lam.
6 1/4
F. Zaic
Tissue covered fuselage
Silk covered Wing & Stab
L/20
1/16 x 3/16
1/8 x 1
Gött 342
1/4 x 1/2
1/8 sq
1/16 x 1/8
3/16 x 1/16
1/4 sq
1/8 sq
3/16 x 3/4
31
6.7
Wt. Less fuel 17 3/8 oz.
1/16 x 1/8 Strips on bottom
ELIMINATOR
by KRINE LAFELER
Passaic ~ N.J.
Sept 17, 1955 Achensee, Aust. Sun is shining
new walking shoes. What am I doing here?

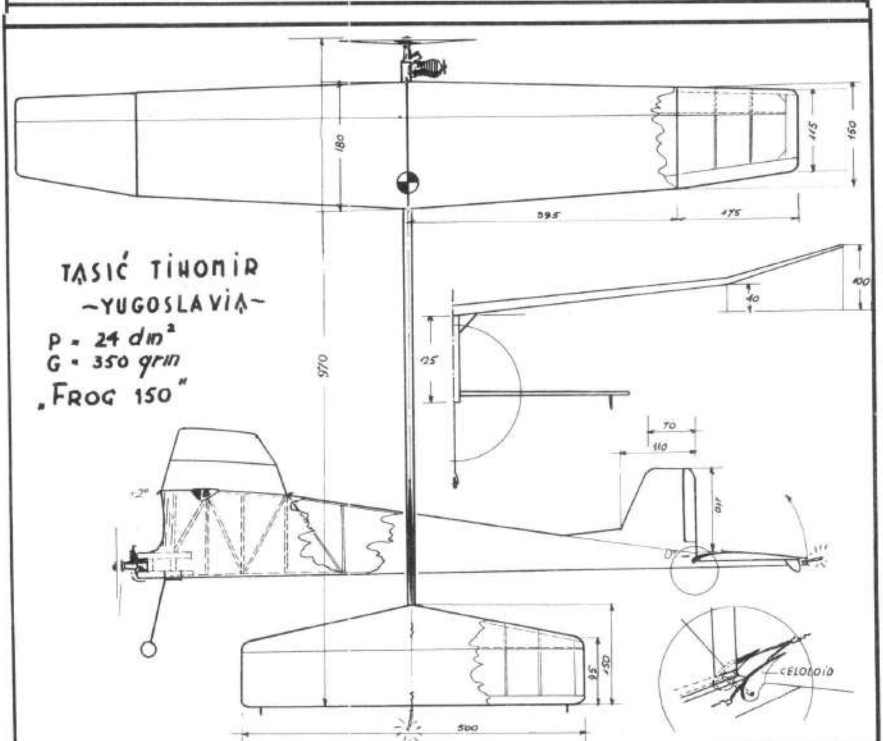

11
16
16
11
5 1/2
9
1/4 x 7/8
1/8 sq on top
1/2 sq.
3/32 sq. Spar
1/4 x 1
6 1/2
1 3/4
1/8 x 3/16
1/2 sq.
+ 3/8
4
1/4 Core
1/32 Sides
FUSELAGE: 3/32 sides
1/16 Top. 1/32 Bottom
1/8 Sheet
0°
4 1/2
R/P – L/G
tilt stab for
Glide
1 3/4 sq.
35
F. Zaic
28
8 1/2 Tread
2° Down
1° Right
7
Wing – 4.00 oz
Tail – 1.75 oz
Fuselage – 5.00 oz
F.A.I. POWER
by G. R. NOLIN
Fairborn, Ohio


330
430
430
330
300
140
2° Geometric Tip Twist
0.8 mm
0.8 x 4
4 x 5
2 x 5
170
2 Piece Wing
Power: Right Glide: Left
2 x 10
1 mm
1 x 5
3.5 x 18
30
4 x 5
4 x 4
4 x 4
5 x 26
2 x 10
125
300
590
178
2°
V.T.O
-1°
4° D/T 0° R/L
2.5 Engine
1.5
100
780
2.5
1st in 1954 FAI
Team Eliminations
4 x 4
178
50
140
K-V-62
V. Khoch Yugoslavia
50

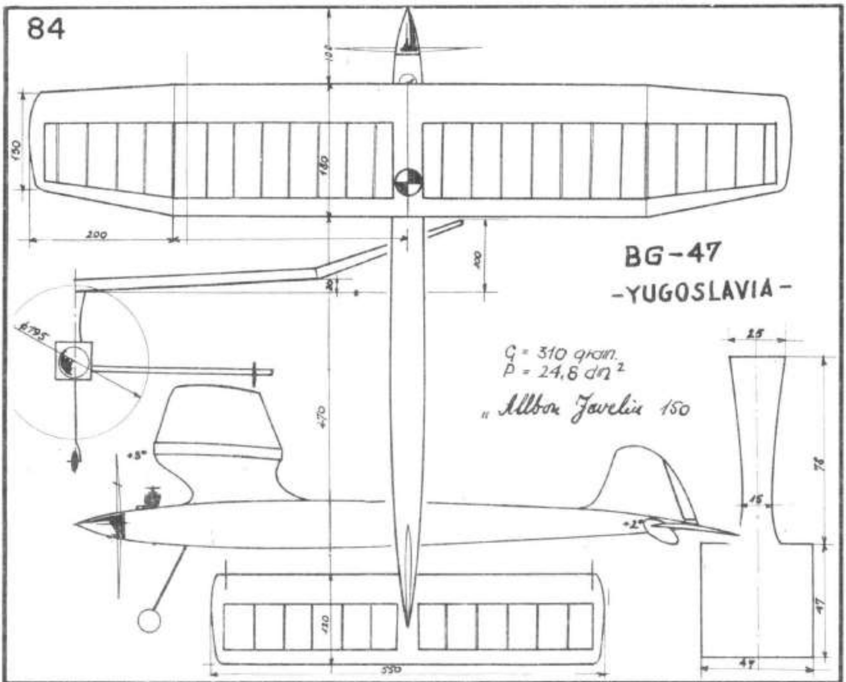

274
476
476
274
150
250
200
165
30
140
230
590
170
128
+5°
115
Stab: 75%
Clark Y
+3°
40
3
Top keel
Still Air Average 4m
720
45 Dia.
Max.
5-180s Flights in 1954
at Belgium International
170
Fuselage: Planked
VP-208
V. Praček - Yugoslavia
115

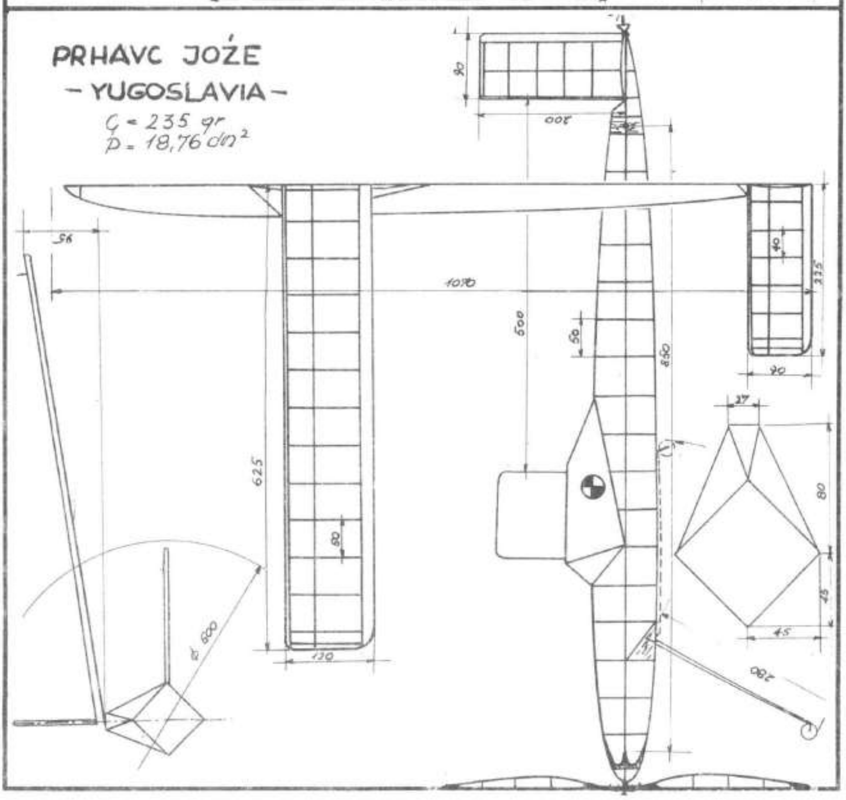


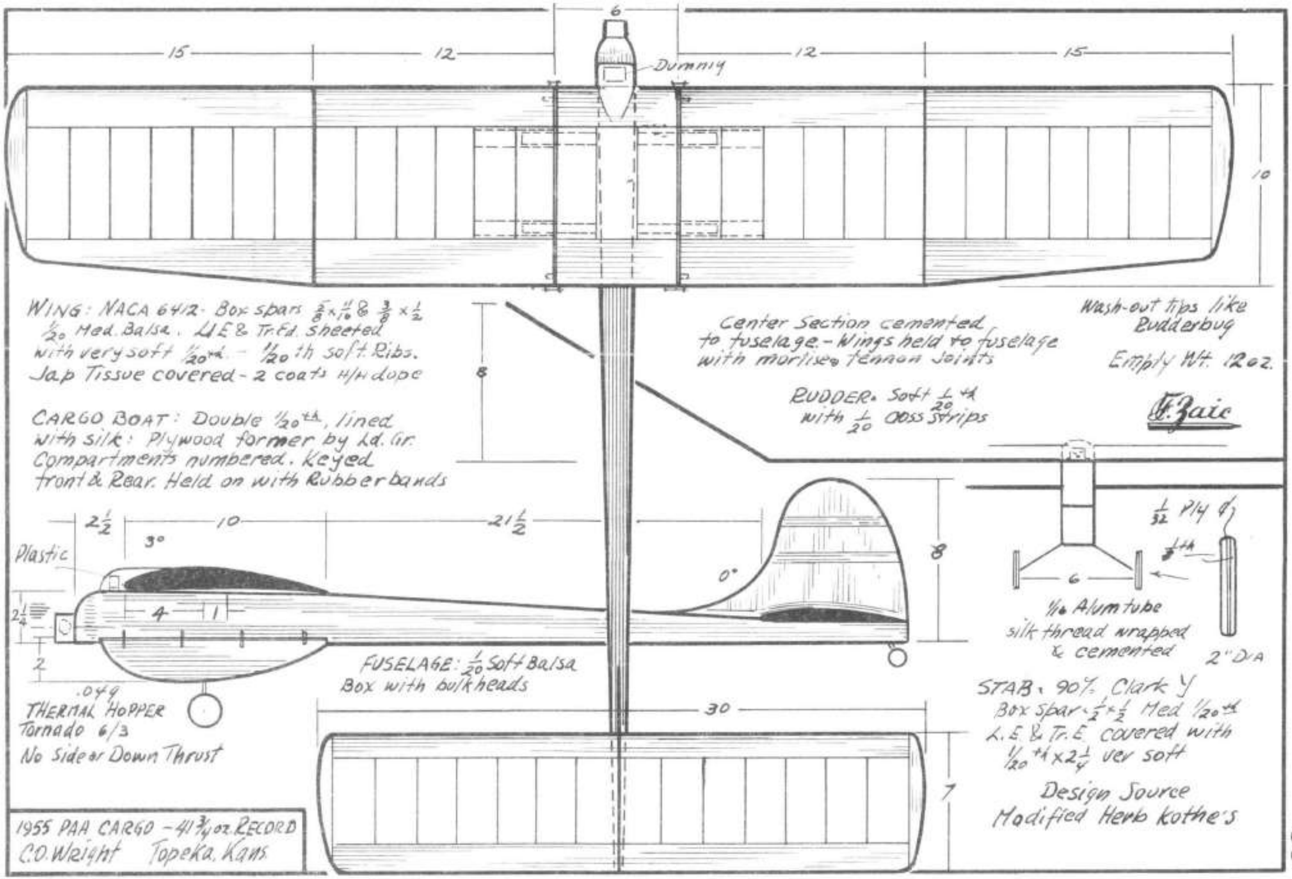
STRASBERGER T.
- YUGOSLAVIA -
P = 25 dm²
G = 310 grm
„Oskar 150"
600
200
100
75
125
φ 200
110
549
110
90
140
1000
250
90
150



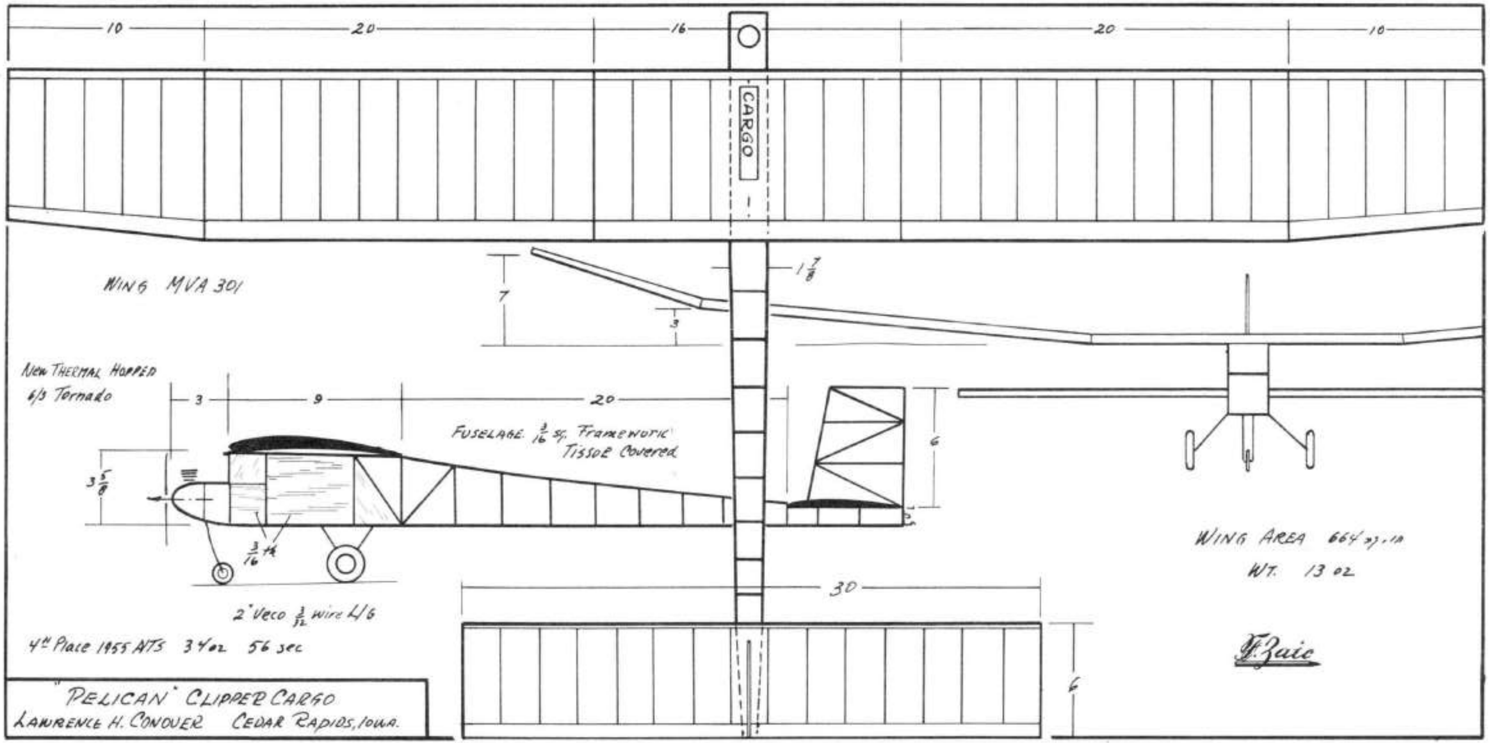
TASIĆ TIHOMIR
-YUGOSLAVIA-
P = 24 dm²
G = 350 grm
„FROG 150"
180
970
115
150
595
175
100
40
125
70
110
110
95
150
500
CELOLOID

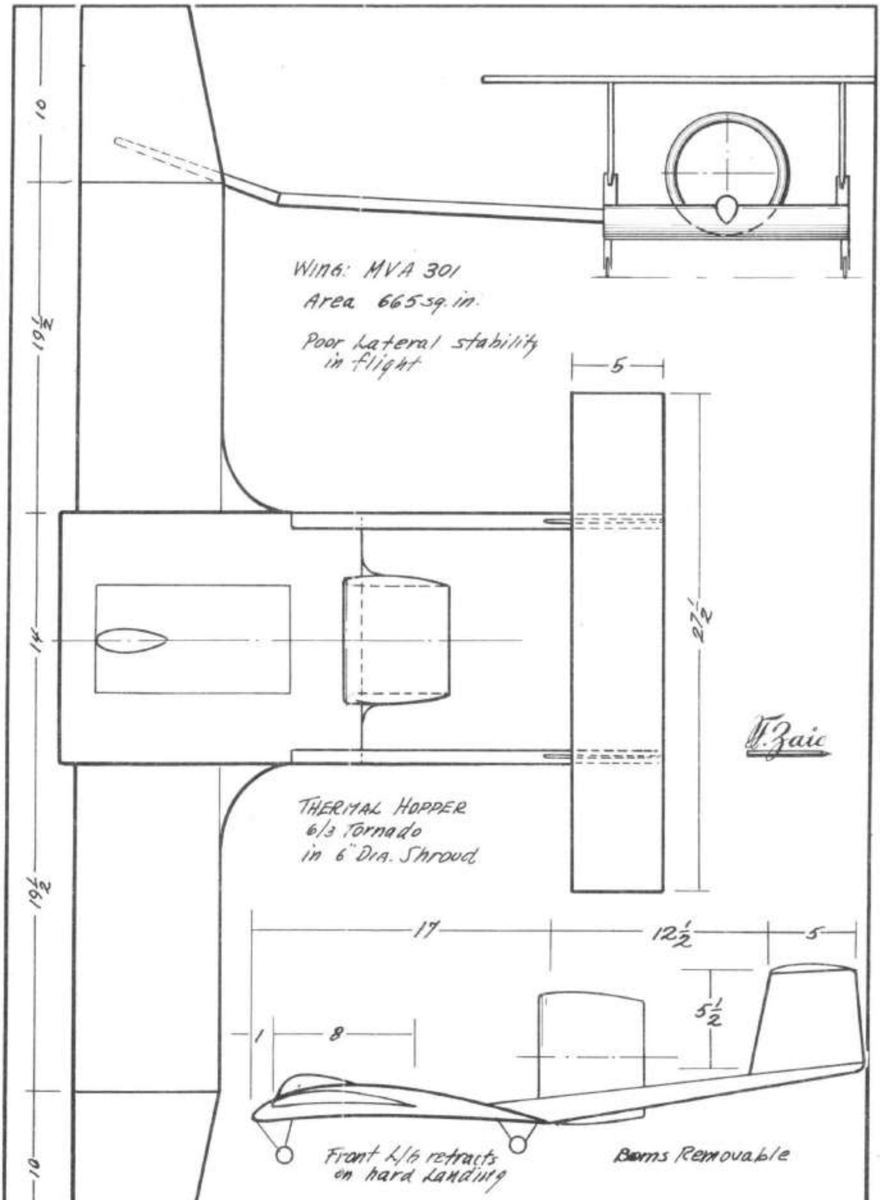

BG-47
-YUGOSLAVIA-
G = 310 gram.
P = 24,8 dm²
„Allbon Javelin 150

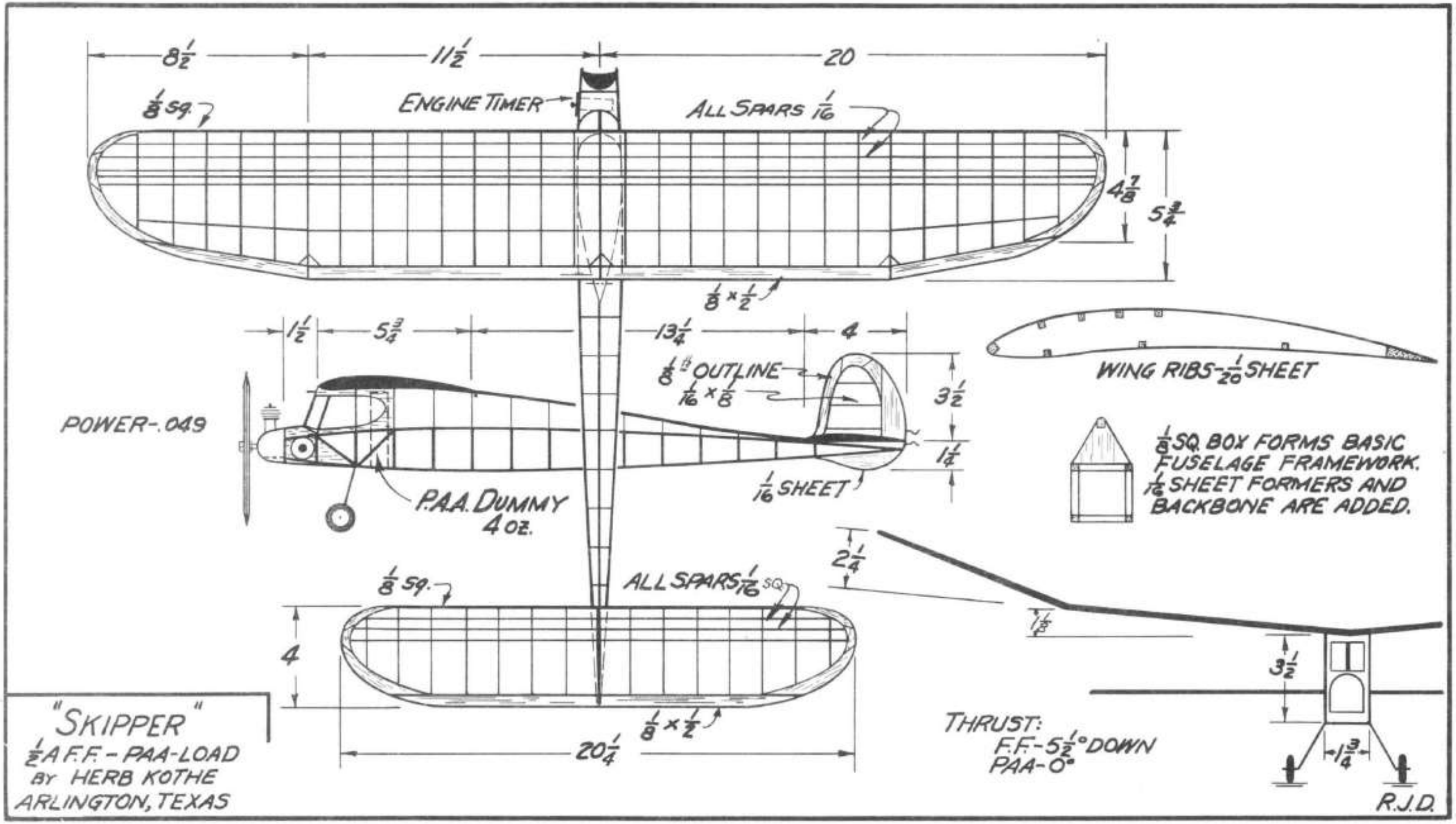

PRHAVC JOŻE
- YUGOSLAVIA -
G = 235 gr
P = 18,76 dm²



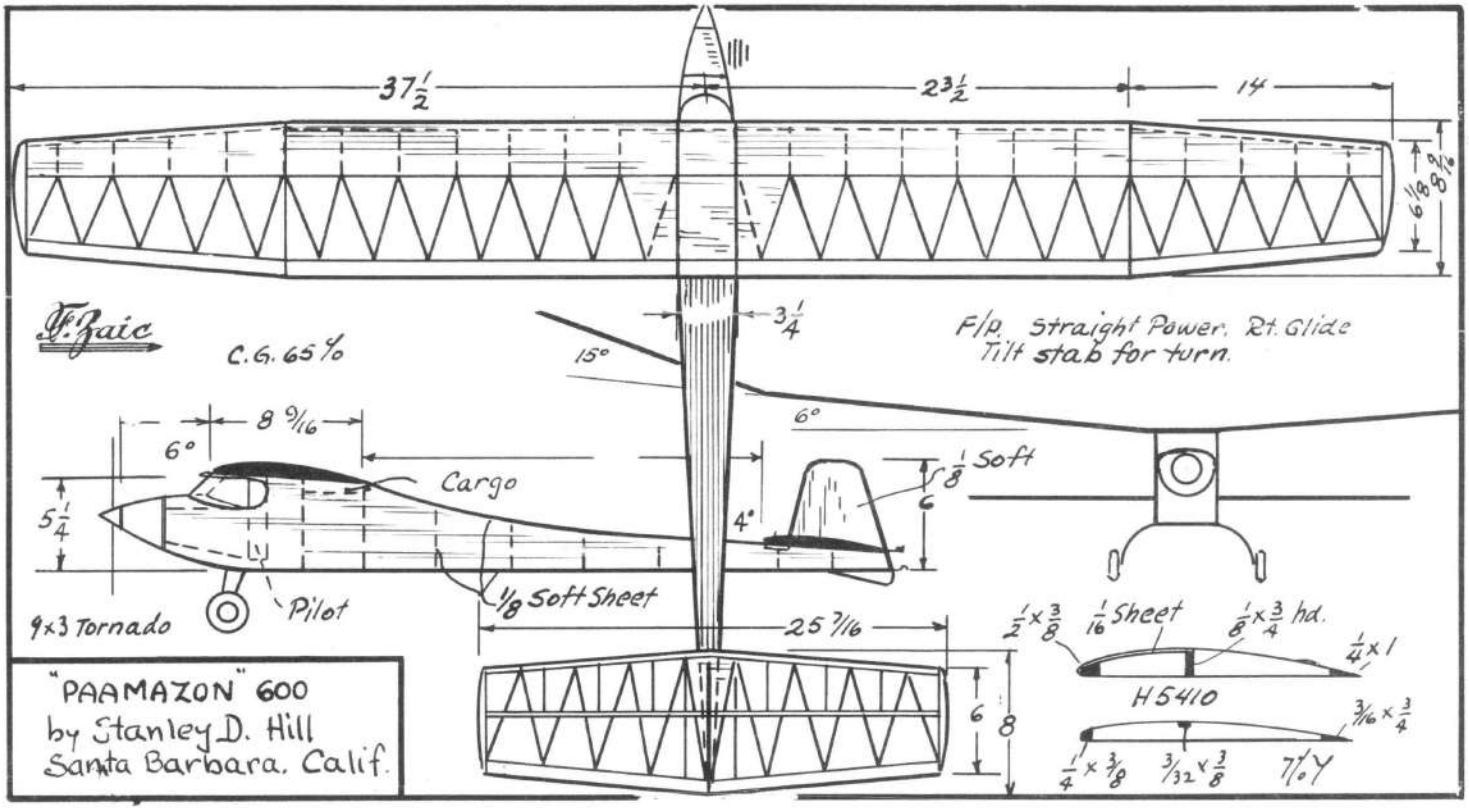
15
12
6
12
15
Dummy
10
WING: NACA 6412 - Box spars 1/8 x 1/16 & 3/8 x 1/2
1/20 Med. Balsa. L.E & Tr.Ed. sheeted
with very soft 1/20th - 1/20th soft Ribs.
Jap Tissue covered - 2 coats H/H dope
CARGO BOAT: Double 1/20th, lined
with silk: Plywood former by Ld. Gr.
Compartments numbered. Keyed
front & Rear. Held on with Rubber bands
8
Center Section cemented
to fuselage. - Wings held to fuselage
with mortise & tennon joints
RUDDER: Soft 1/20th
with 1/20 cross strips
Wash-out tips like
Rudderbug
Empty Wt. 12 oz.
F. Zaic
2 1/2
10
21 1/2
3°
Plastic
0°
8
2 1/4
4
1
2
.049
THERMAL HOPPER
Tornado 6/3
No Side or Down Thrust
FUSELAGE: 1/20 Soft Balsa
Box with bulkheads
1/32 Ply
1/8th
6
1/16 Alum tube
silk thread wrapped
& cemented
2" DIA
30
7
STAB: 90% Clark Y
Box spar 1/2 x 1/2 Med 1/20th
L.E & Tr.E covered with
1/20th x 2 1/4 ver soft
Design Source
Modified Herb Kothe's
1955 PAA CARGO - 41 3/4 oz. RECORD
C.O. Wright Topeka, Kans.

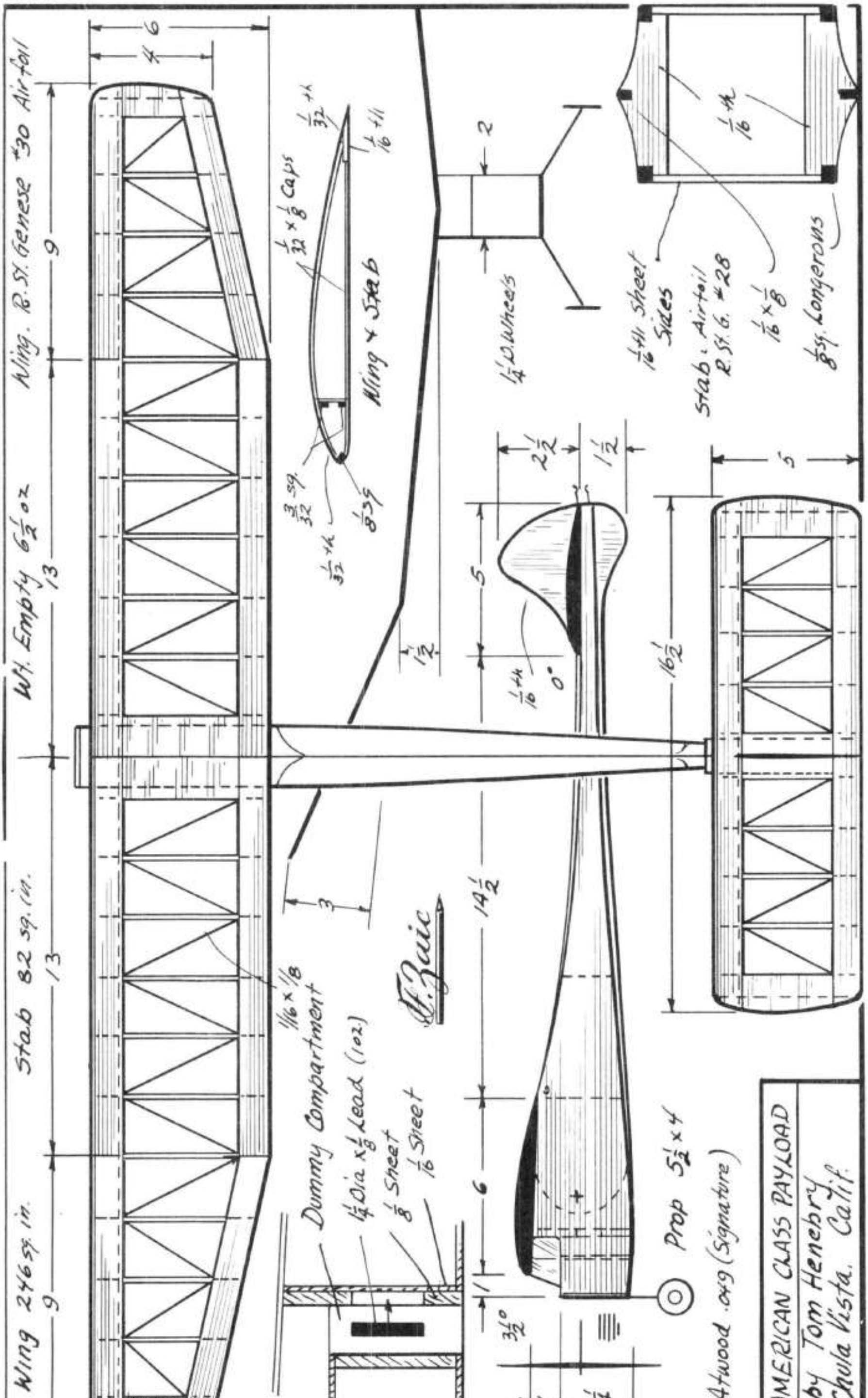

CARGO
WING MVA 301
New Thermal Hopper
6/3 Tornado
FUSELAGE 3/16 sq. Framework
Tissue Covered
2" Veco 1/32 wire L/G
4th Place 1955 AMS 3 1/4 oz 56 sec
WING AREA 664 sq. in.
WT. 13 oz
F. Zaic
"PELICAN" CLIPPER CARGO
LAWRENCE H. CONOVER CEDAR RAPIDS, IOWA.

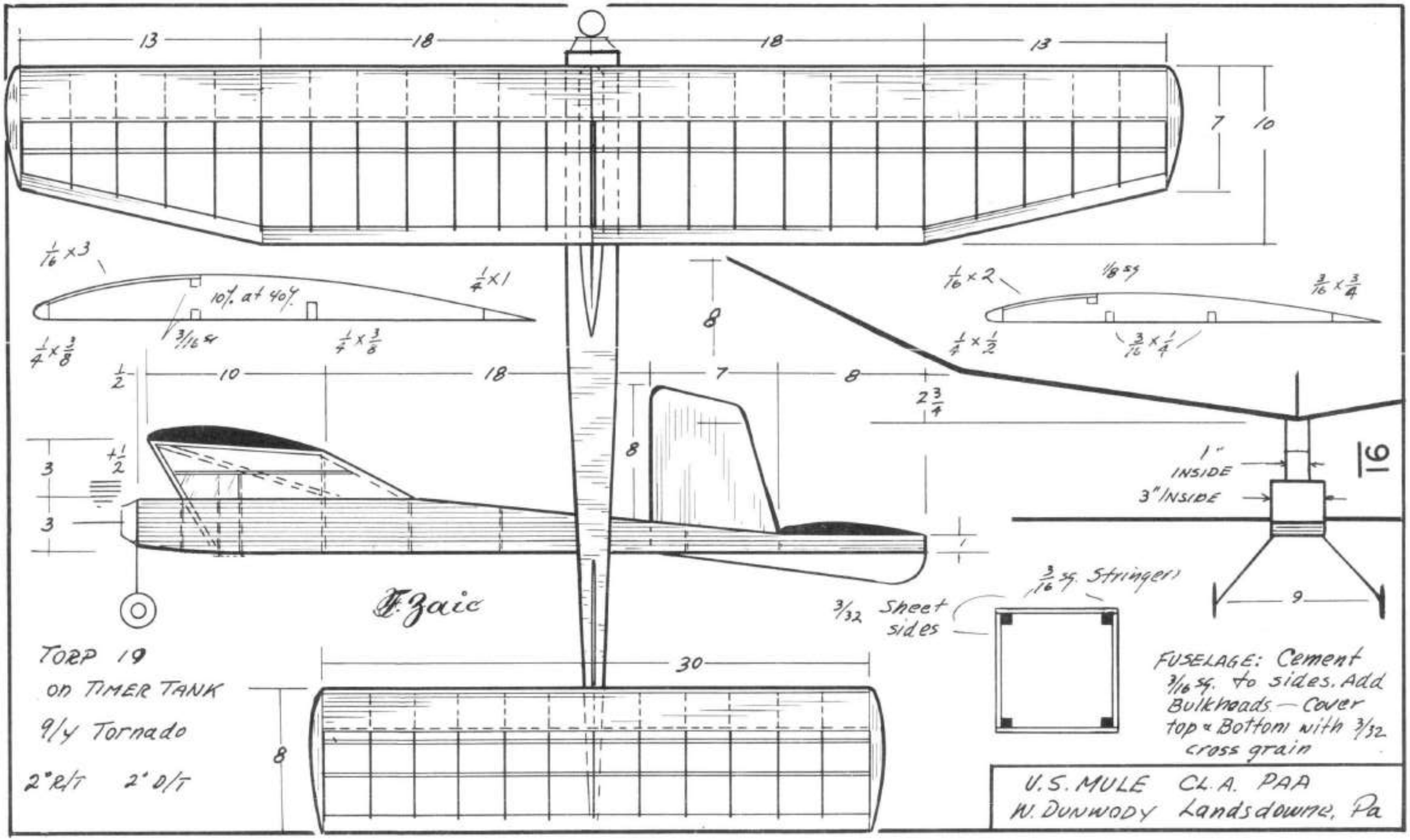

10
19½
14
19½
10
Wing: MVA 301
Area 665 sq. in.
Poor lateral stability in flight
5
27½
THERMAL HOPPER
6/3 Tornado
in 6" Dia. Shroud
17
12½
5
5½
1
8
Front L/G retracts on hard landing
Booms Removable
Wt. 16 oz
Lifted 34 oz
FLYING DUTCHMAN CLIPPER CARGO
LAWRENCE H. CONOVER – CEDAR RAPIDS, IOWA



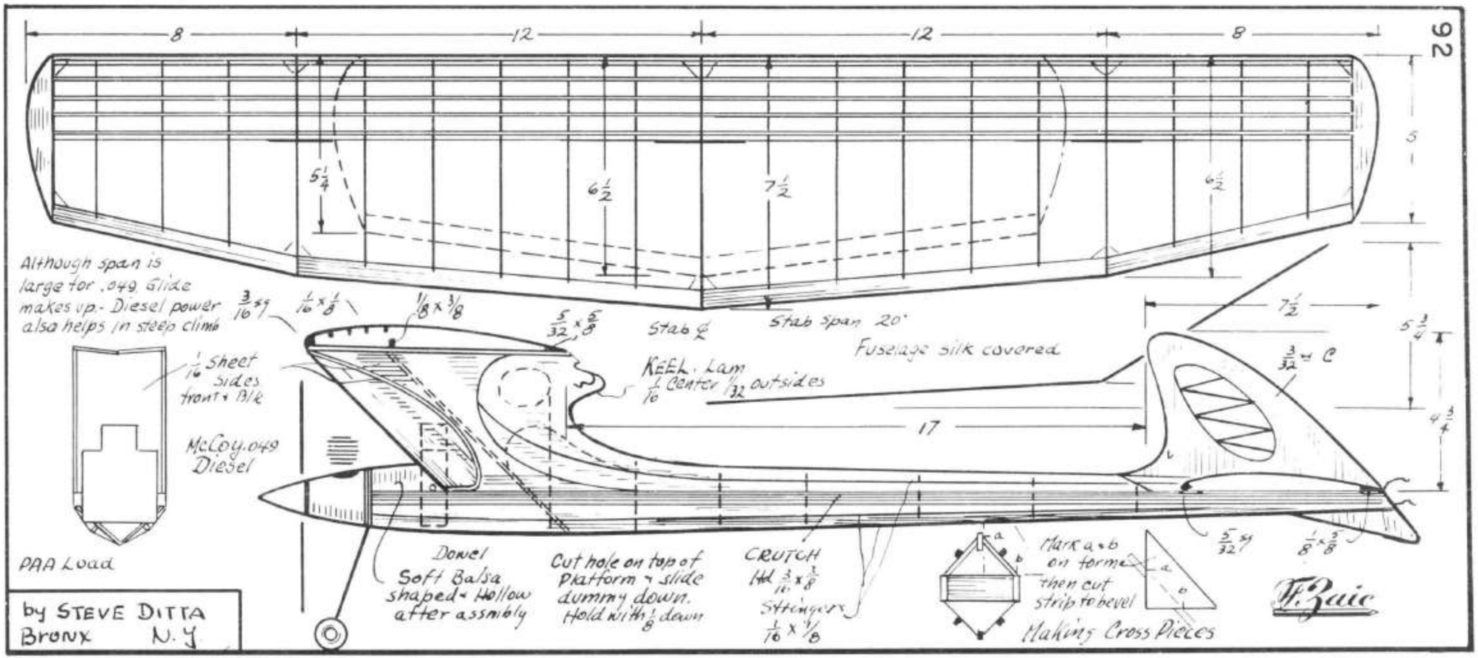
8 1/2
11 1/2
20
1/8 SQ.
ENGINE TIMER
ALL SPARS 1/16
4 7/8
5 3/4
1/8 × 1/2
1 1/2
5 3/4
13 1/4
4
1/8" OUTLINE
1/16 × 1/8
3 1/2
1 1/4
POWER-.049
P.A.A. DUMMY
4 OZ.
1/16 SHEET
WING RIBS-1/20 SHEET
1/8 SQ. BOX FORMS BASIC FUSELAGE FRAMEWORK. 1/16 SHEET FORMERS AND BACKBONE ARE ADDED.
2 1/4
1 1/8
3 1/2
1 3/4
1/8 SQ.
ALL SPARS 1/16 SQ.
4
1/8 × 1/2
20 1/4
"SKIPPER"
1/2 A F.F. - PAA-LOAD
BY HERB KOTHE
ARLINGTON, TEXAS
THRUST:
F.F.-5 1/2° DOWN
PAA-0°
R.J.D.


37 1/2
23 1/2
14
6 1/8
8 9/16
F. Zaic
C.G. 65%
3 1/4
15°
F/P. Straight Power. Rt. Glide
Tilt stab for turn.
6°
8 9/16
6°
1/8 Soft
Cargo
5 1/4
4°
6
Pilot
1/8 Soft Sheet
9×3 Tornado
25 7/16
1/2 × 3/8
1/16 Sheet
1/8 × 3/4 hd.
1/4 × 1
H5410
3/16 × 3/4
6
8
1/4 × 3/8
3/32 × 3/8
7% Y
"PAAMAZON" 600
by Stanley D. Hill
Santa Barbara, Calif.

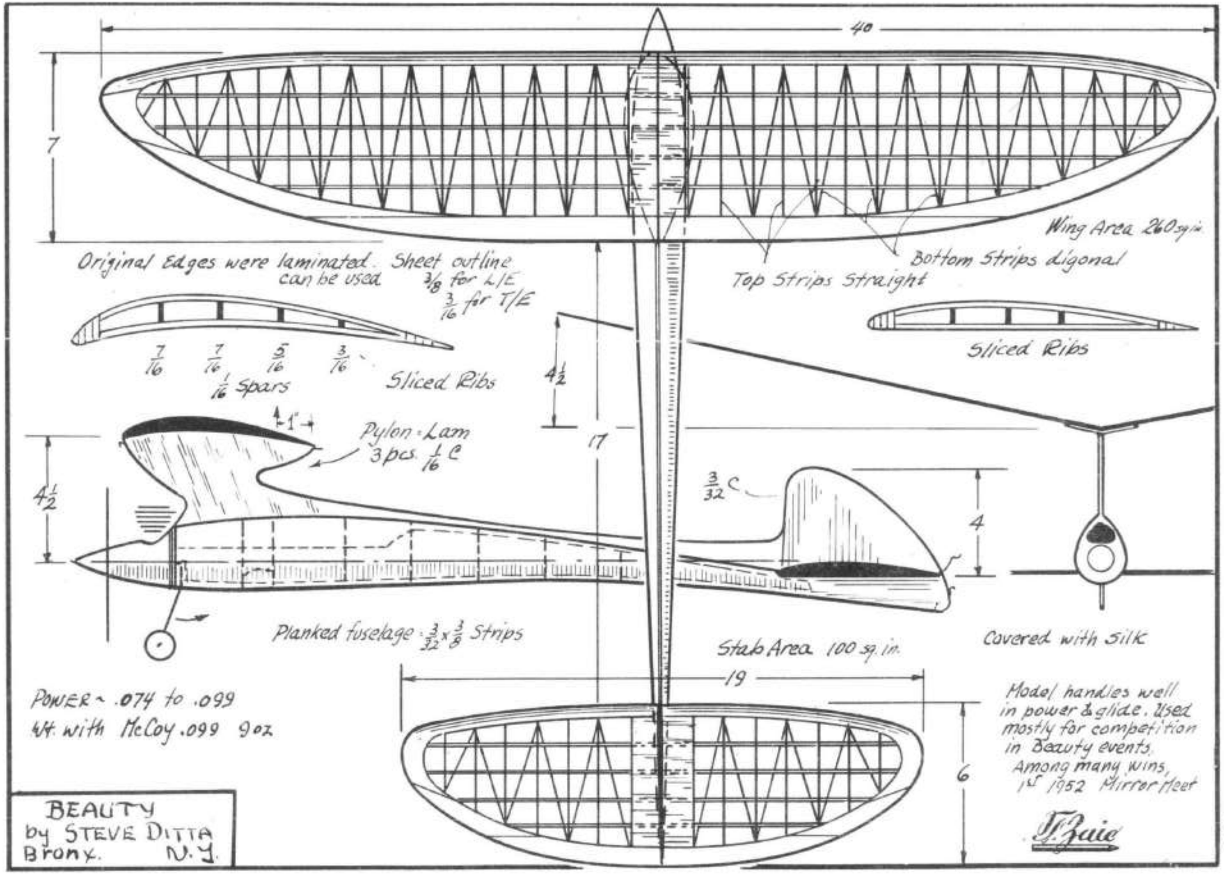

Wing 246 sq. in.
Stab 82 sq. in.
Wt. Empty 6½ oz
Wing. R. St. Genese #30 Airfoil
1/32 x 1/8 Caps
Wing & Stab
1¼ D. Wheels
1/16 +h Sheet Sides
Stab. Airfoil R. St. G. #28
1/16 x 1/8
1/8 sq. Longerons
1/16 x 1/8
Dummy Compartment
1/4 Dia x 1/8 Lead (1oz)
1/8 Sheet
1/16 Sheet
Prop 5½ x 4
Atwood .049 (Signature)
AMERICAN CLASS PAYLOAD
by Tom Henebry,
Chula Vista, Calif.

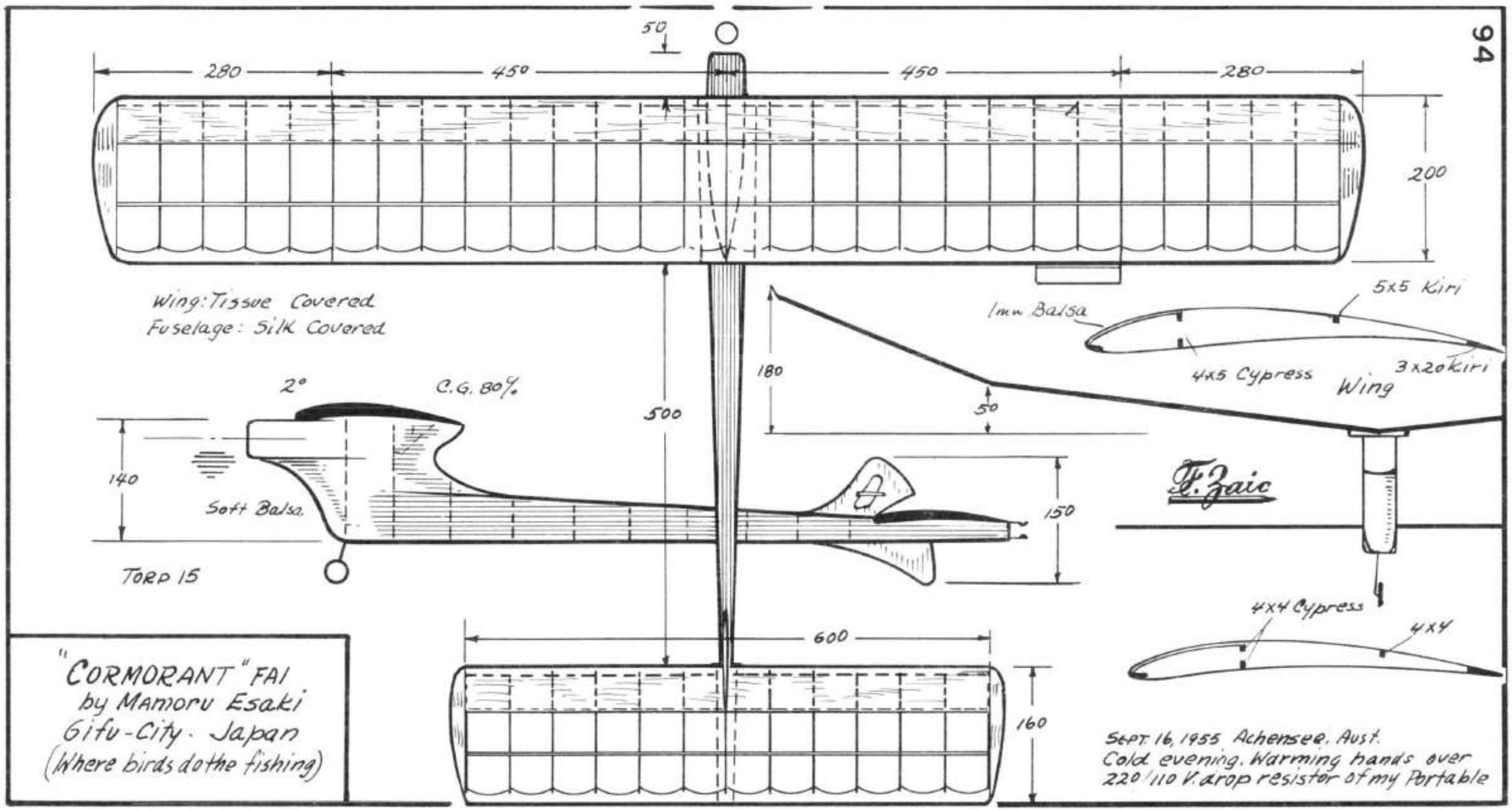


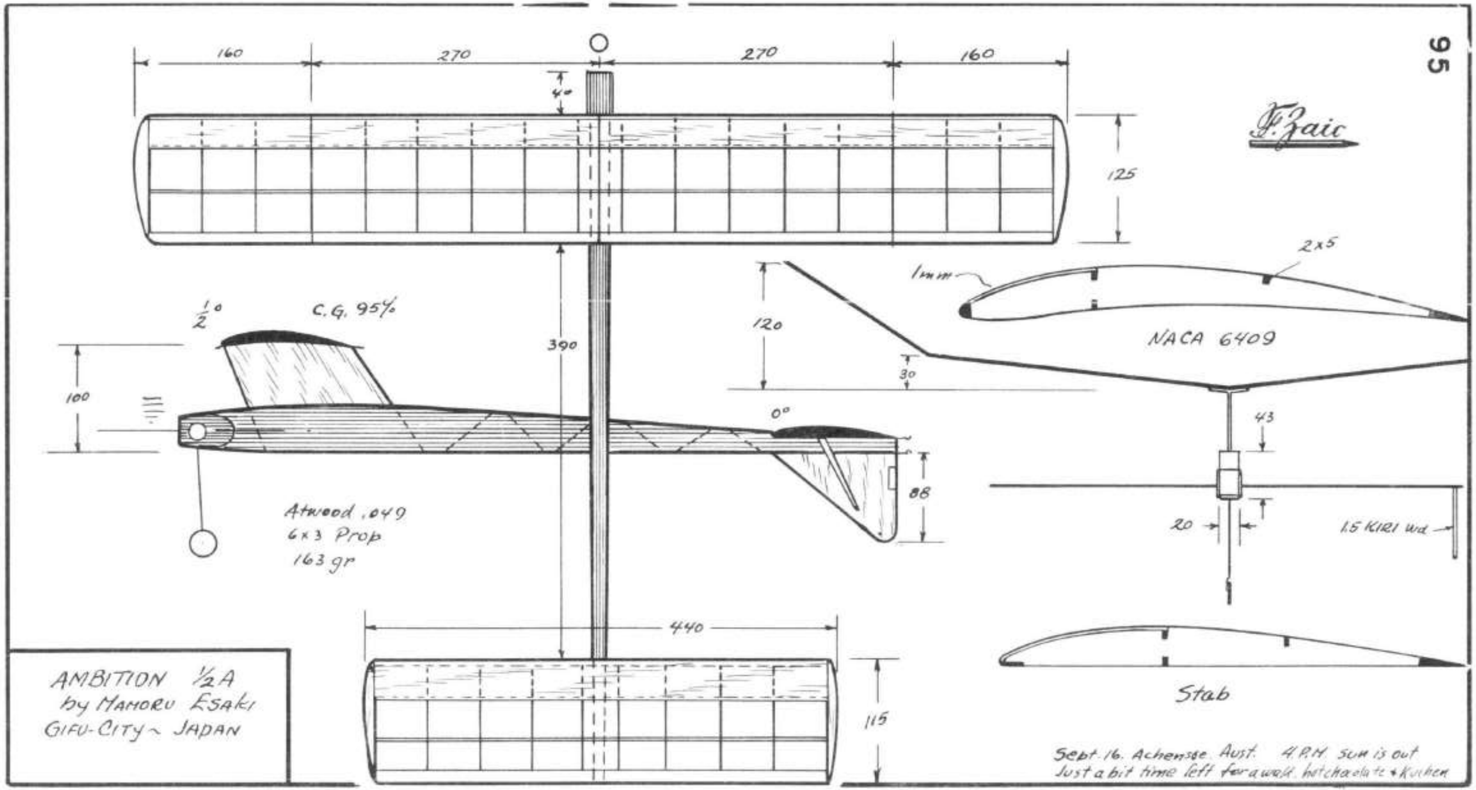
13
18
18
13
7
10
1/16 x 3
10% at 40%
1/4 x 1
3/16 sq
1/4 x 3/8
1/4 x 3/8
1/16 x 2
1/8 sq
3/16 x 3/4
1/4 x 1/2
3/16 x 1/4
8
1/2
10
18
7
8
2 3/4
8
3
+1/2
3
1
1" INSIDE
3" INSIDE
91
9
F. Zaic
3/16 sq. Stringers
3/32 Sheet sides
30
8
TORP 19
on TIMER TANK
9/4 Tornado
2° R/T 2° D/T
FUSELAGE: Cement 3/16 sq. to sides. Add Bulkheads. — Cover top & Bottom with 3/32 cross grain
U.S. MULE CL.A. PAA
W. DUNWODY Landsdowne, Pa

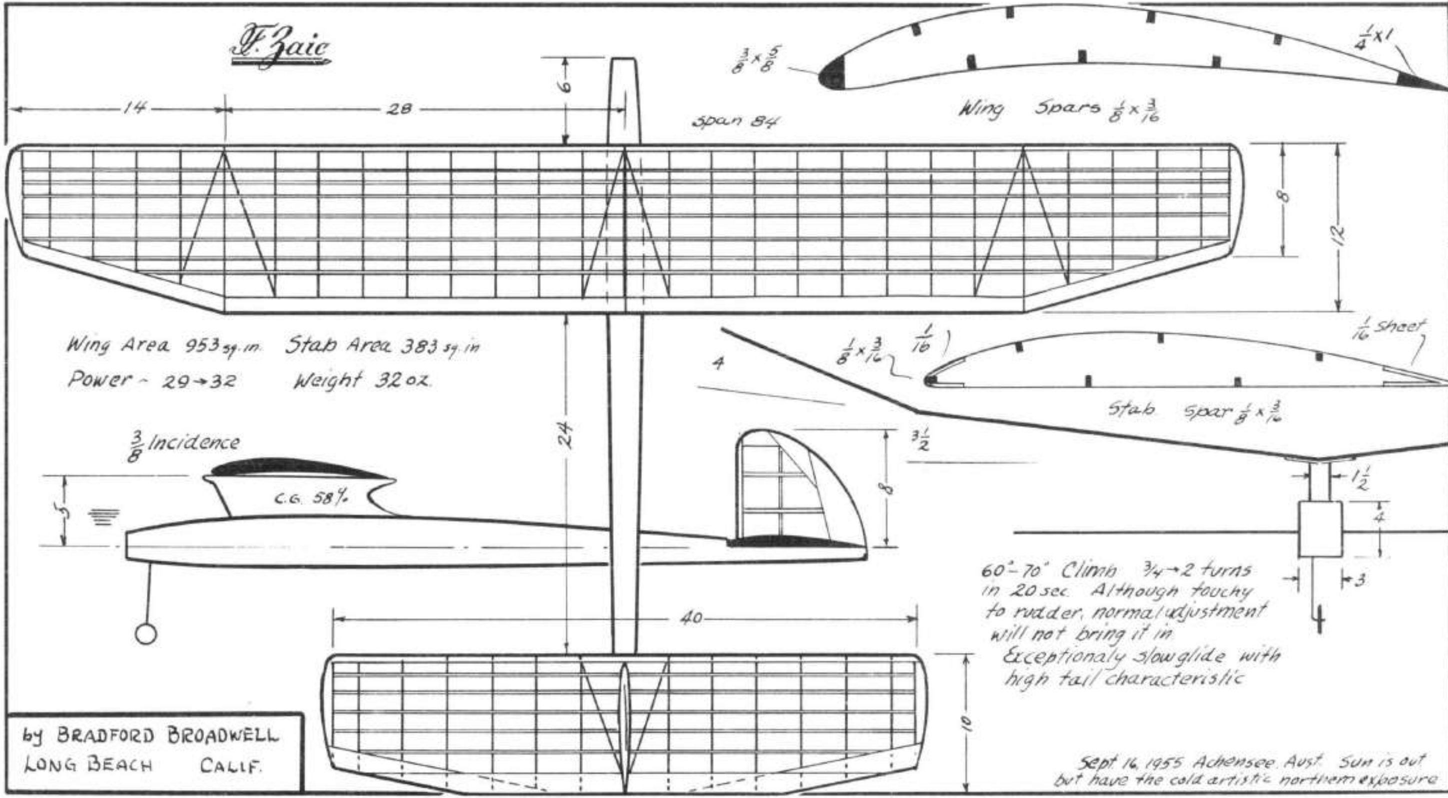


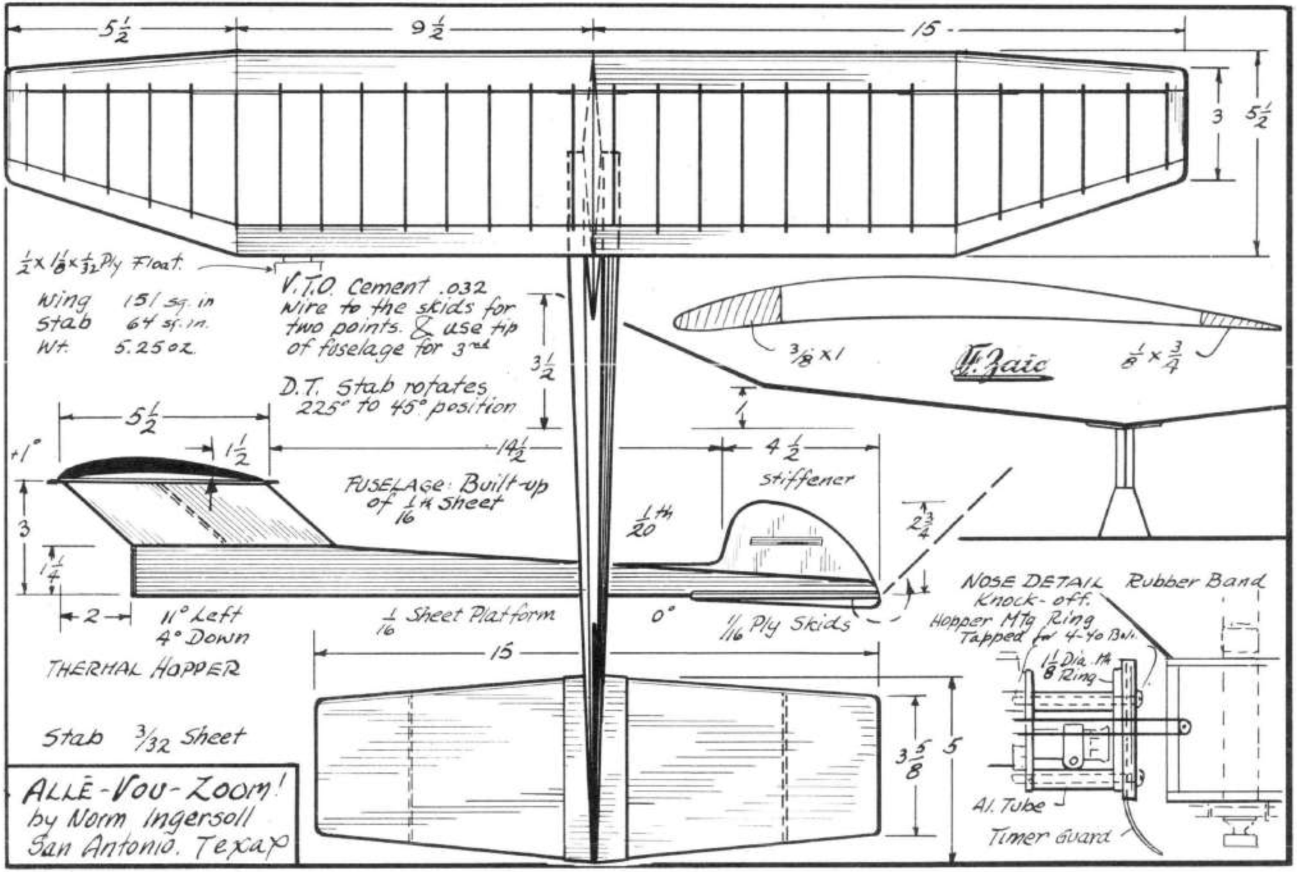
8
12
12
8
5
5 1/4
6 1/2
7 1/2
6 1/2
Although span is large for .049 Glide makes up.- Diesel power also helps in steep climb
3/16 sq
1/16 x 1/8
1/8 x 3/8
5/32 x 5/8
Stab ℄
Stab span 20"
7 1/2
5 3/4
Fuselage silk covered
3/32 " C
1/16 Sheet sides front + Blk
KEEL. Lam 1/16 Center 1/32 outsides
17
4 3/4
McCoy .049 Diesel
PAA Load
Dowel
Soft Balsa shaped + Hollow after assmbly
Cut hole on top of Platform + slide dummy down. Hold with 1/8 dowel
CRUTCH Hd 3/16 x 1/8
Stringers 1/16 x 1/8
Mark a + b on former then cut strip to bevel
Making Cross Pieces
5/32 sq
1/8 x 5/8
F. Zaic
by STEVE DITTA
Bronx N.Y.


40
7
Wing Area 260 sq. in.
Original Edges were laminated. Sheet outline can be used 3/8 for L/E 3/16 for T/E
Top Strips Straight
Bottom Strips digonal
7/16
7/16
5/16
3/16
1/16 Spars
Sliced Ribs
Sliced Ribs
4½
17
1"
Pylon - Lam 3 pcs. 1/16 C
4½
3/32 C
4
Planked fuselage: 3/32 x 3/8 Strips
Stab Area 100 sq. in.
Covered with silk
19
6
POWER ~ .074 to .099
Wt. with McCoy .099 9 oz
Model handles well in power & glide. Used mostly for competition in Beauty events. Among many wins, 1st 1952 Mirror Meet
BEAUTY
by STEVE DITTA
Bronx. N.Y.

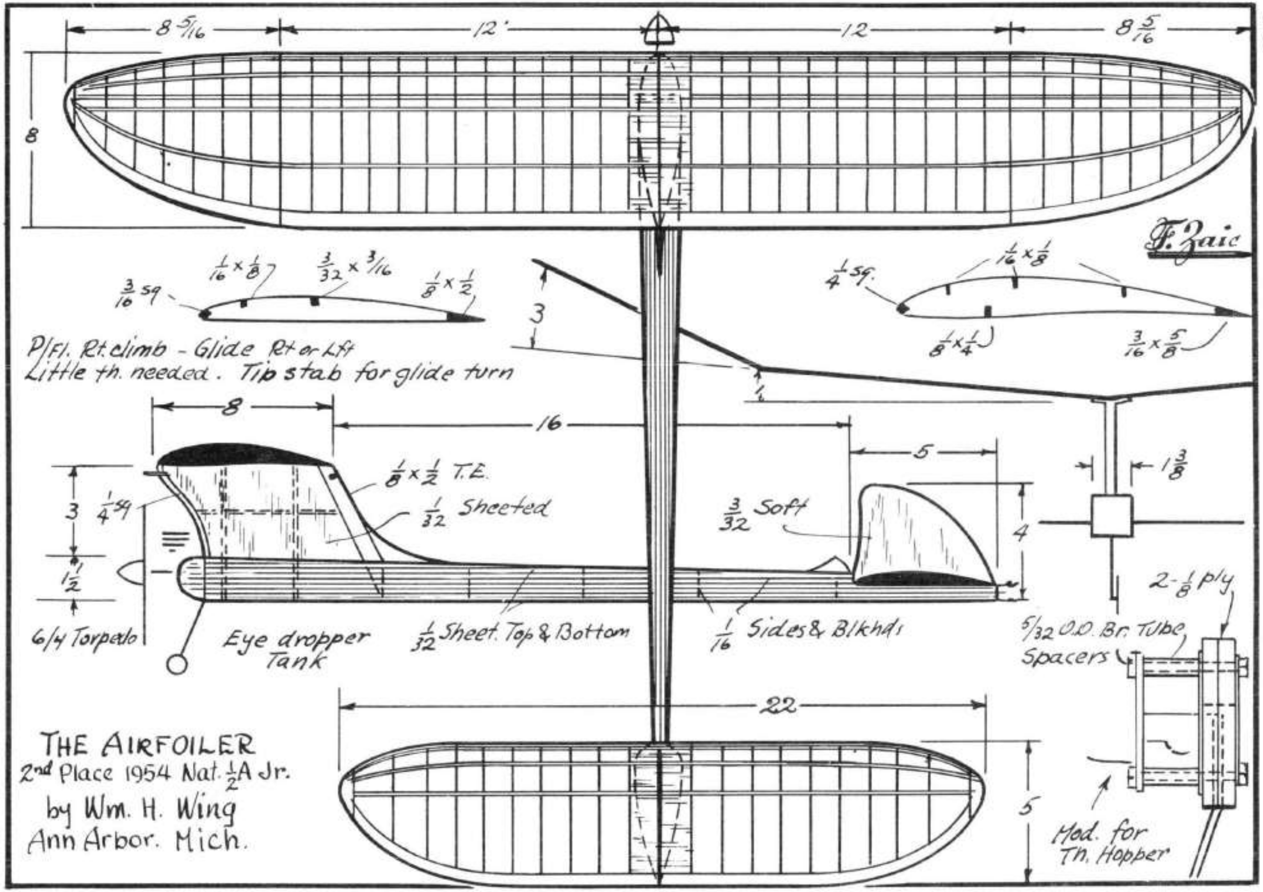

50
280
450
450
280
200
Wing: Tissue Covered
Fuselage: Silk Covered
1mm Balsa
5x5 Kiri
4x5 Cypress
3x20 Kiri
Wing
180
50
2°
C.G. 80%
500
140
Soft Balsa
150
F. Zaic
Torp 15
4x4 Cypress
4x4
600
160
"CORMORANT" FAI
by Mamoru Esaki
Gifu-City. Japan
(Where birds do the fishing)
Sept. 16, 1955 Achensee, Aust.
Cold evening. Warming hands over
220/110 V. drop resistor of my Portable

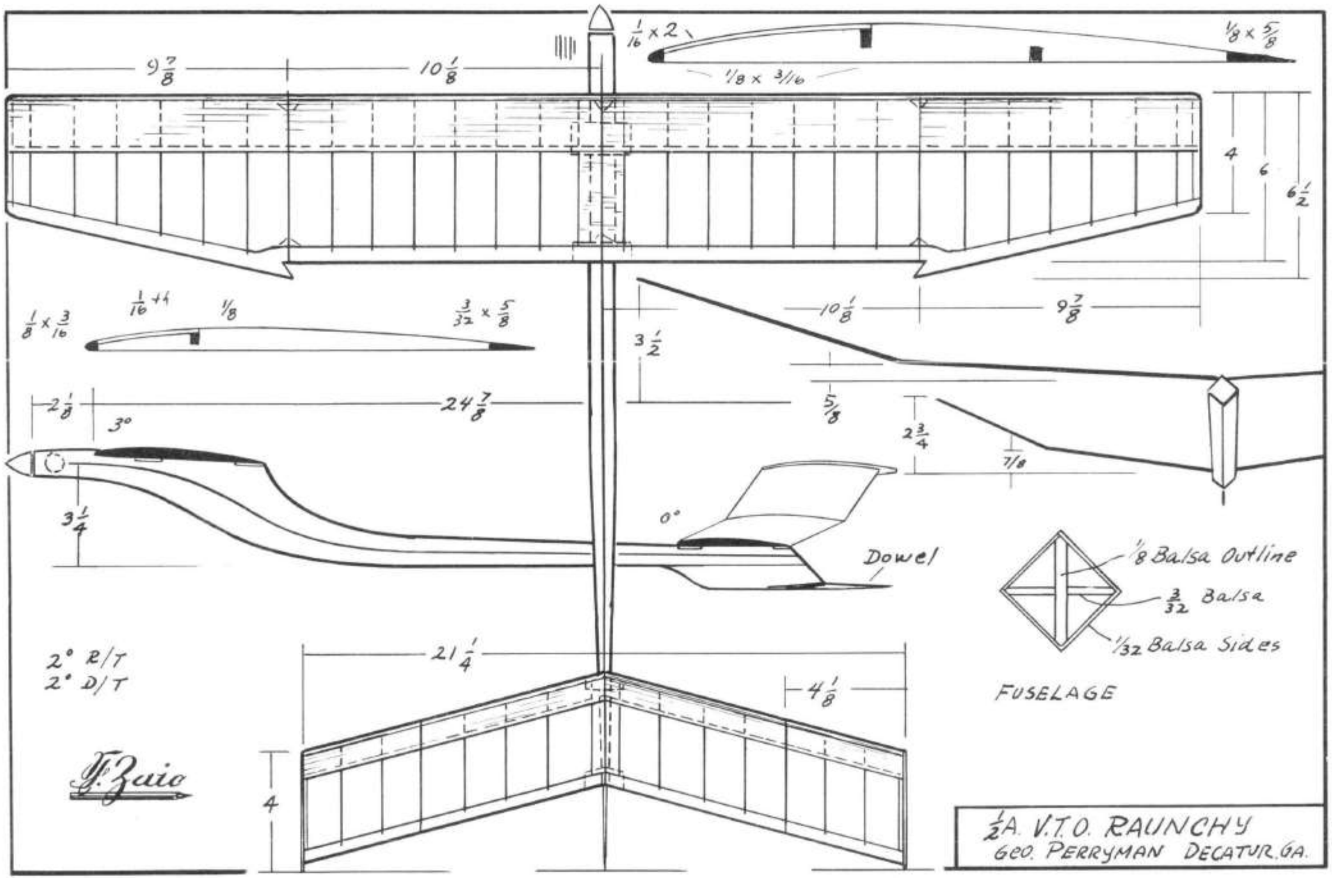

160
270
270
160
40
125
F. Zaic
2x5
1mm
NACA 6409
120
30
43
20
1.5 KIRI wd
C.G. 95%
1/2°
100
390
0°
88
Atwood .049
6x3 Prop
163 gr
440
115
Stab
AMBITION 1/2A
by MAMORU ESAKI
GIFU-CITY ~ JAPAN
Sept. 16. Achensee. Aust. 4 P.M. sun is out
Just a bit time left for a walk, hot chocolate + Kuchen


F. Zaic
14
28
6
Span 84
3/8 x 5/8
Wing Spars 1/8 x 3/16
1/4 x 1
8
12
Wing Area 953 sq. in. Stab Area 383 sq. in
Power ~ 29→32 Weight 32 oz.
4
1/8 x 3/16
1/16
1/16 Sheet
Stab Spar 1/8 x 3/16
3/8 Incidence
5
C.G. 58%
24
3 1/2
8
1 1/2
4
3
60°-70° Climb 3/4→2 turns in 20 sec. Although touchy to rudder, normal adjustment will not bring it in.
Exceptionaly slow glide with high tail characteristic
40
10
by BRADFORD BROADWELL
LONG BEACH CALIF.
Sept 16, 1955 Achensee Aust. Sun is out but have the cold artistic northern exposure

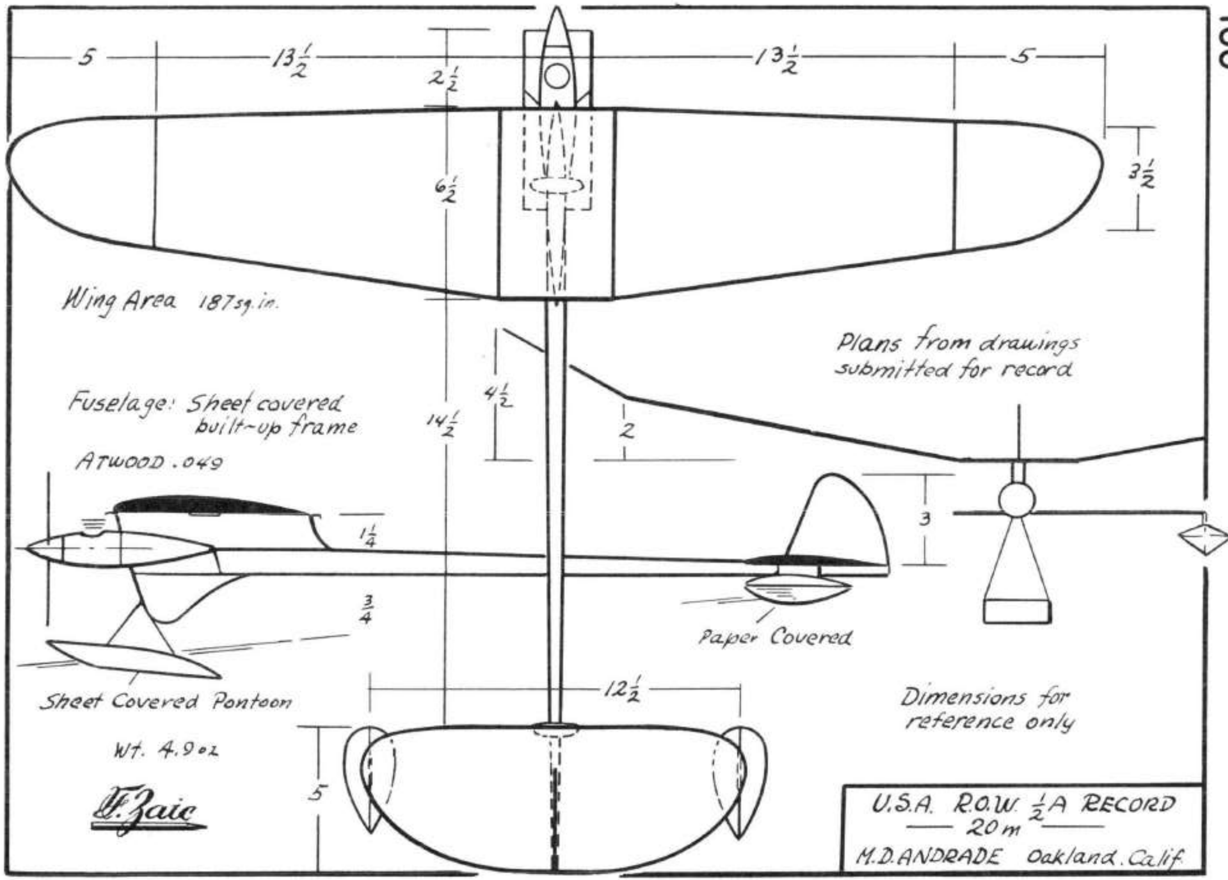


5 1/2
9 1/2
15
3
5 1/2
1/2 x 1 1/8 x 1/32 Ply Float.
Wing 151 sq. in
Stab 64 sq. in.
Wt. 5.25 oz.
V.T.O. Cement .032 wire to the skids for two points. & use tip of fuselage for 3rd
D.T. Stab rotates 225° to 45° position
3 1/2
3/8 x 1
1/8 x 3/4
1
5 1/2
1 1/2
+1°
14 1/2
4 1/2
stiffener
FUSELAGE: Built-up of 1/16 th Sheet
1/20 th
2 3/4
3
1 1/4
2
11° Left
4° Down
1/16 Sheet Platform
0°
1/16 Ply Skids
NOSE DETAIL
Rubber Band
Knock-off.
Hopper Mtg Ring
Tapped for 4-40 Bolt
1 1/8 Dia. th Ring
THERMAL HOPPER
15
Stab 3/32 Sheet
3 5/8
5
Al. Tube
Timer Guard
ALLĒ-VOU-ZOOM!
by Norm Ingersoll
San Antonio, Texas

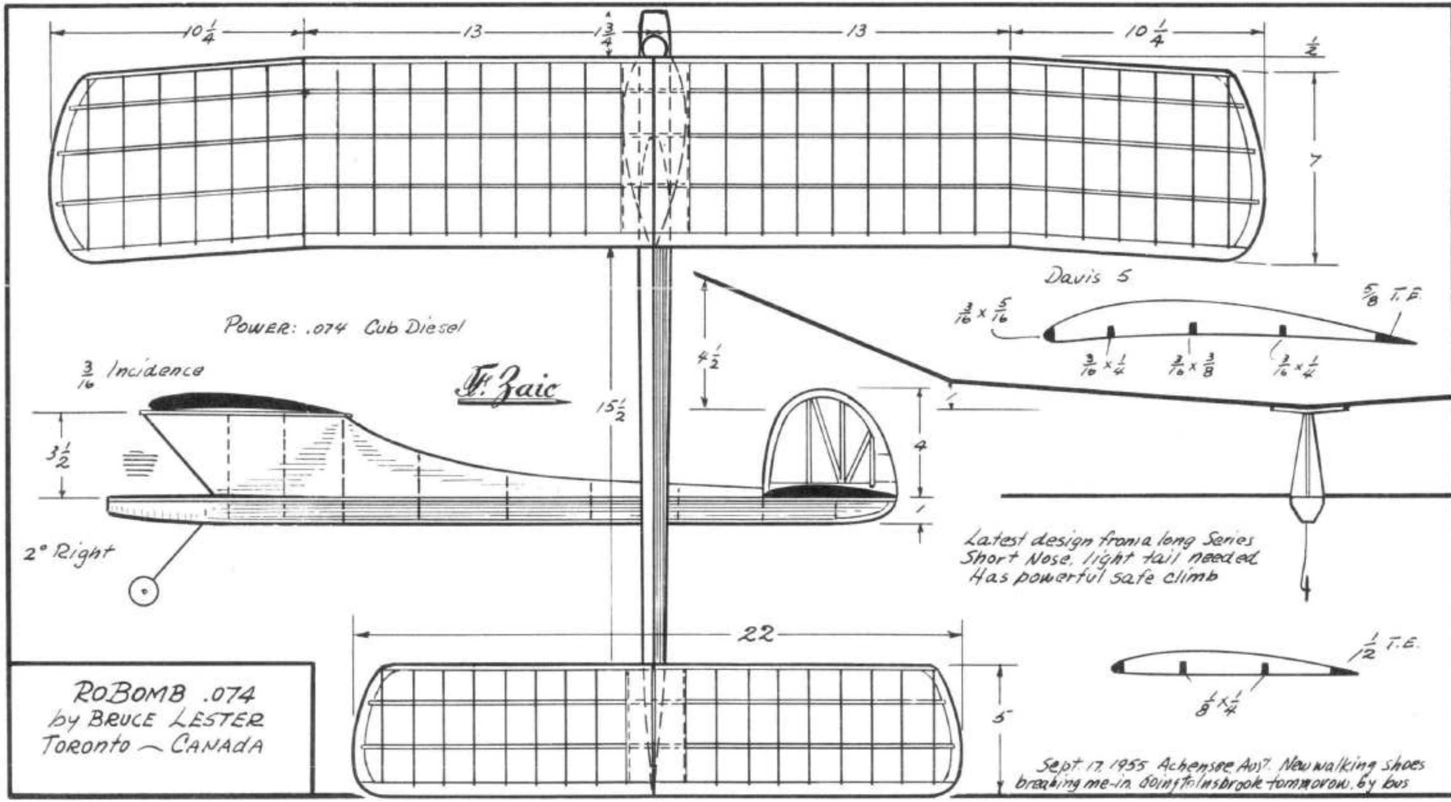

THE AIRFOILER
2nd Place 1954 Nat. ½A Jr.
by Wm. H. Wing
Ann Arbor. Mich.
F. Zaic
8 5/16
12
12
8 5/16
8
3/16 sq
1/16 × 1/8
3/32 × 3/16
1/8 × 1/2
1/4 sq.
1/16 × 1/8
1/8 × 1/4
3/16 × 5/8
3
P/Fl. Rt. climb - Glide Rt or Lft
Little th. needed. Tip stab for glide turn
8
16
5
1/8 × 1/2 T.E.
1/32 Sheeted
3/32 Soft
3
1/4 sq
1 1/2
4
1 3/8
6/4 Torpedo
Eye dropper Tank
1/32 Sheet. Top & Bottom
1/16 Sides & Blkhds
2-1/8 ply
5/32 O.D. Br. Tube Spacers
22
5
Mod. for Th. Hopper

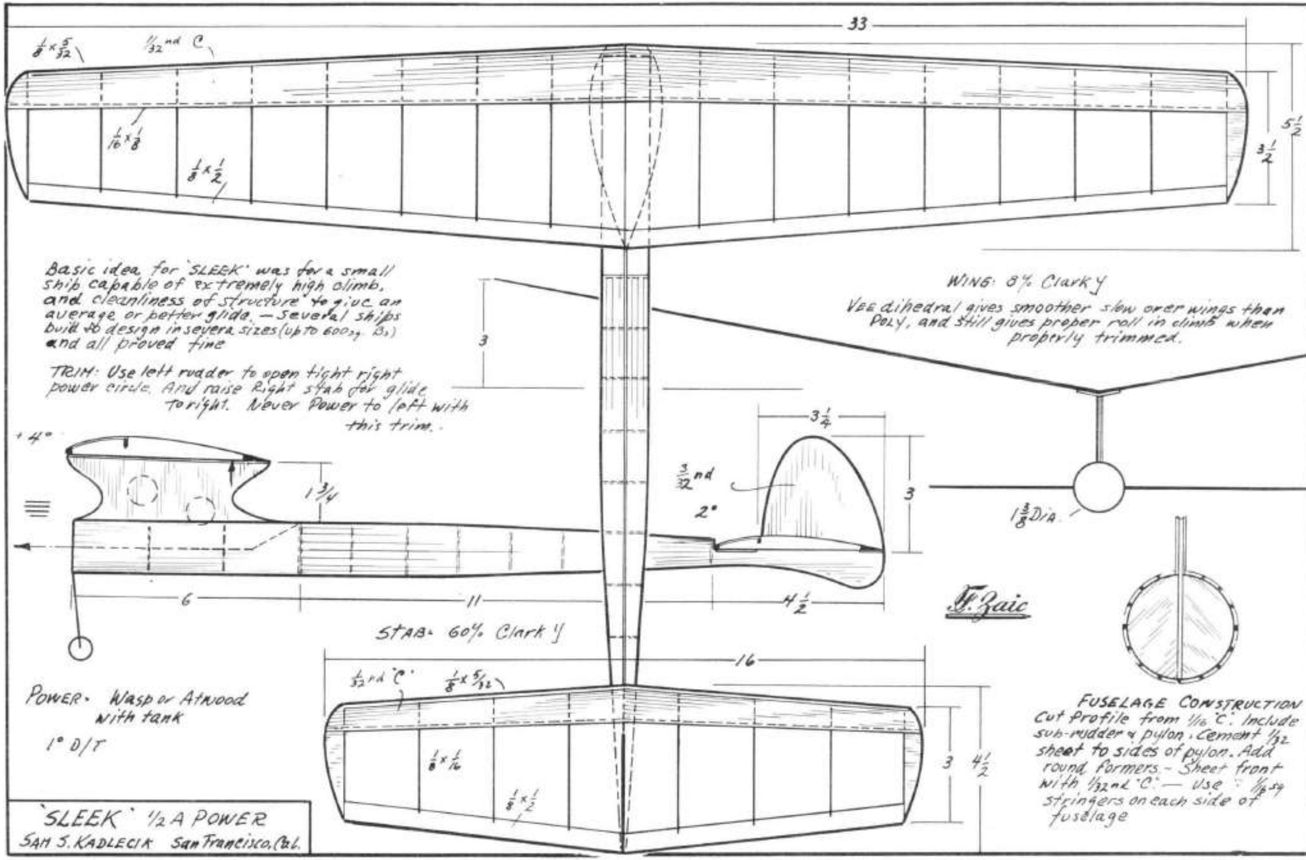


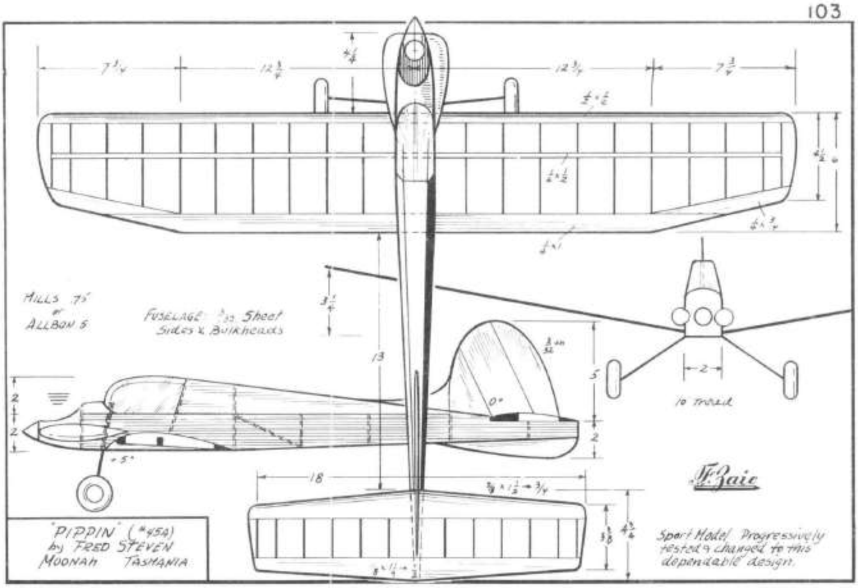
1/16 x 2
1/8 x 5/8
1/8 x 3/16
9 7/8
10 1/8
4
6
6 1/2
1/8 x 3/16
1/16 +h
1/8
3/32 x 5/8
10 1/8
9 7/8
3 1/2
5/8
2 1/8
24 7/8
3°
2 3/4
7/8
3 1/4
0°
Dowel
1/8 Balsa Outline
3/32 Balsa
1/32 Balsa Sides
FUSELAGE
2° R/T
2° D/T
21 1/4
4 1/8
4
1/2A. V.T.O. RAUNCHY
GEO. PERRYMAN DECATUR, GA.

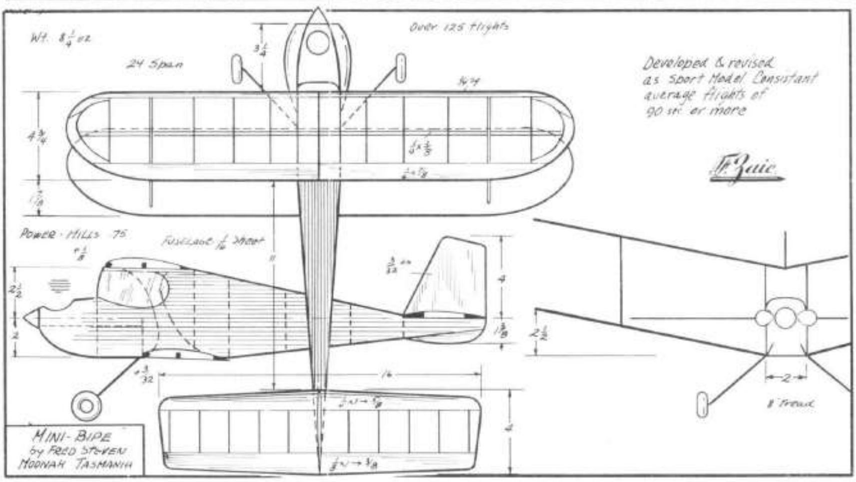


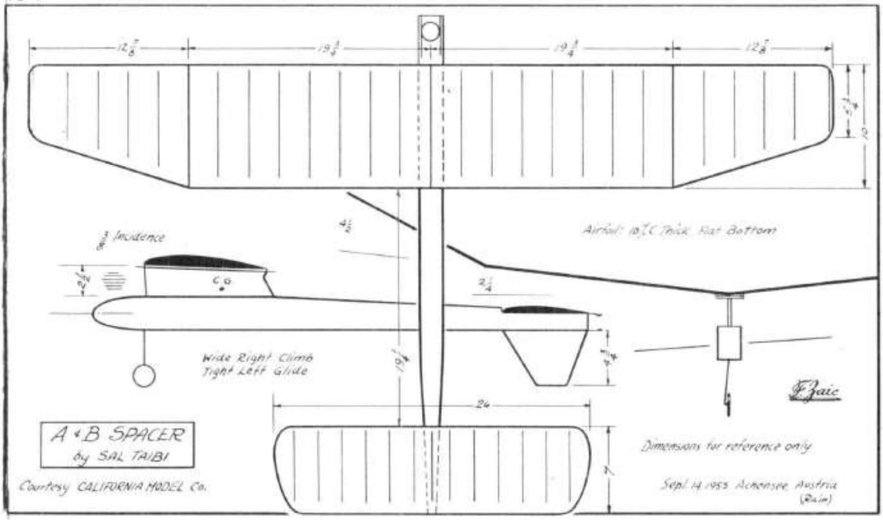
5
13 1/2
2 1/2
13 1/2
5
3 1/2
6 1/2
Wing Area 187 sq.in.
Plans from drawings submitted for record
Fuselage: Sheet covered built-up frame
ATWOOD .049
14 1/2
4 1/2
2
1 1/4
3/4
3
Paper Covered
Sheet Covered Pontoon
12 1/2
Dimensions for reference only
Wt. 4.9 oz
5
F. Zaic
U.S.A. R.O.W. 1/2A RECORD
20 m
M.D. ANDRADE Oakland. Calif.

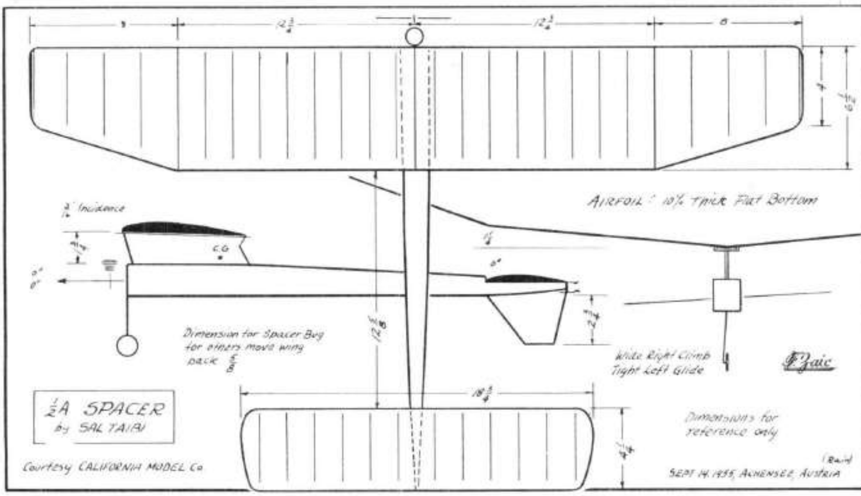

10 1/4
13
1 3/4
13
10 1/4
1/2
7
Davis 5
3/16 x 5/16
5/8 T.E.
3/16 x 1/4
3/16 x 3/8
3/16 x 1/4
POWER: .074 Cub Diesel
3/16 Incidence
F. Zaic
15 1/2
4 1/2
3 1/2
4
1
2° Right
Latest design from a long Series
Short Nose, light tail needed
Has powerful safe climb
22
1/12 T.E.
1/8 x 1/4
5
ROBOMB .074
by BRUCE LESTER
TORONTO ~ CANADA
Sept. 17. 1955 Achensee Aus. New walking shoes
breaking me-in. Going to Innsbrook tommorow. by bus

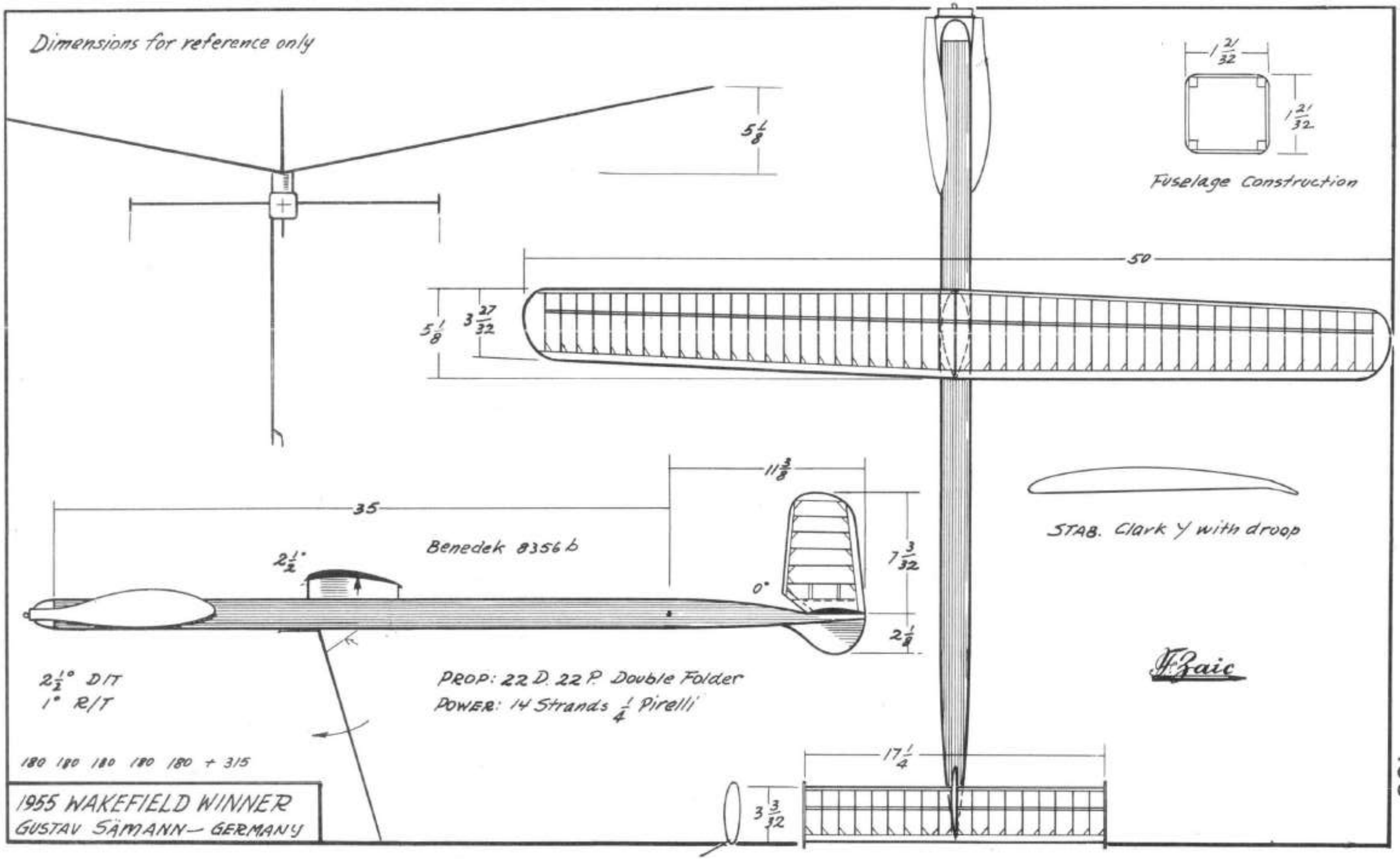

33
1/8 x 5/32
1/32nd C
1/16 x 1/8
1/8 x 1/2
5 1/2
3 1/2
Basic idea for 'SLEEK' was for a small ship capable of extremely high climb. and cleanliness of structure to give an average or better glide. — Several ships built to design in several sizes (up to 600 sq. In.) and all proved fine
TRIM: Use left rudder to open tight right power circle. And raise Right stab for glide to right. Never Power to left with this trim.
WING: 8% Clark Y
VEE dihedral gives smoother slow over wings than POLY, and still gives proper roll in climb when properly trimmed.
3
+4°
1 3/4
3 1/4
3/32nd
2°
3
1 3/8 DIA.
6
11
4 1/2
F. Zaic
STAB. 60% Clark Y
16
1/32nd 'C'
1/8 x 5/32
1/8 x 1/16
1/8 x 1/2
3
4 1/2
POWER. Wasp or Atwood with tank
1° D/T
FUSELAGE CONSTRUCTION
Cut Profile from 1/16 'C'. Include sub-rudder & pylon. Cement 1/32 sheet to sides of pylon. Add round formers. — Sheet front with 1/32nd 'C'. — Use 3 1/16 sq stringers on each side of fuselage
'SLEEK' 1/2 A POWER
SAM S. KADLECIK San Francisco, Cal.

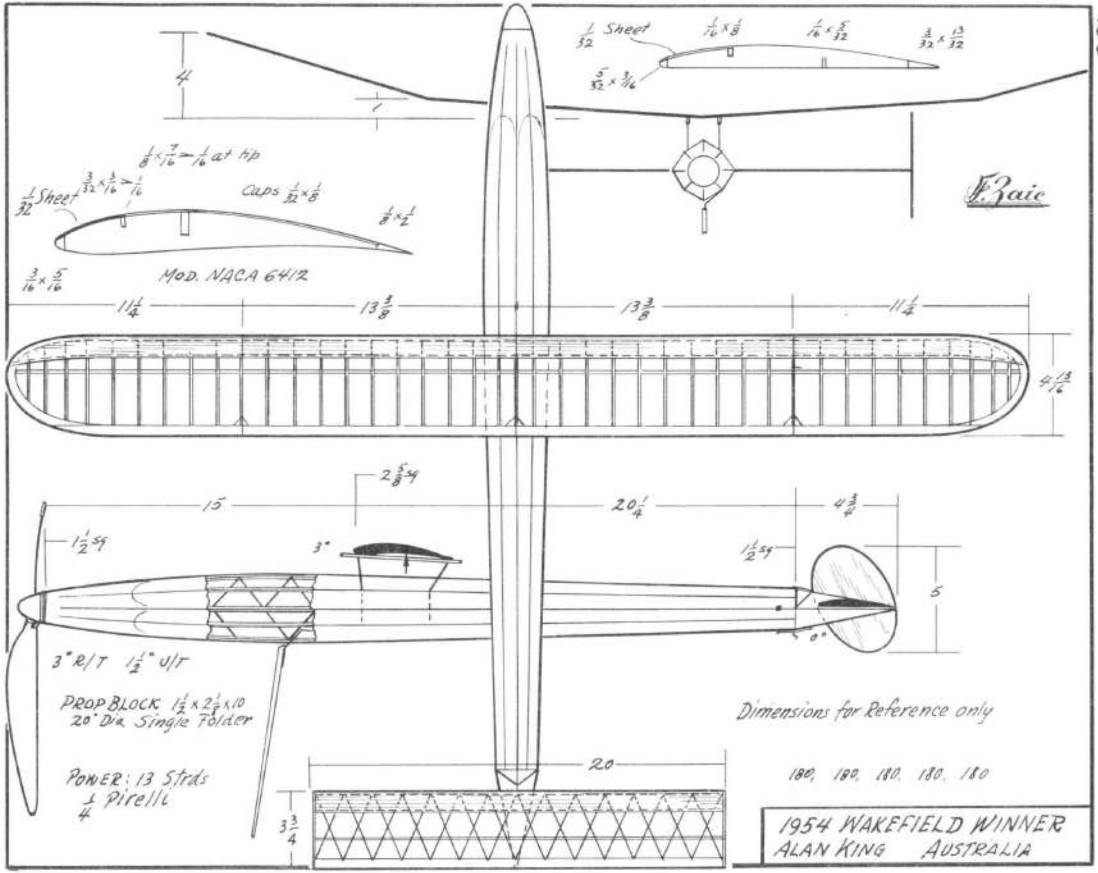

HILLS .75 or ALLBON 5
FUSELAGE 1/32 Sheet Sides & Bulkheads
10 Tread
"PIPPIN" (#45A) by FRED STEVEN MOONAH TASMANIA
F. Zaic
Sport Model Progressively tested & changed to this dependable design.

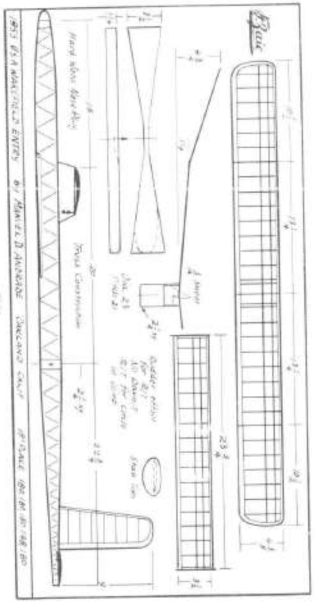

Wt. 8 1/4 oz
Over 125 flights
24 Span
Developed & revised as Sport Model Consistant average flights of 90 sec or more
F. Zaic
POWER - HILLS .75
FUSELAGE 1/16 sheet
8 Tread
"MINI-BIPE" by FRED STEVEN MOONAH TASMANIA

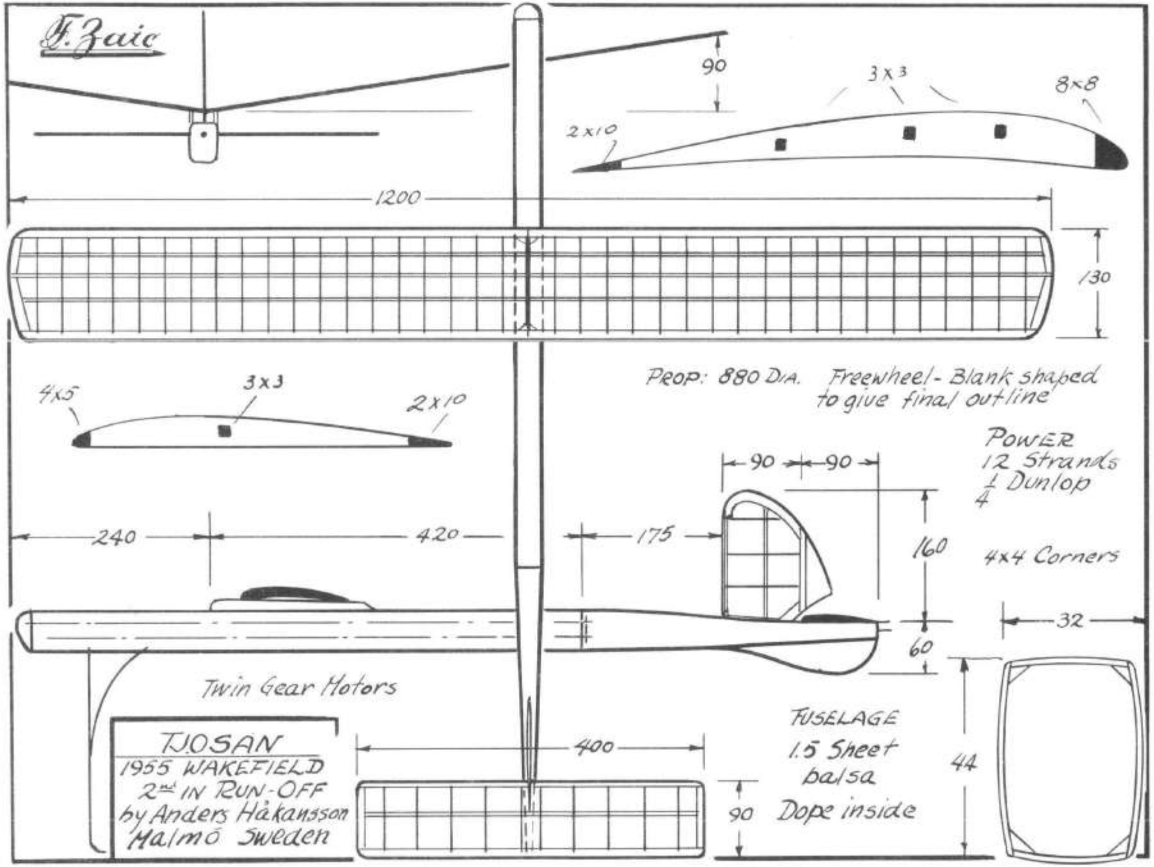

Incidence
C.G.
Airfoil: 10% C Thick Flat Bottom
Wide Right Climb
Tight Left Glide
24
A & B SPACER
by SAL TAIBI
Courtesy CALIFORNIA MODEL Co.
Dimensions for reference only
Sept. 14, 1955 Achensee, Austria
(Rain)
F. Zaic

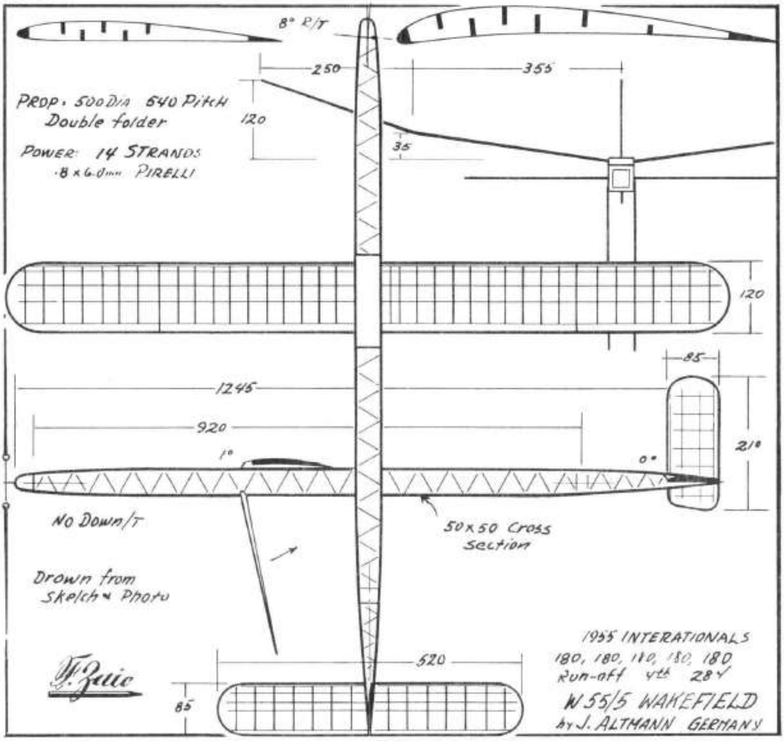

Incidence
C.G.
AIRFOIL: 10% THICK FLAT BOTTOM
Dimension for Spacer Bug
for others move wing
back
Wide Right Climb
Tight Left Glide
½A SPACER
by SAL TAIBI
Courtesy CALIFORNIA MODEL Co.
Dimensions for
reference only
(Rain)
SEPT. 14, 1955, ACHENSEE, AUSTRIA
F. Zaic

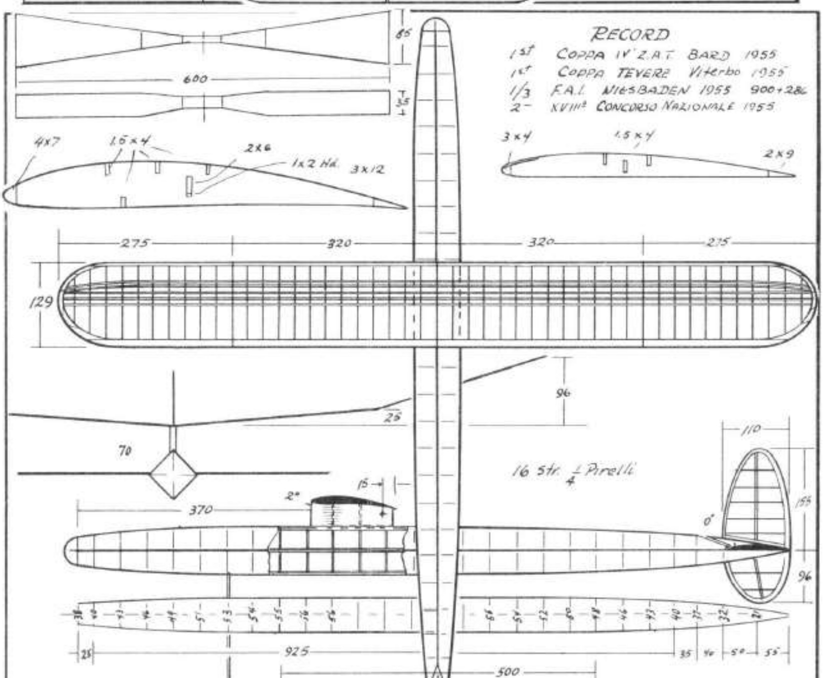

Dimensions for reference only
Fuselage Construction
50
STAB. Clark Y with droop
35
Benedek 8356 b
PROP: 22 D. 22 P. Double Folder
POWER: 14 Strands 1/4 Pirelli
2 1/2° D/T
1° R/T
180 180 180 180 180 + 315
1955 WAKEFIELD WINNER
GUSTAV SÄMANN — GERMANY

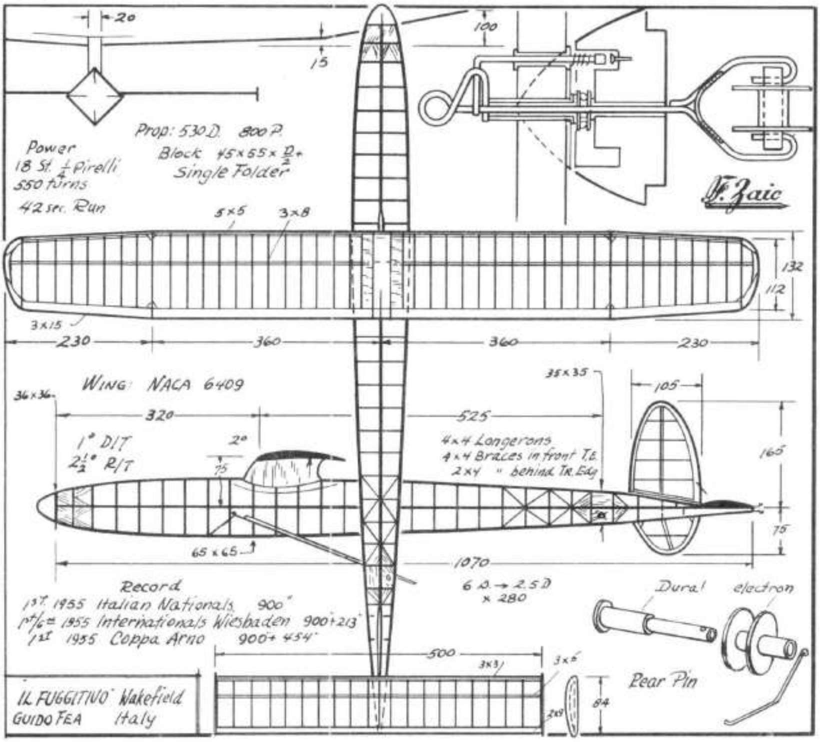

1954 WAKEFIELD WINNER
ALAN KING AUSTRALIA
F. Zaic
Dimensions for Reference only
180, 180, 180, 180, 180
MOD. NACA 6412
3" R/T 1½" U/T
PROP BLOCK 1½ x 2⅛ x 10
20" Dia. Single Folder
POWER: 13 Strds
¼ Pirelli
1/32 Sheet
Caps 1/32 x 1/8
1/8 x 1/2
3/16 x 5/16
11¼
13⅜
13⅜
11¼
4 13/16
15
20¼
4¾
5
20
3¾
2⅝ sq
1½ sq
1½ sq
3"
0°
4
1

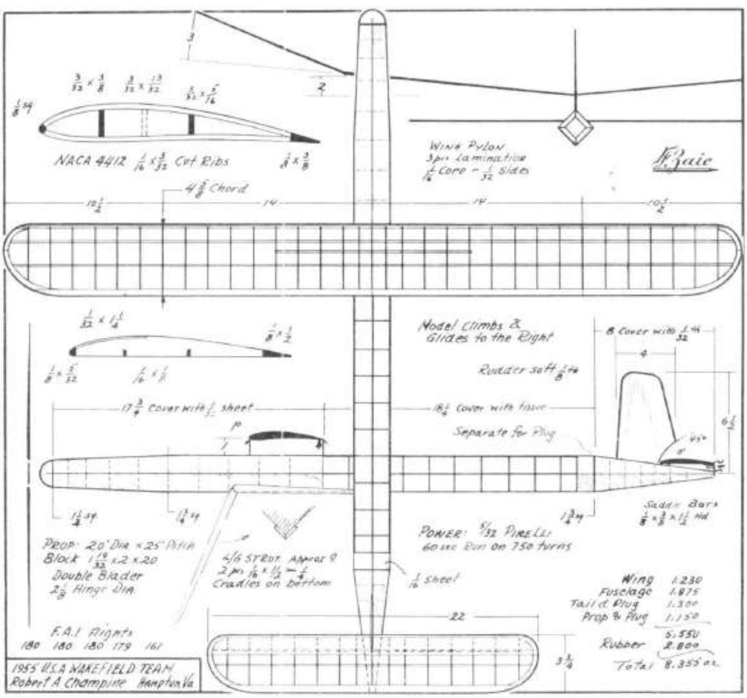


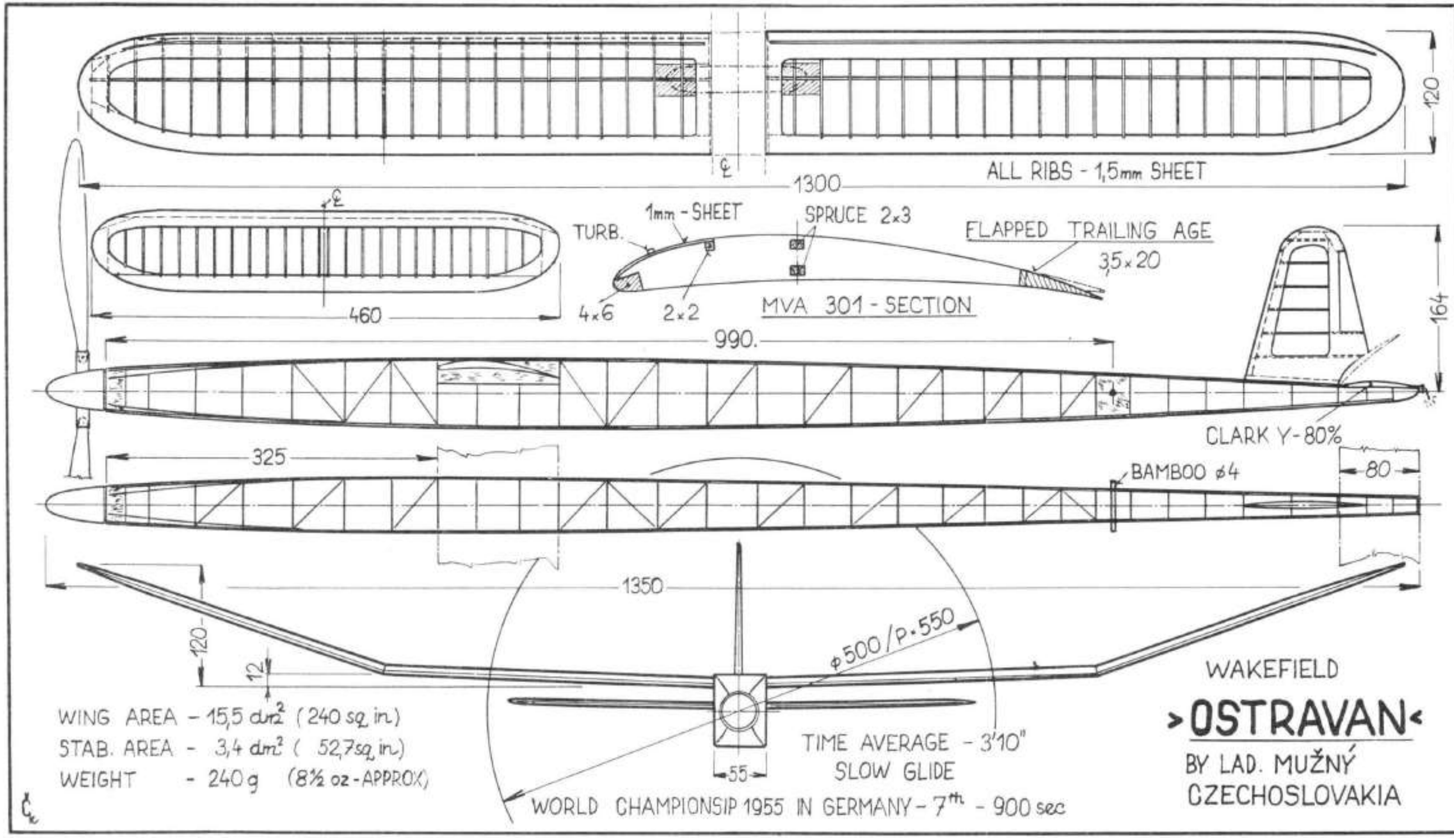

F. Zaic
90
3 x 3
8 x 8
2 x 10
1200
130
4x5
3x3
2x10
PROP: 880 DIA. Freewheel - Blank shaped to give final outline
POWER
12 Strands
1/4 Dunlop
90
90
160
4x4 Corners
240
420
175
32
60
Twin Gear Motors
FUSELAGE
1.5 Sheet balsa
Dope inside
44
400
90
TJOSAN
1955 WAKEFIELD
2nd IN RUN-OFF
by Anders Håkansson
Malmö Sweden

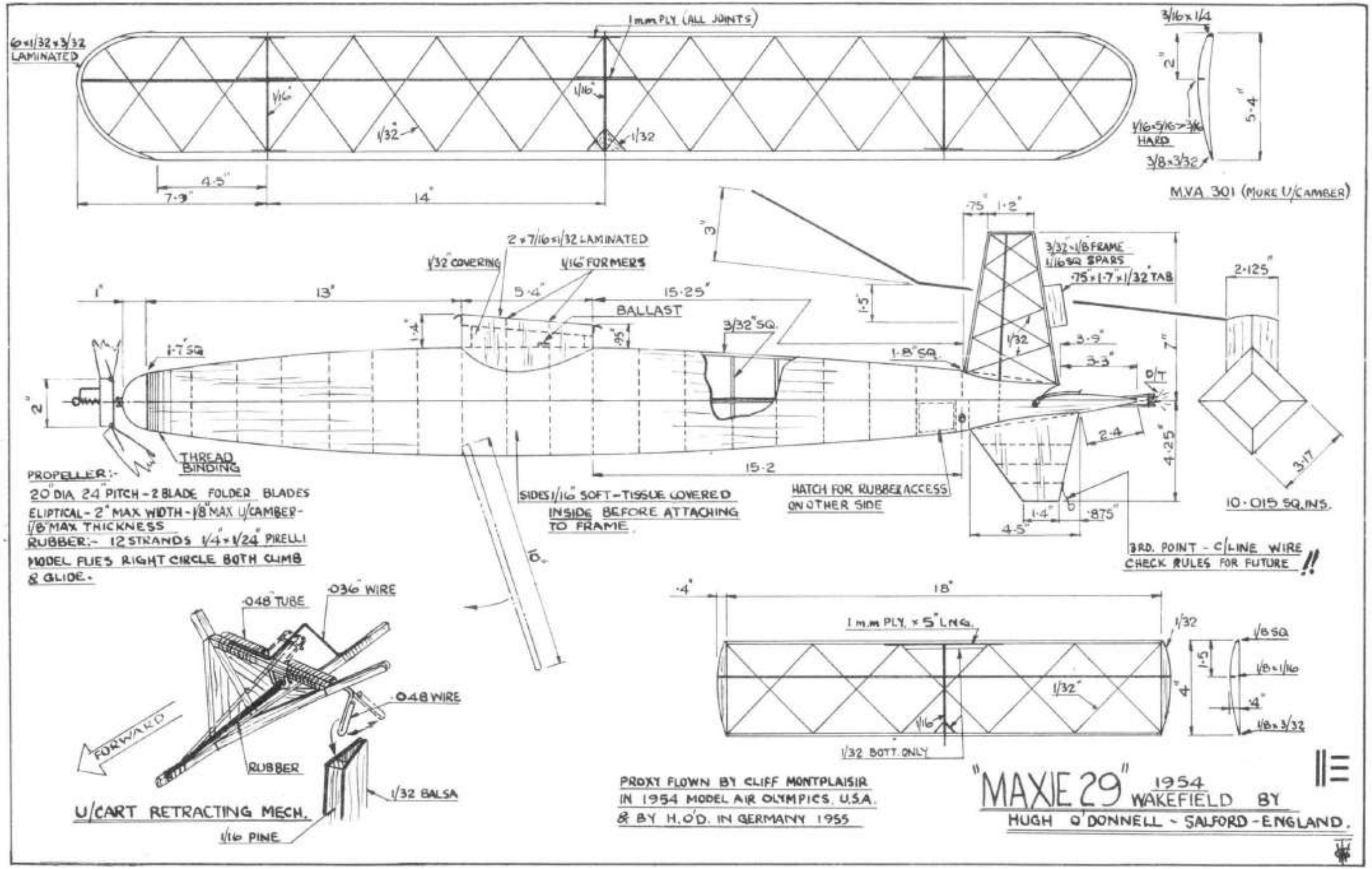

8° R/T
250
355
PROP. 500 DIA 640 PITCH
Double folder
120
POWER: 14 STRANDS
.8 x 6.0mm PIRELLI
35
120
85
1245
920
210
1°
0°
No Down/T
50 x 50 Cross Section
Drawn from Sketch & Photo
F. Zaic
520
85
1955 INTERATIONALS
180, 180, 180, 180, 180
Run-off 4th 284
W 55/5 WAKEFIELD
by J. ALTMANN GERMANY

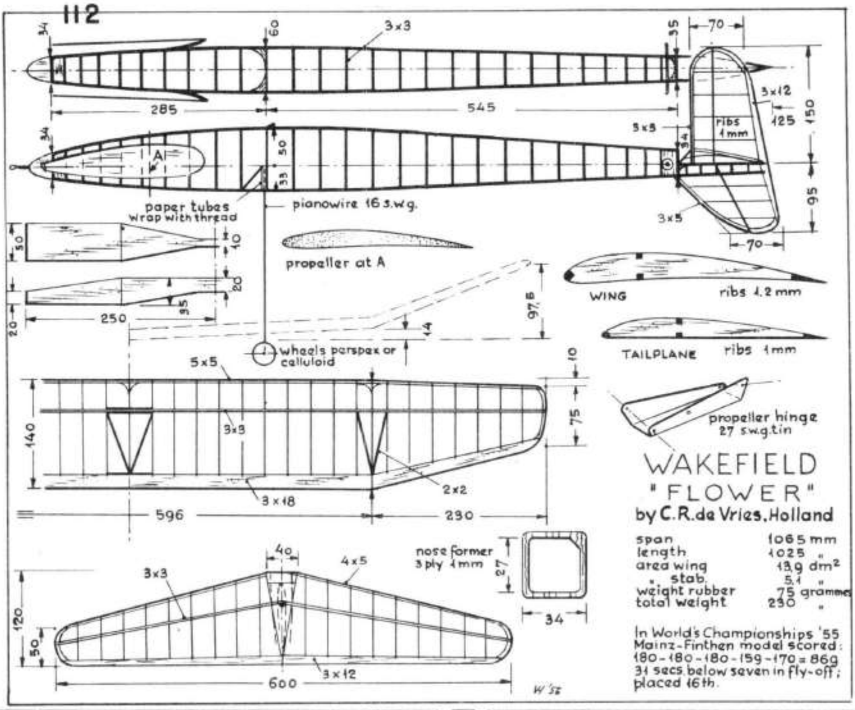

85
600
35
RECORD
1st COPPA IV Z.A.T. BARD 1955
1st COPPA TEVERE Viterbo 1955
1/3 F.A.I. WIESBADEN 1955 900+286
2 - XVIIIth CONCORSO NAZIONALE 1955
4x7
1.5x4
2x6
1x2 Hd.
3x12
3x4
1.5x4
2x9
275
320
320
275
129
96
25
70
16 Str. 1/4 Pirelli
110
15
2°
370
0°
155
96
925
25
35
40
50
55
500
93
F. Zaic
S.V. 40ter WAKEFIELD
VINCENZO SCARDICCHIO - Italy

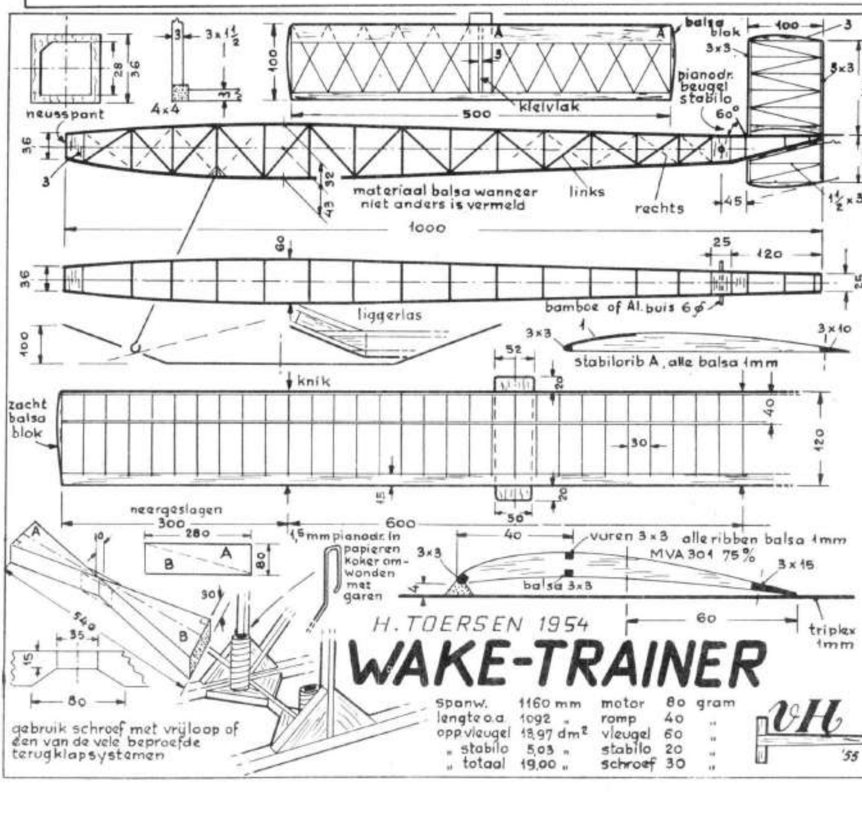

Prop: 530 D. 800 P.
Block 45 x 55 x D/2 + Single Folder
Power 18 St. 1/4 Pirelli 550 turns
42 sec. Run
WING NACA 6409
1° D/T
2½° R/T
4x4 Longerons
4x4 Braces in front T.E.
2x4 " behind Tr. Edg.
Record
1st 1955 Italian Nationals 900"
1st/6th 1955 Internationals Wiesbaden 900+213"
1st 1955 Coppa Arno 900+454"
Dural
electron
Rear Pin
IL FUGGITIVO Wakefield
GUIDO FEA Italy

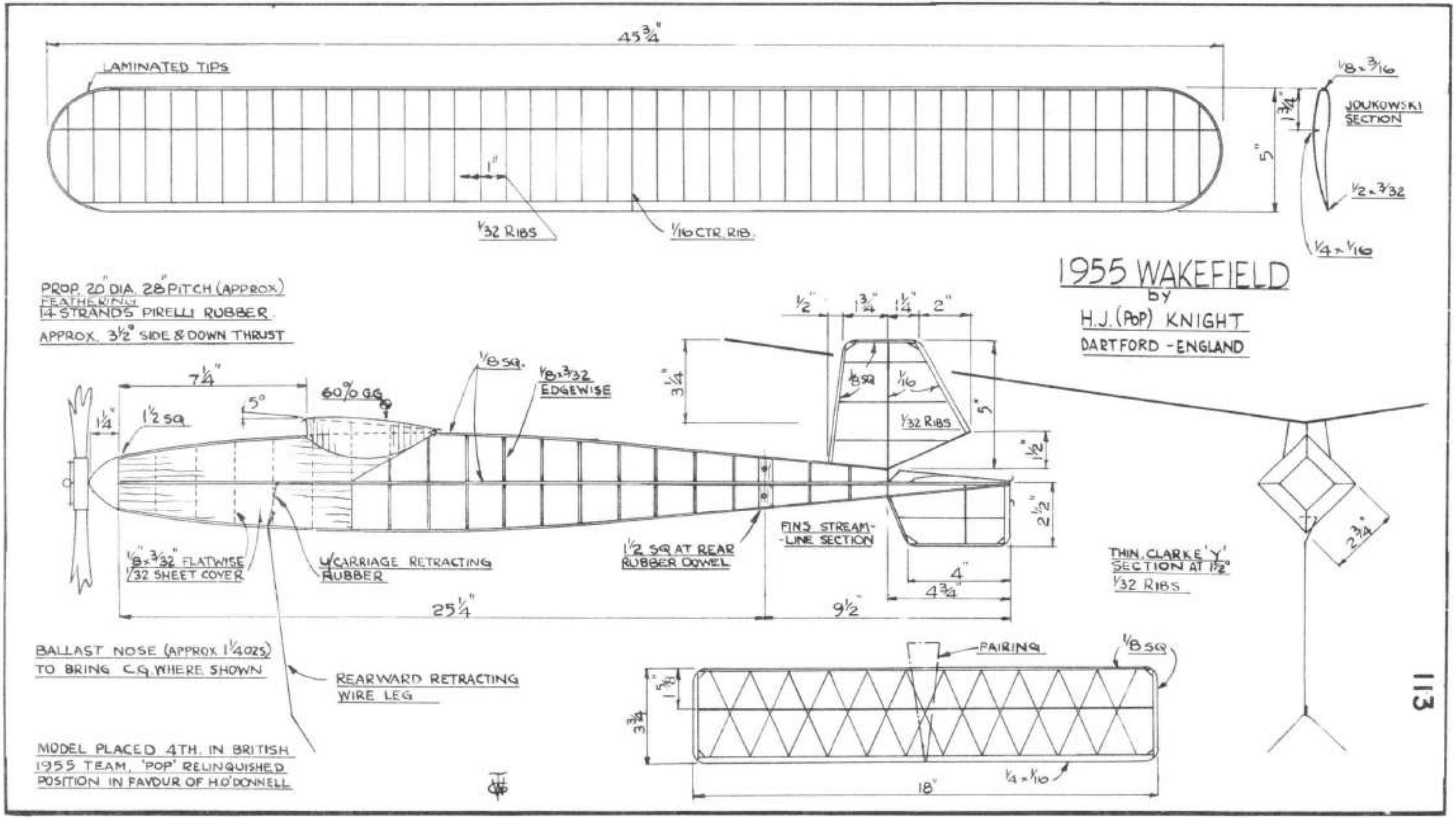

NACA 4412 1/16 x 3/32 Cut Ribs
Wing Pylon 3 pcs. Lamination 1/16 Core - 1/32 Sides
4 5/8 Chord
Model Climbs & Glides to the Right
Rudder soft 1/8 sq.
Separate for Plug
PROP: 20" Dia x 25" Pitch
Block 1 19/32 x 2 x 20
Double Blader
2 1/8 Hinge Dia.
POWER: 5/32 PIRELLI
60 sec Run on 750 turns
F.A.I. Flights
180 180 180 179 161
Wing 1.230
Fuselage 1.875
Tail & Plug 1.300
Prop & Plug 1.150
5.550
Rubber 2.800
Total 8.355 oz.
1955 U.S.A. WAKEFIELD TEAM
Robert A. Champine Hampton, Va.

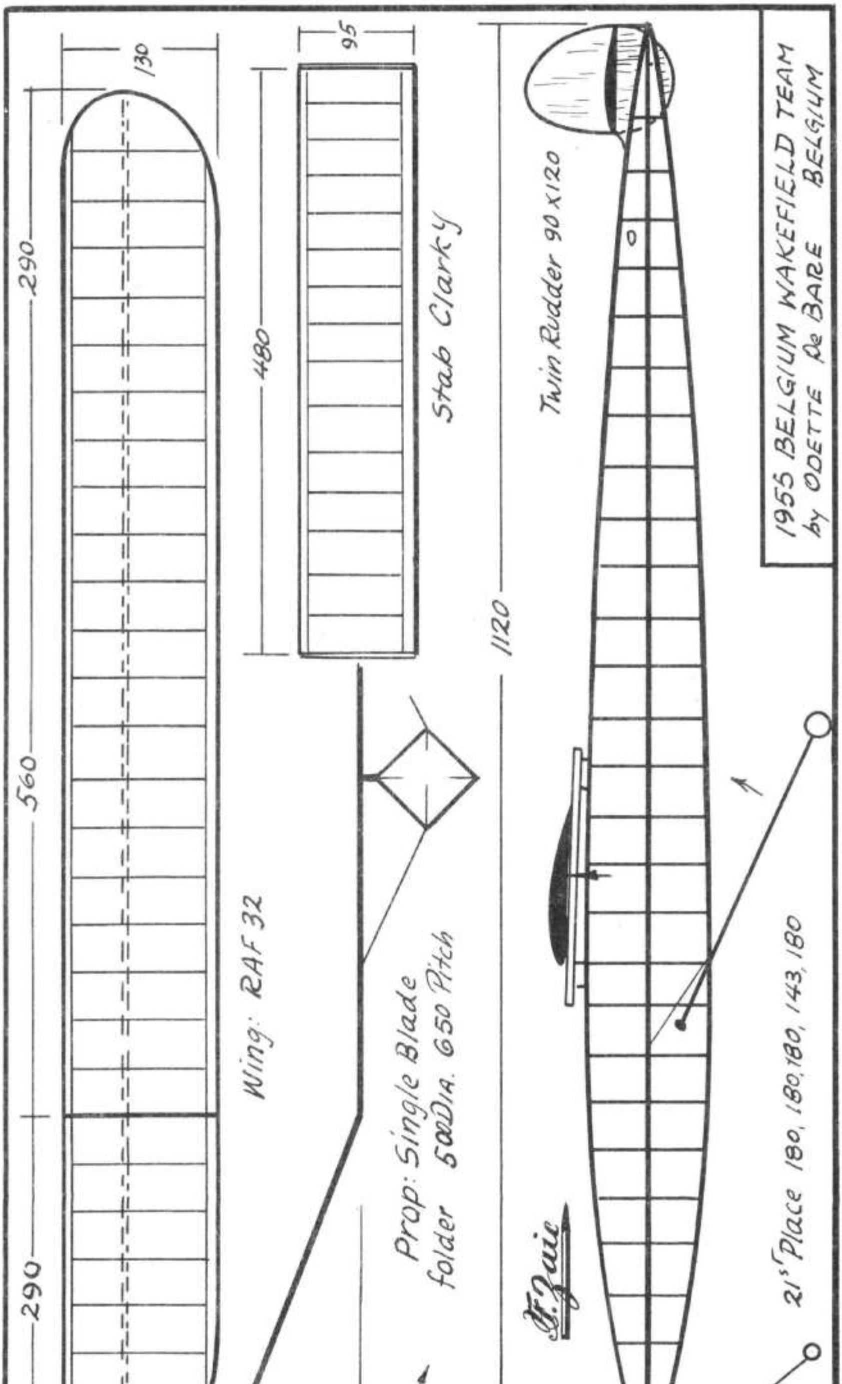

110
ALL RIBS - 1,5mm SHEET
1300
120
460
TURB.
1mm - SHEET
SPRUCE 2×3
FLAPPED TRAILING AGE
3,5×20
4×6
2×2
MVA 301 - SECTION
164
990.
CLARK Y-80%
325
BAMBOO ø4
80
1350
120
12
ø500 / P. 550
55
WAKEFIELD
>OSTRAVAN<
BY LAD. MUŽNÝ
CZECHOSLOVAKIA
WING AREA - 15,5 dm² (240 sq. in.)
STAB. AREA - 3,4 dm² (52,7 sq. in.)
WEIGHT - 240 g (8½ oz - APPROX)
TIME AVERAGE - 3'10"
SLOW GLIDE
WORLD CHAMPIONSIP 1955 IN GERMANY - 7th - 900 sec

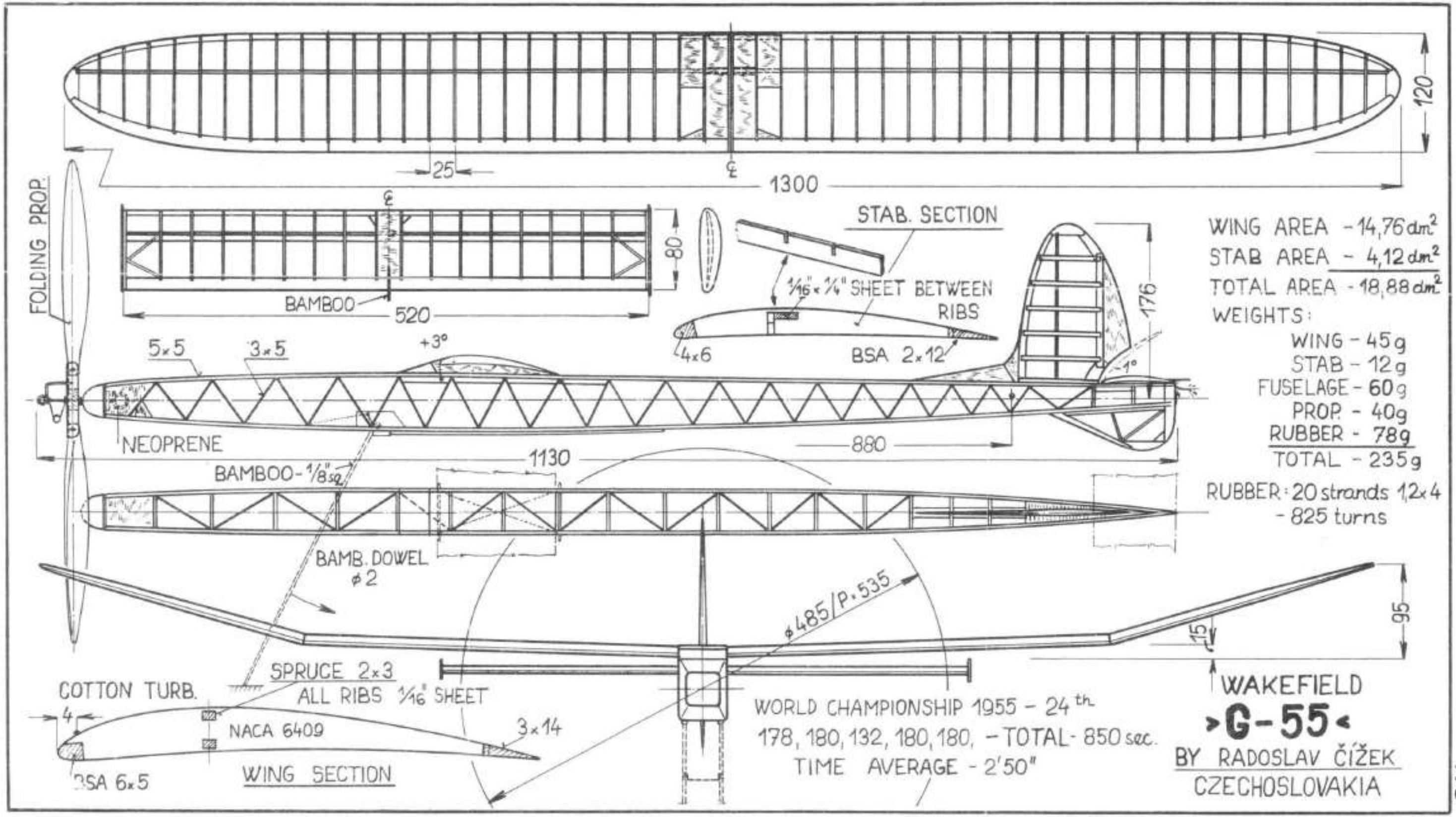

1 mm PLY (ALL JOINTS)
6 x 1/32 x 3/32 LAMINATED
1/16"
1/16"
1/32"
1/32
4.5"
7.9"
14"
3/16 x 1/4
2"
5.4"
1/16 x 5/16 > 3/16 HARD
3/8 x 3/32
M.V.A. 301 (MORE U/CAMBER)
2 x 7/16 x 1/32 LAMINATED
1/32 COVERING
1/16 FORMERS
1"
13"
5.4"
15.25"
BALLAST
1.4"
.95"
1.7 SQ
3/32" SQ.
1.5"
3"
.75" 1.2"
3/32 x 1/8 FRAME
1/16 SQ SPARS
.75 x 1.7 x 1/32 TAB
2.125"
1.8" SQ
1/32
3.9"
3.3"
7"
D/T
2"
THREAD BINDING
2.4
4.25"
3.17
15.2
PROPELLER:-
20" DIA 24" PITCH - 2 BLADE FOLDER BLADES
ELIPTICAL - 2" MAX WIDTH - 1/8" MAX U/CAMBER - 1/8" MAX THICKNESS
RUBBER:- 12 STRANDS 1/4 x 1/24" PIRELLI
MODEL FLIES RIGHT CIRCLE BOTH CLIMB & GLIDE.
SIDES 1/16" SOFT - TISSUE COVERED INSIDE BEFORE ATTACHING TO FRAME
HATCH FOR RUBBER ACCESS ON OTHER SIDE
1.4"
.875"
4.5"
10.015 SQ.INS.
3RD. POINT - C/LINE WIRE
CHECK RULES FOR FUTURE !!
.048" TUBE
.036" WIRE
.048 WIRE
FORWARD
RUBBER
1/32 BALSA
U/CART RETRACTING MECH.
1/16 PINE
.4"
18"
1 m.m PLY. x 5" LNG.
1/32
1/8 SQ
1.5
1/8 x 1/16
4"
.4"
1/8 x 3/32
1/32"
1/16
1/32 BOTT. ONLY
PROXY FLOWN BY CLIFF MONTPLAISIR
IN 1954 MODEL AIR OLYMPICS. U.S.A.
& BY H. O'D. IN GERMANY 1955
"MAXIE 29" 1954 WAKEFIELD BY
HUGH O'DONNELL - SALFORD - ENGLAND.
II E

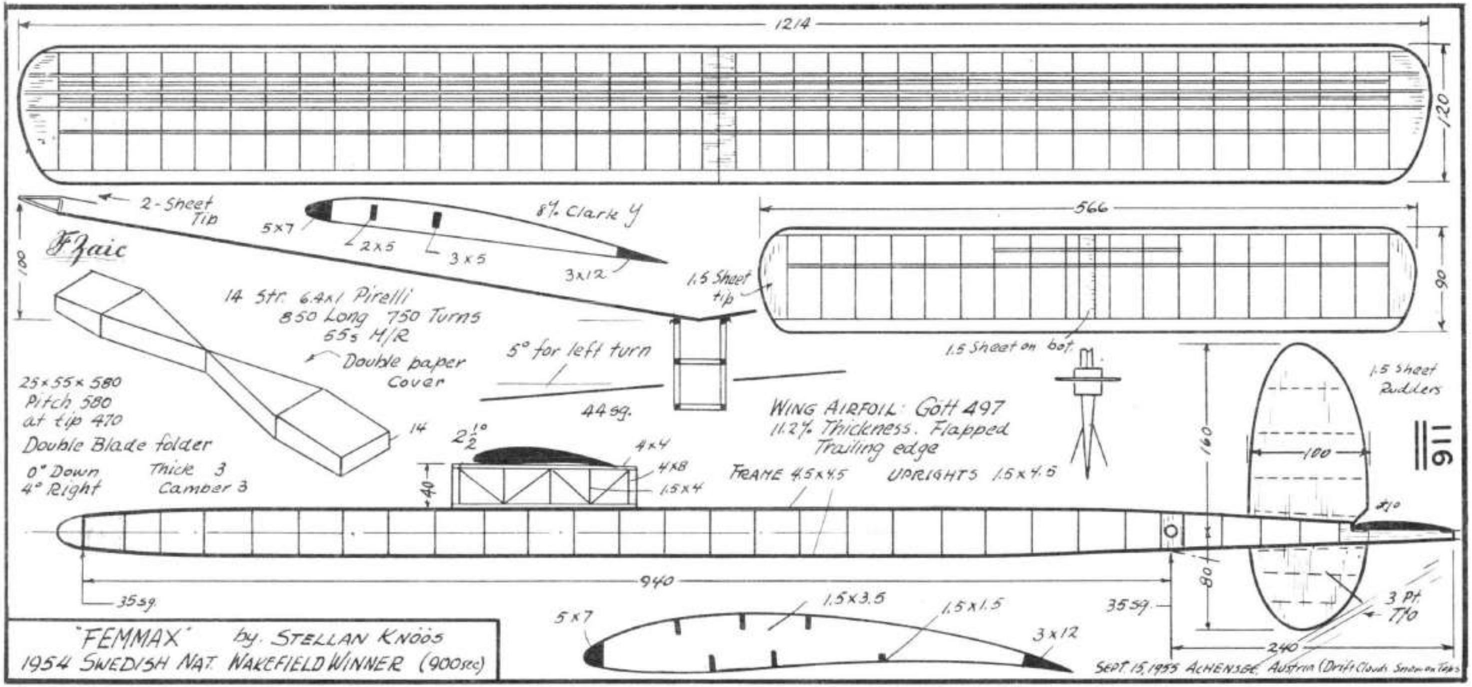

112
paper tubes wrap with thread
pianowire 16 s.w.g.
propeller at A
wheels perspex or celluloid
WING
ribs 1.2 mm
TAILPLANE
ribs 1mm
propeller hinge 27 s.w.g.tin
WAKEFIELD
"FLOWER"
by C.R.de Vries, Holland
span 1065 mm
length 1025 "
area wing 13,9 dm²
" stab. 5,1 "
weight rubber 75 grammes
total weight 230 "
nose former 3 ply 1mm
In World's Championships '55 Mainz-Finthen model scored: 180-180-180-159-170 = 869 31 secs. below seven in fly-off; placed 16th.


neusspant
balsa blok
pianodr. beugel stabilo
kielvlak
materiaal balsa wanneer niet anders is vermeld
links
rechts
bamboe of Al. buis 6 ⌀
liggerlas
stabilorib A, alle balsa 1mm
knik
zacht balsa blok
neergeslagen
1,5 mm pianodr. in papieren koker omwonden met garen
vuren 3x3
alle ribben balsa 1mm
MVA 301 75%
balsa 3x3
triplex 1mm
H. TOERSEN 1954
WAKE-TRAINER
spanw. 1160 mm
lengte o.a. 1092 "
opp.vleugel 13,97 dm²
" stabilo 5,03 "
" totaal 19,00 "
motor 80 gram
romp 40 "
vleugel 60 "
stabilo 20 "
schroef 30 "
gebruik schroef met vrijloop of één van de vele beproefde terugklapsystemen
vH '55

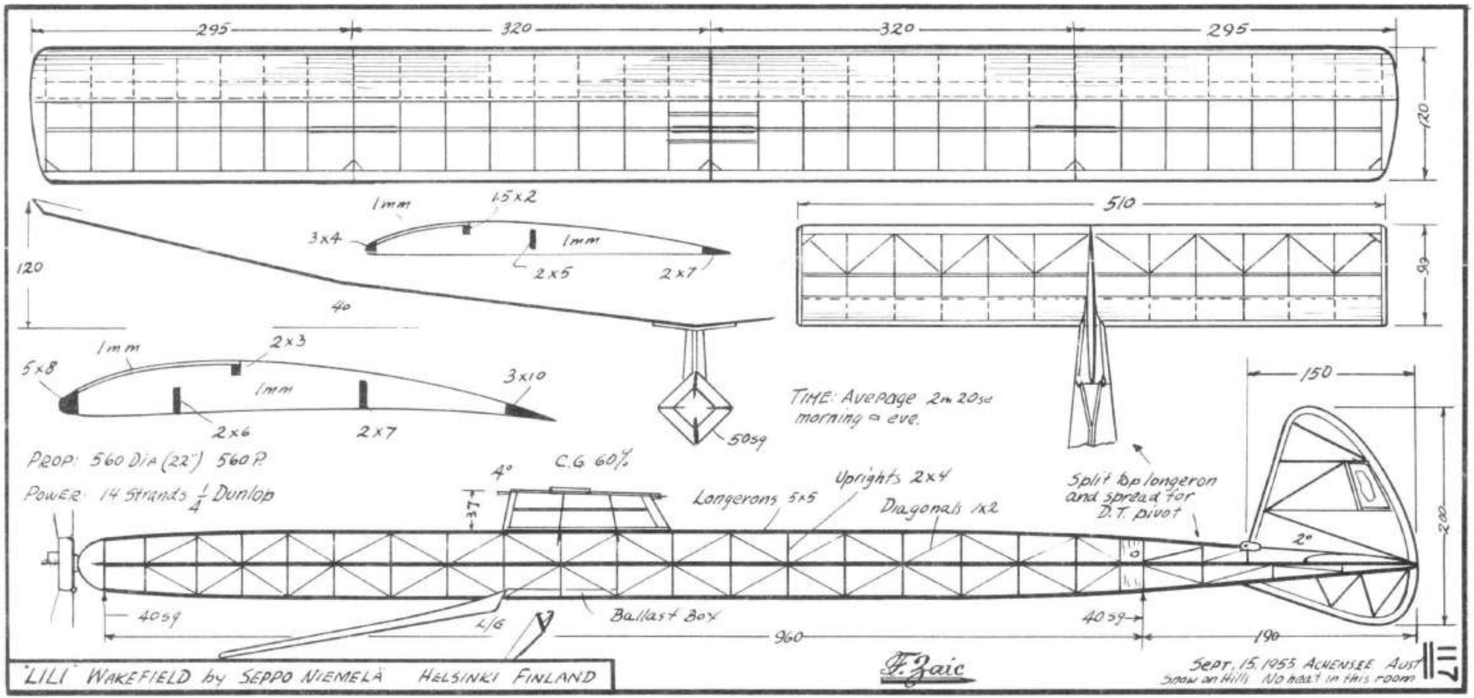

1955 WAKEFIELD
by
H.J. (POP) KNIGHT
DARTFORD - ENGLAND
45¾"
LAMINATED TIPS
1"
1/32 RIBS
1/16 CTR. RIB.
5"
1¾"
1/8 × 3/16
JOUKOWSKI SECTION
1/2 × 3/32
1/4 × 1/16
PROP. 20" DIA. 28" PITCH (APPROX)
FEATHERING
14 STRANDS PIRELLI RUBBER.
APPROX. 3½° SIDE & DOWN THRUST
7¼"
1¼"
1/2 SQ
5°
60% CG
1/8 SQ.
1/8 × 3/32 EDGEWISE
1/8" × 3/32" FLATWISE
1/32 SHEET COVER
U/CARRIAGE RETRACTING RUBBER
1/2 SQ AT REAR RUBBER DOWEL
FINS STREAM-LINE SECTION
½"
1¾"
¼"
2"
3¼"
1/8 SQ
1/16
1/32 RIBS
5"
1½"
2½"
4"
4¾"
25¼"
9½"
THIN CLARKE 'Y' SECTION AT 1½°
1/32 RIBS
2¾"
BALLAST NOSE (APPROX 1¼ OZS) TO BRING C.G. WHERE SHOWN
REARWARD RETRACTING WIRE LEG
MODEL PLACED 4TH. IN BRITISH 1955 TEAM, 'POP' RELINQUISHED POSITION IN FAVOUR OF H.O'DONNELL
FAIRING
1/8 SQ
1⅝"
3¾"
1/4 × 1/16
18"


1955 BELGIUM WAKEFIELD TEAM
by ODETTE De BARE BELGIUM
Twin Rudder 90 X 120
Stab Clark Y
Wing: RAF 32
Prop: Single Blade
folder 500 DIA. 650 Pitch
21st Place 180, 180, 180, 143, 180
290
560
290
130
95
480
1120
110

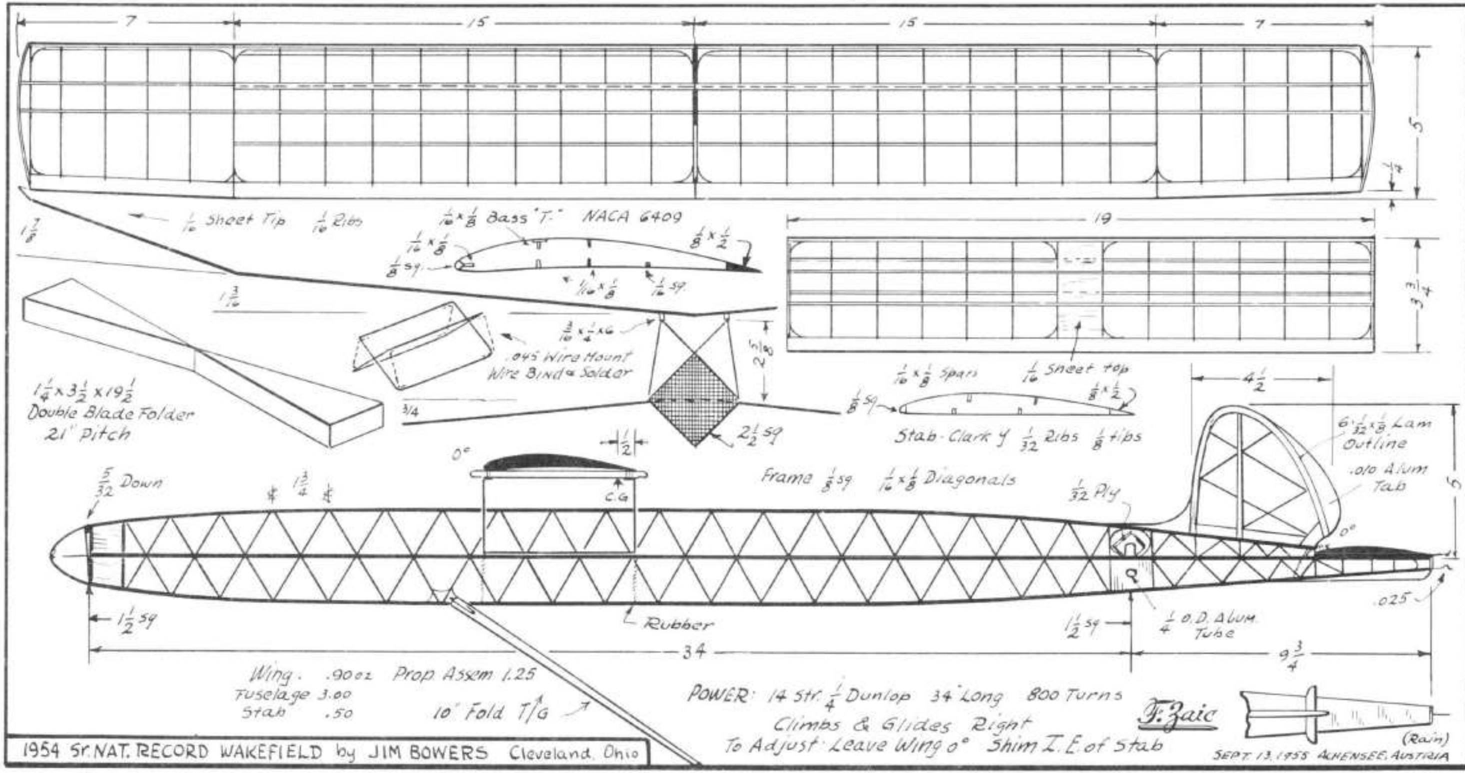

1300
120
25
FOLDING PROP.
STAB. SECTION
80
520
BAMBOO
1/16" × 1/4" SHEET BETWEEN RIBS
4×6
BSA 2×12
176
1°
WING AREA - 14,76 dm²
STAB AREA - 4,12 dm²
TOTAL AREA - 18,88 dm²
WEIGHTS:
WING - 45 g
STAB - 12 g
FUSELAGE - 60 g
PROP. - 40 g
RUBBER - 78 g
TOTAL - 235 g
5×5
3×5
+3°
NEOPRENE
880
1130
BAMBOO - 1/8" sq.
RUBBER: 20 strands 1,2×4
- 825 turns
BAMB. DOWEL
ø 2
ø485/P-535
95
15
SPRUCE 2×3
COTTON TURB.
ALL RIBS 1/16" SHEET
4
NACA 6409
3×14
BSA 6×5
WING SECTION
WORLD CHAMPIONSHIP 1955 - 24 th.
178, 180, 132, 180, 180, - TOTAL - 850 sec.
TIME AVERAGE - 2'50"
WAKEFIELD
›G-55‹
BY RADOSLAV ČÍŽEK
CZECHOSLOVAKIA



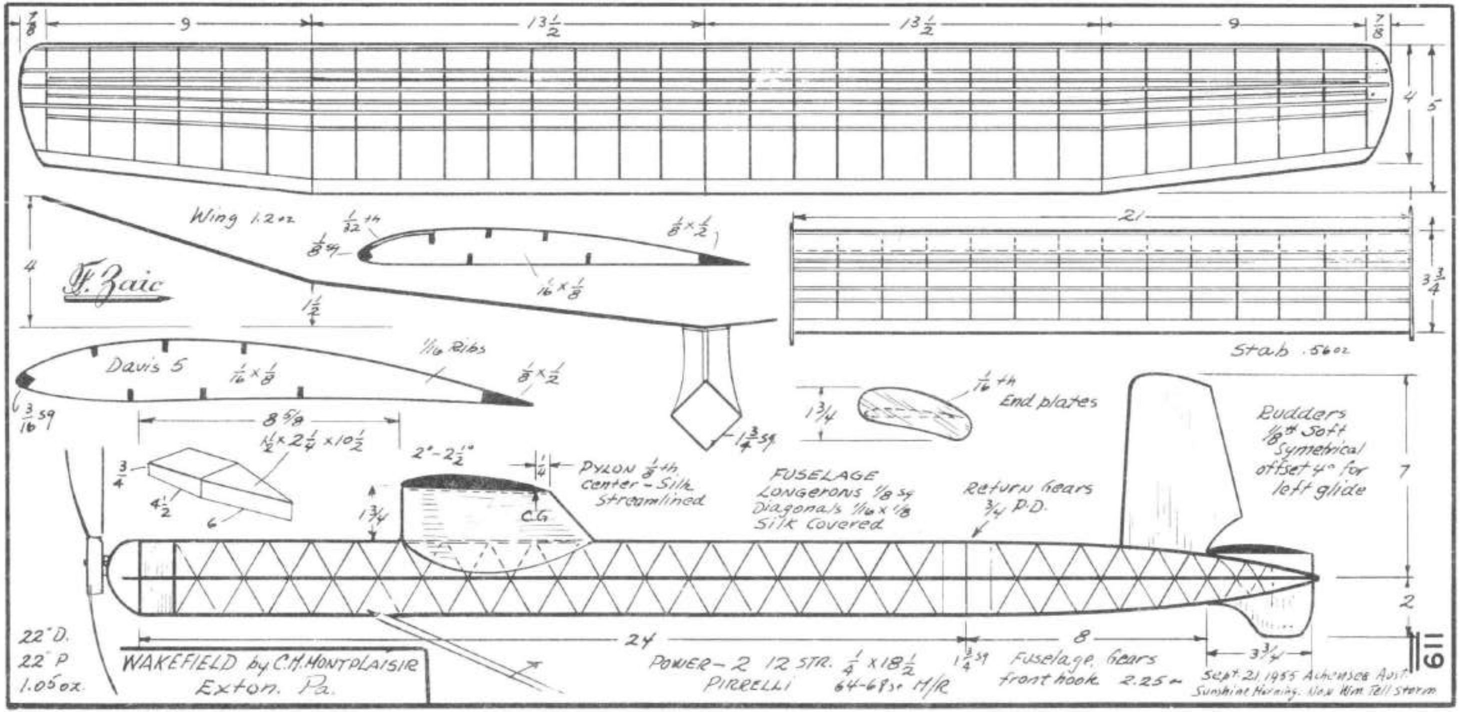
1214
120
2-Sheet Tip
8% Clark Y
5x7
2x5
3x5
3x12
F Zaic
100
566
90
1.5 Sheet tip
1.5 Sheet on bot.
14 Str. 6.4x1 Pirelli
850 Long 750 Turns
55s M/R
Double paper Cover
5° for left turn
44 sq.
25x55x580
Pitch 580
at tip 470
Double Blade folder
0° Down
4° Right
Thick 3
Camber 3
14
2½°
4x4
4x8
1.5x4
40
FRAME 4.5x4.5
UPRIGHTS 1.5x4.5
WING AIRFOIL: Gött 497
11.2% Thickness. Flapped Trailing edge
160
100
1.5 Sheet Rudders
116
940
35 sq.
35 sq.
80
3 Pt. T/o
240
5x7
1.5x3.5
1.5x1.5
3x12
"FEMMAX" by. STELLAN KNÖÖS
1954 SWEDISH NAT. WAKEFIELD WINNER (900 sec)
SEPT. 15, 1955 ACHENSEE, Austria (Drift Clouds Snow on Tops)

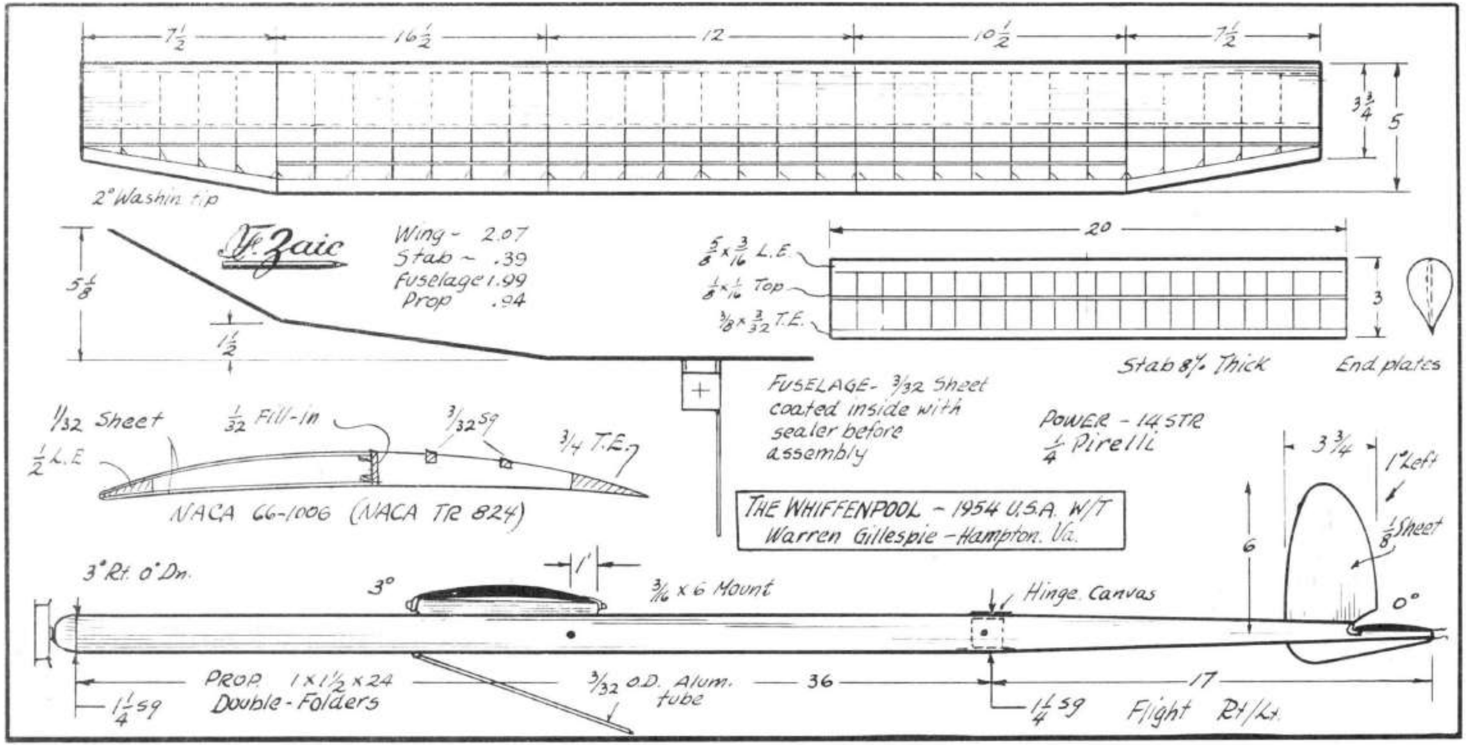


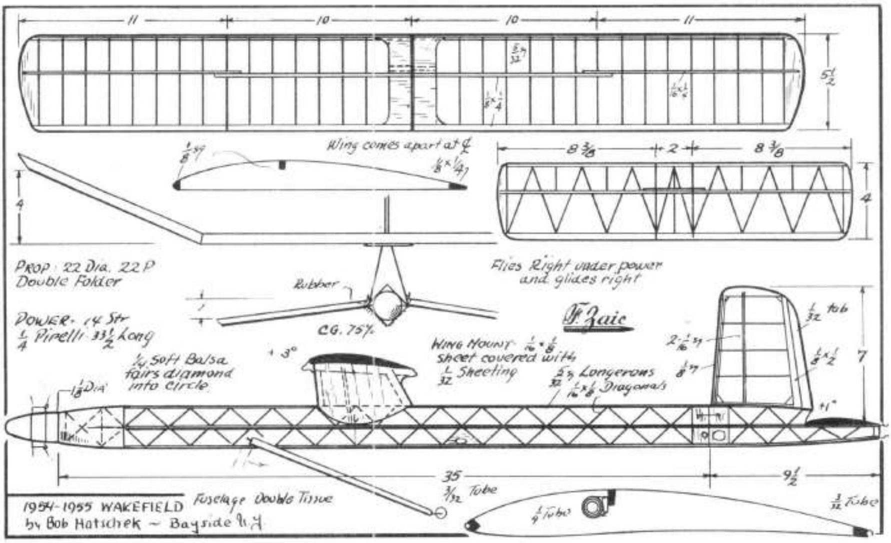
295
320
320
295
120
1mm
1.5x2
3x4
1mm
2x5
2x7
120
40
510
90
1mm
2x3
5x8
3x10
1mm
2x6
2x7
50sq
TIME: Average 2m 20sc
morning & eve.
PROP: 560 DIA (22") 560 P.
POWER: 14 Strands 1/4 Dunlop
4°
C.G 60%
37
Longerons 5x5
Uprights 2x4
Diagonals 1x2
Split top longeron
and spread for
D.T. pivot
150
200
2°
40sq
L/G
Ballast Box
40sq
960
190
"LILI" WAKEFIELD by SEPPO NIEMELÄ HELSINKI FINLAND
F. Zaic
Sept. 15, 1955 Achensee Aust
Snow on Hills No heat in this room
117

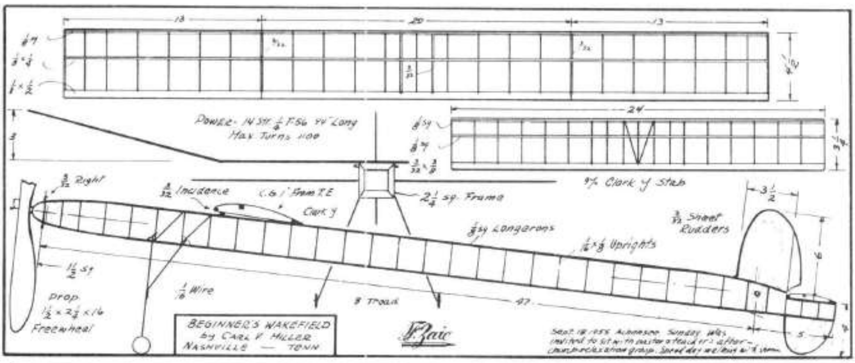


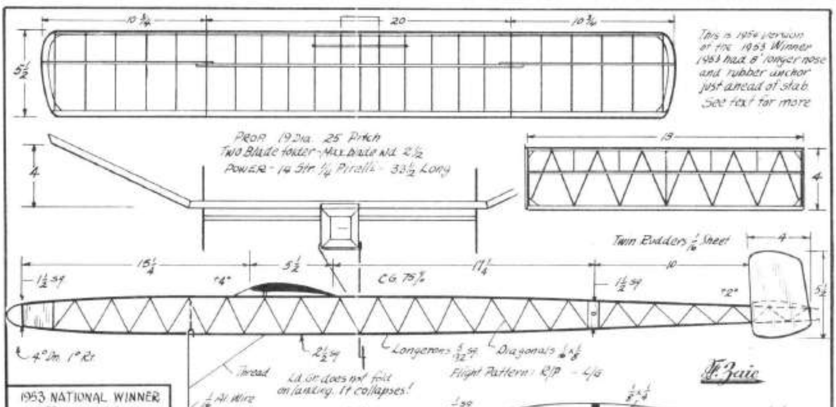
1/16 Sheet Tip
1/16 Ribs
1/16 x 1/8 Bass "T"
NACA 6409
1/8 x 1/2
1/8 sq.
1/16 x 1/8
1/16 sq.
3/16 x 1/4 x 6
.045 Wire Mount
Wire Bind & Solder
1 1/4 x 3 1/2 x 19 1/2
Double Blade Folder
21" Pitch
2 1/2 sq
1/16 x 1/8 Spars
1/16 Sheet top
Stab - Clark Y 1/32 Ribs 1/8 tips
6-1/32 x 1/8 Lam
Outline
.010 Alum
Tab
5/32 Down
C.G.
Frame 1/8 sq 1/16 x 1/8 Diagonals
1/32 Ply
Rubber
1 1/2 sq
1/4 O.D. Alum.
Tube
.025
Wing .90 oz Prop Assem 1.25
Fuselage 3.00
Stab .50
10" Fold T/G
POWER: 14 Str. 1/4 Dunlop 34" Long 800 Turns
Climbs & Glides Right
To Adjust Leave Wing 0° Shim T.E. of Stab
F. Zaic
(Rain)
SEPT. 13, 1955 ACHENSEE, AUSTRIA
1954 Sr. NAT. RECORD WAKEFIELD by JIM BOWERS Cleveland, Ohio

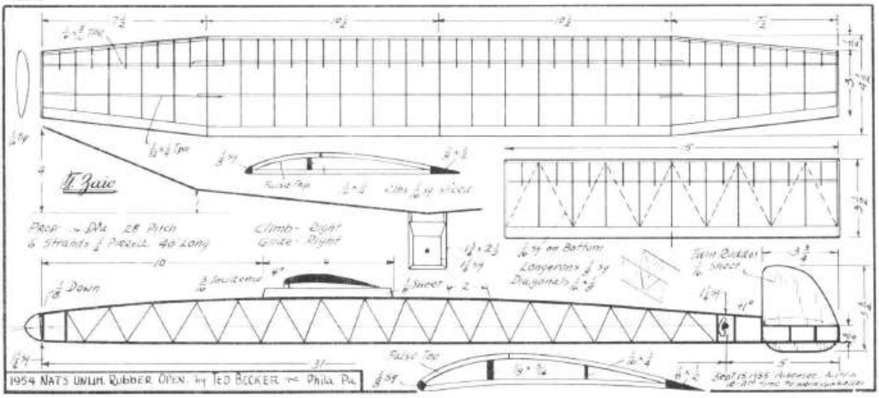

Wing 1.2 oz
F. Zaic
Davis 5
1/16 Ribs
Stab .56 oz
End plates
Rudders 1/8" Soft Symetrical offset 4° for left glide
PYLON 1/8 th. Center - Silk Streamlined
FUSELAGE Longerons 1/8 sq. Diagonals 1/16 x 1/8 Silk Covered
Return Gears 3/4 P.D.
C.G.
22" D.
22" P
1.05 oz.
WAKEFIELD by C.H. MONTPLAISIR
Exton, Pa.
POWER - 2 12 STR. 1/4 x 18 1/2
PIRELLI 64-69 st. M/R
Fuselage, Gears front hook 2.25 oz
Sept. 21, 1955 Achensee Aust. Sunshine Morning. New Wm Tell storm
119


7½
16½
12
10½
7½
3¾
5
2° Washin tip
F. Zaic
Wing - 2.07
Stab ~ .39
Fuselage 1.99
Prop .94
5⅛
½
20
⅝ x 3/16 L.E.
⅛ x 1/16 Top
3/8 x 3/32 T.E.
3
Stab 8% Thick
End plates
1/32 Sheet
½ L.E.
1/32 Fill-in
3/32 Sq
¾ T.E.
NACA 66-1006 (NACA TR 824)
FUSELAGE - 3/32 Sheet coated inside with sealer before assembly
POWER - 14 STR ¼ Pirelli
3¾
1° Left
⅛ Sheet
6
THE WHIFFENPOOL - 1954 U.S.A. W/T
Warren Gillespie - Hampton, Va.
3° Rt. 0° Dn.
3°
1"
3/16 x 6 Mount
Hinge Canvas
0°
PROP. 1 x 1½ x 24
Double-Folders
3/32 O.D. Alum. tube
36
17
1¼ Sq
1¼ Sq
Flight Rt/Lt.

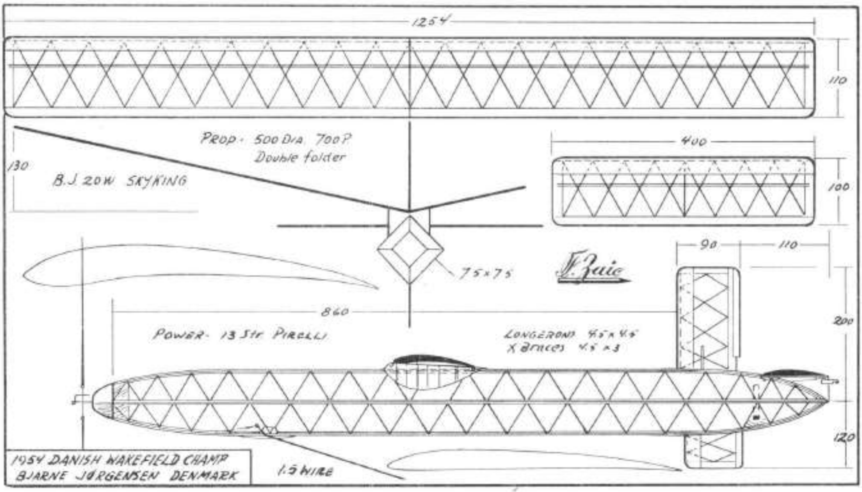

Wing comes apart at ℄
Prop : 22 Dia. 22 P
Double Folder
Power - 14 Str
1/4 Pirelli 33 1/2 Long
Rubber
C.G. 75%
Flies Right under power
and glides right
F. Zaic
Wing Mount 1/16 × 1/8
Sheet covered with
1/32 Sheeting
1/4 Soft Balsa
fairs diamond
into circle
1/8 Dia
5/32 Longerons
1/16 × 1/8 Diagonals
1/32 tab
1954-1955 WAKEFIELD
by Bob Hatschek ~ Bayside N.Y.
Fuselage Double Tissue
3/32 Tube
1/4 Tube


Power - 14 Str 1/8 F.56 44" Long
Max Turns 1100
3/32 Right
3/32 Incidence
C.G. 1" From T.E
Clark Y
2 1/4 sq. Frame
9% Clark Y Stab
3/32 Sheet
Rudders
1/8 sq Longerons
1/16 × 1/8 Uprights
1/16 Wire
Prop
1 1/2 × 2 1/2 × 16
Freewheel
8 Tread
BEGINNER'S WAKEFIELD
by CARL V. MILLER
NASHVILLE — TENN
F. Zaic

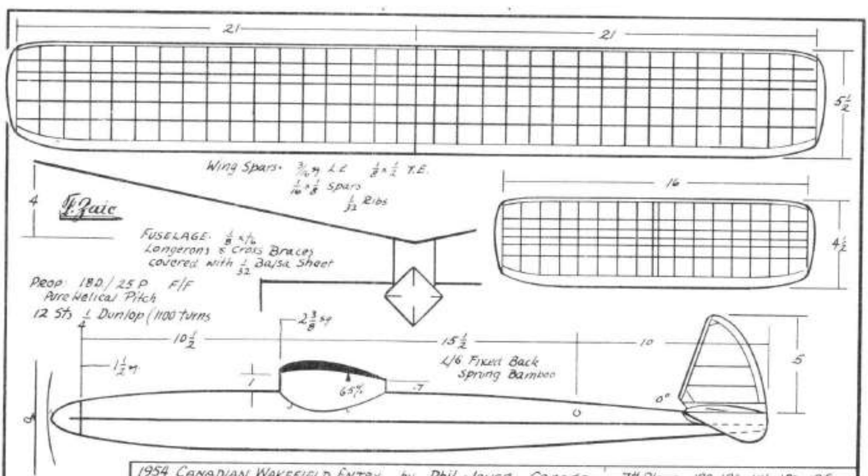

This is 1954 version
of the 1953 Winner
1953 had 8" longer nose
and rubber anchor
just ahead of stab.
See text for more
Prop 19 Dia. 25 Pitch
Two Blade folder - Max blade wd. 2 1/2
Power - 14 Str. 1/4 Pirelli - 33 1/2 Long
Twin Rudders 1/16 Sheet
C.G. 75%
Longerons 3/32 sq.
Diagonals 1/16 × 1/8
Flight Pattern: R/P - L/G
Thread
Ld. Gr. does not fold
on landing. It collapses!
1/16 M. Wire
4° Dn. 1° Rt
1953 NATIONAL WINNER
OPEN WAKEFIELD
Bob Hatschek - Bayside N.Y.
F. Zaic



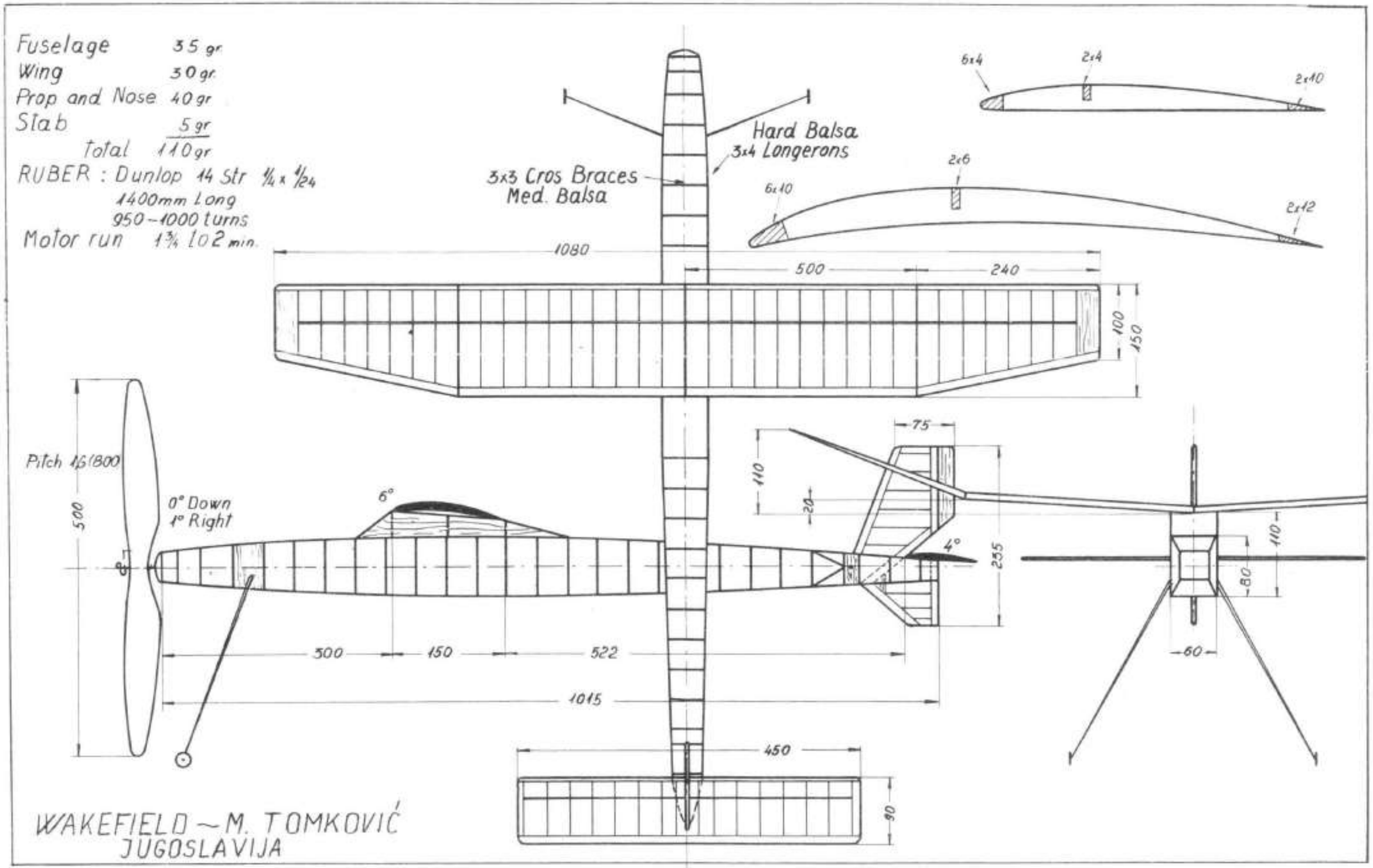
1954 NATS UNLIM. RUBBER OPEN. by TED BECKER Phila. Pa.

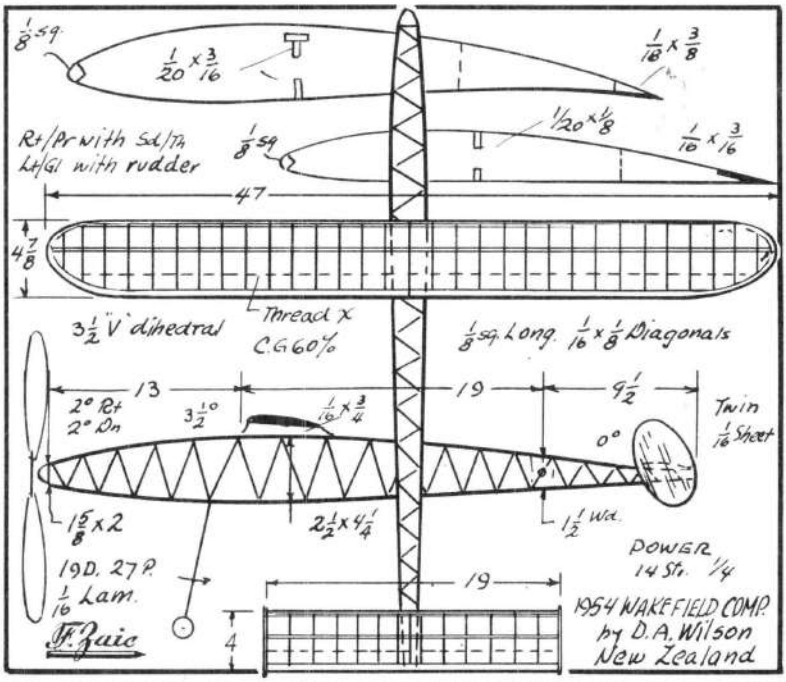


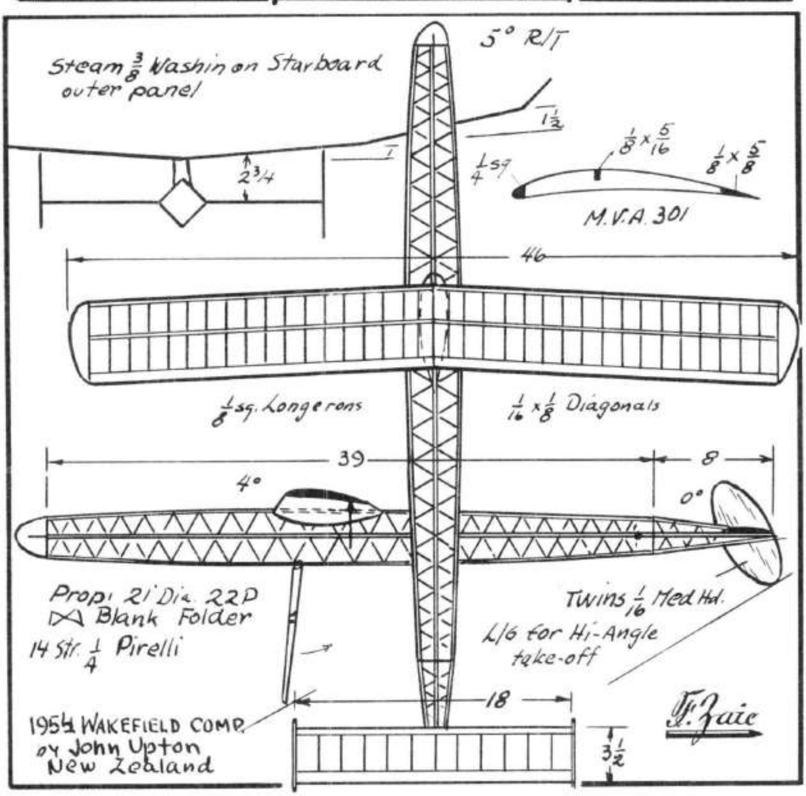
1954 DANISH WAKEFIELD CHAMP
BJARNE JØRGENSEN DENMARK

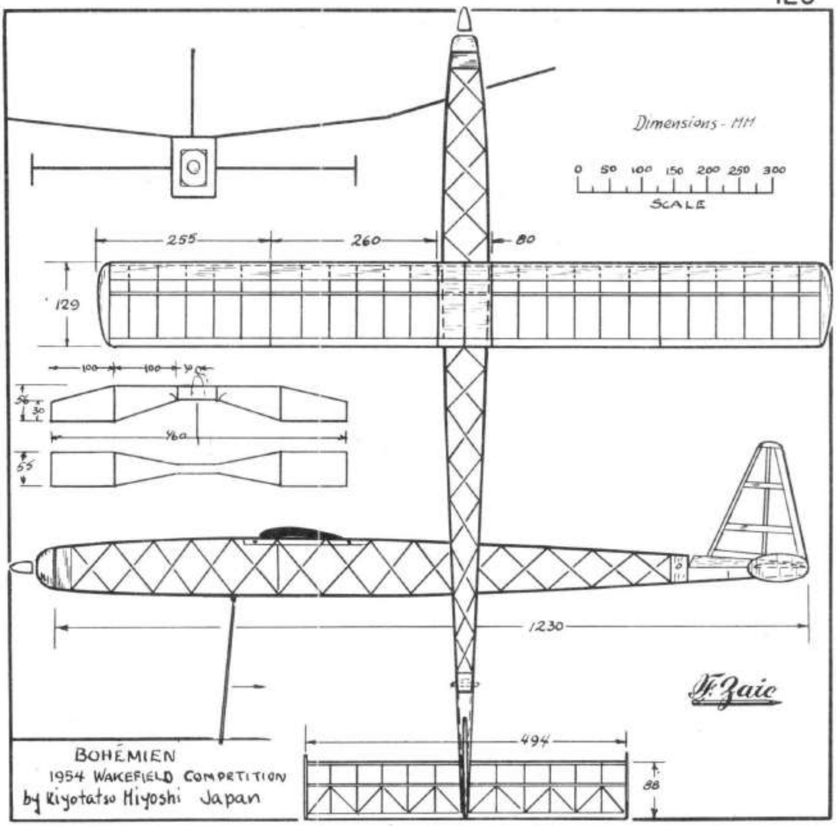


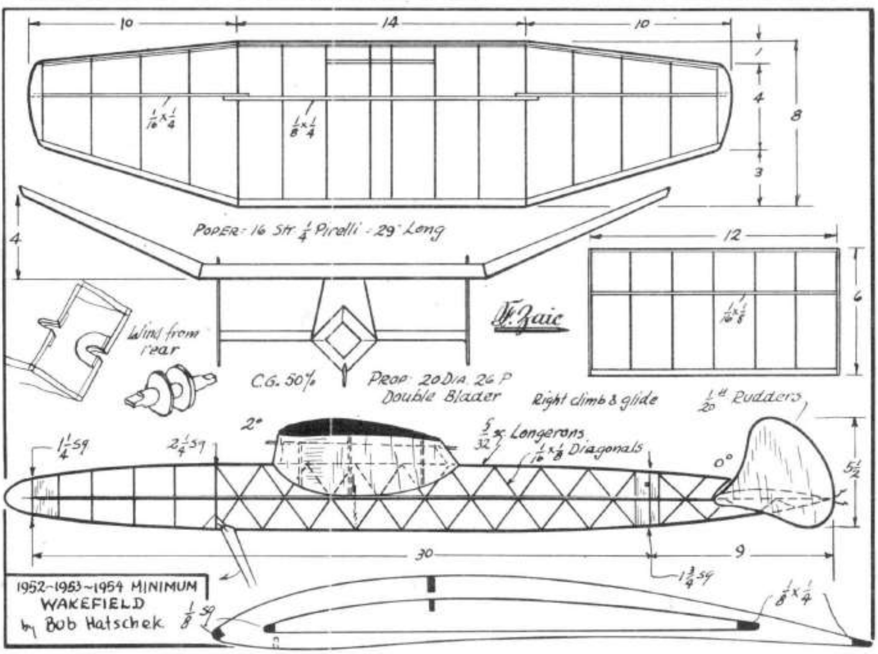
1954 CANADIAN WAKEFIELD ENTRY by Phil Joyce Canada 7th Place 180, 180, 141, 180, 125

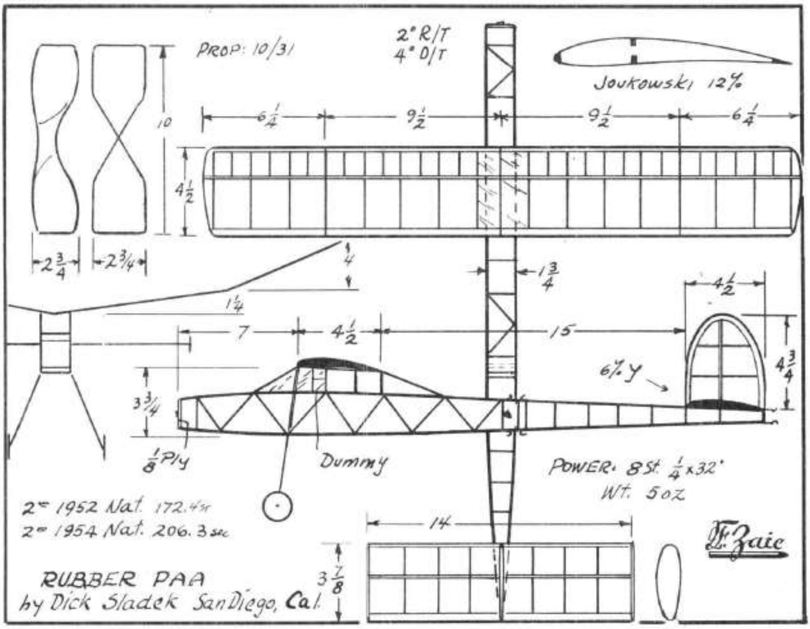

Fuselage 35 gr
Wing 30 gr
Prop and Nose 40 gr
Stab 5 gr
Total 110 gr
RUBER : Dunlop 14 Str 1/4 x 1/24
1400mm Long
950-1000 turns
Motor run 1¾ to 2 min.
Hard Balsa
3x4 Longerons
3x3 Cros Braces
Med. Balsa
6x4
2x4
2x10
2x6
6x10
2x12
1080
500
240
100
150
Pitch 1,6/800
500
0° Down
1° Right
6°
4°
75
110
20
255
110
80
60
300
150
522
1015
450
90
WAKEFIELD ~ M. TOMKOVIĆ
JUGOSLAVIJA

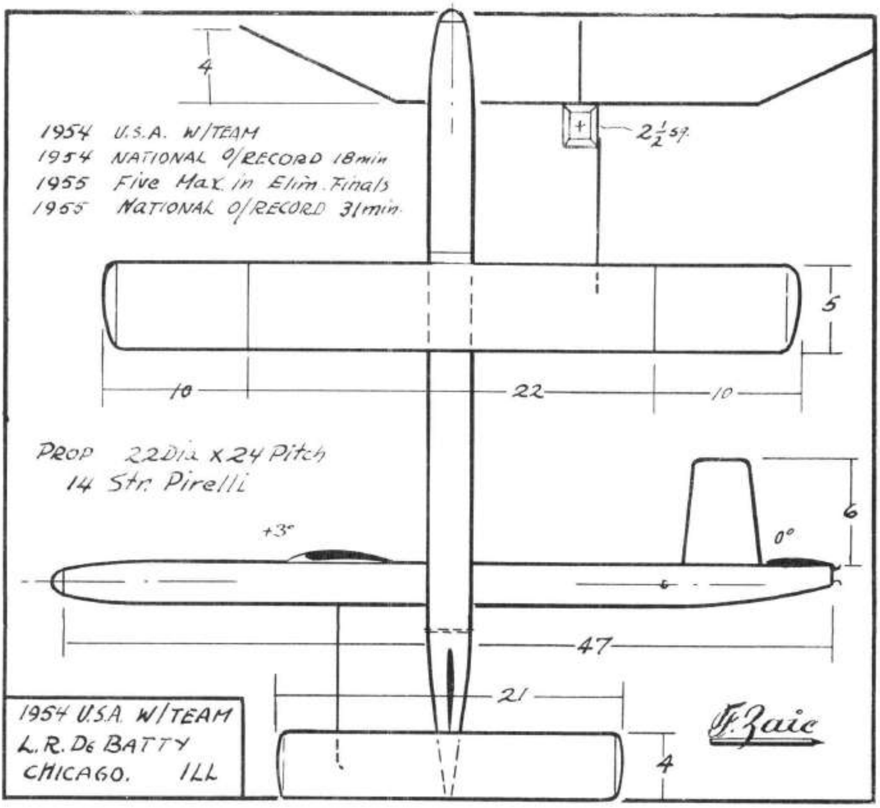

1/8 sq.
1/20 x 3/16
1/16 x 3/8
Rt/Pr with Sd/Th
Lt/Gl with rudder
1/8 sq.
1/20 x 1/8
1/16 x 3/16
47
4 7/8
Thread X
C.G 60%
3 1/2" V dihedral
1/8 sq. Long. 1/16 x 1/8 Diagonals
13
19
9 1/2
2° Rt
2° Dn
3 1/2°
1/16 x 3/4
0°
Twin
1/16 Sheet
1 5/8 x 2
2 1/2 x 4 1/4
1 1/2 Wd.
19D. 27P.
1/16 Lam.
POWER
14 Str. 1/4
19
4
1954 WAKEFIELD COMP.
by D.A. Wilson
New Zealand
F. Zaic

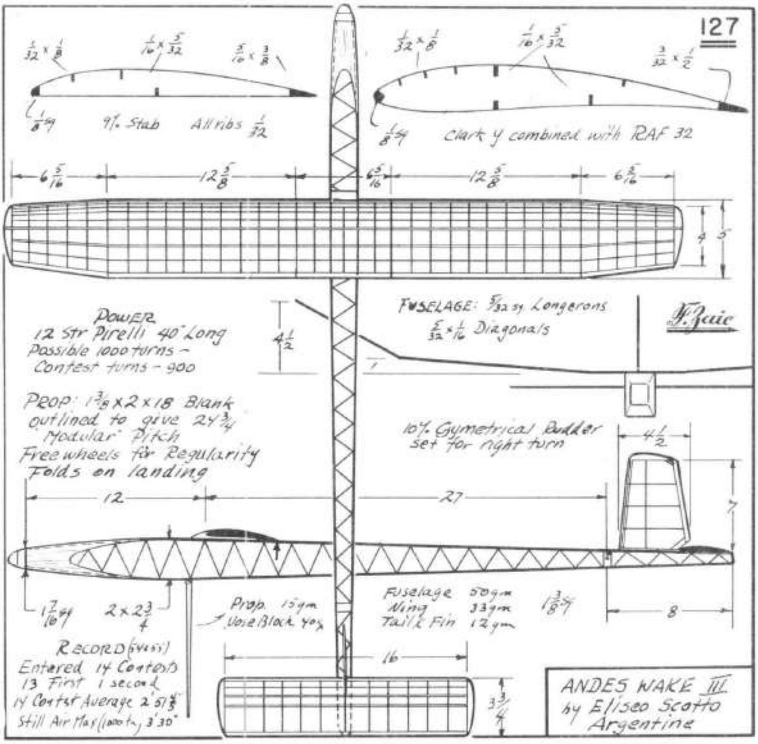

5° R/T
Steam 3/8 Washin on Starboard
outer panel
1 1/2
1
2 3/4
1/4 sq.
1/8 x 5/16
1/8 x 5/8
M.V.A. 301
46
1/8 sq. Longerons
1/16 x 1/8 Diagonals
39
8
4°
0°
Prop: 21" Dia. 22P
Blank Folder
14 Str. 1/4 Pirelli
Twins 1/16 Med Hd.
L/6 for Hi-Angle
take-off
18
3 1/2
1954 WAKEFIELD COMP.
by John Upton
New Zealand
F. Zaic

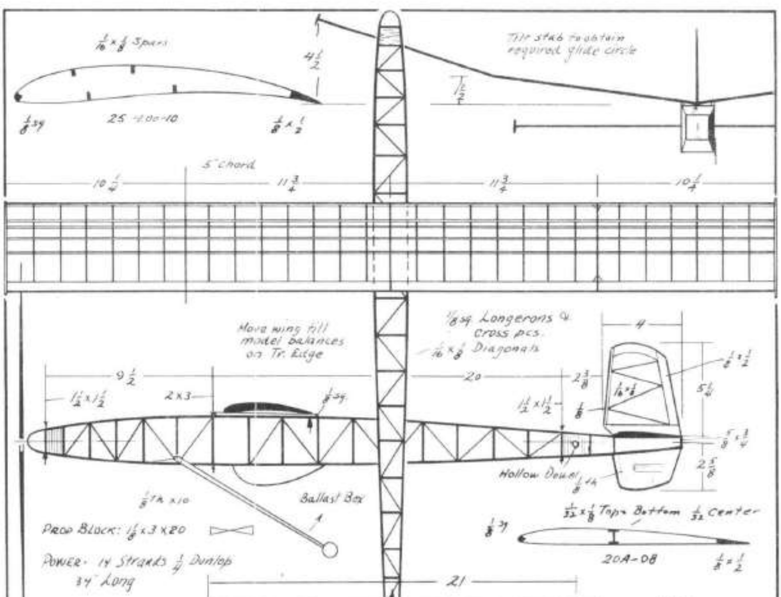

Dimensions - MM
0 50 100 150 200 250 300
SCALE
255
260
80
129
100
100
50
56
30
480
55
1230
F. Zaic
494
88
BOHÉMIEN
1954 WAKEFIELD COMPETITION
by Kiyotatso Miyoshi Japan

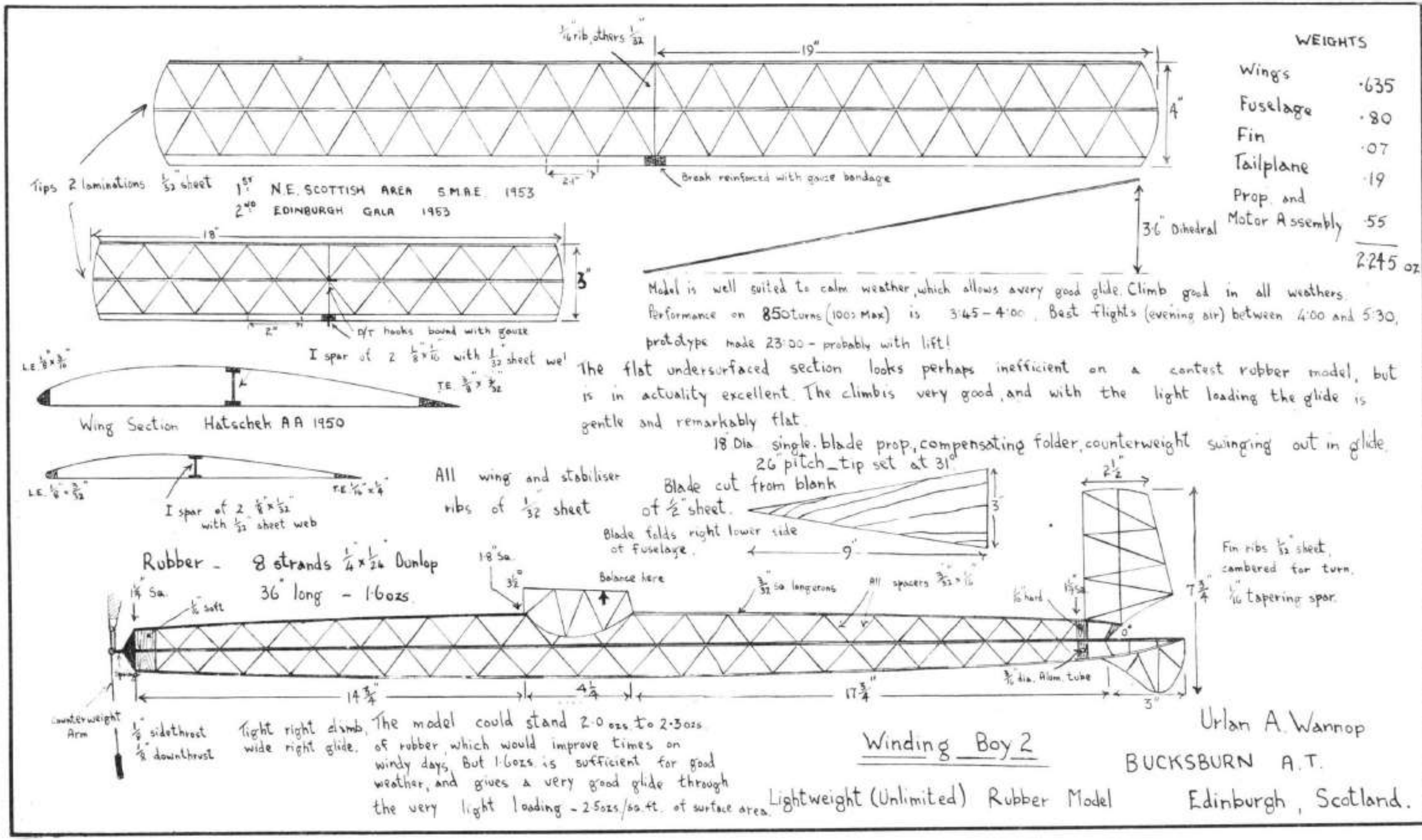

10
14
10
1
4
8
3
1/16 x 1/4
1/8 x 1/4
4
POPER - 16 Str. 1/4 Pirelli - 29" Long
12
6
1/16 x 1/8
F. Zaic
Wind from rear
C.G. 50%
PROP: 20 DIA. 26 P
Double Blader
Right climb & glide
1/20" Rudders
2°
5/32 sq. Longerons
1/16 x 1/8 Diagonals
1 1/4 sq
2 1/4 sq
0°
5 1/2
30
9
1 3/4 sq
1/8 sq
1/8 x 1/4
1952-1953-1954 MINIMUM
WAKEFIELD
by Bob Hatschek

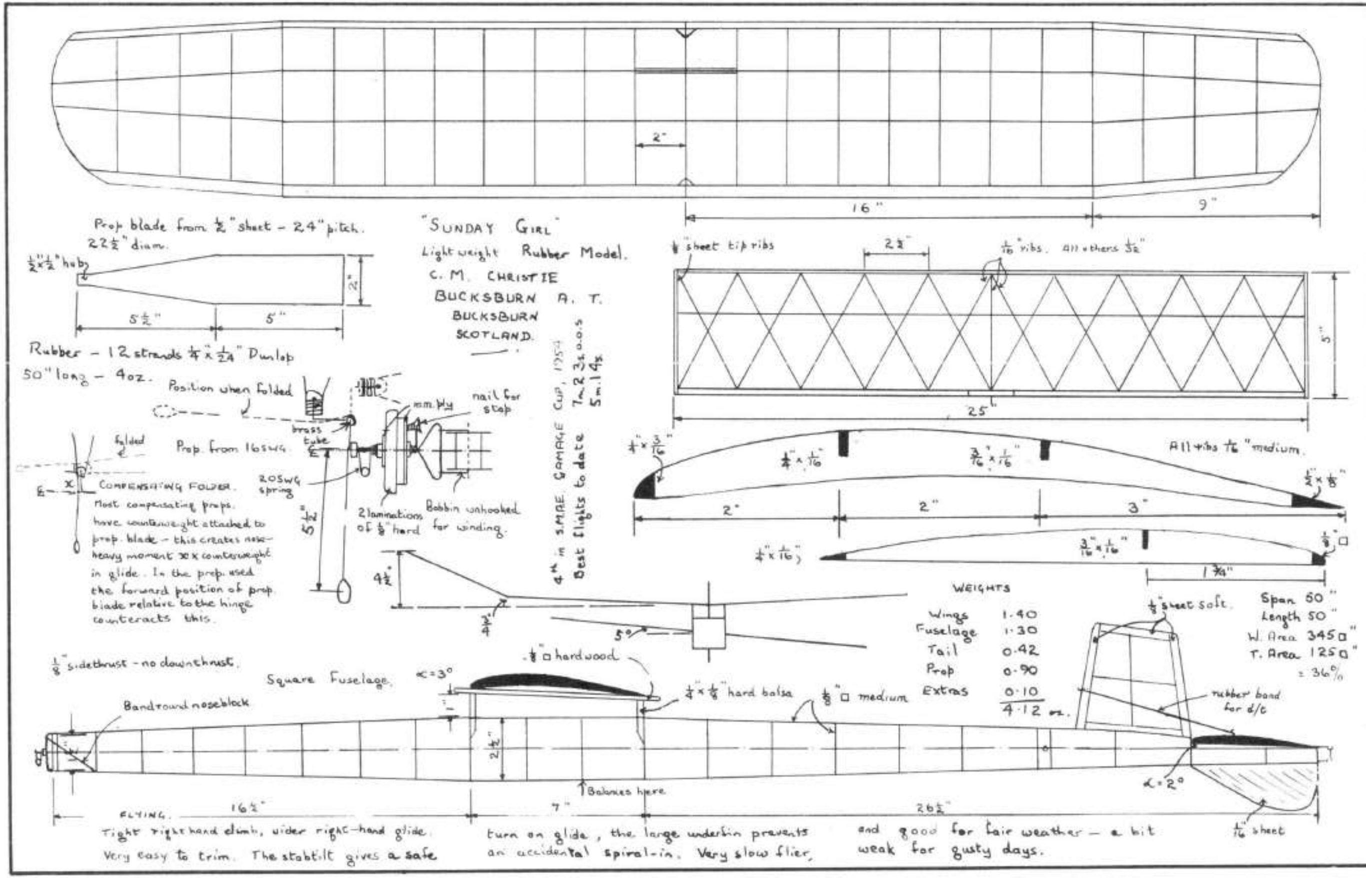

PROP: 10/31
2° R/T
4° D/T
Joukowski 12%
6 1/4
9 1/2
9 1/2
6 1/4
10
4 1/2
2 3/4
2 3/4
4
1 1/4
1 3/4
4 1/2
7
4 1/2
15
4 3/4
6% Y
3 3/4
1/8 Ply
Dummy
POWER. 8 St. 1/4 x 32"
Wt. 5 oz
2nd 1952 Nat. 172.4 sec
2nd 1954 Nat. 206.3 sec
14
3 7/8
RUBBER PAA
by Dick Sladek San Diego, Cal.
F. Zaic


4
2 1/2 sq.
1954 U.S.A. W/TEAM
1954 NATIONAL O/RECORD 18 min
1955 Five Max. in Elim. Finals
1955 NATIONAL O/RECORD 31 min.
5
10
22
10
PROP 22 Dia x 24 Pitch
14 Str. Pirelli
6
+3°
0°
47
21
4
1954 U.S.A. W/TEAM
L.R. De BATTY
CHICAGO. ILL
F. Zaic

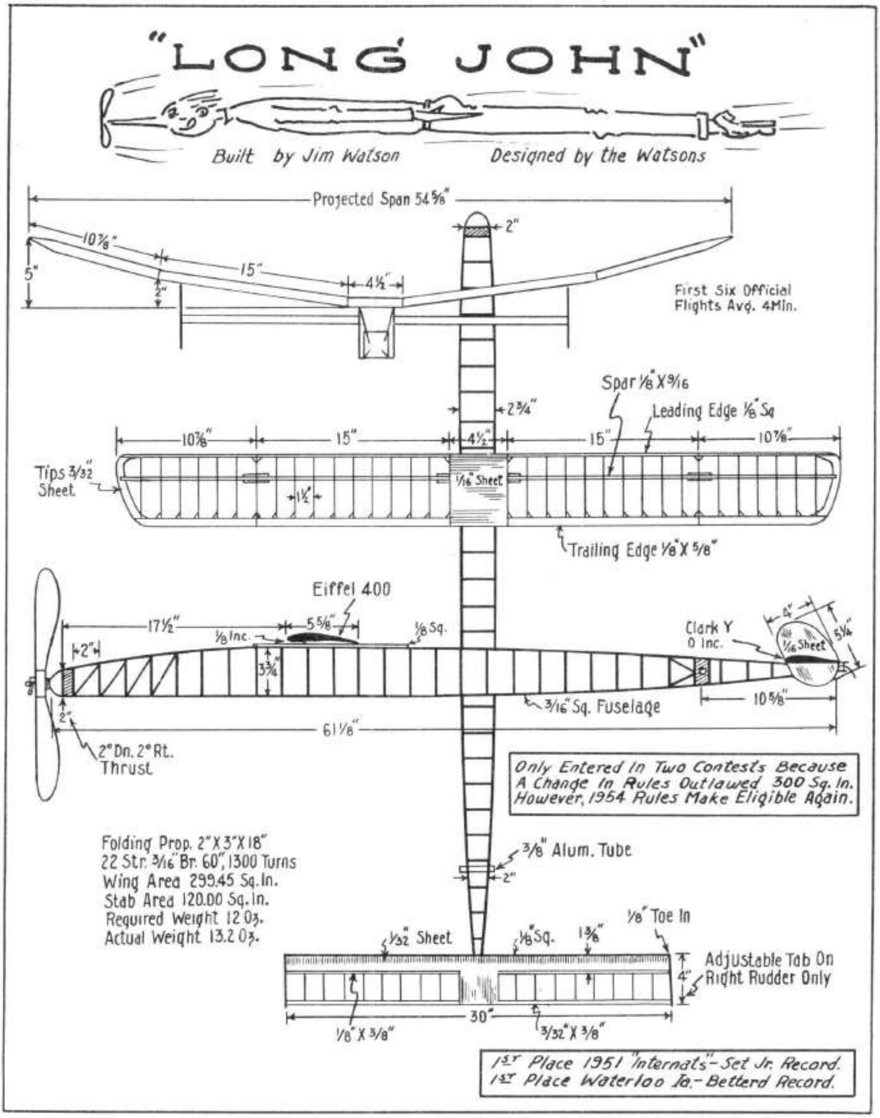

9% Stab
All ribs 1/32
Clark Y combined with RAF 32
FUSELAGE: 5/32 sq. Longerons
5/32 x 1/16 Diagonals
POWER
12 Str Pirelli 40" Long
Possible 1000 turns -
Contest turns - 900
PROP: 1 3/8 x 2 x 18 Blank
outlined to give 24 3/4
"Modular" Pitch
Free wheels for Regularity
Folds on landing
10% Symetrical Rudder
set for right turn
Prop. 15 gm
Nose Block 4 oz
Fuselage 50 gm
Wing 33 gm
Tail & Fin 12 gm
RECORD (5 years)
Entered 14 Contests
13 First 1 second
14 Contest Average 2' 51 4/5"
Still Air Max (1000 t.) 3' 30"
ANDES WAKE III
by Eliseo Scotto
Argentine
F. Zaic

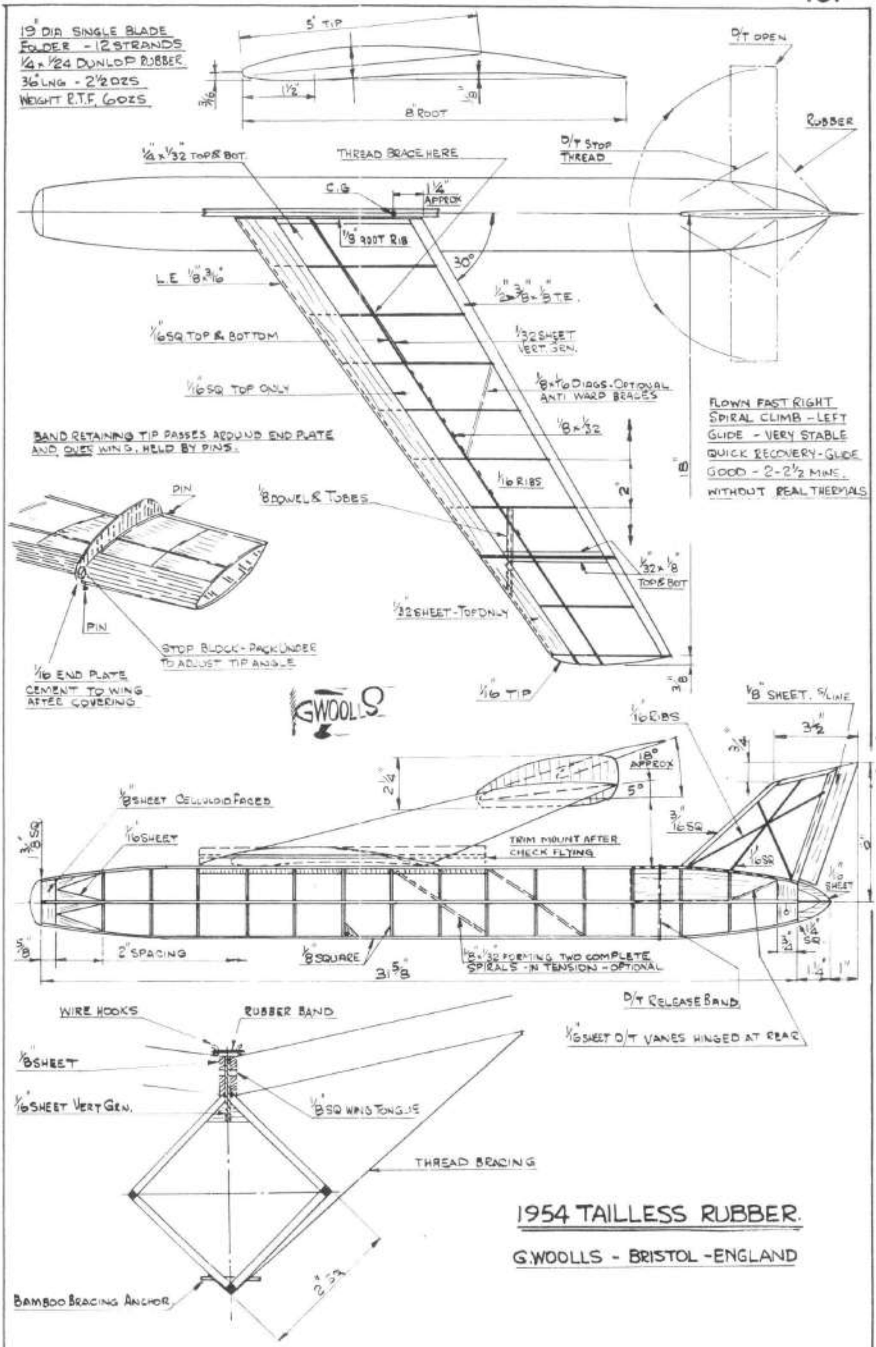

1/16 x 1/8 Spars
25 4-00-10
Tilt stab to obtain
required glide circle
5" Chord
Move wing till
model balances
on Tr. Edge
1/8 sq. Longerons &
Cross pcs.
1/16 x 1/8 Diagonals
Hollow Dowel 1/8 th.
Ballast Box
PROP BLOCK: 1 1/2 x 3 x 20
POWER - 14 Strands 1/4 Dunlop
34" Long
1/32 x 1/8 Top & Bottom 1/32 Center
20A-08
"WONDERBAR" WAKEFIELD
P. VISSER South Africa
F. Zaic

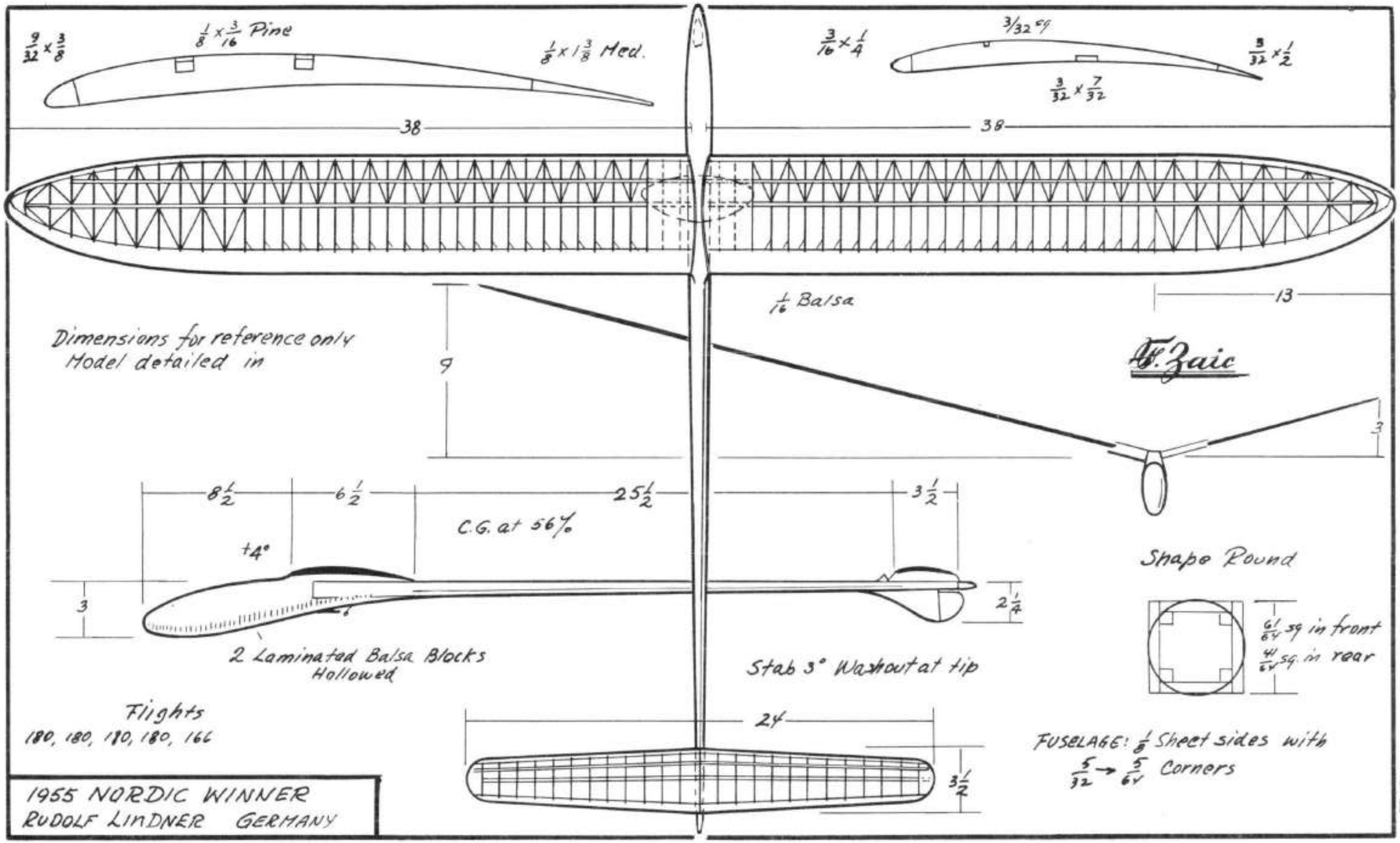

WEIGHTS
Wings ·635
Fuselage ·80
Fin ·07
Tailplane ·19
Prop. and Motor Assembly ·55
2·245 oz
19"
4"
Tips 2 laminations 1/32" sheet
1st N.E. SCOTTISH AREA S.M.A.E. 1953
2nd EDINBURGH GALA 1953
Break reinforced with gauze bandage
3·6" Dihedral
18"
3"
D/T hooks bound with gauze
Model is well suited to calm weather, which allows a very good glide. Climb good in all weathers.
Performance on 850 turns (1005 Max) is 3:45 – 4:00. Best flights (evening air) between 4:00 and 5:30,
prototype made 23:00 – probably with lift!
The flat undersurfaced section looks perhaps inefficient on a contest rubber model, but is in actuality excellent. The climb is very good, and with the light loading the glide is gentle and remarkably flat.
Wing Section Hatschek AA 1950
18" Dia. single-blade prop, compensating folder, counterweight swinging out in glide.
26" pitch – tip set at 31°
All wing and stabiliser ribs of 1/32" sheet
Blade cut from blank of 1/2" sheet.
Blade folds right lower side of fuselage.
9"
3"
2 1/2"
Fin ribs 1/32" sheet, cambered for turn.
1/16" tapering spar.
7 3/4"
Rubber – 8 strands 1/4 x 1/24 Dunlop
36" long – 1·6 ozs
Balance here
All spacers
1/16" hard
Counterweight Arm
14 3/4"
4 1/4"
17 3/4"
3"
1/8" sidethrust
1/8" downthrust
Tight right climb, wide right glide.
The model could stand 2·0 ozs to 2·3 ozs of rubber, which would improve times on windy days. But 1·6 ozs is sufficient for good weather, and gives a very good glide through the very light loading – 2·5 ozs/sq. ft. of surface area.
Winding Boy 2
Lightweight (Unlimited) Rubber Model
Urlan A. Wannop
BUCKSBURN A.T.
Edinburgh, Scotland.



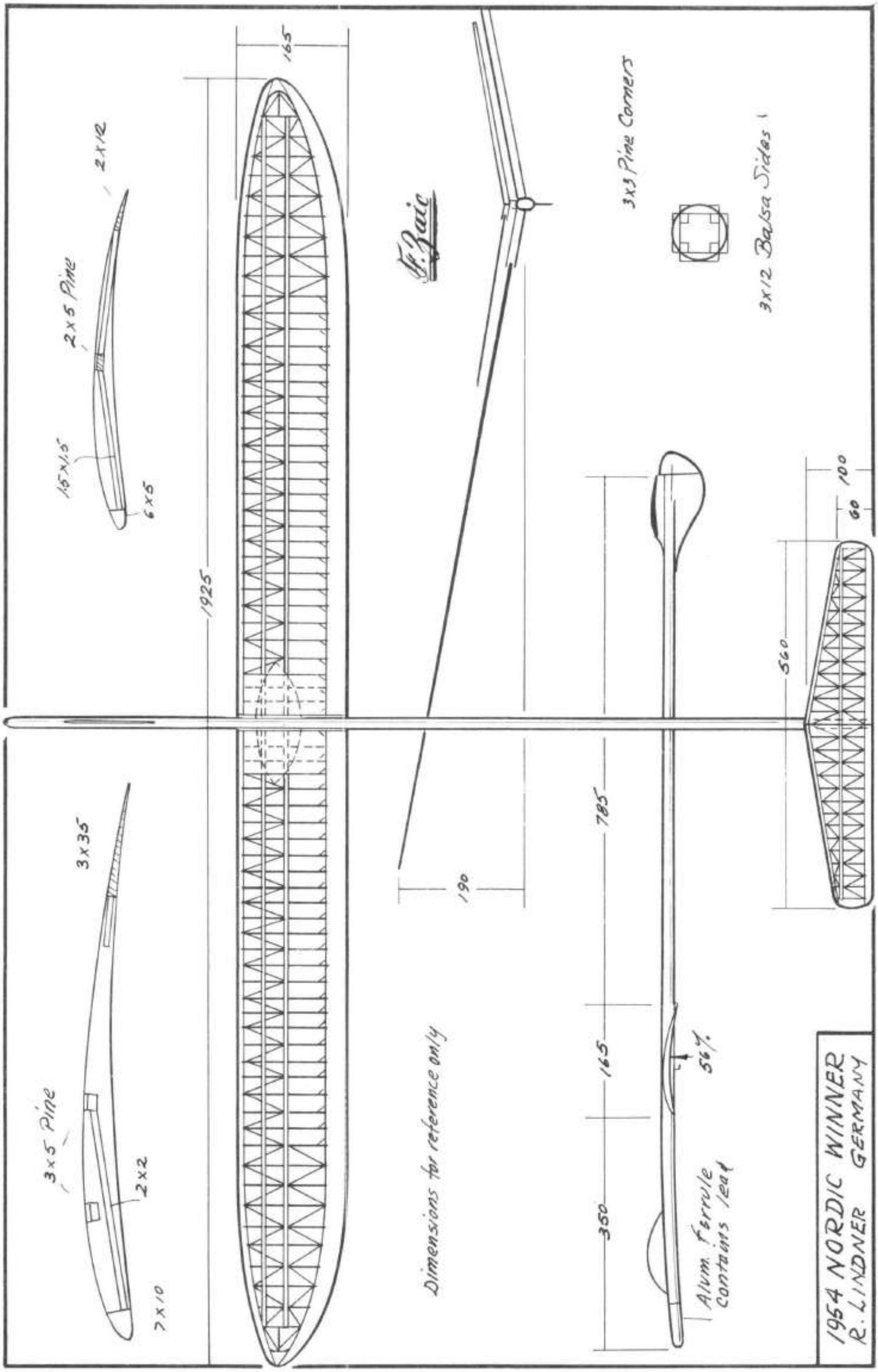
Prop blade from ½" sheet - 24" pitch.
22½" diam.
½"x½" hub
Rubber - 12 strands ¼" x 1/24" Dunlop
50" long - 4oz.
Position when folded
"SUNDAY GIRL"
Light weight Rubber Model.
C. M. CHRISTIE
BUCKSBURN A. T.
BUCKSBURN
SCOTLAND.
4th in S.M.A.E. GAMAGE CUP, 1954
Best flights to date
7m. 2 3s. o.o.s
5m. 14s
nail for stop
mm. ply
brass tube
Prop. from 16swg
20swg spring
2 laminations of ⅛" hard
Bobbin unhooked for winding.
COMPENSATING FOLDER.
Most compensating props have counterweight attached to prop. blade - this creates nose-heavy moment x x counterweight in glide. In the prop. used the forward position of prop. blade relative to the hinge counteracts this.
⅛" sheet tip ribs
1/16" ribs. All others 1/32"
All ribs 1/16" medium.
WEIGHTS
Wings 1.40
Fuselage 1.30
Tail 0.42
Prop 0.90
Extras 0.10
4.12 oz.
⅛" sheet soft.
Span 50"
Length 50"
W. Area 345□"
T. Area 125□"
= 36%
rubber band for d/t
1/16" sheet
⅛" sidethrust - no downthrust.
Square Fuselage.
⅛" □ hardwood
¼" x ⅛" hard balsa
⅛" □ medium
Bandround noseblock
Balances here
FLYING.
Tight right hand climb, wider right-hand glide. Very easy to trim. The stabtilt gives a safe turn on glide, the large underfin prevents an accidental spiral-in. Very slow flier, and good for fair weather - a bit weak for gusty days.

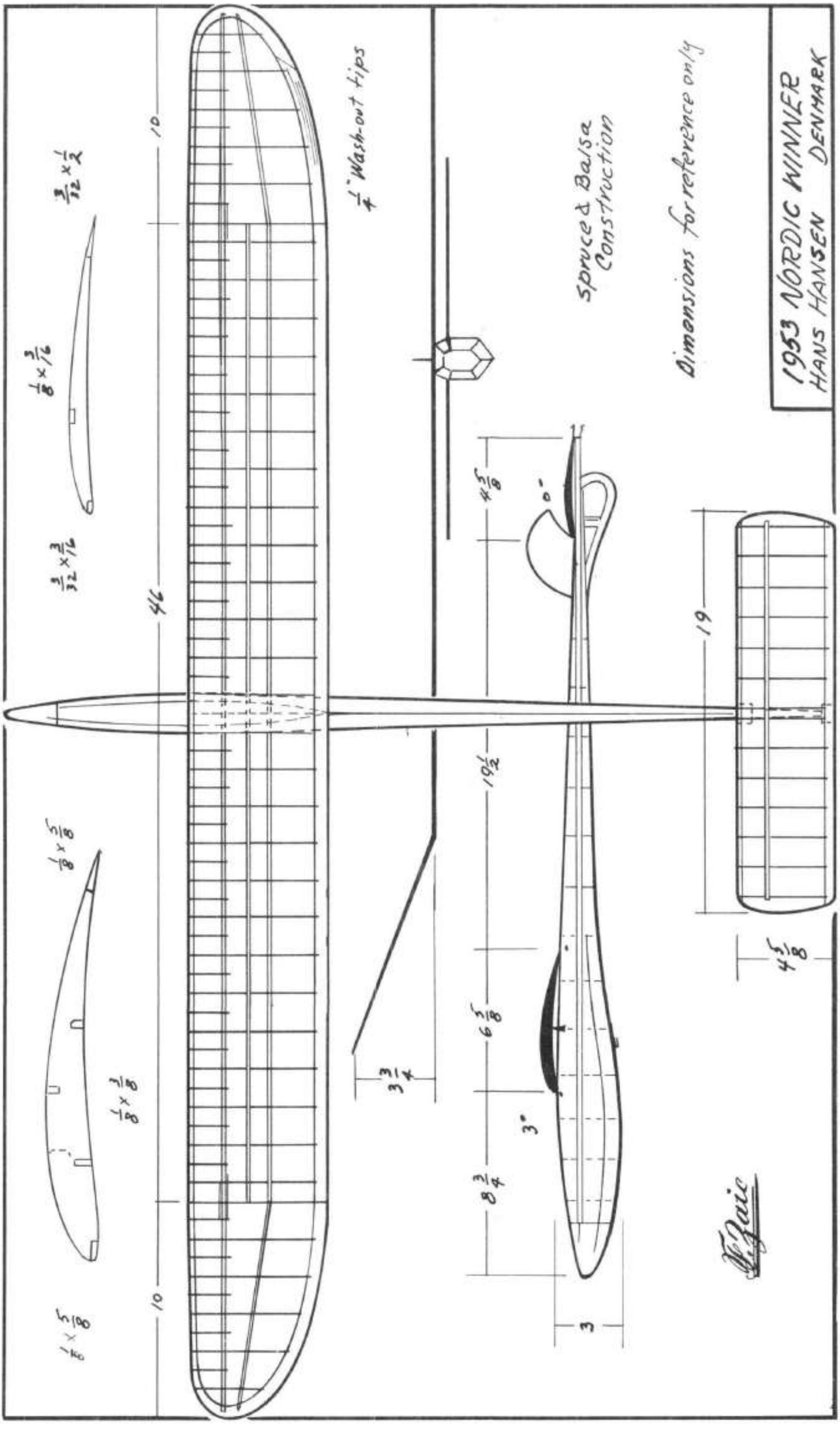

"LONG JOHN"
Built by Jim Watson
Designed by the Watsons
Projected Span 54 5/8"
10 7/8"
15"
4 1/2"
5"
2"
First Six Official Flights Avg. 4Min.
Spar 1/8" X 9/16
2 3/4"
Leading Edge 1/8" Sq
10 7/8"
15"
4 1/2"
15"
10 7/8"
Tips 3/32" Sheet
1/16" Sheet
1 1/2"
Trailing Edge 1/8" X 5/8"
Eiffel 400
17 1/2"
5 5/8"
1/8 Inc.
1/8 Sq.
2"
3 3/4"
Clark Y
0 Inc.
4"
5 1/4"
1/16 Sheet
3/16" Sq. Fuselage
10 5/8"
61 1/8"
2"
2° Dn. 2° Rt. Thrust
Only Entered In Two Contests Because A Change In Rules Outlawed 300 Sq. In. However, 1954 Rules Make Eligible Again.
Folding Prop. 2" X 3" X 18"
22 Str. 3/16" Br. 60", 1300 Turns
Wing Area 299.45 Sq. In.
Stab Area 120.00 Sq. In.
Required Weight 12 Oz.
Actual Weight 13.2 Oz.
3/8" Alum. Tube
2"
1/8" Toe In
1/32" Sheet
1/8" Sq.
1 3/8"
Adjustable Tab On Right Rudder Only
4"
30"
1/8" X 3/8"
3/32" X 3/8"
1ST Place 1951 "Internats"-Set Jr. Record.
1ST Place Waterloo Ia.-Betterd Record.

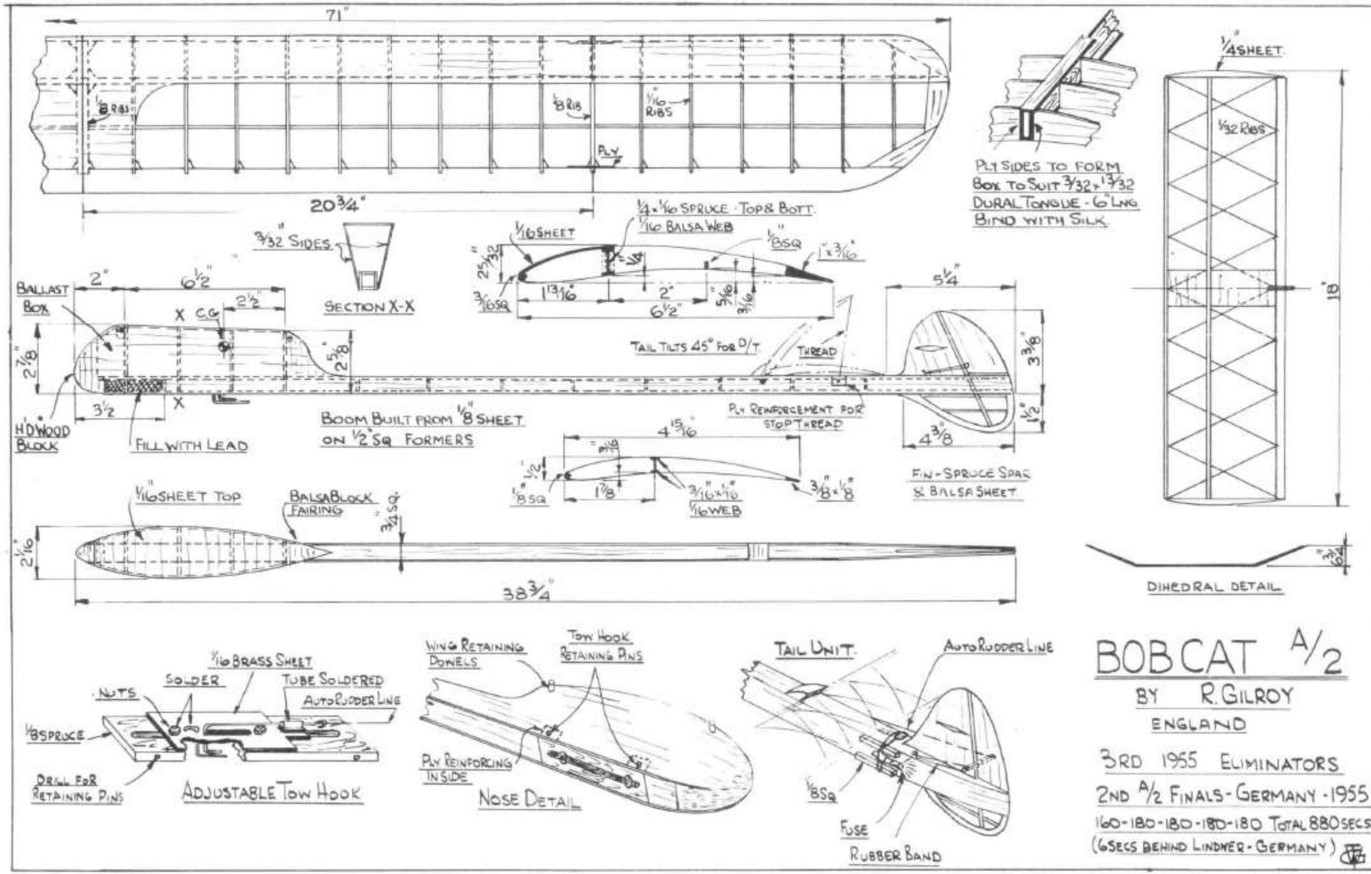

19" DIA SINGLE BLADE FOLDER - 12 STRANDS
1/4 x 1/24 DUNLOP RUBBER
36" LNG - 2 1/2 OZS
WEIGHT R.T.F. 6OZS
5" TIP
8" ROOT
D/T OPEN
RUBBER
D/T STOP THREAD
1/4 x 1/32 TOP & BOT.
THREAD BRACE HERE
C.G
1/4" APPROX
1/8 ROOT RIB
30°
L.E. 1/8 x 3/16
1/2 x 3/8 x 1/8 T.E.
1/16 SQ TOP & BOTTOM
1/32 SHEET VERT. GEN.
1/16 SQ TOP ONLY
1/8 x 1/16 DIAGS - OPTIONAL ANTI WARP BRACES
FLOWN FAST RIGHT SPIRAL CLIMB - LEFT GLIDE - VERY STABLE QUICK RECOVERY - GLIDE GOOD - 2-2 1/2 MINS. WITHOUT REAL THERMALS
BAND RETAINING TIP PASSES AROUND END PLATE AND OVER WING, HELD BY PINS.
1/8 x 1/32
1/16 RIBS
PIN
1/8 DOWEL & TUBES
1/32 x 1/8 TOP & BOT
1/32 SHEET - TOP ONLY
PIN
STOP BLOCK - PACK UNDER TO ADJUST TIP ANGLE
1/16 END PLATE CEMENT TO WING AFTER COVERING
G.WOOLLS
1/16 TIP
1/8 SHEET. S/LINE
1/16 RIBS
18° APPROX
5°
1/8 SHEET CELLULOID FACED
1/16 SHEET
3/16 SQ
1/16 SQ
TRIM MOUNT AFTER CHECK FLYING
1/16 SHEET
2" SPACING
1/8 SQUARE
31 5/8"
1/8 x 1/32 FORMING TWO COMPLETE SPIRALS - IN TENSION - OPTIONAL
D/T RELEASE BAND
1/16 SHEET D/T VANES HINGED AT REAR
WIRE HOOKS
RUBBER BAND
1/8 SHEET
1/16 SHEET VERT GEN.
1/8 SQ WING TONGUE
THREAD BRACING
BAMBOO BRACING ANCHOR
1954 TAILLESS RUBBER.
G.WOOLLS - BRISTOL - ENGLAND

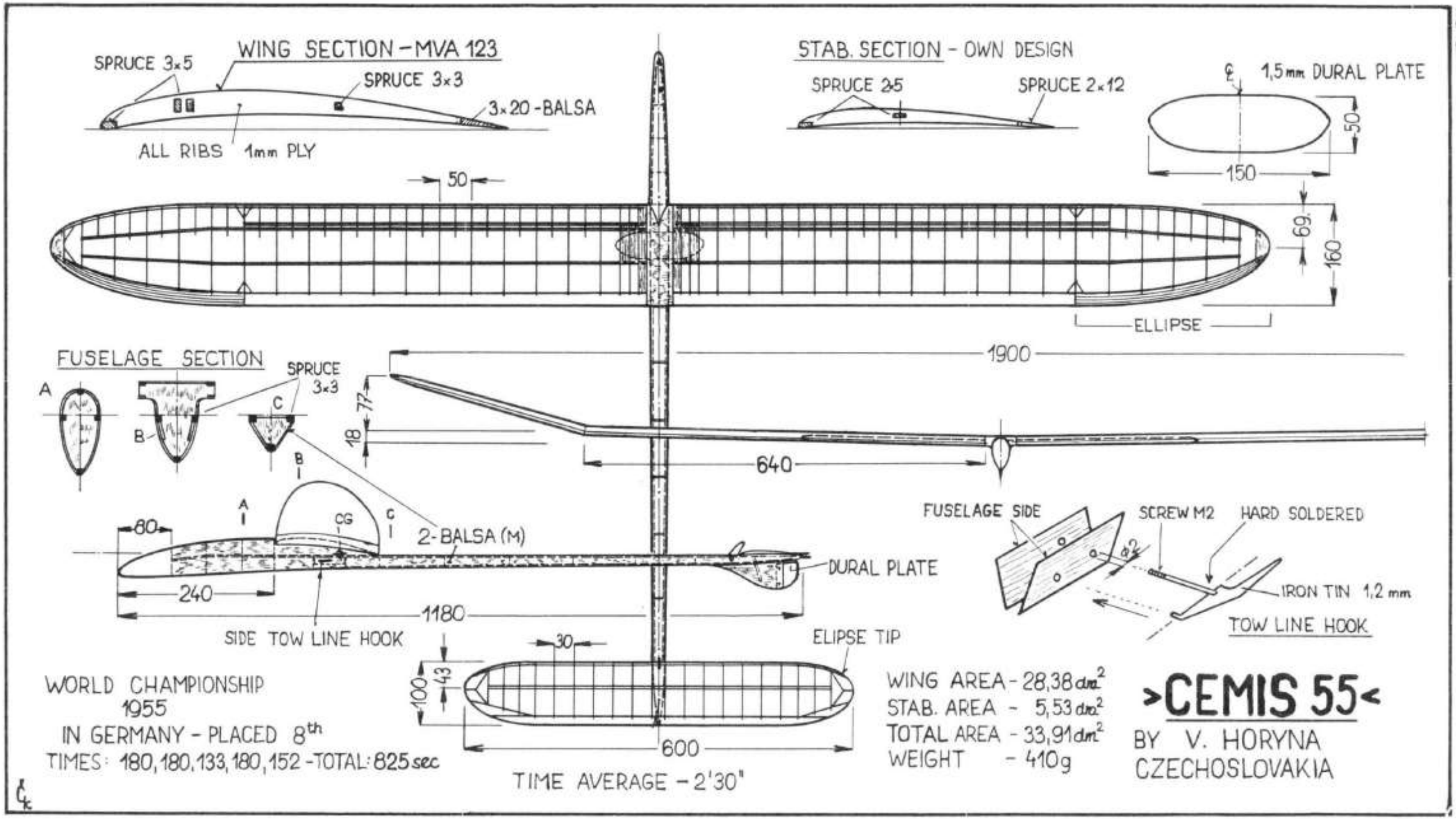


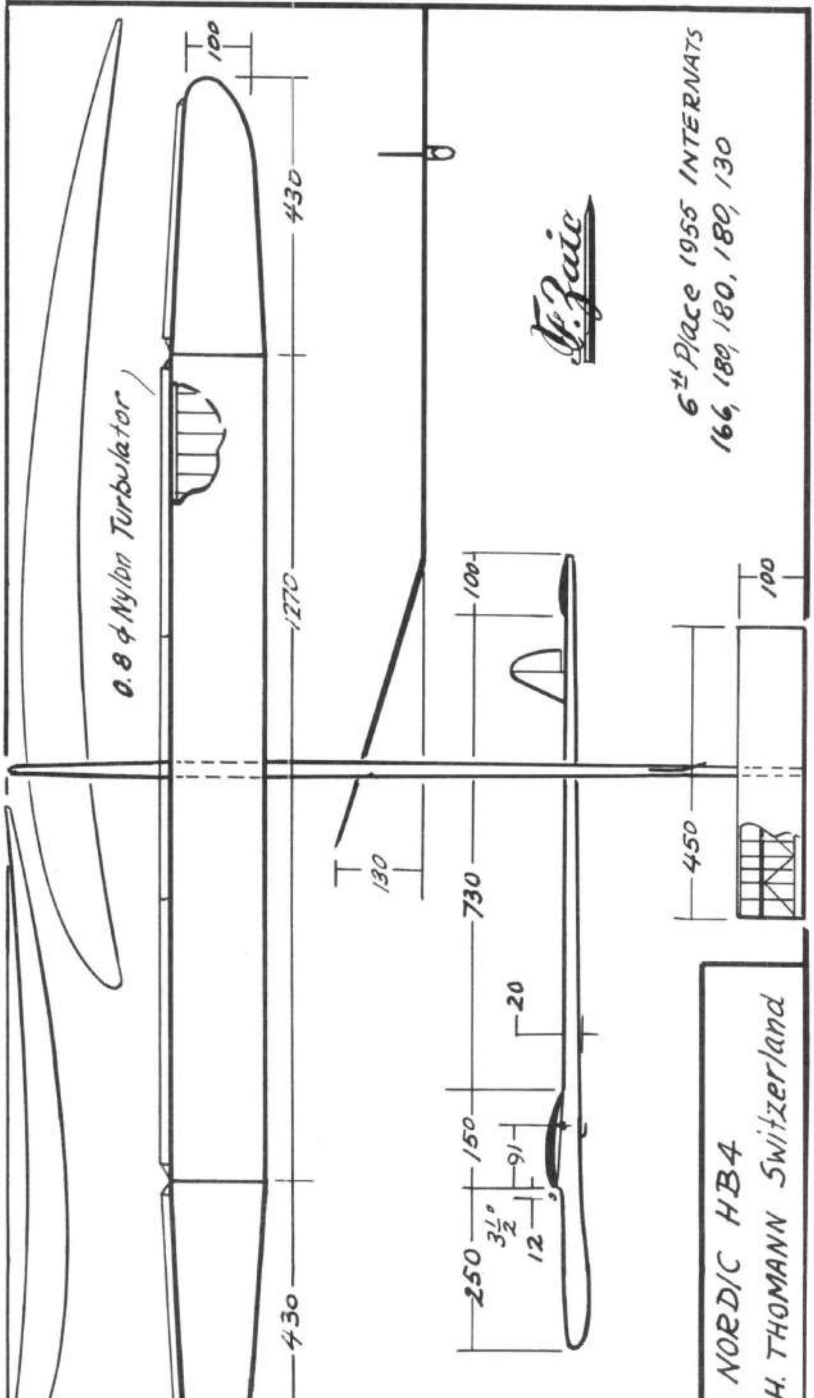
9/32 × 3/8
1/8 × 3/16 Pine
1/8 × 1 3/8 Med.
3/16 × 1/4
3/32 sq
3/32 × 1/2
3/32 × 7/32
38
38
1/16 Balsa
13
Dimensions for reference only
Model detailed in
9
F. Zaic
3
8 1/2
6 1/2
25 1/2
3 1/2
C.G. at 56%
+4°
Shape Round
3
2 1/4
61/64 sq in front
41/64 sq. in rear
2 Laminated Balsa Blocks
Hollowed
Stab 3° Washout at tip
Flights
180, 180, 170, 180, 166
24
FUSELAGE: 1/8 Sheet sides with
5/32 → 5/64 Corners
3 1/2
1955 NORDIC WINNER
RUDOLF LINDNER GERMANY


1954 NORDIC WINNER
R. LINDNER GERMANY
Dimensions for reference only
3x3 Pine Corners
3x12 Balsa Sides
Alum. Ferrule contains lead
56%
1925
165
785
190
350
165
560
100
60
3x5 Pine
2x2
7x10
3x35
2x5 Pine
1.5x1.5
6x5
2x12
F. Zaic


1953 NORDIC WINNER
HANS HANSEN DENMARK
Dimensions for reference only
Spruce & Balsa Construction
1/4" Wash-out tips
46
10
10
19
19 1/2
4 5/8
4 5/8
6 5/8
8 3/4
3
3 3/4
3°
0°
3/32 x 1/2
1/8 x 3/16
3/32 x 3/16
1/8 x 5/8
1/8 x 3/8

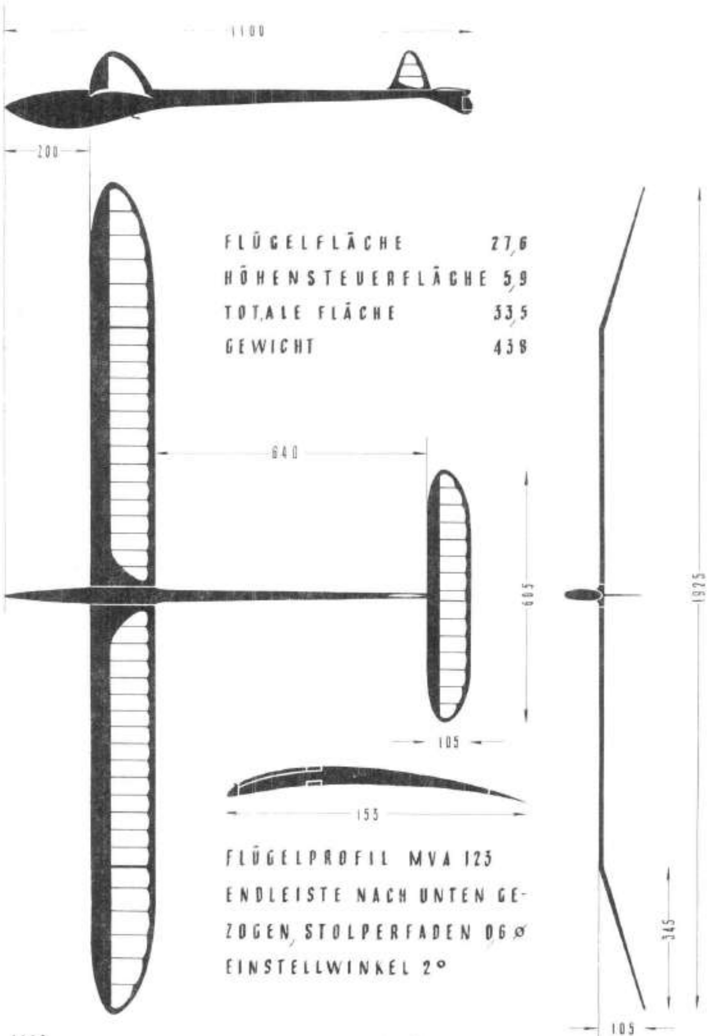

71"
1/8 RIBS
1/8 RIB
1/16 RIBS
PLY
20 3/4"
PLY SIDES TO FORM BOX TO SUIT 3/32 x 13/32 DURAL TONGUE - 6" LNG BIND WITH SILK
1/4" SHEET
1/32 RIBS
18"
3/32" SIDES
SECTION X-X
1/4 x 1/16 SPRUCE - TOP & BOTT.
1/16 BALSA WEB
1/16 SHEET
1/8" SQ
1" x 3/16"
25/32"
3/16 SQ
1 13/16
2"
6 1/2"
5/16
3/16
BALLAST BOX
2"
6 1/2"
2 1/2"
X
C.G.
2 7/8"
5/8"
2 3/8"
3 1/2
X
H'D WOOD BLOCK
FILL WITH LEAD
BOOM BUILT FROM 1/8" SHEET ON 1/2" SQ FORMERS
TAIL TILTS 45° FOR D/T.
THREAD
PLY REINFORCEMENT FOR STOP THREAD
5 1/4"
3 3/8"
1/2"
4 3/8"
FIN - SPRUCE SPAR & BALSA SHEET
4 15/16
1/2"
1/8" SQ
1 7/8
3/16" x 1/4"
1/16 WEB
3/8" x 1/8"
1/16" SHEET TOP
BALSA BLOCK FAIRING
3/4" SQ
2 1/16
38 3/4"
DIHEDRAL DETAIL
1/16 BRASS SHEET
SOLDER
TUBE SOLDERED
NUTS
AUTO RUDDER LINE
1/8 SPRUCE
DRILL FOR RETAINING PINS
ADJUSTABLE TOW HOOK
WING RETAINING DOWELS
TOW HOOK RETAINING PINS
PLY REINFORCING INSIDE
NOSE DETAIL
TAIL UNIT
AUTO RUDDER LINE
1/8 SQ
FUSE
RUBBER BAND
BOBCAT A/2
BY R. GILROY
ENGLAND
3RD 1955 ELIMINATORS
2ND A/2 FINALS - GERMANY - 1955
160-180-180-180-180 TOTAL 880 SECS
(6 SECS BEHIND LINDNER - GERMANY)


WING SECTION - MVA 123
SPRUCE 3×5
SPRUCE 3×3
3×20 - BALSA
ALL RIBS 1mm PLY
STAB. SECTION - OWN DESIGN
SPRUCE 2×5
SPRUCE 2×12
1,5 mm DURAL PLATE
50
150
69
160
ELLIPSE
1900
FUSELAGE SECTION
SPRUCE 3×3
A
B
C
77
18
640
80
CG
2-BALSA (M)
DURAL PLATE
240
1180
SIDE TOW LINE HOOK
FUSELAGE SIDE
SCREW M2
HARD SOLDERED
IRON TIN 1,2 mm
TOW LINE HOOK
30
43
100
600
ELIPSE TIP
WORLD CHAMPIONSHIP
1955
IN GERMANY - PLACED 8th
TIMES: 180, 180, 133, 180, 152 - TOTAL: 825 sec
TIME AVERAGE - 2'30"
WING AREA - 28,38 dm²
STAB. AREA - 5,53 dm²
TOTAL AREA - 33,91 dm²
WEIGHT - 410g
>CEMIS 55<
BY V. HORYNA
CZECHOSLOVAKIA


0.8 ⌀ Nylon Turbulator
430
1270
430
100
130
730
100
20
150
91
$3\frac{1}{2}°$
12
250
450
100
F. Zaic
6th Place 1955 INTERNATS
166, 180, 180, 180, 130
NORDIC HB4
H.H. THOMANN Switzerland

URANIA 138

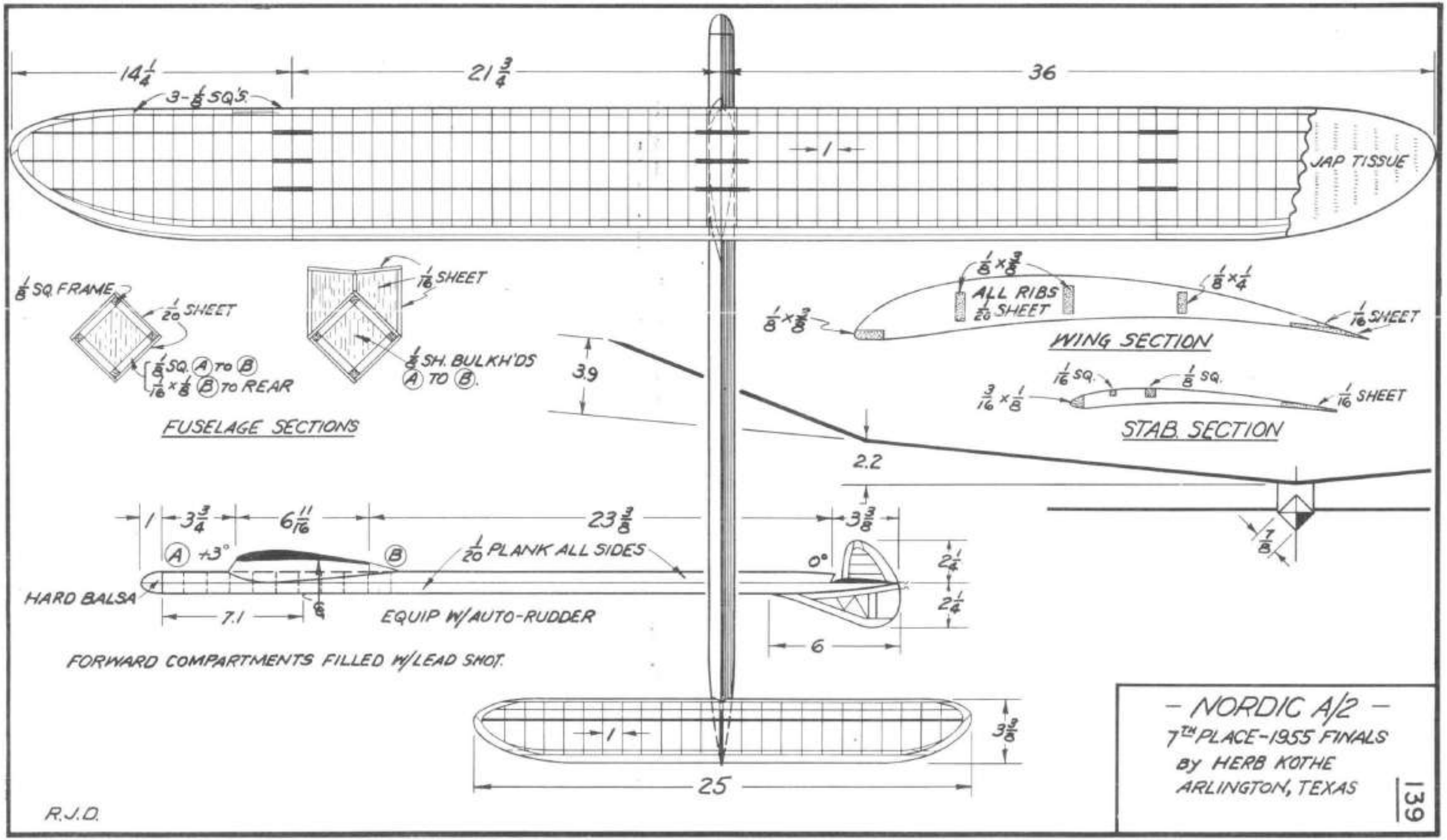
A2 MODELL, KONSTRUIERT VON HANS EGE



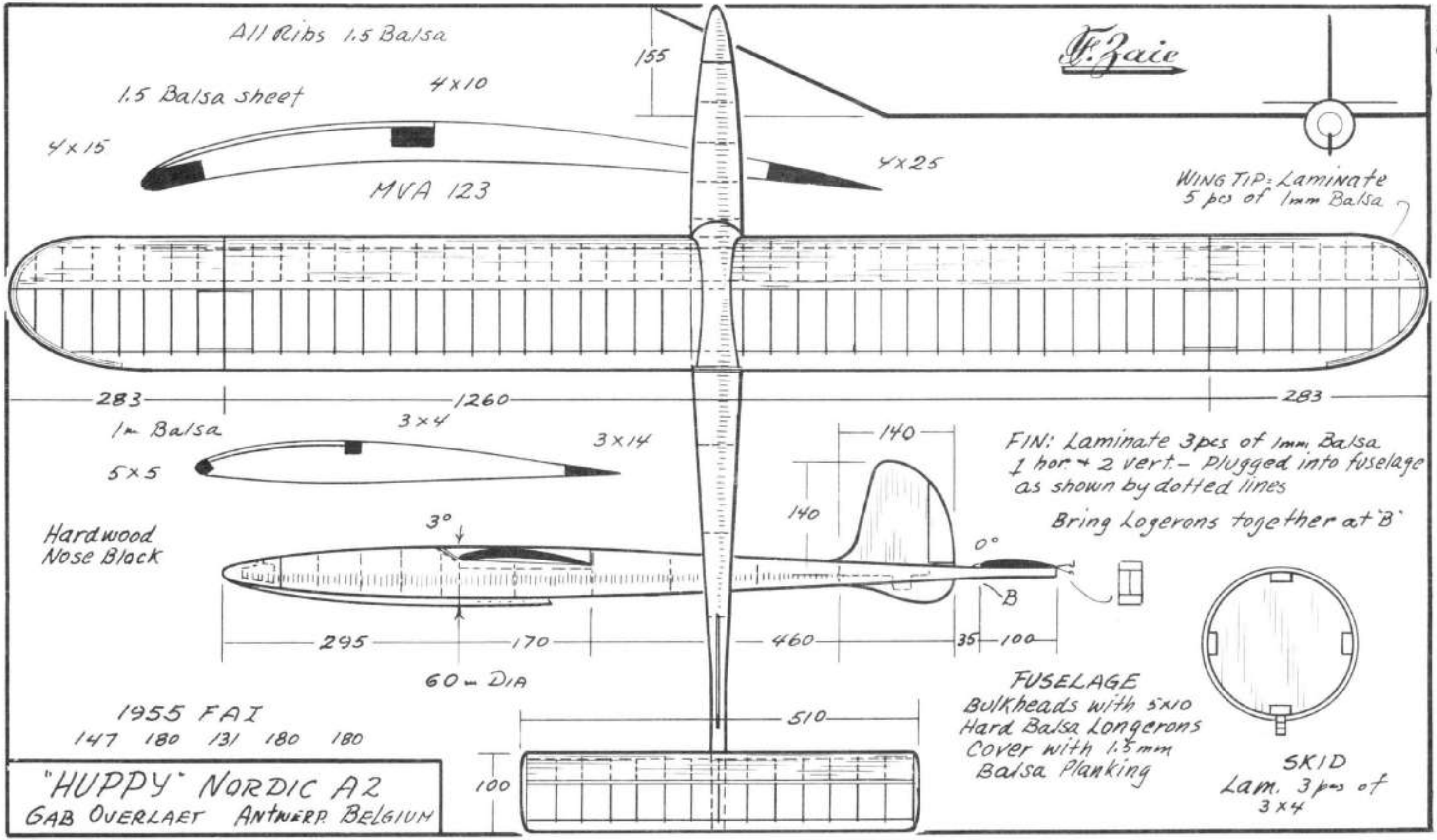
FLÜGELFLÄCHE 27,6
HÖHENSTEUERFLÄCHE 5,9
TOTALE FLÄCHE 33,5
GEWICHT 438

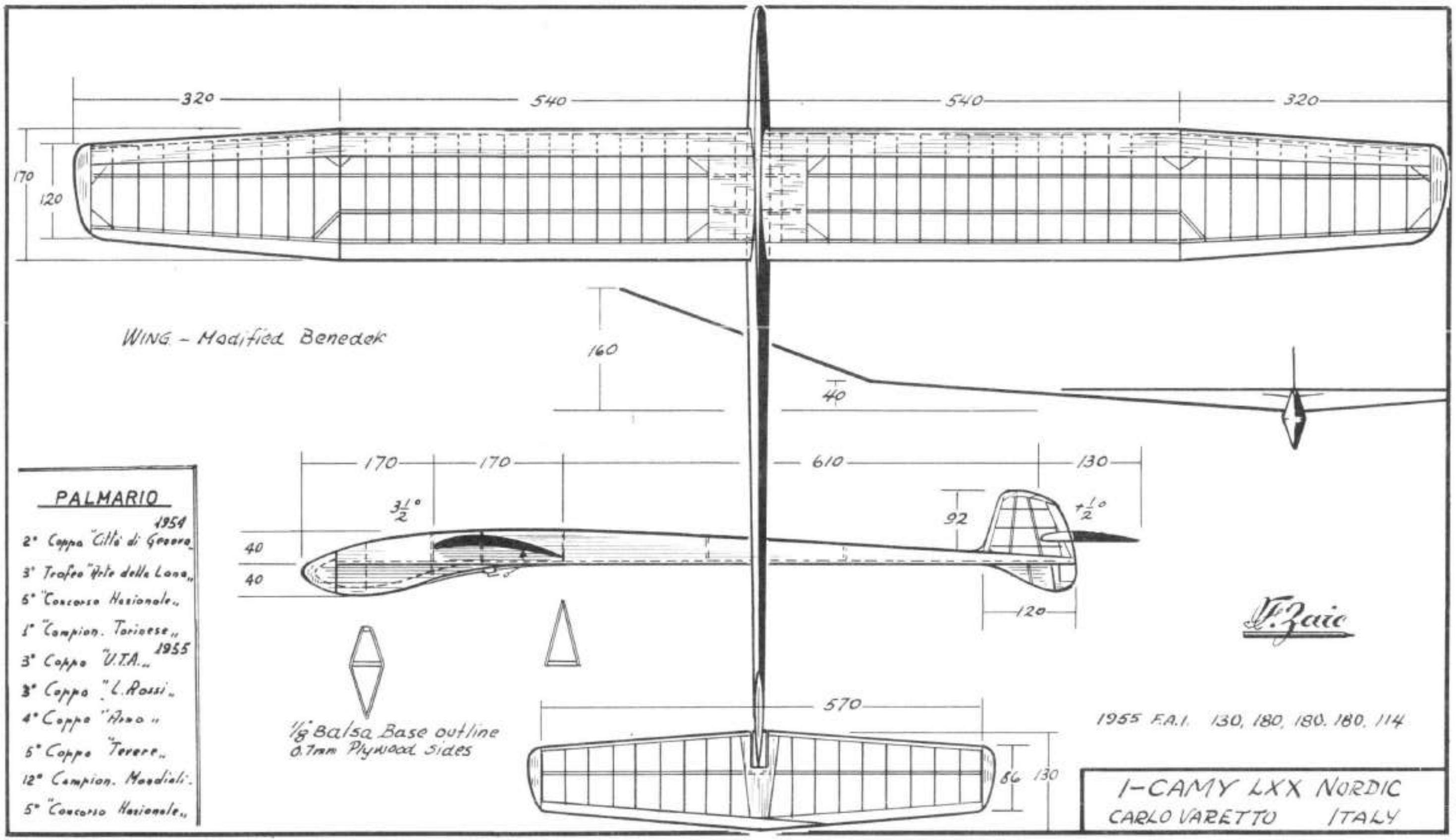
FLÜGELPROFIL MVA 123
ENDLEISTE NACH UNTEN GE-
ZOGEN, STOLPERFADEN 0,6 ø
EINSTELLWINKEL 2°

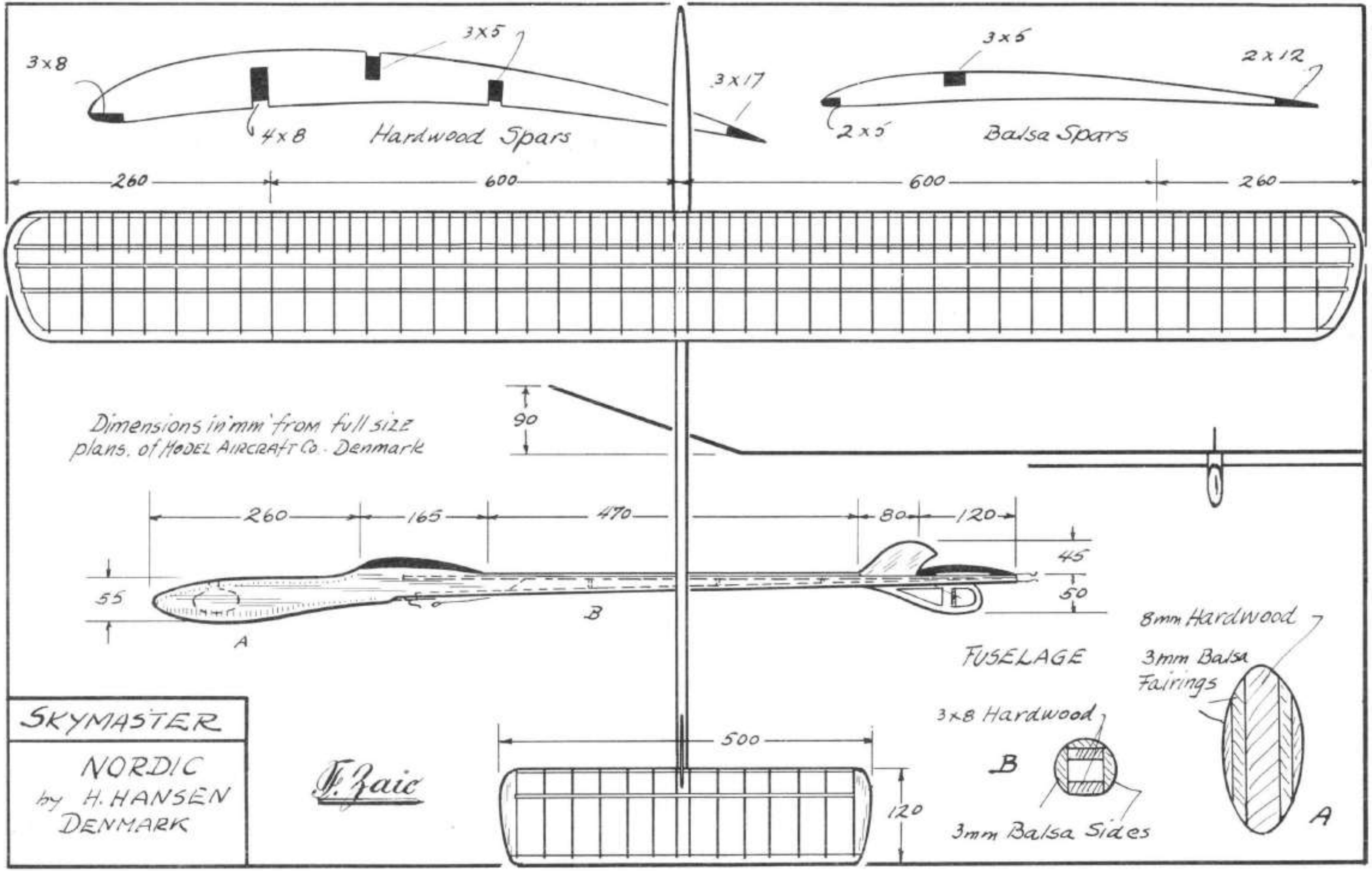
MASSTAB 1:10

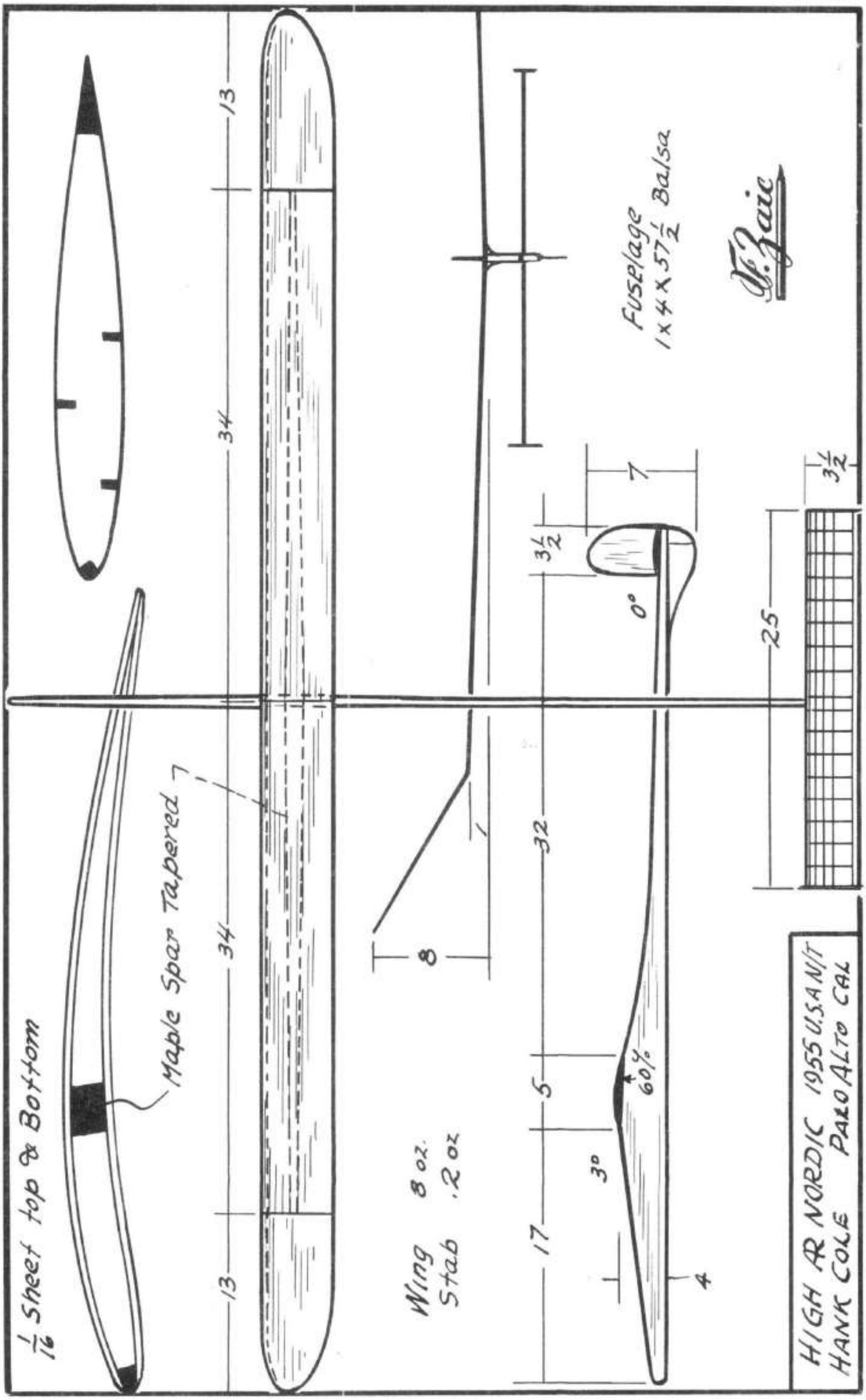


14 1/4
21 3/4
36
3-1/8 SQ'S.
1
JAP TISSUE
1/8 SQ. FRAME
1/20 SHEET
1/8 SQ. (A) TO (B)
1/16 x 1/8 (B) TO REAR
1/16 SHEET
1/8 SH. BULKH'DS (A) TO (B).
FUSELAGE SECTIONS
3.9
2.2
1/8 x 3/8
ALL RIBS 1/20 SHEET
1/8 x 1/4
1/8 x 3/8
1/16 SHEET
WING SECTION
1/16 SQ.
1/8 SQ.
3/16 x 1/8
1/16 SHEET
STAB. SECTION
7/8
1
3 3/4
6 11/16
23 3/8
3 3/8
(A) +3°
(B)
1/20 PLANK ALL SIDES
0°
2 1/4
2 1/4
HARD BALSA
7.1
CG
EQUIP W/AUTO-RUDDER
6
FORWARD COMPARTMENTS FILLED W/LEAD SHOT.
1
3 3/8
25
R.J.D.
- NORDIC A/2 -
7TH PLACE-1955 FINALS
BY HERB KOTHE
ARLINGTON, TEXAS

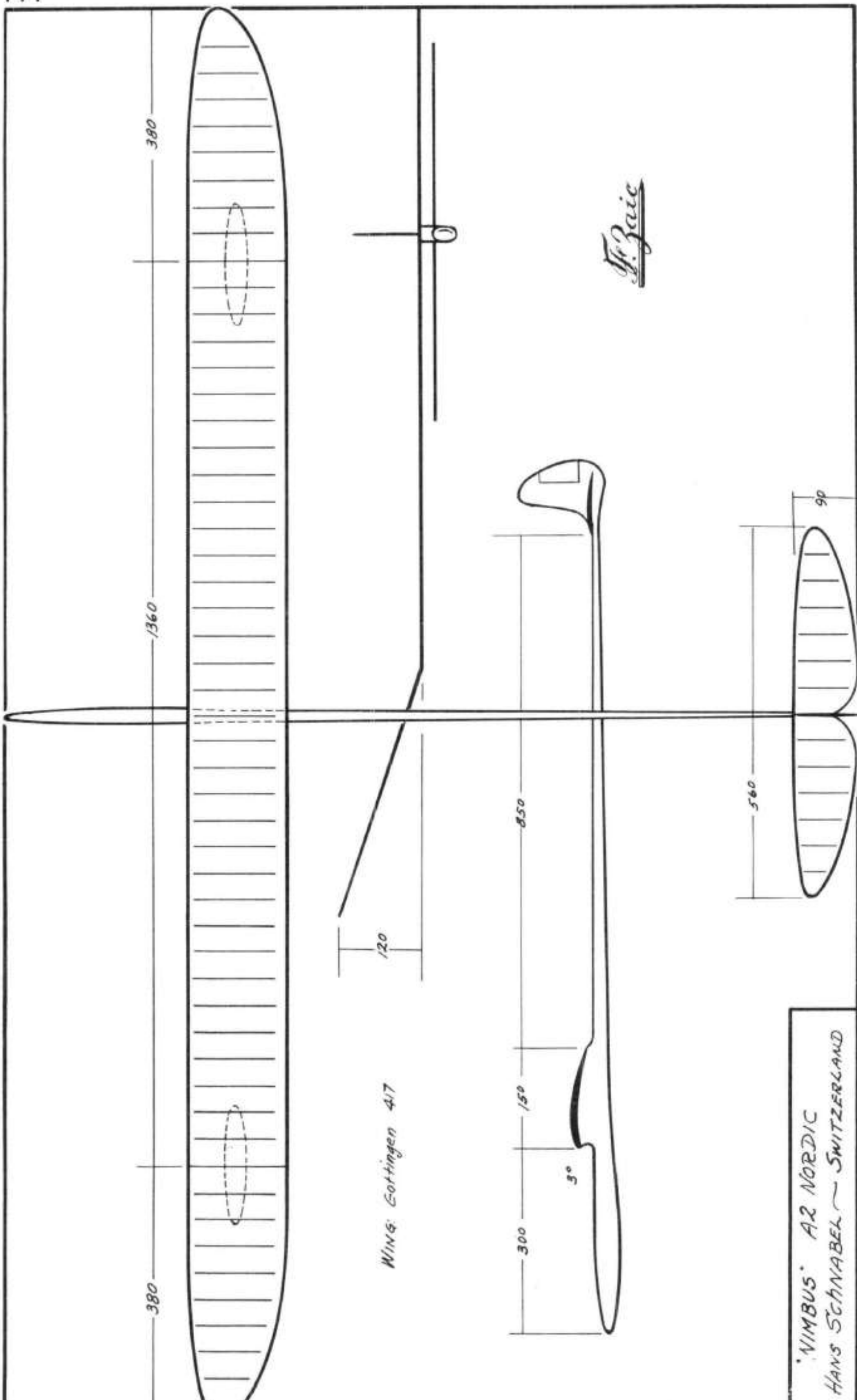

All Ribs 1.5 Balsa
1.5 Balsa sheet
4x10
4x15
4x25
MVA 123
155
F. Zaic
WING TIP: Laminate 5 pcs of 1mm Balsa
283
1260
283
1m Balsa
3x4
3x14
5x5
140
140
FIN: Laminate 3pcs of 1mm Balsa 1 hor. + 2 vert. - Plugged into fuselage as shown by dotted lines
Bring Logerons together at "B"
Hardwood Nose Block
3°
0°
B
295
170
460
35
100
60 m DIA
FUSELAGE
Bulkheads with 5x10 Hard Balsa Longerons Cover with 1.5mm Balsa Planking
1955 FAI
147 180 131 180 180
510
100
SKID
Lam. 3 pcs of 3x4
"HUPPY" NORDIC A2
GAB OVERLAET ANTWERP BELGIUM

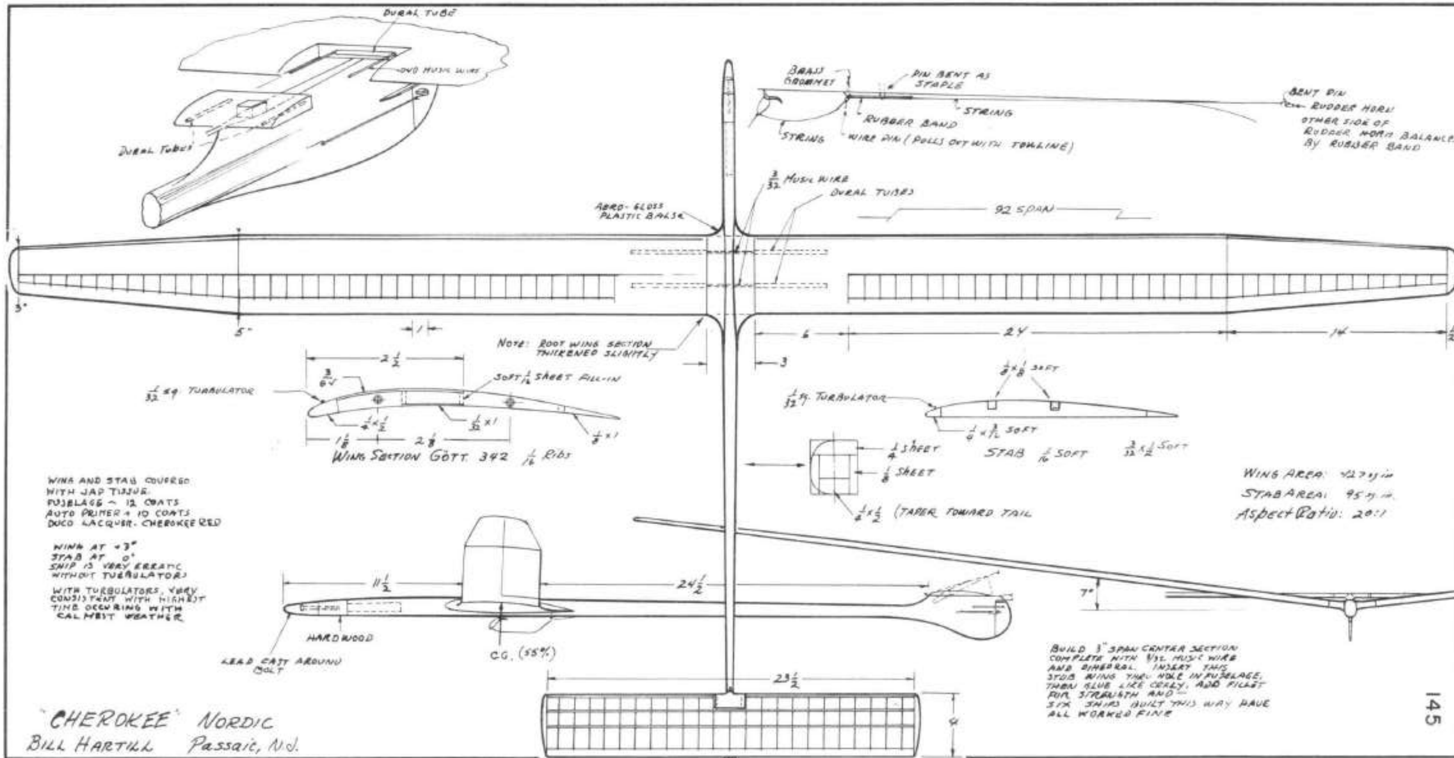

320
540
540
320
170
120
WING - Modified Benedek
160
40
170
170
610
130
$3\frac{1}{2}°$
92
$+\frac{1}{2}°$
40
40
120
PALMARIO
1954
2° Coppa "Città di Genova"
3° Trofeo "Arte della Lana"
6° "Concorso Nazionale"
1° "Campion. Torinese" 1955
3° Coppa "U.T.A."
3° Coppa "L. Rossi"
4° Coppa "Arno"
5° Coppa "Tevere"
12° Campion. Mondiali
5° "Concorso Nazionale"
1/8 Balsa Base outline
0.7mm Plywood sides
570
86
130
1955 F.A.I. 130, 180, 180, 180, 114
I-CAMY LXX NORDIC
CARLO VARETTO ITALY

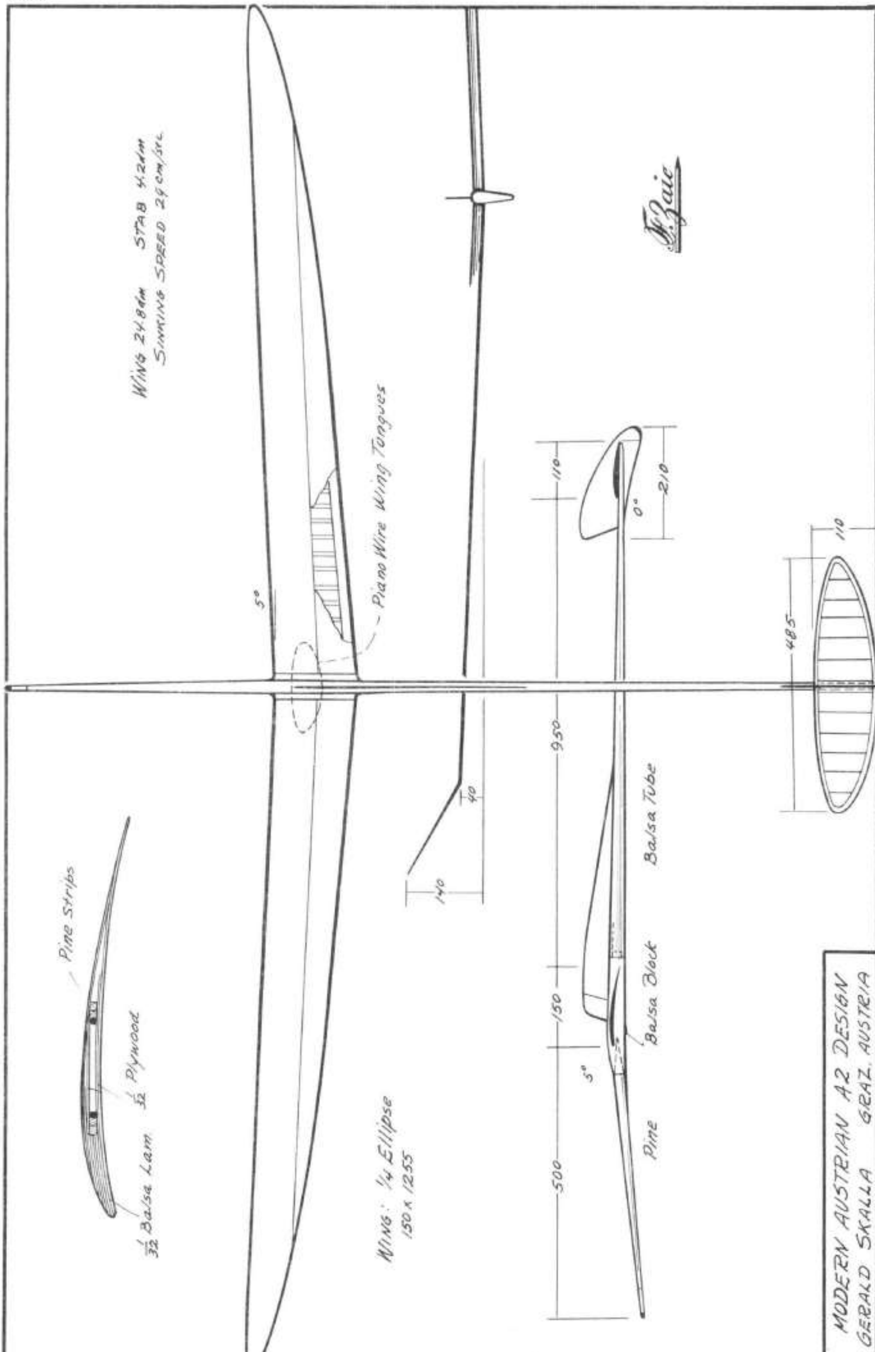

3x8
3X5
3x17
4x8
Hardwood Spars
3x5
2x12
2x5
Balsa Spars
260
600
600
260
90
Dimensions in 'mm' from full size plans. of MODEL AIRCRAFT Co. Denmark
260
165
470
80
120
45
55
50
B
A
FUSELAGE
8mm Hardwood
3mm Balsa Fairings
SKYMASTER
NORDIC
by H. HANSEN
DENMARK
F. Zaic
500
120
3x8 Hardwood
B
3mm Balsa Sides
A



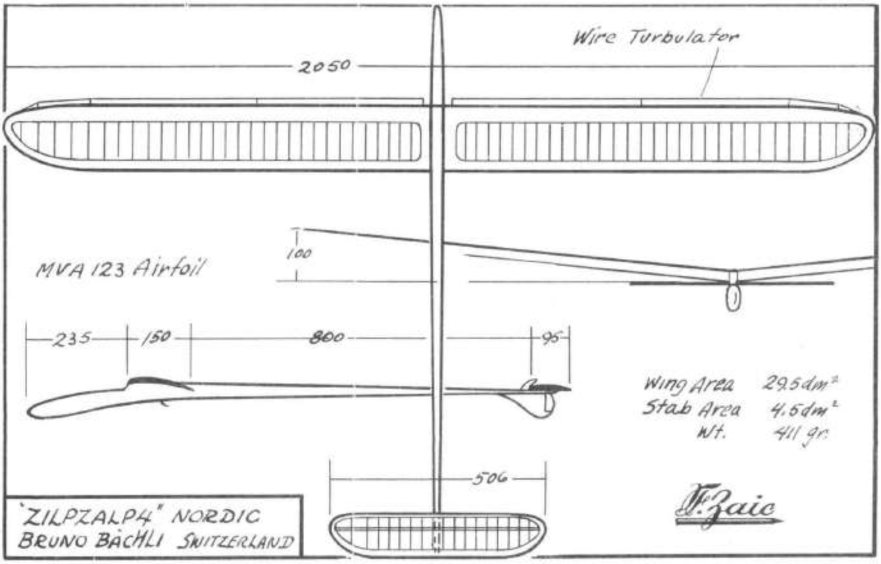
1/16 Sheet top & Bottom
Maple Spar Tapered
13
34
34
13
Wing 8 oz.
Stab .2 oz
Fuselage 1 x 4 x 57½ Balsa
8
17
5
32
60%
3°
4
0°
3½
7
25
3½
HIGH AR NORDIC 1955 U.S.A N/T
HANK COLE PALO ALTO CAL

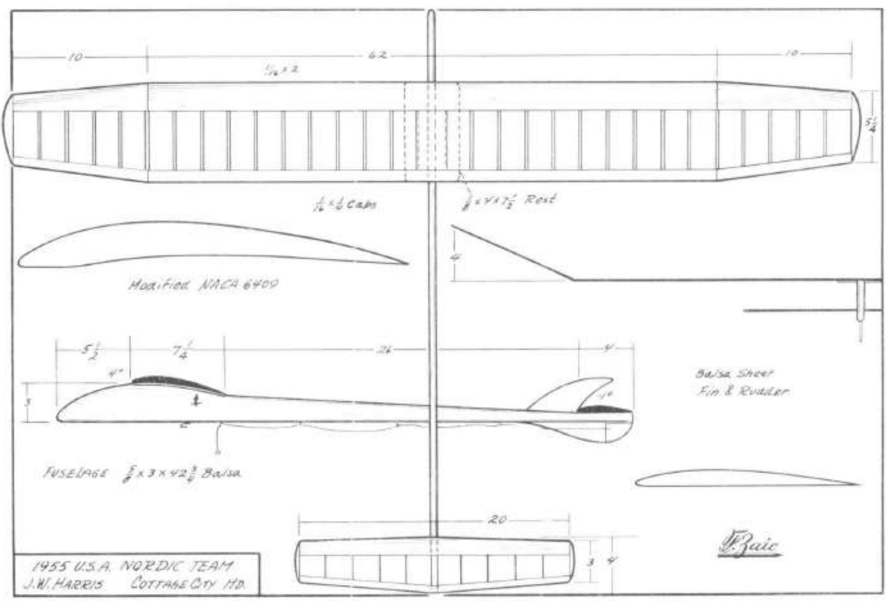

380
1360
380
120
WING: Gottingen 417
850
150
300
3°
560
90
'NIMBUS' A2 NORDIC
HANS SCHNABEL ~ SWITZERLAND

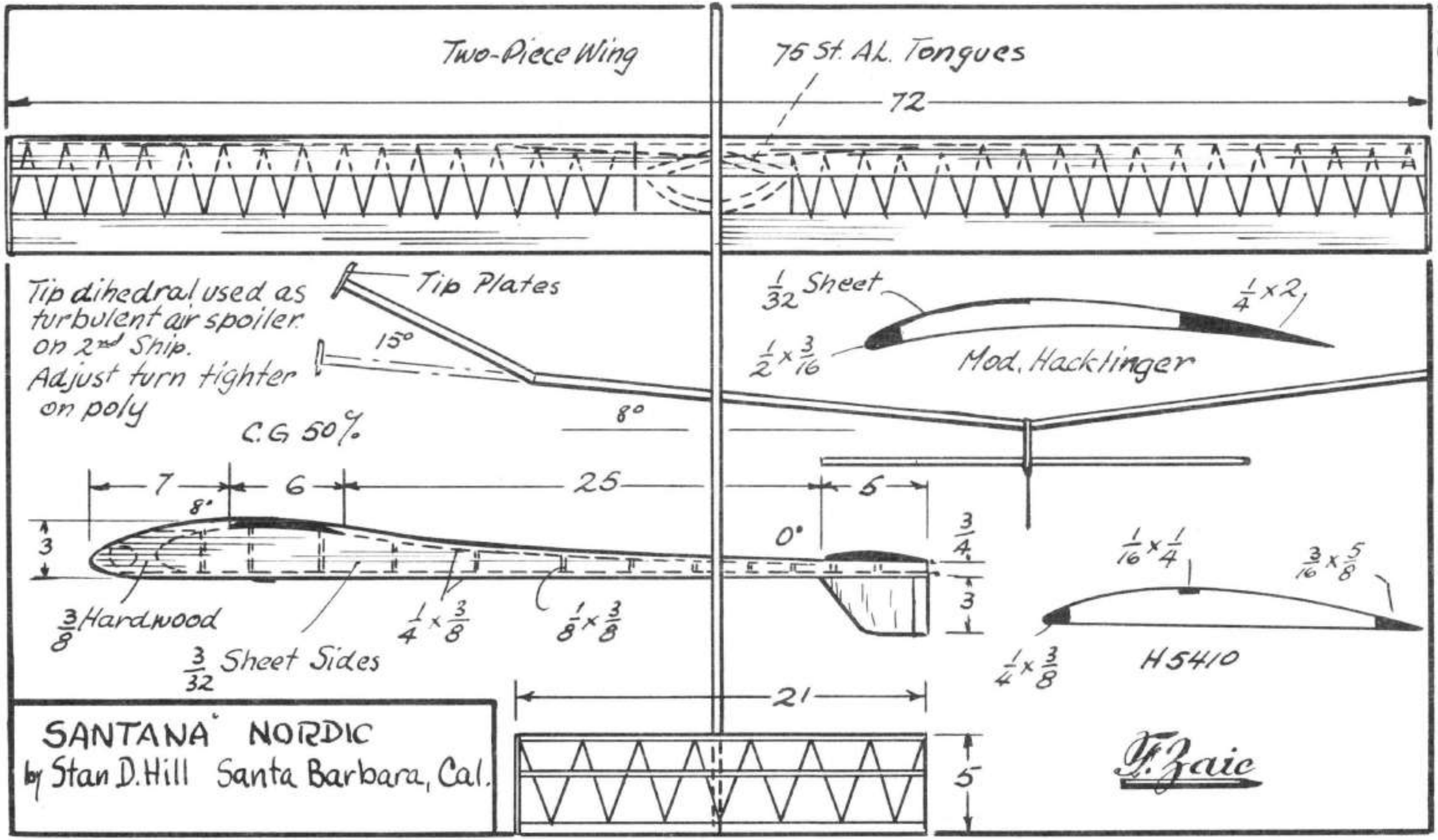

DURAL TUBE
OVD MUSIC WIRE
DURAL TUBES
BRASS GROMMET
PIN BENT AS STAPLE
STRING
RUBBER BAND
WIRE PIN (PULLS OFF WITH TOWLINE)
BENT PIN
RUDDER HORN
OTHER SIDE OF RUDDER HORN BALANCED BY RUBBER BAND
$\frac{3}{32}$ MUSIC WIRE
DURAL TUBES
AERO-GLOSS PLASTIC BALSA
92 SPAN
NOTE: ROOT WING SECTION THICKENED SLIGHTLY
$\frac{1}{32}$ SQ. TURBULATOR
SOFT $\frac{1}{16}$ SHEET FILL-IN
WING SECTION GÖTT. 342 $\frac{1}{16}$ RIBS
STAB $\frac{1}{16}$ SOFT
$\frac{1}{4}$ SHEET
$\frac{1}{8}$ SHEET
$\frac{1}{4}$ x $\frac{1}{2}$ (TAPER TOWARD TAIL
WING AREA: 427 sq in
STAB AREA: 95 sq in
Aspect Ratio: 20:1
WING AND STAB COVERED WITH JAP TISSUE.
FUSELAGE ~ 12 COATS AUTO PRIMER + 10 COATS DUCO LACQUER. CHEROKEE RED
WING AT +3°
STAB AT 0°
SHIP IS VERY ERRATIC WITHOUT TURBULATORS
WITH TURBULATORS, VERY CONSISTENT WITH HIGHEST TIME OCCURING WITH CALMEST WEATHER
HARDWOOD
LEAD CAST AROUND BOLT
C.G. (55%)
BUILD 3" SPAN CENTER SECTION COMPLETE WITH 3/32 MUSIC WIRE AND DIHEDRAL. INSERT THIS STUB WING THRU HOLE IN FUSELAGE, THEN GLUE LIKE CRAZY, AND FILLET FOR STRENGTH AND—
SIX SHIPS BUILT THIS WAY HAVE ALL WORKED FINE
"CHEROKEE" NORDIC
BILL HARTILL Passaic, N.J.

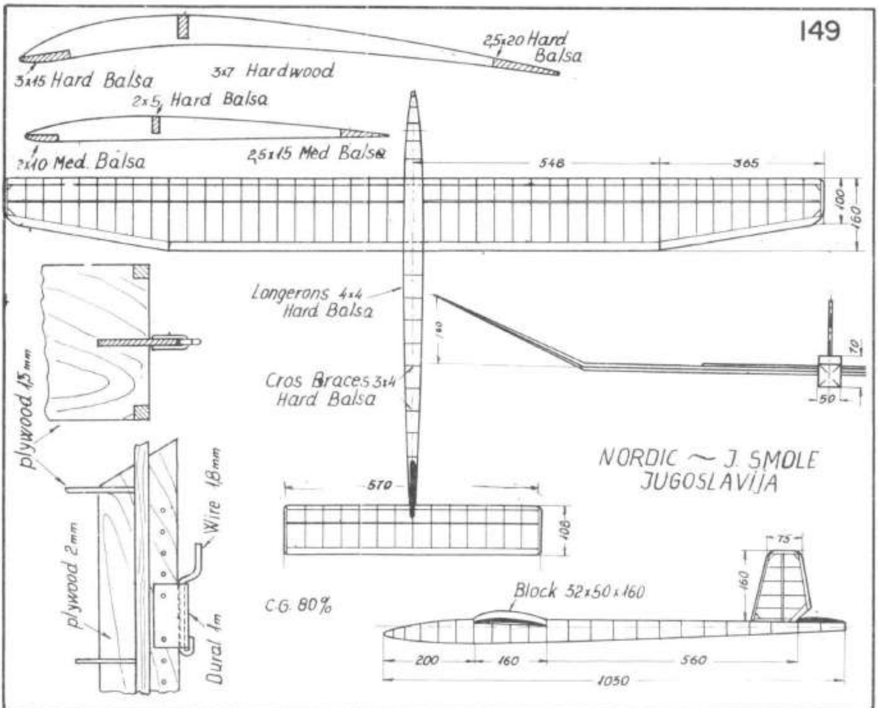


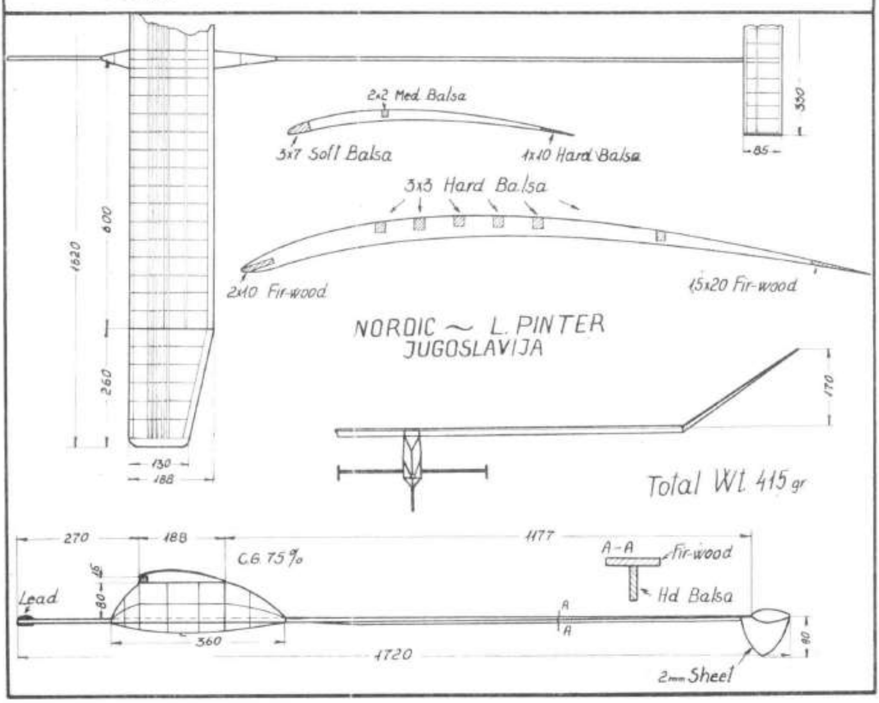
WING 24.84dm STAB 4.2dm
SINKING SPEED 29 cm/sec
Piano Wire Wing Tongues
5°
Pine Strips
1/32 Plywood
1/32 Balsa Lam.
WING: 1/4 Ellipse
150 x 1255
140
40
110
210
0°
110
485
950
Balsa Tube
Balsa Block
150
5°
Pine
500
MODERN AUSTRIAN A2 DESIGN
GERALD SKALLA GRAZ, AUSTRIA

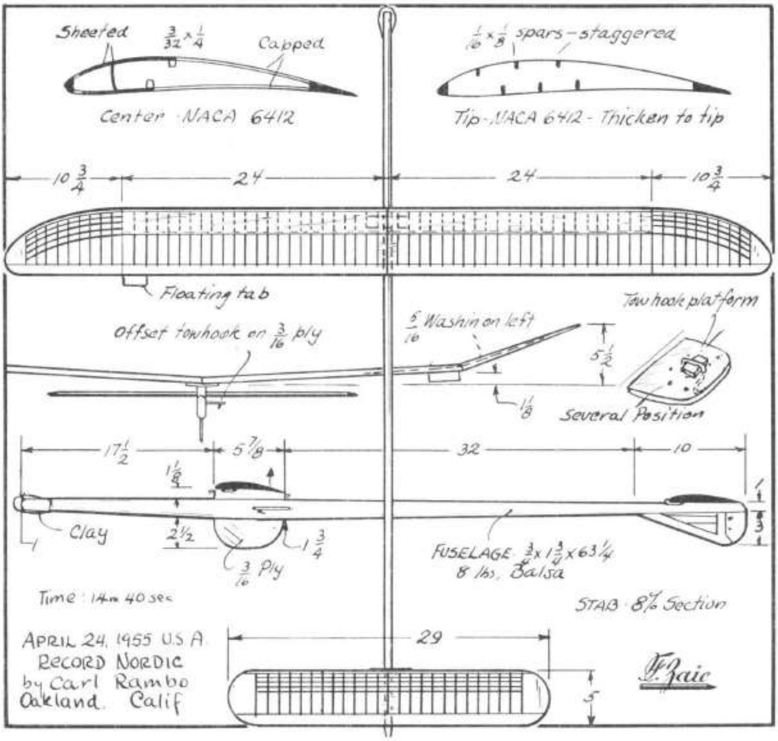

Wire Turbulator
2050
100
MVA 123 Airfoil
235
150
800
95
Wing Area 29.5 dm²
Stab Area 4.5 dm²
Wt. 411 gr.
506
"ZILPZALP4" NORDIC
BRUNO BÄCHLI SWITZERLAND
F. Zaic


10
62
10
Modified NACA 6409
Balsa Sheet
Fin & Rudder
20
1955 U.S.A. NORDIC TEAM
J.W. HARRIS COTTAGE CITY MD.
F. Zaic


Two-Piece Wing
75 St. AL. Tongues
72
Tip Plates
Tip dihedral used as turbulent air spoiler on 2nd Ship. Adjust turn tighter on poly
15°
8°
1/32 Sheet
1/4 x 2
1/2 x 3/16
Mod. Hacklinger
C.G 50%
7
6
25
5
8°
0°
3
3/4
3
3/8 Hardwood
3/32 Sheet Sides
1/4 x 3/8
1/8 x 3/8
1/16 x 1/4
3/16 x 5/8
1/4 x 3/8
H5410
21
5
SANTANA NORDIC
by Stan D. Hill Santa Barbara, Cal.
F. Zaic


3x15 Hard Balsa
3x7 Hardwood
2,5x20 Hard Balsa
2x5 Hard Balsa
2x10 Med. Balsa
2,5x15 Med Balsa
548
365
100
160
Longerons 4x4 Hard Balsa
Cros Braces 3x4 Hard Balsa
plywood 1,5 mm
plywood 2 mm
Wire 1,8 mm
Dural 1 m
70
50
NORDIC ~ J. SMOLE
JUGOSLAVIJA
570
108
C.G. 80%
Block 32x50x160
75
160
200
160
560
1050


2x2 Med Balsa
3x7 Soft Balsa
1x10 Hard Balsa
330
85
3x3 Hard Balsa
2x10 Fir-wood
1,5x20 Fir-wood
1620
800
260
130
188
NORDIC ~ L. PINTER
JUGOSLAVIJA
170
Total Wt. 415 gr
270
188
1177
C.G. 75%
A-A
Fir-wood
Hd Balsa
Lead
80
45
360
1720
80
2 mm Sheet



CARL RAMBO (Oakland, Calif.) May 25, 1955

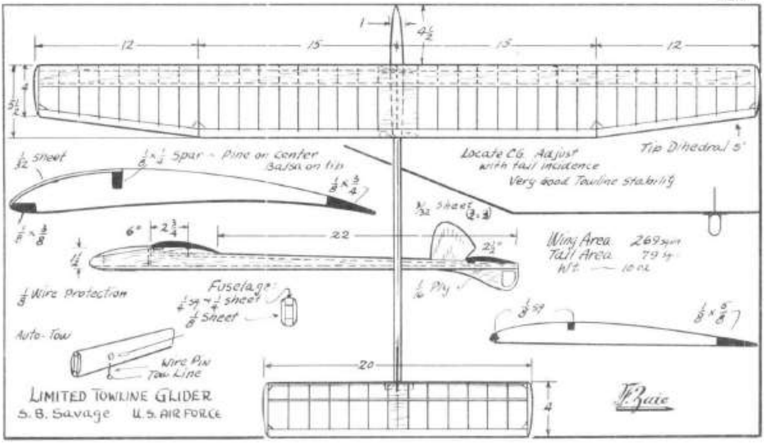
In response to your request for material this info on my Nordic is forwarded. It may have the Open Nordic record of 14:42 established at Sacramento April 24th. I do not believe the time till stand up through all the elims coming up this year. Time was set in extremely windy and cold weather with perfect and a 2:42 (which was the result of an early DT setting to save myself a lot of chasing in the wind).

Basically, the glider is a version of Don Foote's "Westerner". Originally the ship had no rudder and depended upon wing's washin for turn. O.K. at fixed gliding speed but upon increase of speed in thermal, it would open up and stall. My damper (I hate to call it a rudder) has little effect at normal speeds, but the tab takes hold at higher speeds and helps counteract opening up effect mentioned. At normal speeds the model is uneffected by fin as I can remove it or leave it on without noticeable change. The amount of fin area shown is not necessary for the glider but for rudder to aid towing.

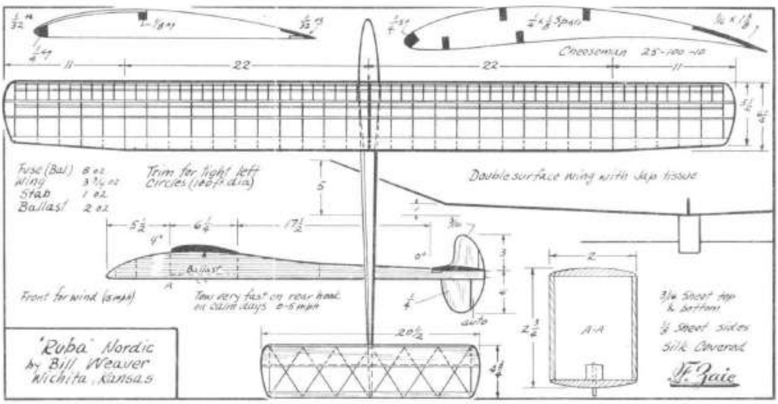
I used washin in left wing for left turn (built-in) and the tab on fin is small enough that it only becomes effective at higher thermal speeds to aid in maintaining constant turning radius. This is a cut and try proposition.

I am approaching a stable turn from the other end of the adjusting process. Most people put on a big rudder with turn and then twist washin into the wing to keep from spinning. I hope you to see the fine distinction here.

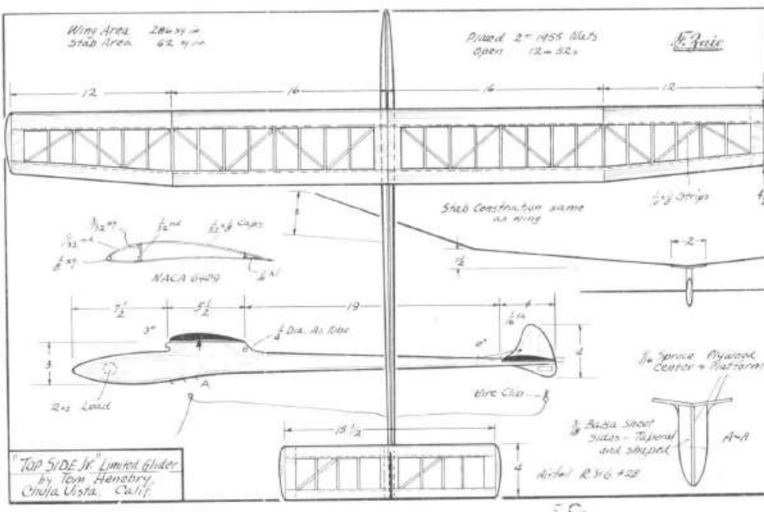
The key under the wing platform is what I think of as a pivoting keel. A large vertical area near the pivoting axis of the ship. Something for the wing wash to lever against without skidding the ship. As a secondary feature it makes a nice landing skid.



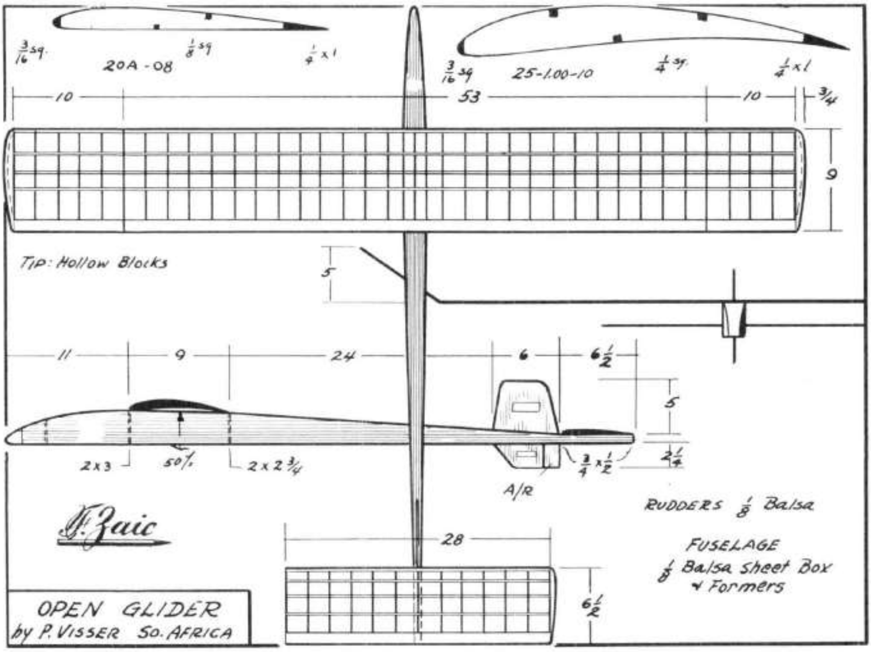
Spar - Pine on center
Balsa on tip
Locate C.G. Adjust with tail incidence
Very good Towline stability
Tip Dihedral 5"
Wing Area 269 sq in
Tail Area 79 sq
Wt. 10 oz
Wire protection
Fuselage
Auto-Tow
Wire Pin
Tow Line
LIMITED TOWLINE GLIDER
S. B. Savage U. S. AIR FORCE
F. Zaic

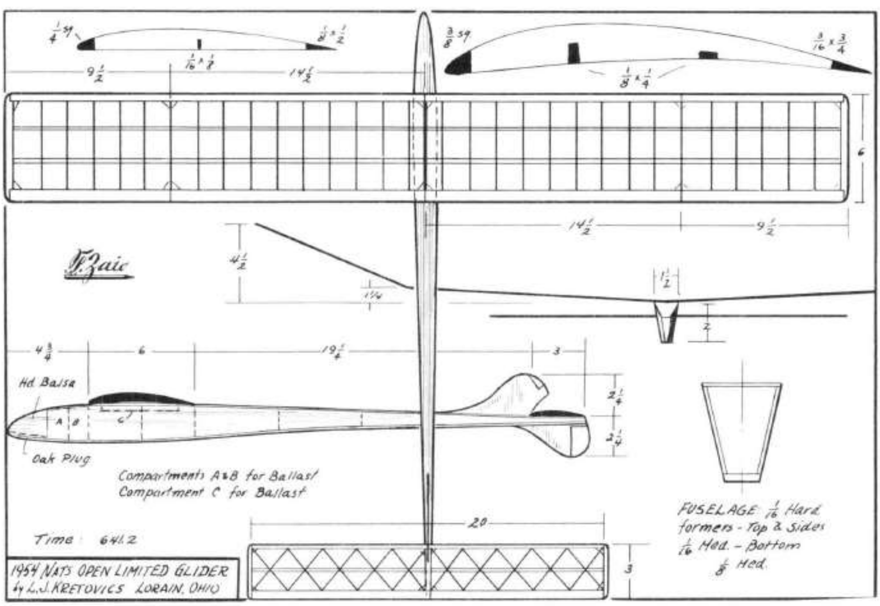


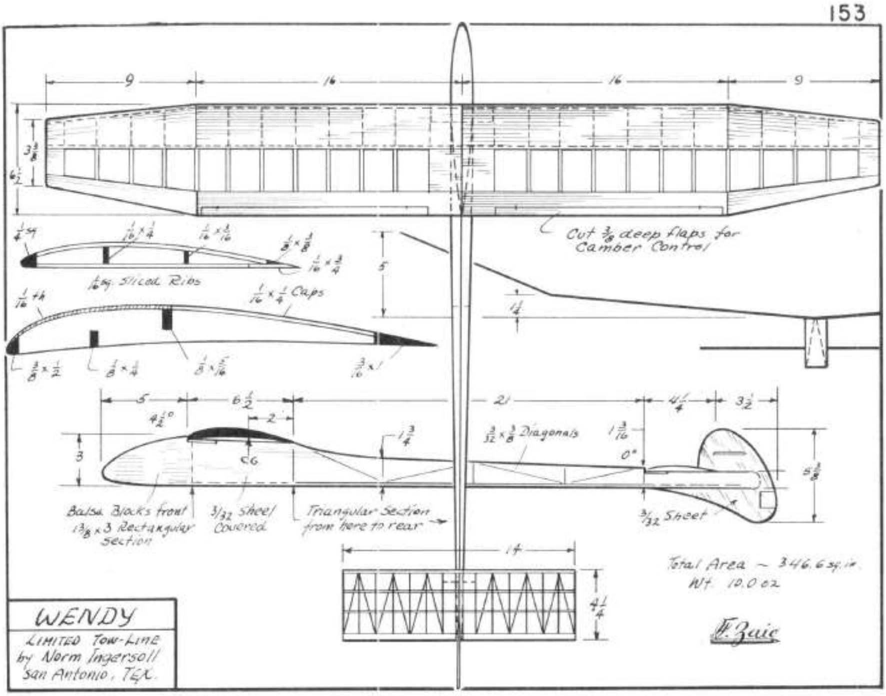
Cheeseman 25-100-10
Fuse (Bal) 8 oz
Wing 3 3/4 oz
Stab 1 oz
Ballast 2 oz
Trim for tight left circles (100 ft dia)
Double surface wing with Jap tissue
Ballast
Front for wind (5 mph)
Tow very fast on rear hook on calm days 0-5 mph
auto
A-A
3/16 Sheet top & bottom
1/8 Sheet sides
Silk Covered
"Ruba" Nordic
by Bill Weaver
Wichita, Kansas
F. Zaic

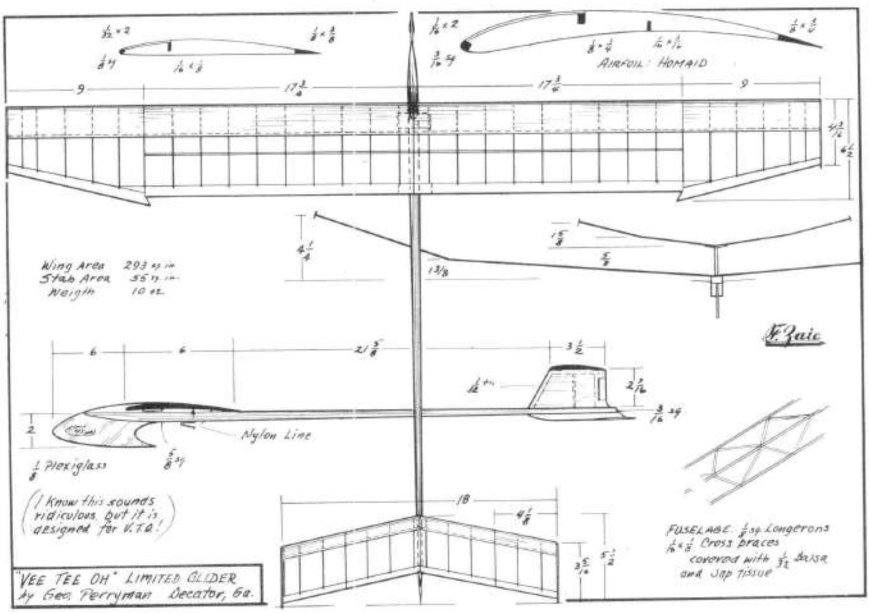


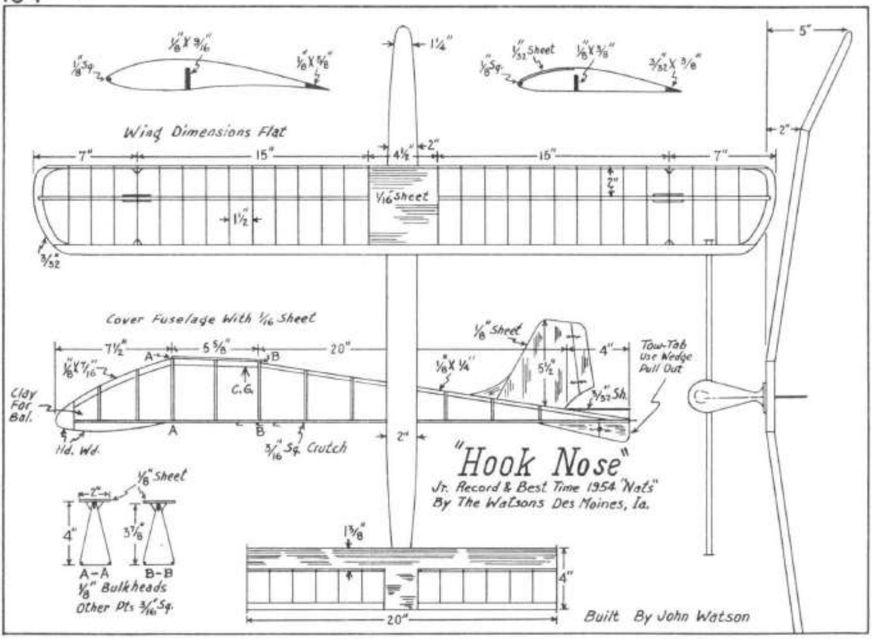
Wing Area 284 sq in
Stab Area 62 sq in
Placed 2nd 1955 Nats
Open 12m 52s
F. Zaic
Stab Construction same as wing
NACA 6409
Wire Clip
A-A
Balsa Sheet Sides - Tapered and shaped
Airfoil R.3.6 #28
"TOP SIDE JR." Limited Glider
by Tom Henebry
Chula Vista, Calif.

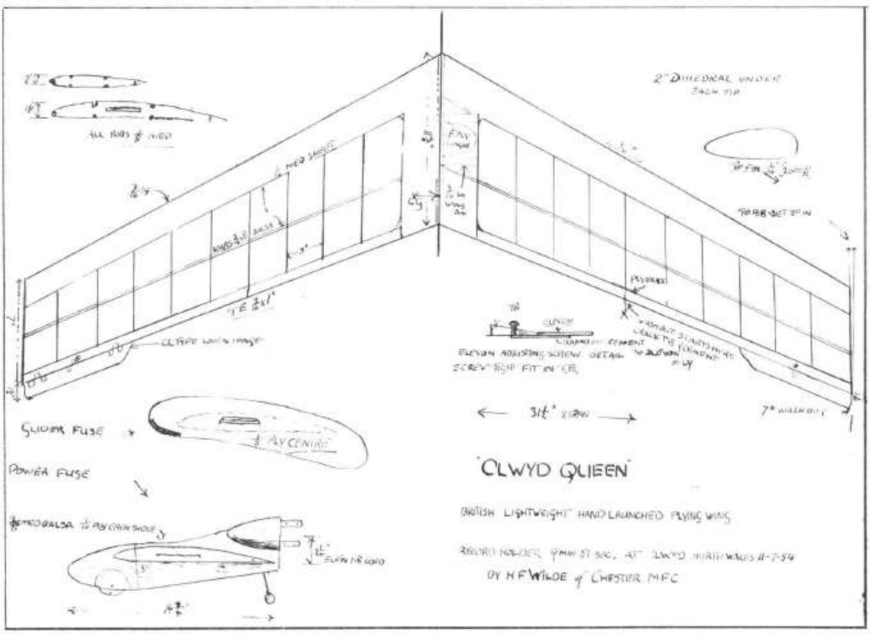

3/16 sq.
20A-08
1/8 sq
1/4 x 1
3/16 sq
25-1.00-10
1/4 sq.
1/4 x 1
10
53
10
3/4
9
TIP: Hollow Blocks
5
11
9
24
6
6 1/2
5
2 1/4
2 x 3
50%
2 x 2 3/4
3/4 x 1/2
A/R
RUDDERS 1/8 Balsa
F. Zaic
28
FUSELAGE
1/8 Balsa Sheet Box
& Formers
6 1/2
OPEN GLIDER
by P. VISSER SO. AFRICA

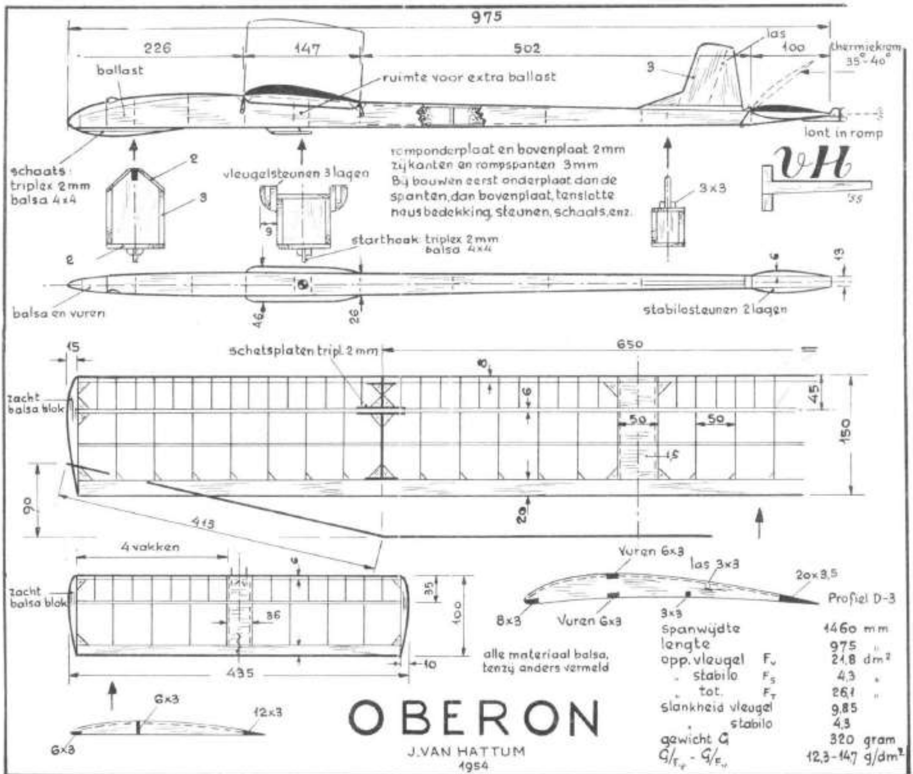

1/4 sq.
1/8 x 1/2
1/16 x 1/8
3/8 sq.
3/16 x 3/4
1/8 x 1/4
9 1/2
14 1/2
6
14 1/2
9 1/2
F. Zaic
4 1/2
1 1/4
1 1/2
2
4 3/4
6
19 1/4
3
Hd Balsa
2 1/4
2 1/4
Oak Plug
Compartments A & B for Ballast
Compartment C for Ballast
FUSELAGE 1/16 Hard
formers - Top & Sides
1/16 Med. - Bottom
1/8 Med.
Time 6:41.2
20
3
1954 NATS OPEN LIMITED GLIDER
by L.J. KRETOVICS LORAIN, OHIO

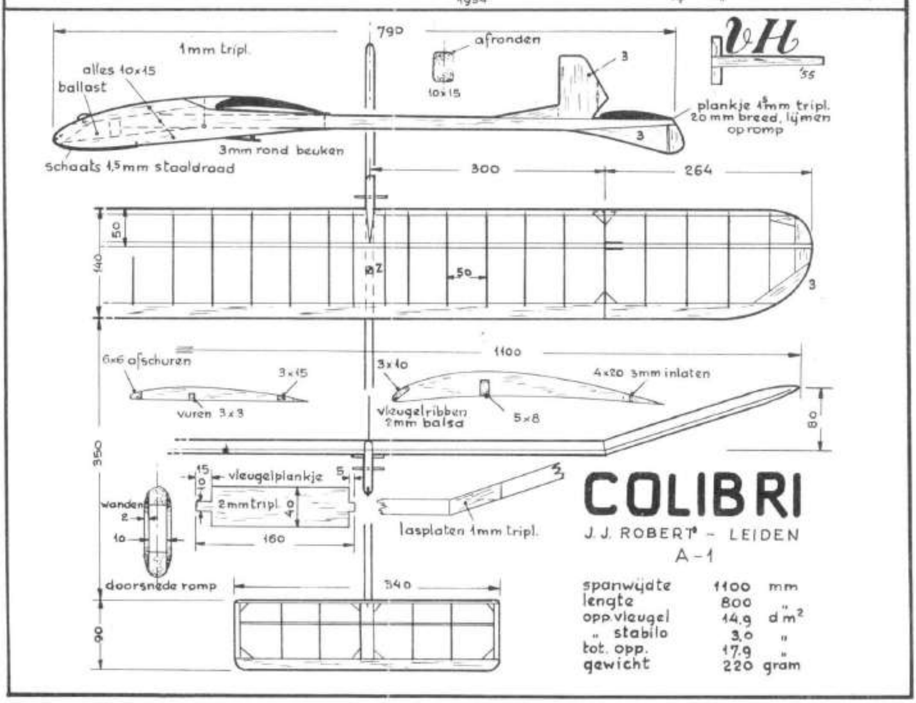

Cut 3/8 deep flaps for Camber Control
1/16 sq. Sliced Ribs
1/16 × 1/4 Caps
Balsa Blocks front 1 3/8 × 3 Rectangular Section
3/32 Sheet Covered
Triangular Section from here to rear
3/32 × 3/8 Diagonals
CG
3/32 Sheet
Total Area ~ 346.6 sq. in.
Wt. 10.0 oz
F. Zaic
WENDY
LIMITED Tow-LINE
by Norm Ingersoll
San Antonio, TEX.

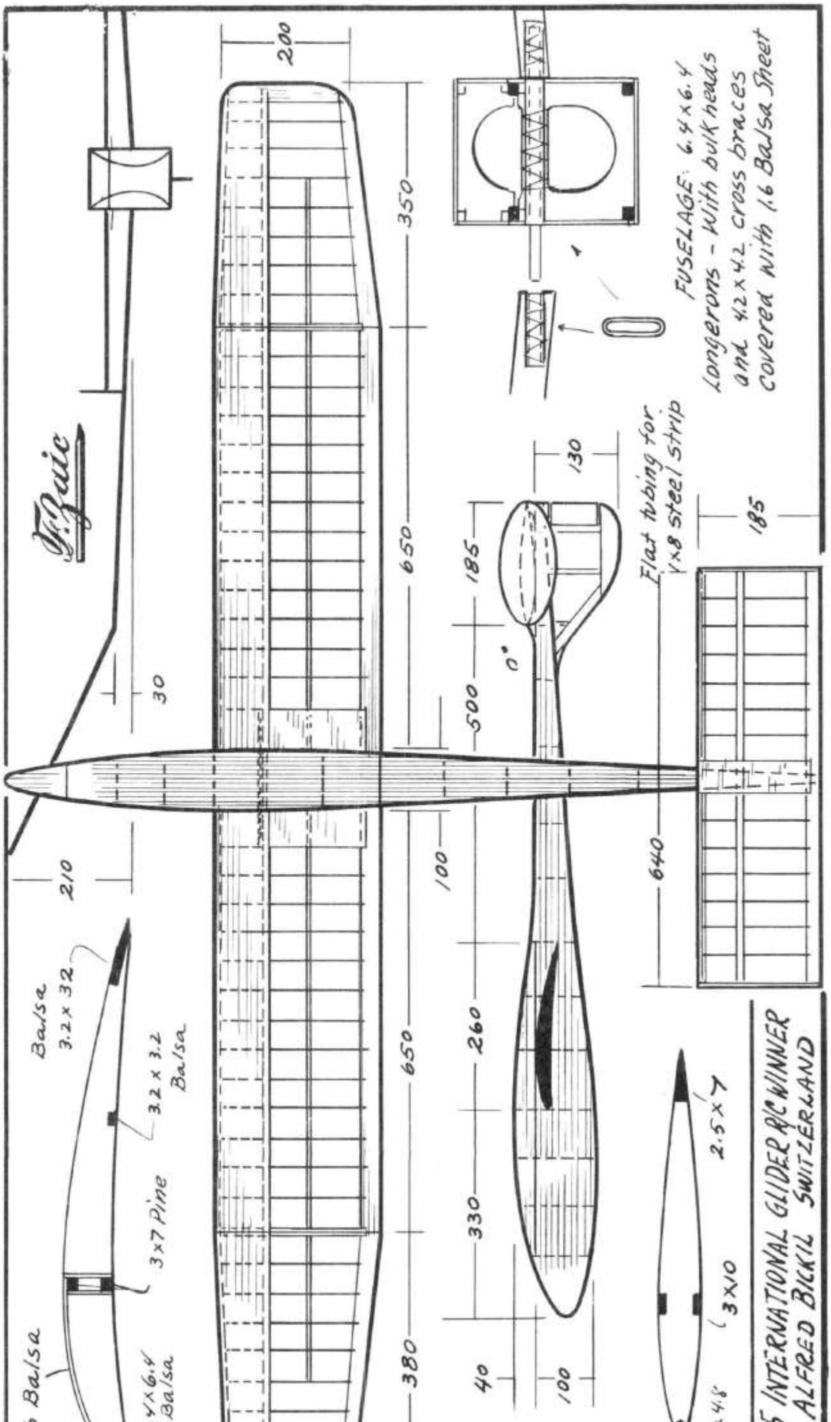

AIRFOIL: HOMAID
Wing Area 293 sq. in.
Stab Area 55 sq. in.
Weigth 10 oz.
F. Zaic
Nylon Line
1/8 Plexiglass
(I Know this sounds ridiculous but it is designed for V.T.O.!)
FUSELAGE: 1/8 sq. Longerons
1/16 × 1/8 Cross braces
covered with 1/32 Balsa and Jap Tissue
"VEE TEE OH" LIMITED GLIDER
by Geo. Perryman Decator, Ga.

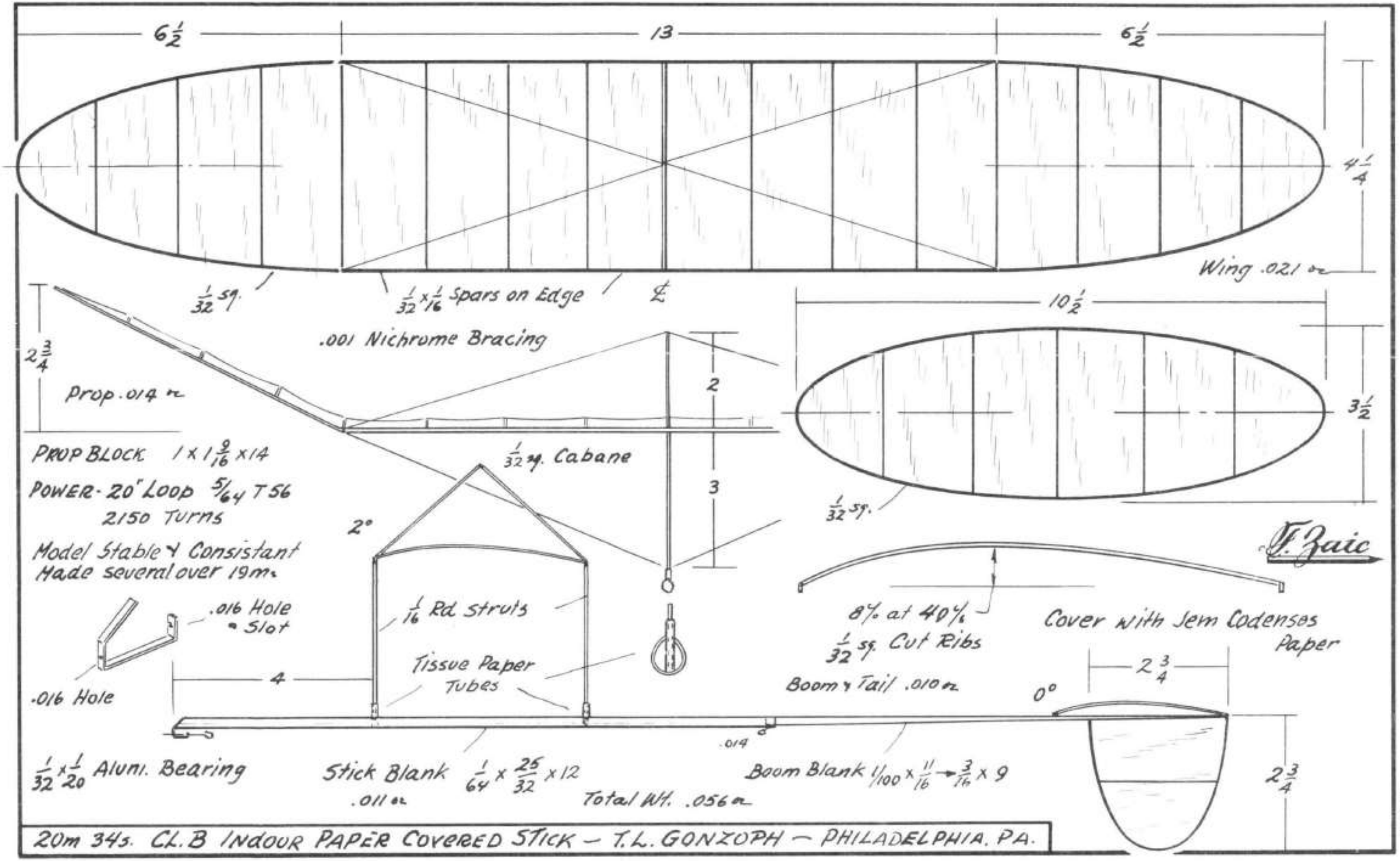

Wind Dimensions Flat
1/16 Sheet
Cover Fuselage With 1/16 Sheet
Clay For Bal.
Hd. Wd.
C.G.
3/16 Sq. Crutch
1/8" Sheet
Tow-Tab Use Wedge Pull Out
3/32 Sh.
"Hook Nose"
Jr. Record & Best Time 1954 "Nats"
By The Watsons Des Moines, Ia.
A-A
B-B
1/8" Bulkheads
Other Pts 3/16" Sq.
Built By John Watson


2" DIHEDRAL UNDER EACH TIP
GLIDER FUSE
POWER FUSE
"CLWYD QUEEN"
BRITISH LIGHTWEIGHT HAND LAUNCHED FLYING WING
BY H F WILDE of CHESTER MFC
7° WASHOUT
ELEVON ADJUSTING SCREW DETAIL

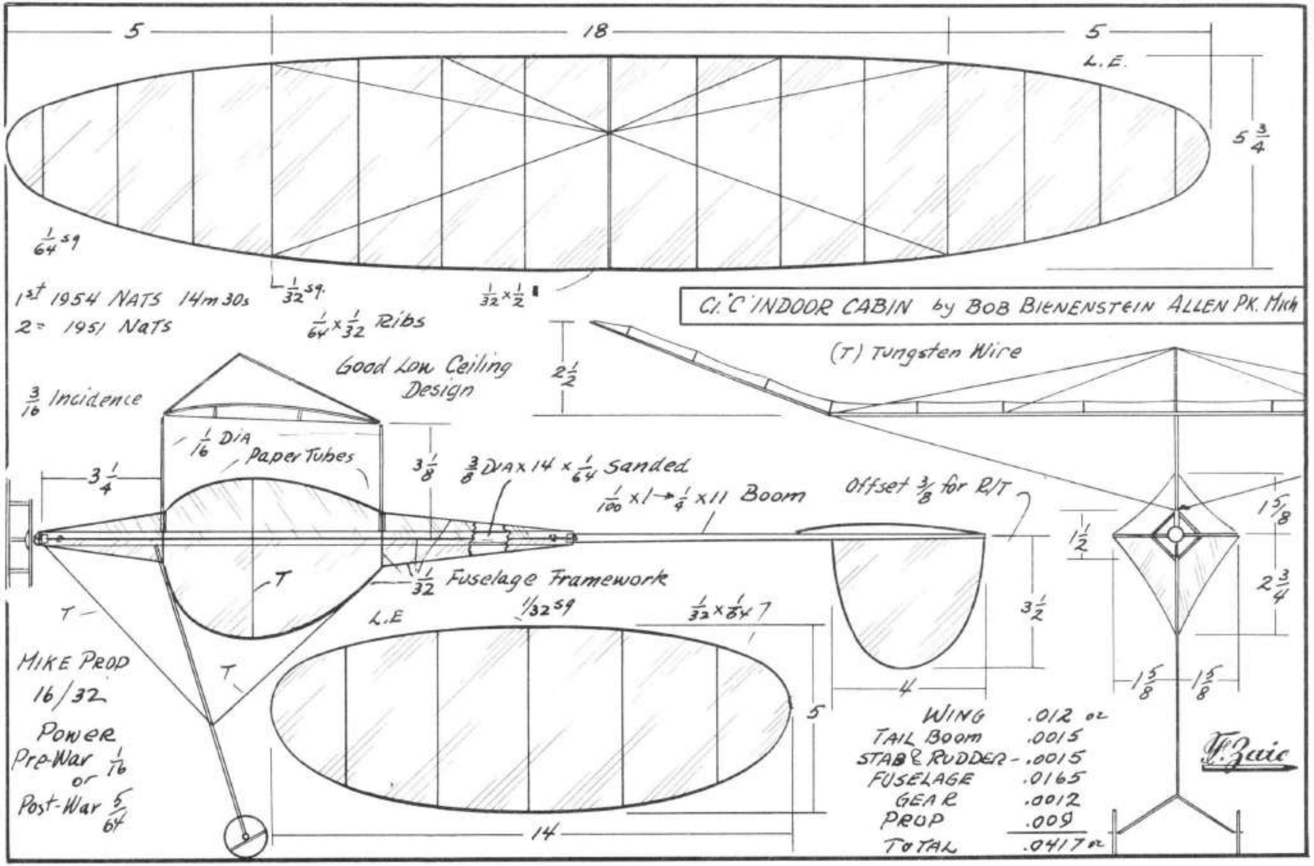

975
226
147
502
las
100
thermiekrem 35°-40°
ballast
ruimte voor extra ballast
lont in romp
schaats: triplex 2mm balsa 4x4
vleugelsteunen 3 lagen
romponderplaat en bovenplaat 2mm
zijkanten en rompspanten 3mm
Bij bouwen eerst onderplaat dan de spanten, dan bovenplaat, tenslotte neusbedekking, steunen, schaats, enz.
3x3
vH '55
starthaak: triplex 2mm balsa 4x4
balsa en vuren
stabilosteunen 2 lagen
schetsplaten tripl. 2mm
650
zacht balsa blok
413
4 vakken
Vuren 6x3
las 3x3
20x3,5
Profiel D-3
8x3
Vuren 6x3
alle materiaal balsa, tenzij anders vermeld
435
6x3
12x3
OBERON
J. VAN HATTUM
1954
spanwijdte 1460 mm
lengte 975
opp. vleugel F_v 21,8 dm²
stabilo F_s 4,3
tot. F_T 26,1
slankheid vleugel 9,85
stabilo 4,3
gewicht G 320 gram
G/F_T - G/F_v 12,3-14,7 g/dm²


790
1mm tripl.
afronden
10x15
vH '55
alles 10x15
ballast
plankje 1,5mm tripl. 20mm breed, lijmen op romp
3mm rond beuken
schaats 1,5mm staaldraad
300
264
1100
6x6 afschuren
3x15
vuren 3x3
3x10
4x20 3mm inlaten
vleugelribben 2mm balsa
5x8
vleugelplankje
2mm tripl.
160
lasplaten 1mm tripl.
wanden
doorsnede romp
340
COLIBRI
J. J. ROBERT - LEIDEN
A-1
spanwijdte 1100 mm
lengte 800
opp. vleugel 14,9 dm²
stabilo 3,0
tot. opp. 17,9
gewicht 220 gram

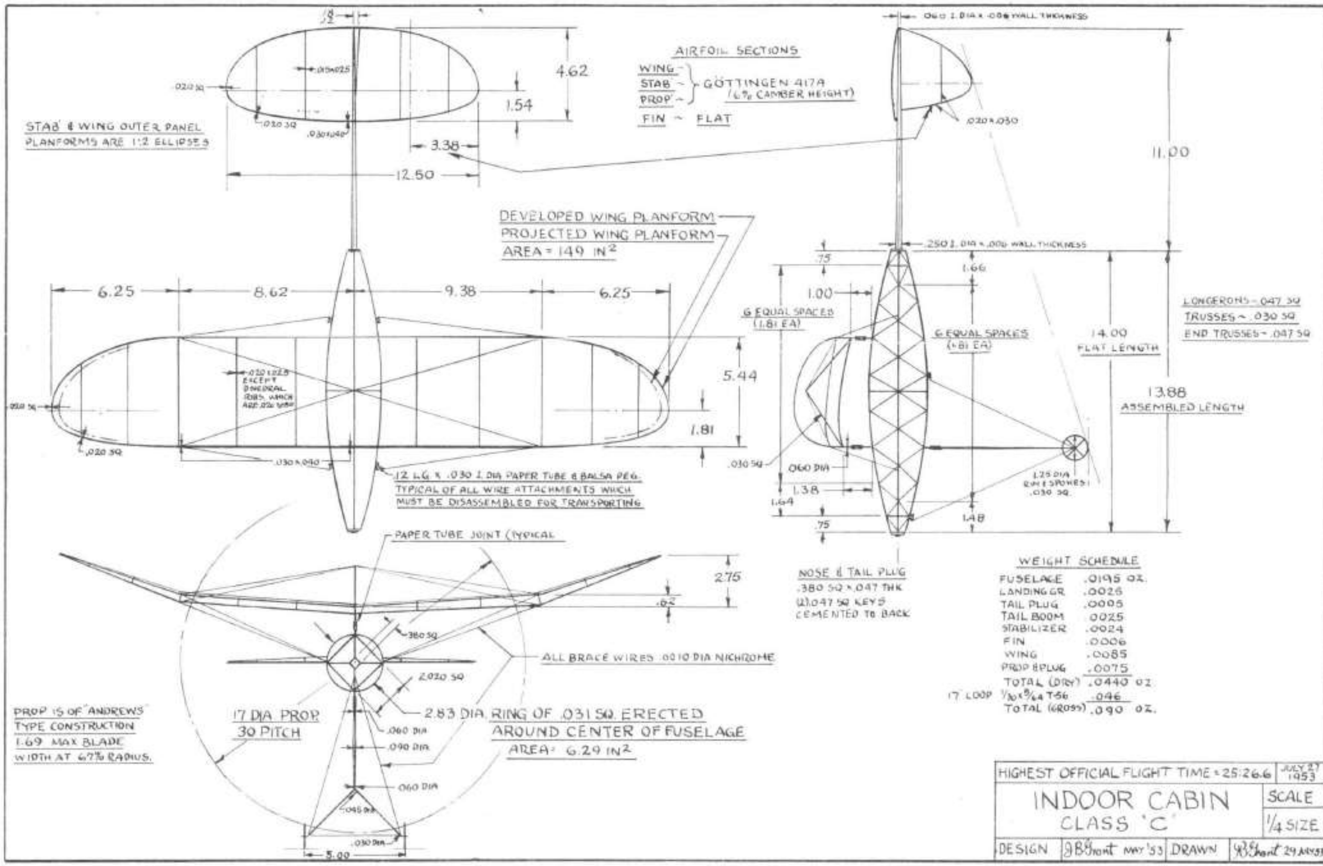

1.6 Balsa
Balsa 3.2 x 32
6.4 x 6.4 Balsa
3x7 Pine
3.2 x 3.2 Balsa
210
30
F. Zaic
200
380
650
650
350
100
40
330
260
500
185
0°
100
130
640
Flat tubing for 1x8 steel strip
4.8x4.8
3X10
2.5x7
185
FUSELAGE: 6.4x6.4 Longerons - With bulkheads and 4.2x4.2 cross braces covered with 1.6 Balsa Sheet
1955 INTERNATIONAL GLIDER R/C WINNER by ALFRED BICKIL SWITZERLAND



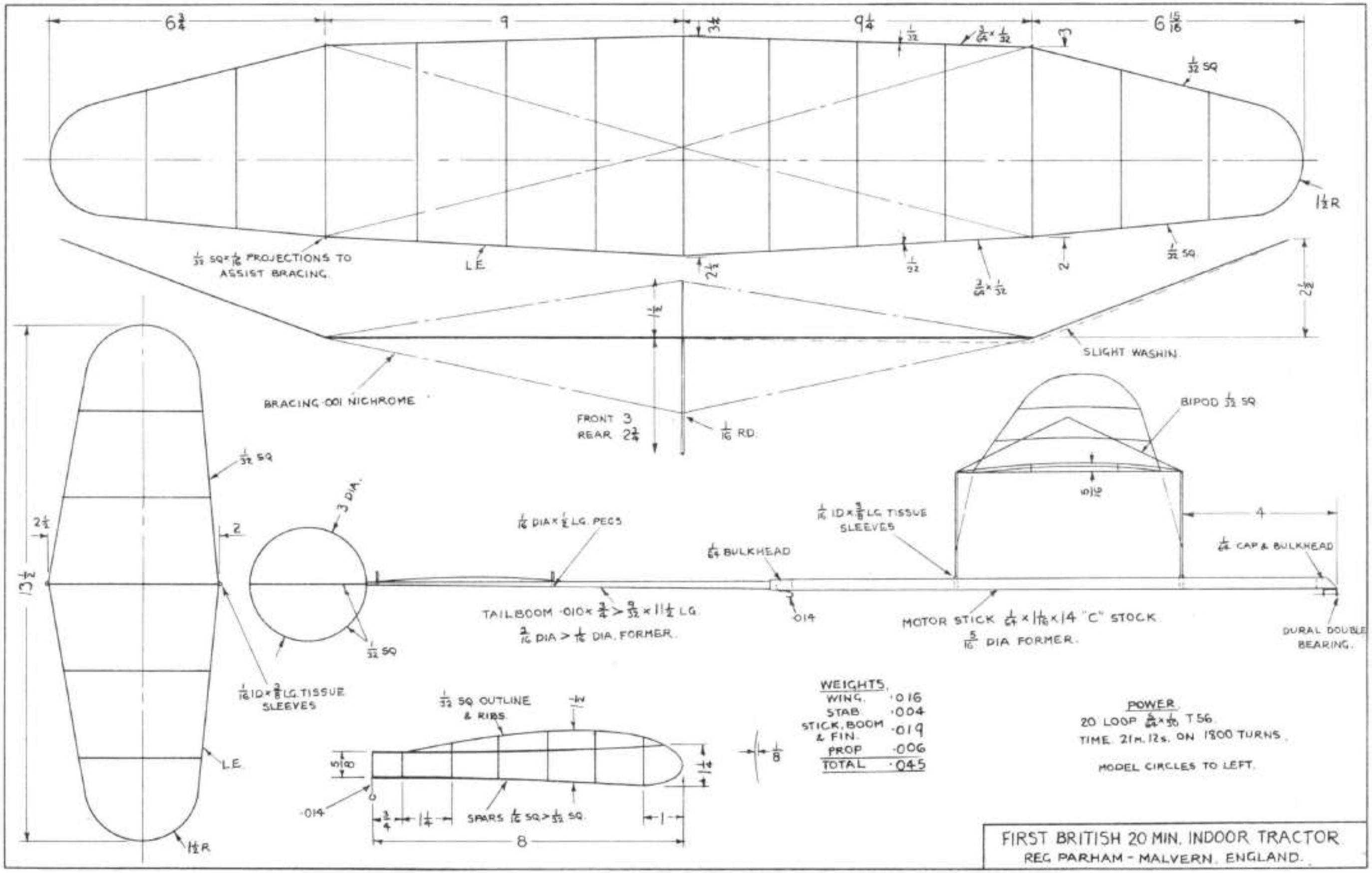
20m 34s. CL.B INDOOR PAPER COVERED STICK — T.L. GONZOPH — PHILADELPHIA, PA.



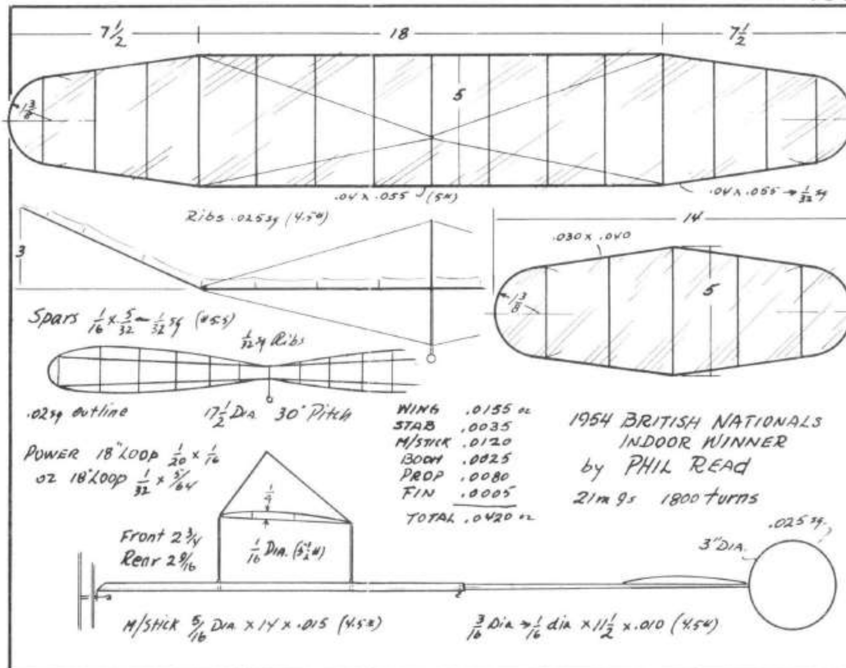
Cl. 'C' INDOOR CABIN by BOB BIENENSTEIN ALLEN PK. Mich
1st 1954 NATS 14m 30s
2= 1951 NaTs
Good Low Ceiling Design
(T) Tungsten Wire
3/16 Incidence
1/16 DIA Paper Tubes
3/8 DIA x 14 x 1/64 Sanded
1/100 x 1 → 1/4 x 11 Boom
Offset 3/8 for R/T
1/32 Fuselage Framework
1/64 x 1/32 Ribs
1/64 sq
1/32 sq.
1/32 x 1/2
1/32 sq
1/32 x 1/64
L.E.
MIKE PROP 16/32
Power Pre-War 1/16 or Post-War 5/64
WING .012 oz
TAIL Boom .0015
STAB & RUDDER - .0015
FUSELAGE .0165
GEAR .0012
PROP .009
TOTAL .0417 oz

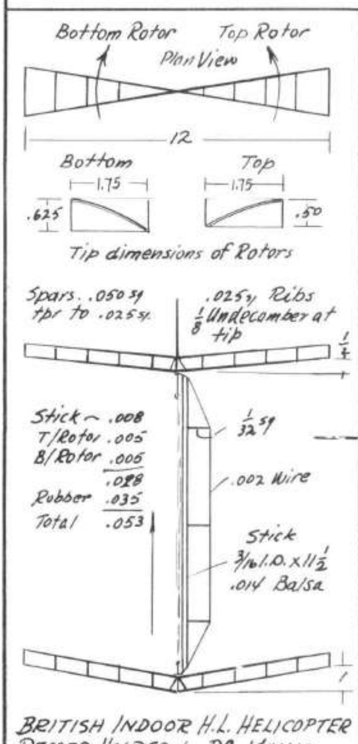


STAB & WING OUTER PANEL PLANFORMS ARE 1:2 ELLIPSES
4.62
1.54
3.38
12.50
AIRFOIL SECTIONS
WING
STAB
PROP
GÖTTINGEN 417A (6% CAMBER HEIGHT)
FIN ~ FLAT
11.00
DEVELOPED WING PLANFORM
PROJECTED WING PLANFORM
AREA = 149 IN²
6.25
8.62
9.38
6.25
5.44
1.81
12 LG x .030 I. DIA PAPER TUBE & BALSA PEG. TYPICAL OF ALL WIRE ATTACHMENTS WHICH MUST BE DISASSEMBLED FOR TRANSPORTING
6 EQUAL SPACED (1.81 EA)
6 EQUAL SPACES (1.81 EA)
14.00 FLAT LENGTH
13.88 ASSEMBLED LENGTH
LONGERONS ~ .047 SQ
TRUSSES ~ .030 SQ
END TRUSSES ~ .047 SQ
PAPER TUBE JOINT (TYPICAL
2.75
ALL BRACE WIRES .0010 DIA NICHROME
2.83 DIA. RING OF .031 SQ. ERECTED AROUND CENTER OF FUSELAGE
AREA: 6.29 IN²
17 DIA PROP
30 PITCH
PROP IS OF "ANDREWS" TYPE CONSTRUCTION 1.69 MAX BLADE WIDTH AT 67% RADIUS.
NOSE & TAIL PLUG .380 SQ x .047 THK (2).047 SQ KEYS CEMENTED TO BACK
WEIGHT SCHEDULE
FUSELAGE .0195 OZ.
LANDING GR .0026
TAIL PLUG .0005
TAIL BOOM .0025
STABILIZER .0024
FIN .0006
WING .0085
PROP & PLUG .0075
TOTAL (DRY) .0440 OZ
17" LOOP 1/30 x 5/64 T-56 .046
TOTAL (GROSS) .090 OZ.
HIGHEST OFFICIAL FLIGHT TIME = 25:26.6 JULY 27 1953
INDOOR CABIN
CLASS 'C'
SCALE
1/4 SIZE
DESIGN
DRAWN
5.00

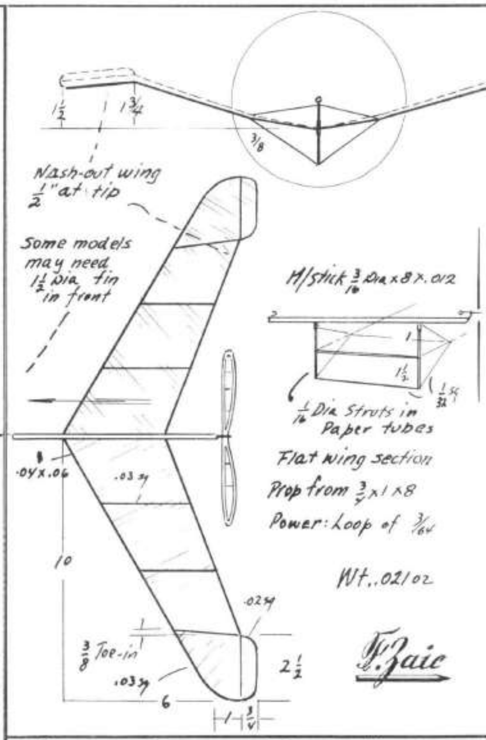


1/32 SQ × 1/16 PROJECTIONS TO ASSIST BRACING.
L.E.
SLIGHT WASHIN.
BRACING ·001 NICHROME
FRONT 3
REAR 2 3/4
1/16 RD.
1/32 SQ
1 1/2 R
BIPOD 1/32 SQ
3 DIA.
1/16 DIA × 1/2 LG. PEGS
1/64 BULKHEAD
1/16 I.D × 3/8 LG. TISSUE SLEEVES
1/64 CAP & BULKHEAD
TAILBOOM ·010 × 3/4 > 9/32 × 11 1/2 LG.
3/16 DIA > 1/16 DIA. FORMER.
·014
MOTOR STICK 1/64 × 1 1/16 × 14 "C" STOCK.
5/16 DIA FORMER.
DURAL DOUBLE BEARING.
1/16 I.D × 3/8 LG. TISSUE SLEEVES
1/32 SQ OUTLINE & RIBS.
SPARS 1/16 SQ > 1/32 SQ.
WEIGHTS.
WING. ·016
STAB. ·004
STICK, BOOM & FIN. ·019
PROP. ·006
TOTAL ·045
POWER.
20 LOOP 3/64 × 1/30 T56.
TIME. 21m. 12s. ON 1800 TURNS.
MODEL CIRCLES TO LEFT.
FIRST BRITISH 20 MIN. INDOOR TRACTOR
REG PARHAM - MALVERN, ENGLAND.

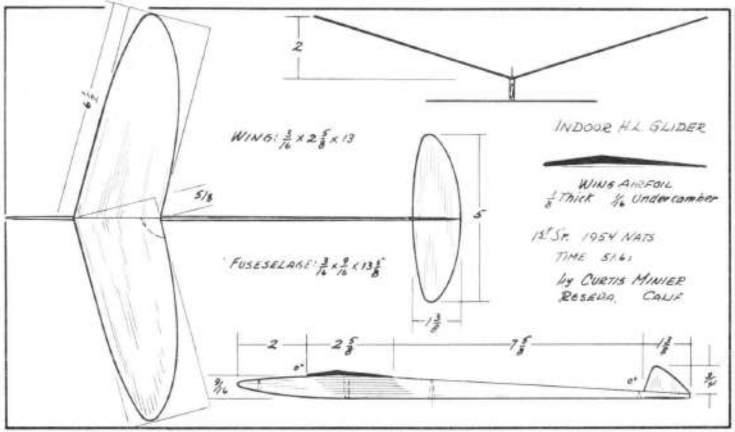


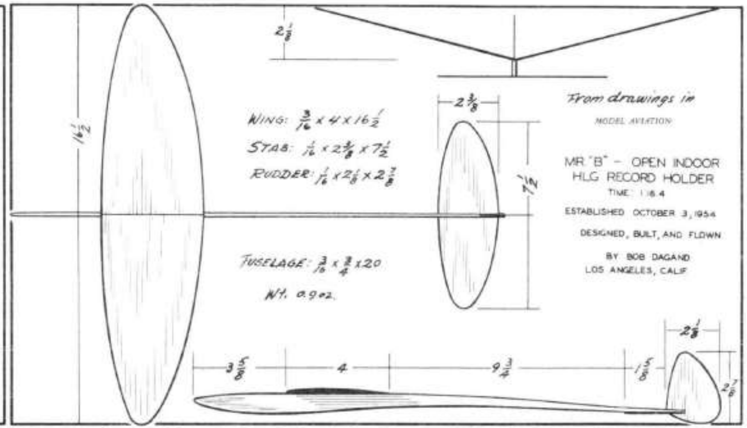


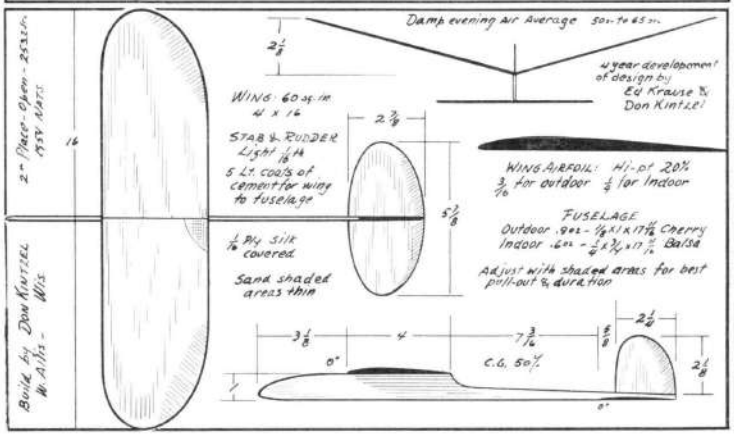
BRITISH INDOOR H.L. HELICOPTER
RECORD HOLDER by R.C. MONK
15" LOOP 1/16 1560 Turns = 5m 1s

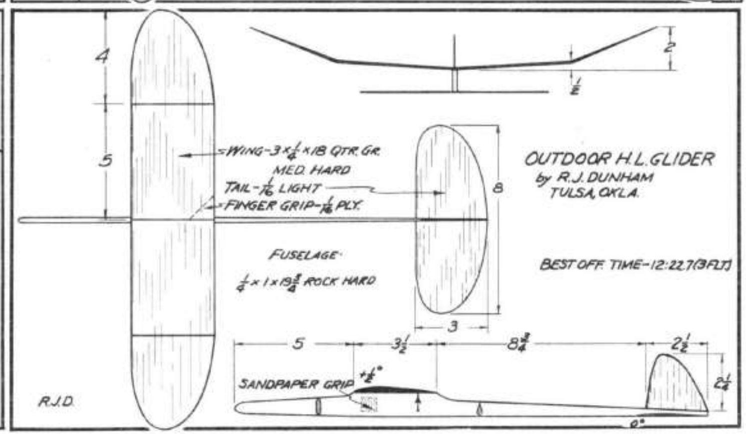


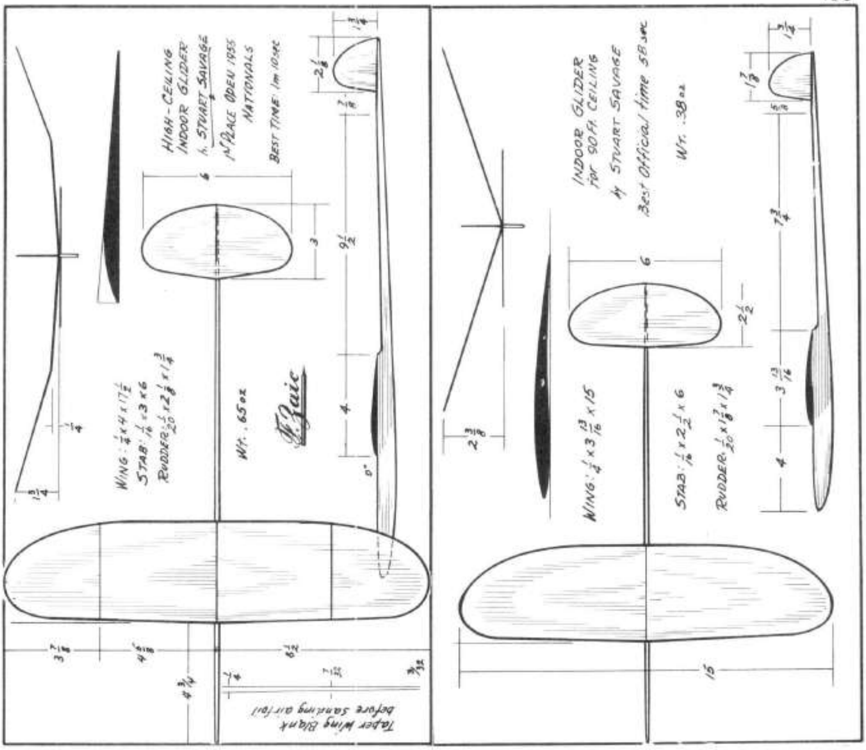
BRITISH TAILLESS H.L. RECORD HOLDER
4m 13s on 1200 Turns by R.C. Monk


INDOOR H.L. GLIDER
WING: 3/16 x 2 5/8 x 13
WING AIRFOIL
1/8 Thick 1/16 Undercamber
FUSESELAGE: 3/16 x 9/16 x 13 5/8
1st Sr. 1954 NATS
TIME 51.61
by CURTIS MINIER
RESEDA, CALIF


WING: 3/16 x 4 x 16 1/2
STAB: 1/16 x 2 3/8 x 7 1/2
RUDDER: 1/16 x 2 1/8 x 2 7/8
FUSELAGE: 3/16 x 3/4 x 20
Wt. 0.9 oz.
From drawings in
MODEL AVIATION
MR "B" - OPEN INDOOR
HLG RECORD HOLDER
TIME: 1:16.4
ESTABLISHED OCTOBER 3, 1954
DESIGNED, BUILT, AND FLOWN
BY BOB DAGAND
LOS ANGELES, CALIF


Damp evening Air Average 50 s. to 65 s.
4 year development of design by
Ed Krause &
Don Kintzel
WING: 60 sq. in.
4 x 16
STAB & RUDDER
Light 1/16 th
5 Lt. coats of cement for wing to fuselage
1/16 Ply silk covered
Sand shaded areas thin
WING AIRFOIL: Hi-pt 20%
3/16 for outdoor 1/8 for Indoor
FUSELAGE
Outdoor .9 oz - 1/8 x 1 x 17 11/16 Cherry
Indoor .6 oz - 1/4 x 3/4 x 17 11/16 Balsa
Adjust with shaded areas for best pull-out & duration
C.G. 50%
2nd Place - Open - 25.3 sec. 1954 NATS
Build by Don Kintzel
W. Allis - Wis.


WING-3 x 1/4 x 18 QTR. GR.
MED. HARD
TAIL-1/16 LIGHT
FINGER GRIP-1/16 PLY.
FUSELAGE
1/4 x 1 x 19 3/4 ROCK HARD
OUTDOOR H.L. GLIDER
by R.J. DUNHAM
TULSA, OKLA.
BEST OFF. TIME-12:22.7 (3 FLT.)
SANDPAPER GRIP
R.J.D.

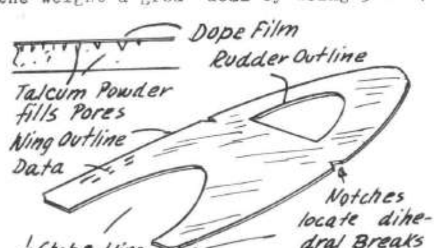


Here is a list of the items which I feel contribute about equally to the glider's total time: 1:-Technique of Launch. 2:-Excellence of Workmanship. 3:-Quality of Wood. 4:-Design of Glider.

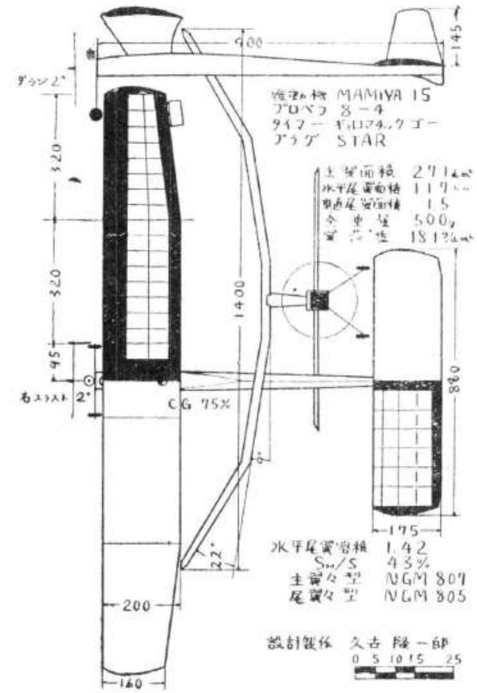
I use a ~wire leading edge on all my gliders (it ismade from .010 or .012 control-line wire) Glue it along the leading edge of the wing blank before the airfoil is formed. It serves three purposes: It aids in building an accurate airfoil (especially undercambered wings). It gives a much smaller radius than it would be possible without it. And it protects the leading edge from nicks. I have collided many times into seats and found the model in perfect condition upon retrieving it.

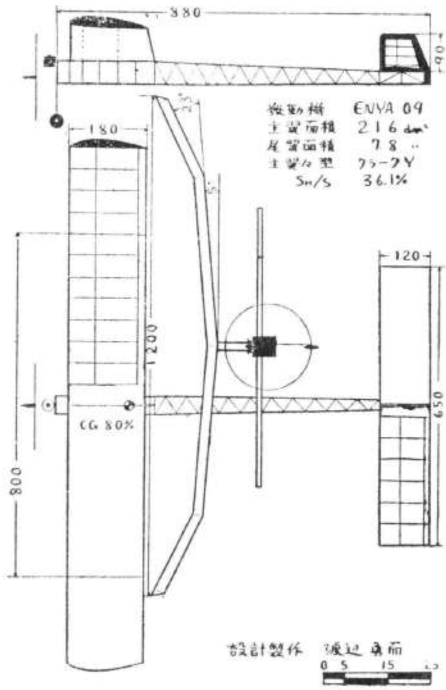
The finish I use is as follows: Take the undoped wing and spread talcum powder on it. This is rubbed into the pores with finger tips, and surplus wiped off. Then a thin coat of glider polish is brushed on to seal it. Usually one treatment of this works. I use just one coat of thin glider polish on the remainder of the model. The talc and dope treatment gives an extremely light finish. Most of the weight is usually in the clear dope, but with this method there is only a thin film of dope over talc.

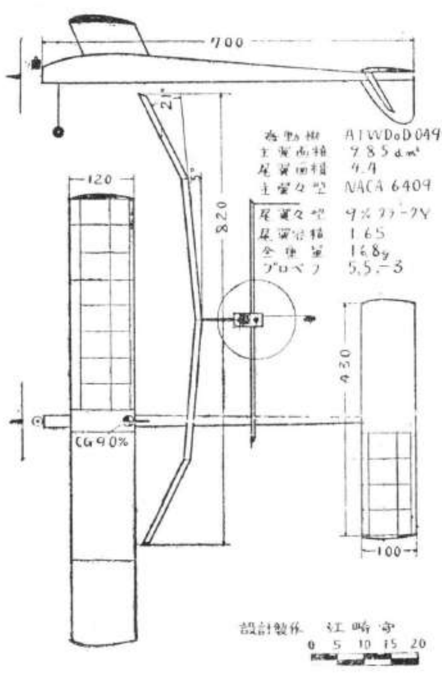
It seems a waste to go to the trouble of finding the lightest wood, and then go right around and increase the weight a grea deal by using 3 or 4 coats of wood filler. I have never been able to notice any real improvement in the glider caused by the better finish. Usually, any improvement in time is caused by higher altitude mostly due to the increase weight, and in this case the glider was probably too light for the ceiling anyway. I would rather concentrate the weight in the fuselage. By the way, when flying under unfamiliar ceiling, I build 3 gliders, and vary the weight of fuselage stock to get a range of glider weights.

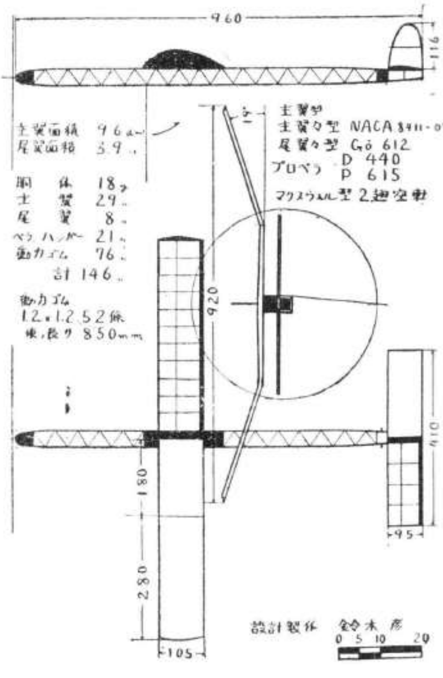


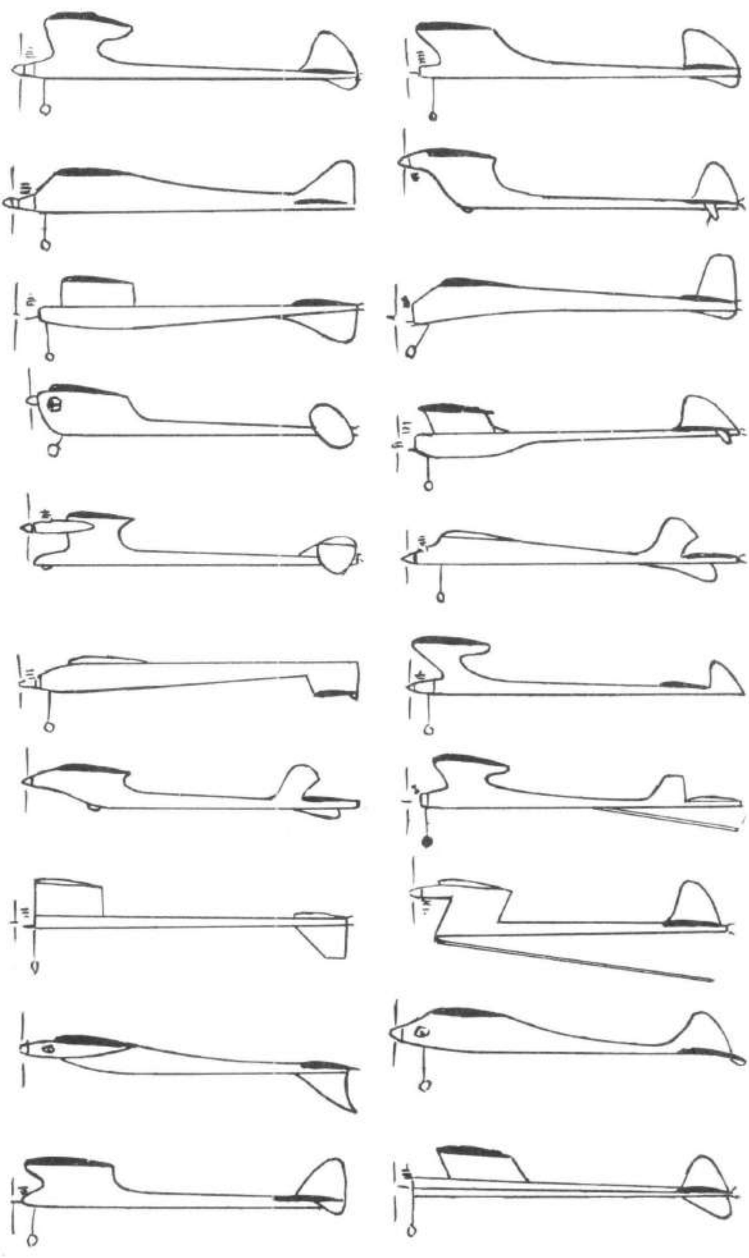
【第7回全日本模型飛行機競技大会入賞機図面集・2】



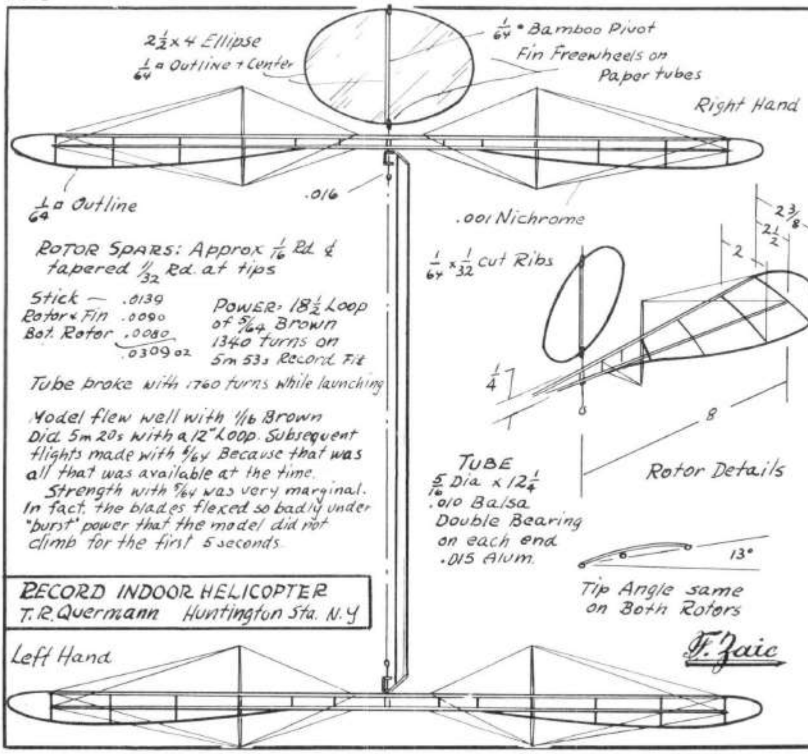








PROFILES OF MODELS I HAVE SEEN OR MADE — M.ESAKI—JAPAN—1955



NOTES ON POWER MODELS

by Norman Marcus —————— England

Here are few notes that may be of help with your new book. These concern gas models, which I believe, have still to be developed much further—especially those with no power or weight restrictions (like our open competition). As follows:

1. The fuselage should be shaped so that the side areas are roughly symmetrical about the thrust line—to balance the side forces (i.e. their moments about the C.G.) due to the slipstream.

2. Wing should be clear of main prop blast to avoid extra lift due to slipstream on port (left) wing (mainly).

3. Tailplane should be in prop blast — increased tail force or lift during climb. Do not use much downthrust as this directs the prop blast above the tail.

4. No sidethrust as prop blast on pylon (in front of C.G.) tends to turn model in opposite direction when it is used.

5. Best fin position behind the tail — gives increased moment arm.

The plan enclosed is of my last gas model (early 1955) "Eureka" which has been around now for 2 years. During its first year, 1953, it out-climbed all other gas jobs over here, but this year one or two have been rivalling it. Most prominent being Tom Smith's "Fried Fritter" which climbs vertically (literally) without turning. He has been very successful this year with this model which has taken 3 to 4 years to develop.

ROBERT BURNS (Scotland) September 6, 1954

You never heard of me, but this letter is about 17 years overdue. I took up aeromodelling all that time ago and I was lucky enough to meet up with your Year Books early on, and what a help they were. So my thanks are due, with interest!

I have been an invalid all these years and it isn't too much to say that this flying game has been most of my life in that time, starting a club here, forming the Scottish Aeromodellers Association, helping with the SMAE Area in its early days and doing a lot of thinking, writing, drawing and just plain hacking. In fact if it was all to do over again, I would start right away.

Now the main reason for this letter is that Joe Maxwell brought me your two Year Books along when I saw him last week, after years of separation. And I have been through them with a lot of interest and some regret. Regret for the old days and ways, which that bit about the change in the outlook of modern modellers brought to mind. I agree they don't like to think now. It is all "Quick and Easy" that goes with them. Of course in their defense we only had rubber jobs to argue about and all the skill and brains of the whole club went into them, so we could all follow any article even if it was deep enough to cause frowns and odd scribbles on paper before we got it. But now the same amount of effort is spread pretty thin, control line, radio, power durations, glider, scale and sports flying share the energy we used to put into only one branch, and it gets sort of thin before it is done.

Now don't mind if I say I have some thoughts about Torque which does not match with your findings in the 51-52 book. It isn't a fair test to use a weight on a wing to duplicate the effects of power flight. This because the slipstream is always spiralling behind a model propeller. I know from trials that this is so. It means that if there is any flat surface just behind the prop, such as wing or pylon, there is a lot of sideways lift generated by the spirals and these act to balance out some of the torque. In fact you can balance it all out with a thin pylon and I know one or two designs which over-balance it, although that ought to be impossible. The thickness of the pylon is very important. If it is thin, there is a lot of help for the model, but a bluntnosed thick pylon has little effect. I have had a midwing which needed no side thrust at all, but it seems that the strength of the anti-torque effect is greatest only when the surface is very close to the propeller. On sports models with a lot of weight, and light engines, hence long noses and rather fat fuselages, the effect is least. Likewise low wing models seem to gain little from the spiral, but a typical pylon comes off best.

If I had the energy to test it I would compare a model with clay on a tip, and thrust given by a Jetex, with another having the same weight and thrust but with a propeller. But I am laid up so can't do the job.

Now for the next argument. When you worked out the clay weight on the tip, you don't seem to have a factor for the drag of the wing. Surely the tip with the clay (on page 26 to 28) will have more drag and this will act against the side forces, hence maybe why for one given dihedral and torque (taking pylon help etc. into account) we get a neat balance. The drag would not vary with dihedral angle for any given torque since the extra lift is the same, but the side force will. Which raises a lot of complicated questions.

Now I think of it I can put up a good argument for the existance of the help from spirals in the slipstream by quoting experience. I have often changed props and found that the power turn had altered. The engine revs were about the same and from the shape of the published test results there could not be enough variation of the torque produced by the engine to disturb a fly's eyebrow. Yet the model would act definitely, much like giving 1" of sidethrust. Now this could only be because the propeller was churning the air to a different extent than the other one. A real bad prop, the sort you carve in half an hour instead of taking twice as long and doing it right, would always tend to give a left turning model a straighter flight, or put more right into one which had a little already. Pitch change does the same, although it will change speed a little too.

These days I am playing about with scale models, and radio, but this year I build a rubber job again and what fun it has been. I often took it out when I was rather under par and couldn't be bothered with the radio jobs. I solved the turning troubles on this one by low cunning. I used a single bladed folder, and set the fin for what would have been a left turn in the glide. Then I set in a bit of right sidethrust, and finally stopped the prop with the blade on the left and the counter-weight sticking out to the right. Just like your bit of clay. Result, a slightly right yaw and extra drag in glide from right wing which would normally give a right turn in glide, balanced by left fin adjustment. Hence a near straight glide. Under full turns, a right turn holds down the nose (gyroscopics) and this fades out to near straight at end, when trim is set for the nose heavy condition by slight upthrust. Then the prop tops and folds, and a near straight glide. What more can you want? It was worked out on the drawing and it duly trimmed out, so I haven't forgotten how, even after ten years away from rubber.

I have been thinking some more about the lack of interest in the type of model theory which was popular (even if only to a limited degree) in 1938. I have found myself that model mags. won't take articles explaining ideas behind designs. They want the designs however. Then modellers adapt these and the new theory gets built into models and altered and developed but the very peeople who ultimately own winning models as a result will tell you theory is bunk.

Another aspect is the huge increase in aircraft design staffs since the 1939 expansion. Now a hundred times as many men know the fullsize aerodynamic approach to design, and they can only follow articles of the type which use the standard way of presenting theory. You and I are handicapped, we both seem to have worked things out from first principles aided by sound instincts but the wise guys won't have it unless it is in the form they are used to. And the rest won't have it either, as above. So we are forced to accept the situation.

Since 1938 I have done a lot of work on models, aerodynamically I studied Wakefield design, wing aspect ratio, some pioneering work on stability which was liked by the LSARA, and I have done a lot of glider design and development. In addition I have spent time studying diesel engines, fuel chemistry for team racing, stunt models, deltas, the effects of drag reduction on power duration models, some unpublished design theory for these, ducted cooling for low drag, and sundry other notions. Then radio control set me reviving an old interest, building transmitters and a lot of receivers which after trials were reduced to components and rebuilt again. Actuators, two-speed units, test gear, wavemeters, and just models to fly them in. So after over a hundred models and a lot of side issues, you would think I had done it all. But no . . .

I still want time to try autogyros, helicopters, ducted fans, flying boats, and maybe other types which will come along before I get these done with. And radio is only starting. So you can see why thinking is spread thinner than it used to be.

I know men who spread it thick, still. One is a scale fan, does nothing else, and is full of deep knowledge of tiny details of all sorts of aircraft. A few others spent years with one type, and end up famous. But they sure kill themselves over it, and I don't think that it is worth all that just to put up the time of a Wakefield from 3 minutes 45, to say 4 minutes 15. See what I mean?

Of course we all have to live, and this is a spare time affair, even the man who keeps a model shop and spends all his time in the atmosphere of the thing, doesn't get time to do much, if he wants to keep eating. Around here there isn't enough trade to keep a model shop on aircraft alone, they all sell toys and radio or bicycles and models become a sideline owing to the small financial return compared to the others. When that happens the dealers don't take the trouble to help and prefer to sell a kit which is a simple transaction with little effort, compared to helping a worthy type to assemble all the items from stock for building something of his own. It is the same tendency as is in all trades now, (packaged goods) as the village grocer no longer weighs out things, just picks up a packet and there you are.

I have been running a model club in this small town for 18 years, and I would despair of it, but it isn't as bad as you think. You can't keep a good boy down. If he has the stuff in him, out it will come, given the little bit of help which every kid needs when he is young and things sort of gang up on him. I have had quite a few boys who are now doing well in the aircraft industry, or elsewhere, and some of them even remember to come back and thank me for the starting push! The rest just take it up, play about, and quit. But I suppose the few good ones justify it all.

Anyway, I have been overdue to thank you for the help I had out of your books long ago, so now I can call that quits. If you can still keep it going, you never know, there might be more like me who would like a push themselves. . . .

BOB GILROY (England) — January 25, 1956

As regards the short nose idea, I find that the low moment of inertia makes for a quick stall recovery. I also use an undercamber tailplane (something like Hacklinger's section) which has a very powerful action and raises the rear end of the aircraft when an incipient stall appears. These two effects work together to give one of the fastest stall recoveries I have seen, and often results in a slight gain in height.

The short nose gives no difficulty on the tow line, provided that sufficient side area is retained by using a fairly deep front fuselage profile.

The wing is thinned down Hansen section but retaining his drooped trailing edge which gives the same effect as 10 deg. of flap.

The fuselage aft of the C.G. and the tailplane must be kept light or excessive ballast will be required to bring the C.G. to the desired 55 or 60 per cent of the wing chord.

ABOUT NORDICS

by John Wordin —— Middletown, N. Y.

Tow Hook Position: I usually put it at 50% chord and then try it. It usually has to be moved forward. Experience only can tell just how much. If the glider tends to veer off to one side just after launch, move the hook forward. If it dives into the ground right after launch, the tow hook should be moved forward much more than if it begins to veer off after it is up fifteen feet or so. On my model, ¼ inch movement will take care of the dive tendencies, and 3/16 inch of fifteen feet. And only ⅛ inch change will smoothen out veering when the glider is approaching the top. By shifting the tow hook gradually, overhead launch should be achieved without difficulty. The position should be determined in calm weather; and it will also hold on windy days.

Why do I use straight dihedral? I find it just as efficient as tip, and much easier to construct due to the fact that there is only one break at the center. I also had trouble of tip breakage at the dihedral joints.

I also use relatively large rudders. In the early development of the glider it was found that small rudders would not work; even in combination with low dihedral I experience spiral dives.

I built a small wind tunnel just to test for an efficient tip plate shape. I found that air spills over the back of the plate into the last 40% of the chord. This can be counteracted by making the plate larger nearer the trailing edge.

About airfoils: I have a collection of some one hundred. Few I designed myself and had good results. The others are mostly NACA and Eiffels. Hans Hansen's airfoil makes my models glide straight into the wind. While NACA 6409, which may be good for all around flying, makes my Nordic designs wander. So I laid out JW 1009 which is a cross between the two. Gives the exact results that I want. Nice tight circles without dives. So far performance has been good. Been catching many risers that other ships did not get.

On the subject of moment arms: I find that three to four chords distance between wing's T.E. and stabilizer's L.E. is a good. And for nose length, found that this proportion worked well.

$$\text{Nose Moment} \times \sqrt{\text{Wing Area}} = \text{Tail Moment} \times \sqrt{\text{Tail Area}}$$

I have a short moment design in the testing stage. Glides good but has poor towing characteristics. The circle is very tight, as it should be expected. Here is a summary on five designs that I made and tested:

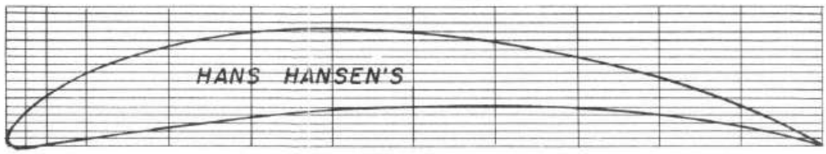
SHIP	RUDDER AREA	TAIL MOMENT	DIHEDRAL	
JASCO	33 sq. in.	24 in.	Tip	5½ in.
I	18 sq. in.	21 in	"	5 in
II	37 sq. in.	24 in	"	5 in
III	41 sq. in.	25 in	Straight	5 in
IIII	36 sq. in.	17 in.	"	5 in

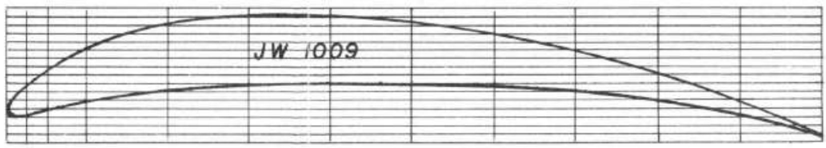
JASCO NORDIC had a good glide with NACA 6409, but it did a lot of wandering, gliding left, right and straight; even with excessive rudder. Shortened its moment arm to 19 in. It then had a constant left circle. Original rudder area used.

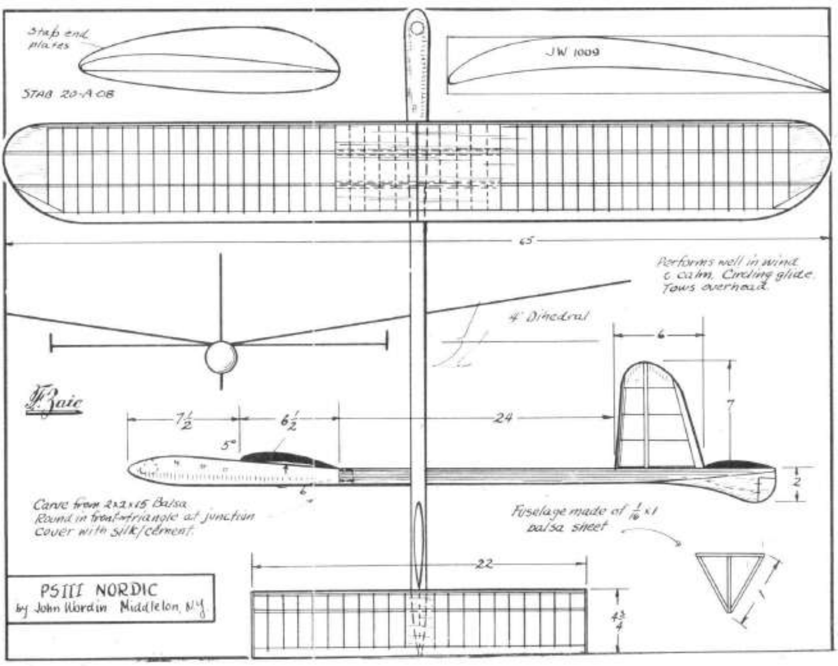
No. 1. Was a good ship except that it had a tendency to spiral dive, and the tips kept breaking off.

No. 2. Was a better glider than No. 1, but the tips broke off many times. Lost two designs. No. 2 was very hard to adjust to circle, having a tendency to glide into the wind. I think it was due to the use of Hanson's airfoil. Change to my airfoil solved this problem.

No. 3 and No. 4. Just back from a flying session with No. 3 and 4. As you can see No. 4 is short moment layout, and it bounces a lot in the wind just like the "old floater" used to. Tow is not as good as No. 3. Tried this experiment with No. 3.: First I flew it as I usually do and got good results with no evidence of dives or stalls. I then removed 10 sq. in. from the rudder, and the effect was very evident. It never made a circle without spinning into a spiral dive. Luckily, the model was able to take it.







STUART SAVAGE (USAAF)

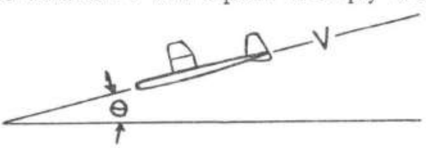
August 8, 1955

I hope that the enclosed info will not reach you too late. At the time you wrote I had no airplanes that I could send you plans of. I built most of the airplanes I have flown this year in about a month. I returned from the Nats last week. I took first in indoor H.L. gliders but couldn't make the first 10 in any other event I entered. Competition was about the toughest I have ever seen. If you failed to make a max or a near max on any one flight it was hopeless to continue.

With this letter I am sending you plans for this year's Limited Towline Glider and a couple of successful indoor gliders. The towline has received many favorable comments and several fellows have asked for plans. It has wonderful towline stability, just a few running steps and it is overhead. A careful look at the airfoil will reveal the drooped trailing edge advocated by the Danish Nordic flyers.

The effect this drooped trailing has is amazing. A friend of mine, Denny Rusling had a Nordic with a rather fast glide, due to the wing section. (Thin airfoil, little camber.) I told him of the results I was getting with flapped trailing edges. Since he had quite a wide trailing edge he decided to cut a flap and droop it about 10 degrees. The effect was immediately noticeable, the glide slowed down and duration went up.

All this made me think. In the past we always used to try to increase our L/D ratio. This is an important factor but doesn't tell the whole story. The real thing we should try to increase is our $C_L^{3/2}/C_D$ which is proportional to duration. I will explain it simply below.



Θ = GLIDING ANGLE

V = VELOCITY

$$\text{COT } \theta = \frac{L}{D} = \frac{C_L}{C_D}$$

From the sketch it can be seen that duration is a function of 1/V and C_L/C_D • 1/V is a function of $\sqrt{C_L}$. Therefore duration is proportional to $\sqrt{C_L} \times C_L/C_D$ or $C_L^{3/2}/C_D$. This is why the boys have been getting increase in performance from elastic turbulators. They enabled the plane to fly at a higher C_L before stalling out. The C_D also goes up and, although the L/D may be lower, the $C_D^{3/2}/C_D$ is increased and duration goes up.

In a few days I will send you plans of my ½A FF and a Limited rubber job. I have not been too pleased with the way my ½As have been performing. In the 1st couple of years I think I have been approaching the problem from the wrong angle.

With the advent of some good kits and increased ability of the average contest flyer it has come to the point where you can no longer afford to have one of those 1½ minute flights that just happen for no apparent reason. Perhaps I just have had more than my share of downdrafts but more likely there is something lacking in the airplanes themselves. The set-up I have been using is thin airfoils (approx. 7 deg.) large wing area, big horizontal tail (40-45%) and rearward C.G. position.

I have had several planes capable of an honest 5-6 min. in dead evening air. I used to think that all I needed wa sa slight bump and I was good for a max. Bitter experience has proven me wrong. A 2½-3 min. flight was hard to explain. I doubt if all of them are due to down drafts.

I have come to realize that the combination of light wing loading (hence low forward speed), critically thin airfoil and critical aerodynamic set-up (big tail, near 0 - 0 degree set-up) yields an airplane which is easily upset in normal gusty day-time flying conditions. A slight tail gust can stall it out and cause a considerable loss in altitude before recovering. Usually, by the time the airplanes are down to about 150 ft. altitude (remember this is where towlines just start hunting for thermals) it is just about as good as in your hand. They have never come close to matching the standard of consistency of flight time reached by my rubber jobs and gliders. None of this consistency was due to being out of trim.

I am now working on a different set-up. Still air times will probably go down. I have not tested anything yet so that I cannot give you any results. It was getting to be disappointing to be beaten by planes I felt I could outperform in dead air. I really did not know which way to turn. I was beginning to think it was almost a matter of pure chance. The new plane may not pan out as I hope, but I now have a firmer grasp of the problem and should come up with an improvement.

V. P. INGERSOLL — ALLE-VOU-ZOOM ½A — San Antonio, Tex.

This model was born of earnest desperation in the attempt to evolve a ½A contest gassie that could turn in consistent performance under any and all conditions. From 1951 to the present, I've constructed all of my free flight designs along the same pattern with excellent results. This particular model is a departure from it's lineage in several ways and hence, I chose to submit it.

This ship climbs faster than any free flight I have ever seen and has a fast, flat glide. The climb pattern imitates the "dutch roll" made popular by the ZEEK. Despite the attitude or natural elements, it always tends to keep the nose up during the power run: the climb-glide transition is only average.

Unusual features include the external "Thermal Hopper" set-up (I'm indebted to Bert Striegler of San Antonio for this novel mount), the empennage (small rudder and all-sheet stab) and the overall decalage set-up. You'll probably raise an eyebrow at the thrust off-sets required to control the original model. This model was constructed in August of 1953 and a subsequent version in the Fall of last year. The latest version required only 2 degrees of left thrust. The only design changes in the two models are in the stabilizer (the latter has a normal airfoil and is mounted on top of the fuselage). Perhaps warps in the first model necessitated the extreme thrust off-sets.

WcNDY (LIMITED TOWLINE GLIDER)

This towline is the second in the series and performs well under tow and in the glide. The wing flaps were incorporated for the purpose of trimming to obtain the ultimate time. If I were still in Indiana, and had the benefit of the still, evening air there, something definite might be ascertained, but in the ever-present Texas gale they have done little more than aid the model in coping with wind variations.

The airfoil in this model is original and an auto-rudder hook up is used. I would strongly recommend this model to my friends without hesitation.

"SLICK STICK" DEVELOPMENT

by Pete Buskell —————————————— England

My long moment "Slick Stick" design was developed from an earlier moderate moment model. The basic 70% C.G., right spiral climb and right glide were retained. This set-up being about the best, in my experience, to cope with 30 m.p.h. winds which always seem to fall on our elimination days.

Snag with 70% C.G. is trimming out the loop on high power. My usual method in adjusting is to keep motor straight, and adjust incidence of wing and stab, with stab in the slip stream.

I thought that a long moment might give better power handling. On test, power handling was improved, but not to the degree hoped. Ship would handle a 2.5 cc wih ease but not a 3.5 cc. Trouble was that stab needed more than plus 1.5 rigging to control the loop. And at this setting ship developed a left turn on take-off. Due, it is thought, to spiral slip stream effect. (This was cured by increasing the stab chord to 8 inches from 6½ inches and reducing span to give same area. Hence more stab area in slip stream.)

Power handling, with the new stab, was considerably improved. The 3.5 cc being controlled at under 1 stab incidence. Incidental advantage was easier rigging adjustment since wing and stab chord were similar.

Another difficulty experienced with the 2.5 cc. model was in finding a propeller which would enable a full motor power to be used. On test we found that dropping below 9 inch diam resulted in considerable loss of efficiency. This indicated a 9 x 4 to reach peak revs. But in practice, more height was gained on a 9 x 6, even though the motor was considerably below peak. What was needed was a high A/R 9 x 6. A wooden one was out of question on account of strength. So we got round to carving from Tufnol which is tedious to work but gives a thin high efficiency prop which will satisfactorily absorb normal landing shocks. We rate them 20% more efficient than standard commercial props.

One advantage of the long M.A. is that the stab operates outside the downwash from the wing which results in exceptional ability to recover from the stall. On ships which suffer from stall build-up, I think the cause is changing downwash angle with changing angle of attack, causing effective angle changes which aggravate the stall.

Other tests have been to find the most aft C.G. position whicch gives reliable operation in all weathers. 75-80% seems to be the limit depending on the trim used. 85% is OK up to moderate wind conditions, but in the rough the ship is liable to not quite make the first roll cut, and comes whistling back at you

With a view to improve the latter, the original design date was checked up again and we found that the C.G. in practice was ½ to ¾ inches lower than originally estimated. This means that the C.L.A. was not on or below the C.G. but above it. The ship normally trimmed with wash-in on the starboard (right) wing. which, combined with the effects of torque causes a left drift on the climb. Thus the side areas are under load, and if their centre is above the C.G. we have a force rolling into a spin. To check on, this a new fuselage was built having a lower C.L.A. Tests are not yet completed but the power flight pattern appears much improved. Ship climbs almost vertically with a very positive roll-out.

PETE BUSKELL (England) January 10th, 1955

Nice to hear from you again and to hear you are still keeping up the good work.

About those five dashes — — — — — in the 1954 FAI finals. My fault I think. Seems like I had pushed the C.G. a btt too much. Had flown one of them for two years without trouble, but don't think it was Hager's fault as Lanfranchi showed me a film of him making a perfect take-off flight pattern as per normal. He must have been dead unlucky.

After Hager's horrifying experience I checked up on the original design layout and found one major point which didn't work out as planned. This was vertical C.G. location. I checked on what "Sticks" I have left and find it comes ½ inch to ¾ inch lower than estimated. Thus the C.L.A. is not on or below but definitely above. This means that the roll out must be due to wash-in on the right wing only, i.e. the side pattern drag is to high to allow the ship to reach drift angle necessary to equalize the warp. This checks in practice as a warp free ship flies a right spiral banked in. If I lower the C.L.A. some I should get better rolling ability. Ship is built but not tested. Will let you know.

Incidentally, I think the advantage of straight climbers is largely overated. They appear to climb faster due to high forward speed brought about by the aft C.G., but normally do not exceed 45° climb. The 70" spiral model doesn't make much forward speed but climbs about 70° which adds up about the same height in the end.

About stall, I see the Germans claim to reach 12 deg. with thin sections and tubulators. I've abandoned the latter myself as I find a blunt carved L/E gives similar results and less effort.

As you will see from my "stick" piece I think the violent type stall is due in main to down wash effects. I am led to this view by a recent test. Built a "Stick" with 5 inches shorter M.A. thinking spiral stability might be better and got a few shocks. First, I had to reduce incidence about 3 deg., which says we were out of downwash before and have moved into it. Second, the stability deteriorated out of all proportion to the reduced M.A. and became average. Lastly, I was unable to get sufficient elevation on power. Finally got it climbing straight at 45° but needed 2 deg. neg. on the stab to do so. This I put down to the slip stream killing the downwash so bringing the power rigging down to 1 deg. Anyhow, the glide stability did not compare with the long model so I checked it in.

It aroused my interest sufficiently to get out the 52 year book and work out a pitching moment chart for 70" model without downwash. It shows a considerable improvement in recovery forces. All of which probably explains why my long ship has gentle type stall more a la text book.

Had to break for a few days at this point and managed to get out the new ship. Roll out is very much improved, climb being near vertical, rolling the inside wing up all the time.

On gliders! our mob are abandoning the long moment small stab model after two years of careful observation. Though they are tops in still air they are liable to mush out of lift if it is at all turbulent. Geoff Hancock has an interesting new model. High aspect wing, short moment. 30% stab with lifting section and ultra short nose. The nose in fact is a block of lead. It has almost instantaneous recovery and good thermal locking properties.

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JOHN WORTH (Hampton, Va.) July 28, 1953

Just finished the 53 yearbook and as with all previous editions I feel much enriched. Realizing the financial troubles the postwar books have presented I feel very grateful that somehow you have managed to get them out. Probably at this time I wouldn't have much sympathetic company, considering the non-technical minded group we have in modeling, but I wouldn't mind paying $5.00 a copy. My sincere thanx to you for your continued efforts with the books. Someday, I'm sure, the score will add up in your favor with a reward more substantial than financial.

Incidentally, somebody in the 53 book wrote that he thought the material should be presented in regular engineering form. To me, that's for the birds! I'm sure that there are hundreds along with me who can understand your presentation but would balk at the engineering type. You've presented technical information in a way we can understand and apply to current practice. In fact, I think that maybe one good reason we have largely neglected much good applicable full-scale technical data is that there is such doubletalk and high fallutin' language that we've been discouraged from wading through it. It takes an engineer to understand it and that's what we should change. My pet gripe is legal language and a close second is engineering language. To me, there's no reason why we can't keep it on a conversational level with resort only to illustrative sketches. We all know that common practice takes the good and proved engineering features and uses them in a sort of rule of thumb that does away with reference to formulae and charts. Sure, they are necessary the first time to prove the worth of an idea but after that we forget the fancy talk and boil down the info into usable talk and action. The place for the books, I feel, is to do the boiling down, to analyse in simplified form the theories or engineering studies that apply to the model field.

I have a feeling that we're coming into a resurgence of technical thinking. Around the radio control field the past year or so I've taken note that there is much talk and evidence of greater engineering consideration in the design of models. The radio control model is now coming into its own in that it is commonly recognized that a good model for this field must be one which is not merely converted from freeflight use, but must be engineered from nose to tail. Jim Walker apparently was one of the first to realize this as for years now he has been flying a ship many of us at first thought was just too much airplane and too little model. But there is much thought now that he has been working in the right direction. We might not go so far as he, but we are realizing the need for better construction, use of better materials, provision for better flight characteristics, etc.

My feeling, too, is that it is the old timers—the fellows who saw in the early yearbooks the value of engineering in design—who will give the model field its new shot in the arm. I think I have plenty of company in fellows who originally used the yearbook information liberally then later got away somewhat, relying on a few tried and true rules of thumb to guide model design and trim, but now realize the need for a return to the book to come up with better radio control airplanes.

We're becoming more concerned with power on and off effects, c.g. locations, and something not too much considered before: control surface size, effectiveness, movement, actuation, etc. We realize the need for better structure, better airplane to engine matching, a better balance between stability and maneuverability. We're getting nearer to full scale practice and maybe closer to usable Reynold's number information. There's one important factor influencing all this—the wind. The plain old simple breeze that has bothered us for years is having much to say about model design. The up and coming radio control model is an investment—too much of one to sit around on the ground on those few days us old-timers (next year I'll be thirty!) are able to get out on the field. And while in past years there has been a goodly number of r-c gents who seemed to prefer to have the wind as an excuse not to fly the models but to sit around and chat, there is a steadily growing number of fellows who are not grounded by the wind. Their models indicate the trend —the wing loading is up, there's little difference between power on and off speed, they land with a sinking speed and scares the pants off the floater boys but that also brings the model in somewhere close to the 'spot'. These models are built to take it on the nose and I mean that literally. The past month I've had a ship that has survived smashes that would have made tissue and balsa dust out of the old type ships.

On one flight the ship completed a series of four vertical banked circles within ten feet of the ground by piling in under full power into a stack of rocks. It hit hard enough to tear the cylinder head out of the crankcase and fold a rugged landing gear back flat against the fuselage, but the airplane itself needed only regluing of some joints and was back flying the next evening. This next session saw it come in for a hot bouncy landing on the ramp in front of our NACA hangar at Langley Field—it hit once, bounced and soared fifty feet or more into a wire meshed reinforced glass window, neathly punching a 3 inch diameter hole in same. Try punching one with a hammer! This time damage to model was less, involving only scrapping of a part of a too fancy cowl and some touch up with fuel proofer. Last night we piled the ship in from a prolonged spiral and this time removal of about six inches of nose was necessary! But the rest of the ship is good as ever. Radio still works fine.

But I've got my next winter project set up now. I've started to engineer the next radio model from the spinner to the rudder. Using previous lessons as a guide, the old yearbooks to take care of aerodynamics, better structure with much plywood and metal, I hope to have a ship that will look good, fly better, and last longer. This will be no heavy clunker for I don't believe weight makes a stronger model. I mentioned Jim Walker before as having indicated the direction for future radio models, although perhaps on the extreme side, particularly in size, and Walt Good should be mentioned too. His Rudderbug has much engineering and probably represents a less extreme example than Walker's of what a good radio ship should be like. Now we can carry the ball a step further and take these examples to guide design of even better models.

So maybe I'll have something positive to report for the next yearbook, whenever that might be. If it all pans out like I expect, I'd like to write up what I learn and the thinking behind it. It may be six months or a year from now and I think that others in the field will have much to report along similar lines. My guess is that 1954 will be the year to watch in radio control. That's when I think we'll see some real airplanes and some hot flying. And behind it all somewhere I think that the yearbooks will have played a big part—if not in direct application now at least in the past schooling they have given to guide us in design and adjustment.

Heading for the Nats this week—maybe I'll see you there. Hope so. For now, best regards and thanx again for your efforts with the books.

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January 4, 1956

Surprise and Happy New Year! I haven't died, as you might have suspected from my lack of correspondence. But there has been much water under the old bridge in the past year. All of a sudden I find now that I am deep in a project that didn't exist last summer. This is right down your alley and I hope to have a lot to report to you over the next six months or so.

Since last October the BrainBusters have been reformed and many of us are full blast in a model research program. It all started when Bob Champine came back from the Internationals and got everybody fired up on what the boys in Europe and elsewhere are doing. Bob, who is an NACA Flight Research pilot—same section as Hewitt Phillips and myself—was top U. S. man on the '55 Wakefield team. He came back with a bunch of color stereos and gave a talk on the meet. From what he said and what the pictures showed, plus the actual results of the meet, he got a warm reception from his proposal to get some research on the road since it appears obvious that the U. S. has no monopoly on talent.

First step was the reformation of the BrainBusters into the B.I.G.—BrainBusters International Group. Many of the old members are back in the fold. Joe Boyle, Tex Hartmangruber, myself, Woody Blanchard, Max Faget, etc. Hoping to reinterest Caldwell Johnson and Joe Dodson, among others. nitial purpose of club is to serve as an info exchange medium. At meetings, specific topics are programmed. Boys bring in their models or idea and everybody else gives them a good going over. Not to tear them apart but to offer suggestions for betterment. Such topics as the detection and use of thermals, towline techniques, rubber lubing, etc., indicate the scope of these discussions. The club interest so far is confined to the FAI free flight categories—Gas, Wakefield and Nordic. No controline interest.

As an offshoot of this, most of the members are helping out in the research program which was started by Bob Champine and Harry Shoaf. It started cut with simple outdoor glide tests, at night in calm weather. Idea was to shoot flash pictures to get a sequence picture of the glide that could be measured. After one session in 34 degree weather that lasted from 8 pm to 1 am the program was considerably overhauled! The process has been greatly refined and we finally feel that we're on the right road to getting the first truly accurate and reliable model data.

Glide tests are conducted indoors, over about a 200 ft. course, using a special catapult. Over a 40 ft. section of the glide path, flashes are made at intervals to obtain a sequence picture of the test. The resulting print is then measured to find rate of descent, coefficients of lift and drag, model attitudes and angles, airspeed, etc. The technique has taken three months to develop and is quite elaborate, to insure accuracy. Even though indoors, temperature and humidity records are taken, various correction factors are figured, such as less distortion, model deviation from straight track, etc. It takes a week to work up the data after one glide session! So far, the actual data obtained has been limited and all concentration has been on developing the techniques. But now we are about set and the next session will be for the record.

The enclosed photo is one of our earlier and cruder attempts. Since then the results are much better, with sharper individual images and better background. We have lights on the model, too, to provide light streaks between images to show continuity. We are also getting six images on a print now instead of only four.

At present we are working on Wakefields and we hope to try out every wing and tail available locally. Later we will work with complete modes, but right now we are using a "Standard" fuselage, with adjustable incidences and c.g., lights at c.g. and tip of fin. Nordics will probably get attention after the Wakefield program, then FAI gas.

Several of the boys are corresponding actively with the European gang so there is a good bit of information exchange. Frank Parmenter writes regularly to several English boys, Champine is in touch with a German, Harry Shoaf is also writing to a German boy. This helps to keep interest up and provides extra "meat" for llively meetings.

Hewitt Phillips is advising on much of the test procedures. He is greatly interested in what we're doing and has been very helpful. Hewitt is probably the best combination of modeler and scientist in the country. He no longer flies actively, but I have an idea that our present activity may stir him up again. He has always had models in his office and always talks with anyone that asks his advice.

Meanwhile, Harry Shoaf has the most ambitious project of all well in the works. He is building a low speed wind tunnel for wing section testing. He has been designing the tunnel for over two years, doing much consulting with all the NACA tunnel people. As a result, he has probably the best tunnel design for model work that has yet bee dreamed up. Last summer he did a lot of construction and has much of the detail work finished, such as, the tunnel prop, balance system, recording system. Data will be obtained by pressure distribution method rather than moving of model. Wing sections will be orificed with tubes to outside the tunnel to a manometer board which will indicate directly the pressure distribution. This board can be photographed and measured on the print. Harry hopes to be using the tunnel by next winter.

He has also developed a quick and relatively simple method for making the test wings. It uses a sort of routing method on a circular saw and requires no particular skill once the airfoil templates are made. The installation of the orifice tubes is also fairly simple. Originally this was a stumbling block, but Harry developed a fairly simple procedure that makes it practical. We're expecting great things from this tunnel, to get some truly accurate low Reynold's number data.

So, quite a lot has happened since I last wrote. It may be that we are on the verge of a scientific upswing in modeling. We've gotten interest elsewhere, too, which indicates that the interest is not just local. One of the Baltimore boys writes that he has located a wind tunnel that a couple of Glenn L. Martin engineers built about three or four years ago but dropped due to lack of interest. The tunnel is located in a barn and may be taken over by the Baltimore Aero-Craftsmen as a club project. This tunnel uses strain gages and I think is big enough to handle a complete model of Wakefield size. Hope they put it to work. Let me know what you think of all this—will keep you posted on our results.

Best regards—

John.

FROM THE SUBLIME

by Pylonius ——————————————— Uwanhim?

If the model stalls move the wings backwards . . . er . . . forwards . . . no . . . backwards . . . now let's see . . . OK we'll skip it. Knew it was hopeless asking me to write for the Year Book. Might be alright for those learned pundits who can discuss 'Circular Flo' (is that the correct Americanised spelling?) without thinking she's the fat barmaid at the Rose and Crown, but whenever I sart to give forth on the technicalities I am promptly asked to put a sock in it, for Pete's sake. Now it seems I must press on regardless for Frank Zaic.

Come to think of it, Mr. Zaic must be something of a philanthropist. After all, its no mean act to jeopardise the good name of his august volume just to show charity to one who is no longer socially at ease in the Old Country, where Manufacturer and Modeller hunt him relentlessly down with balsa knife and hobby-horse whip. But Mr. Zaic must be a kind man. In fact, I had an inkling of this some years ago, when seeing him at a model meet. He was the only one who didn't laugh when I came up to the take off board. But just afterwards . . . Well, that's different—he's onl yhuman.

Model planes are perverse things, getting up to all sorts of capricious nonsense in spite of the sternest remonstrances of the formulae fiends, but the creatures who throw them about are even more unpredictable. Take, for instance, the bred-in-the-bone modeller—the inveterate Yar Book reader. One moment he's acting like a normal human being, casually lighting the Dût fuse with only two timekeepers to hold his trembling hand steady, and the next he's like a demented being, belting downwind and crying joyfully to the startled birds that his new turbulator theory works, while upfield the crowds are wildly applauding the genius who has managed to get his commercial radio job airborne at the third attempt. But not for the true aeromod the plaudits of the gallery. He is a modest being, content just to win the odd half dozen cups during the season and the Wakefield once in his lifetime.

Sadly, though, the day of the aeromod as a dedicated and single minded fanatic is on the wane. Nowadays, aeromodelling has become more of a family past time, humbly lodged at the bottom of the 'Do It Yourself' list. A couple of bored Spacemen turn an idle, super vision eye away from the telescreen as Pa puts the finishing touches to Grandma's bed-table and reverently opens the Prefabricated Super Kit. Three weks later a gaunt but eager Pa makes for the nearest park under cover of two diminutive and rebellious Davey Crockets. Next day a saddened and wiser Pa struggles gamely with the intricacies of the Eesi Bilt Kitchen Table.

On a slightly more intense level than the family modeller comes the hobby fiend. During early adolescence he invariably acquires the nickname of Stinker; leaving later acquaintances to ponder the intriguing mystery of the origin of this effluvient appellation, whether it was connected with a too morbid preoccupation with a chemical set or a too casual attitude towards personal ablution. Anyway, the hobby fiend arrives on the flying scene fresh from his miniature train triumphs, having endeared himself to the neighbours by electrocuting the Landlady's Pussem-Woossems. Soon his collection of engines has become a byword in the club, and then one glorious, unforgettable day emerges forth his Sportnippy. Never mind if it looks like the result of a quarrel between a firewood dealer and a one armed paperhanger, the wonderful thing is that it fl . . . Well, a 5 c.c. engine. I ask you. Undismayed our hobby fiend gets to work on that super radio job, and a few weeks later the local camera club have acquired a new, enthusiastic member.

A more mature and usually more effluent variant is the character who produces a six channel radio job as his first attempt at aeromodelling. Londoners would quaintly refer to such an initiate as 'Bighead,' and readers of various racial denominations are cordially invited to apply their own suitable colloquialism. A ritzy looking sports car and masse of eye-catching equipment, including a languorous blonde, soon establish him as a prominent and popular figure on the airfield. It might be said that his star remains in the ascendancy just so long as his model doesn't. Or to put it less cryptically, once he yields to the nagging temptation to fly the model both his reputation and the model—are ruined. Some strong willed characters manage to stay impressively grounded for a whole season, adding to and modifying the equipment, mostly by way of replacement blondes. But even the strongest succumb eventually, and the day inevitably arrives when his loyal public gather in not-so-silent homage around the funeral pyre.

Other types of non Year Book readers are too numerous to mention, but all have the imupudence to style themselves aeromodellers, just in the same way that any floozie who does a sightseeing tour of Hollywood calls herself a film actress. Including funny (sic) columnists who don't know whether to put the wing forward or backwards.

DENSITY FACTOR

by Lt./2 Peter W. Soule —————— A.P.O.

Sometimes I have seen people trying to figure out why bigger jobs can "take higher wing loading."

Here, briefly, is the story: For a series of articles or objects of the same geometrical shape and material, but different sizes, the weights will be proportional to the cube of a characteristics length. And area proportional to the square of a characteristic length.

$$W \sim L^3 \qquad A \sim L^2 \qquad W = K_1 L^3 \qquad A = K_2 L^2 \qquad W = K_3 A^{3/2}$$

where the K's are constants.

This says that for any given series of models, say, their weights will vary with the 3/2 power of the wing area. The factor K is called the "aircraft weight density factor." This factor will be pretty close for one class of airplanes. It works out that for a given K_3 any aircraft conforming to $W_o = K_3 S_w^{3/2}$ will fly at the same C_L. That is, the airplanes would be geometrically and aerodynamically similar.

For example, take the "Amazon" series of free flights worked out by experience, no doubt. The wing loadings for the ½A, A, B & D models are quite different, varying from .065 oz/sq. in. for D job, and .033 oz/sq. in. for the ½A, but if W_o is in ounces and Wing area in sq. in. K is about 1/380 for A and ½A, and 1/450 for the big ones. Showing that the smaller jobs tend to be a little more dense due to the fact that they cannot be made as well, but that the K factor is much closer than wing loading for comparing planes of different sizes. For instance, the Piper PA-11 "Super Cub" has a density corresponding to most radio models.

In general, after comparing a great number of models, I find K_3 for free flight duration gas jobs to be about 1/400. For stunt about 1/250, and so on—regardless of the engine intended for them.

URLAN WANNOF (Scotland) January 1, 1954

I am delighted to hear that there will be another YEAR BOOK again this year. I can see that the 1951-52 and 1953 editions did not pay you well financially. But while those of us who digest the BOOKS are not hurt by their not paying you, and it may therefore be easier to say this, we certainly hope you continue to publish them.

They represent far more than could any other magazine or book. The approach of the monthly aeromodelling magazines in both Britain and U. S. A. is regretted by all modellers I know. Being published to make profit they cater for the person who only stays in aeromodelling for a year or little more. As with everyone else, they have to make a living, so they publish the magazine to catch the transient modeller — of whom there are more than there are of serious fliers. So it is only rarely that we get anything in the magazines that is of interest and seriousness. You have to make your own living, but I hope you manage to do it by publishing your YEAR BOOK too.

I feel selfish in saying this, I feel as though I was urging you to starve. I hope it's not that serious! But the YEAR BOOK does mean an awful lot. Its on approach to modelling that is printed nowhere else.

I am enclosing two plans, and I hope they will be of interest to you. The one model is my own, the other is by my friend Charles Christie. Upon receiving your letter, I wrote to him, for I thought he could be of more help to you then could. Charlie is just completing his degree course in Engineering at Aberdeen University, and is writing his thesis—at his Professor's suggestion—on the aerodynamics of aerofoils at model speeds. They have a wind tunnel at Aberdeen, for which Charlie has been building various wing sections. The work is largely completed, but not fully considered. So I have got a summary of the observations so far examined, while there should be a more complete report later.

Charles has been a modeller for longer than I have, and over the past three or four seasons we have both been refining the designs of our respective rubber jobs. While we both fly Wakefields, we are keenest on light weight models, what you call Unlimited Rubber. The two plans show our different approaches, Charlie's being by large models, myself by design half the area and weight. The two models are very similar in performance, both giving a time of around 4 minutes in calm weather full turns. In weather with any lift around—late on summer evenings when there are no thermals, but when there seems to be a cushion of air over the ground on which models float—these lightweights will turn in high times on few turns. They are not models for rough conditions, but I cannot bring myself to build strength into a model with the addition of payload weight.

So while "Winding Boy" and "Sunday Girl" are two different samples of a lightweight model, they have common features. Both have been fitted with compensating folding propellers, both use long fuselages and high pylons. Charlie's next model will have high aspect Ratio as has mine. The efficiency and glide being far better. The high pylons are necessary to control the initial high torque of the motors.

I have used the HATSCHEK AA 1950 section in the wing these past two seasons, and am convinced of its value. After his windtunnel tests, Charlie has also decided to build his next version of his model with a flat undersurfaced section on the wing. We feel that this way we get a more controlled and far better climb, and we have found that the glide is certainly as good as that got with Marquardt S-2 or the more moderate Benedek sections.

After having put a section with Benedek extreme characteristics through the wind tunnel, Charlie is horrified, and completely swears himself off the exaggerated Continental aerofoils. Czepa won the A2 event once, in absolute calm, but he hasn't had that success again. In still conditions "bird" aerofoils perhaps are efficient, but they seem to lose if there is the least disturbance in the air.

I was entertained by Pete Buskell writing of his tests, for he seems to agree that undercamber is a dangerous thing. Don Butler's French Curve and ruler's is very little off a flat bottom surface, which I feel is the reason for its success. A couple of years ago I would have disdained to use a flat bottom section. I would have quite scorned it! Now I am not so scornful. I feel that rubber modellers — and glider fliers too — have slavishly built undercambered surfaces, and have "progressed" by increasing the undercamber. This summer I will have free time as I have not had during my course at University, and I will get wings built using various sections. I think we are on a useful track, and will see if it leads us further than we have so far got. — I dedesign by what I think, and not by what I theorise. Charlie does both.

REG PARHAM (England) — September 4, 1954

My principal news concerns our indoor activity and progress in this field.

At my instigation, Rushy, with his usual tact and thoroughness, managed to get us the use of one of the airship sheds at Cardington for four two day meetings this year. The hanger, in which the ill fater R100 was built, is 600 ft. long, 220 ft. wide and 180 ft. high. It is completely sealed at one end and the doors at the other end are very close fitting and very little drift is apparent. Curtis Janke tells me that this compares well with your best site. Incidentally Cardington is only ten miles from Cranfield.

So far, two meetings have been held. The last being attended by about twenty fliers. Test flying got under way slowly with most of us trying to get used to so much space and height. Bob Copland flying a non braced model with a wood prop put up the best time during the first afternoon of about 13½ min., but in the evening I took out my .045 oz. "C" stick and made three successive flights: 1000 turns about 13½ min., 1600 turns 19 min. 31 sec., 1800 turns 21 min. 12 sec. The last flight was the highest of the meet and gave me the honour of being the first Britisher to exceed 20 mins.

On the following day when the lads had "got their hand in" the standard of flying improved considerably and times below 15 min. were almost frowned upon. We held a contest and Phil Read of Birmingham came out on top with 21:09, Bob Copland with 19:50 and then myself with 19:11.

We have a long way to go before reaching the American expert class, but we are learning fast and will improve. Most of our supplies at present have been sent over by chaps such as Walter Erbach and Joe Bilgri. Joe Maxwell in Scotland has recently started cutting indoor stock and whilst he is having difficulty with the quality, is coming along fine with his cutting technique. He also strips Dunlop and Pirelli rubber down to useful sizes and so at last we are being catered for over here.

H. J. KNIGHT (England) October 17, 1955

Thank you for your card from Monte Carlo. I must first of all make it clear that this letter is not coming from J. B. Knight but from his father, H. J.

John is at present working at Vickers Weybridge. He is employed there on wind tunnel work as he holds a degree B.Sc. (London). He seldom gets home and he is living in lodging (or is it apartment) so his opportunities for modelling are poor and his interest has waned.

However, he still comes along and does retrieving for me, on the rare occasions that I do a spot of flying.

If you saw the names of the finalists of this year's British Wakefield Team you will know that I was in fourth place. I declined the offer of being in the British Team as I felt it was too strenuous for me. (I am 65 and not a very good traveller.)

However, there was no fluke about my getting a place in the team as I knew at the beginning of the season that I had got a model that barring accidents could do the job. I designed it myself and it differs considerably from what most people consider a Wakefield should look like. If you are interested in its details and design and what prompted me to build something different, let me know and I will tell you more. I don't pretend to any knowledge of aerodynamics as applied to model aircraft, but what ideas I had paid off handsomely.

November 19th, 1955

Thank you for your letter of Nov. 3. We have copies of your past Year Books and read them again and yet again with sustained interest. Another one will be more than welcome.

I have this week sent along sketches and details of my 1955 Wakefield to G. Woolls so I trust they will prove of some interest to you.

When you have studied the plans you may likely think it a somewhat odd model. So you may care to know some of the considerations which prompted the design.

The previous Wakefield rule which placed no limit on the weight of rubber motor brought about the long fuselage model; the only consideration being to get the rubber into the fuselage somehow.

However, when the weight of rubber was restricted many modellers still retained the long fuselage because they believed that keeping the motor as long as possible between the hooks avoided the need of much pre-tensioning and allowed more turns to be put on. In addition the weight of the rubber saved was built into the airframe; often by completely sheeting the fuselage.

I watched many of these models fly and the flight path of some of them was far from elegant. It seemed to me that this was largely caused by the weight of the model being distributed over the entire length. This means hat should the normal course of model be distributed, large inertia forces must be overcome before it can resume its correct flight path. In doing so the power stored in the rubber motor is wasted or if it be gliding the sinking speed increases.

I know that I am concerning myself only with mechanical considerations but it seems to me that in the ideal machine all the weight should be as near the C.G. as possible.

In an endeavor to reach this ideal, I have used a rather long moment arm; but I have kept the weight of the tail end of the fuselage, the tail plane and the fin, as light as possible. The wing also is very light, not forgetting the tips. No attempt has been made to get the longest possible distance between the motor hooks. I have gone to the other extreme and kept them as close as I dared (Note Johnny Gorham's remarks page 117 1951-2 Year Book). I placed the L.E. of the wing only 7½ in. from the front of the fuselage, used a reasonably light prop assembly and found I needed about 1¼ ozs. of extra weight to come up to limit. This was stuck on the underside of the upper sheeting just behind the nose block. C.G. came out where I like it at about 60% chord.

The model has a 20 in. low pitched feathering prop, motor 14 strands Pirelli. Takes about 650 turns without risk of breakage and yields about 45 sec. motor run.

The flight path is a steep close R.H. spiral. It holds it with gradually reducing steepness until the last turn and goes into glide smoothly (Tight R.H. circle). It is pretty to watch and the model flies with an effortless buoyancy! Not struggling as some jobs do.

Now, a word about props. Few of us can try all sorts as time conditions and opportunities do not permit. I feel that too many modellers concern themselves with pitch without relating it to diameter,, and the natural speed of the model. More information on props would be welcome. It is a very negleced subject. I can only build from my own experience. With a model flying at the speed of the average Wakefield, I feel that the angle of the blades near the tips should not be above 30 degrees. If more pitch is needed, then increase diameter and retain same tip angle as before.

I hope I have not bored you but it is this constant striving for improvement that makes aeromodelling fascinating. I hope to continue for some time yet, but I fear I am getting too ancient to put forth the effort required to keep in the limelight. (After all, I can remember the Wright Bros. experimenting at Kitty Hawk.) Do you remember this quotation from a "poem" at the time—

"And then one morning up they flew
And all the village seers
Just stood around
And pawed the ground
And chewed each others ears."

Perhaps you have heard it. There is a lot more that I forget.

I am pleased to have accomplished what I have this year. It was not a casual success, but just the result of determined effort and working to a plan. I am satisfied, although I could not make the trip to Germany.

My daughter, Daphne, won the Ladies' Challenge Cup this year, so we shall have one Pot on the sideboard.

You may remember that I won the 1949 Power Comp at British Nationals from over 400 entrants, but I designed and built the engine myself (including die-cast crankcase). That may be news to you.

My very kindest regards.

Yours sincerely,
Harry Knight

M. HACKLINGER (Germany) — January 14, 1955

There has been done many a thing since my first emperical step with turbulators and with model stability. The turbulator experiments have come to a momentary end and the resume was published in the May, 1954, issue of the Aeromodeller. We have experimented with surface turbulators, also with suction holes in the wing, but the old vibrating cord is now as before the best turbulator for both stability and performance.

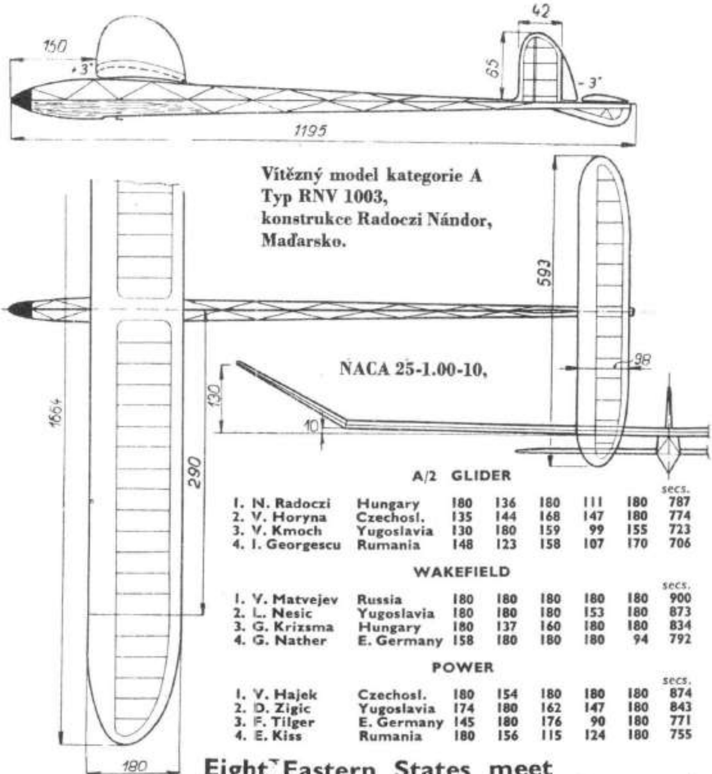
As for aerofoils: From a series of free flight models (beginning with my Graz A2) I had developed a type of fully turbulent airfoil which is in use now one year in many designs. HA12 is to be measured in the Gottigen wind tunnel by Schmitz. Free flight measurements of MP 11, my Bled model with HA12, have been done already in a hall. I have measured performance and angle of attack (by Foto) in long series. The complete report will be published in one of the next issues of the organ of WGL, the 2FW (journal of flight sciences). In the same issue will appear theoretical works of my friends, R. Eppler and F. X. Wortmann, also members of the WGI, regarding calculations of airfoils for low Re numbers. One of these newer calculated airfoils of Eppler is tested now in free flight, seems not to be superior to the practically developed, however, up to now.

What you say on the stability of our "still air designs" is very true. A long time ago we have come to the conclusion that the key to all weather performance is the Longitudinal Stability. Lindners victory in Denmark, besides, followed this cognition. I have, therefore, concentrated my studies on the theory of Longitudinal Dynamic Stability.

We make test flights with various types of stabilizers, have measured and calculated for comparison the moments of inertia of our A2s, varied the $\bar{V}$-values ($\bar{V} = \frac{S_t}{S_w} \cdot \frac{l_h}{\bar{t}}$) and the most important; we hope to find from the Dyn. Stab. theory the trajectories for the case that a stall causes a singularity of the flight path. From this mathematical struggle can be seen definite tendencies at last and it should be possible to find out some general rules independent of the polar curve of the considered model.

But this theory takes much time, so I have concluded previously our mostly emperical experiences with the end to enable the practical modeller to trim his job systematically so that it is flying with minimum sinking speed but with greatest amount of Longitudinal Stability. When this was ready, a friend pointed out that some facts of our system were quite in conformity with the things stated in your 1952-53 Year Book. (That a rearward C.G. makes the model more sensitive and brings about the spiral dive with smaller amount of rudder setting.) It is a fine thing when results found in different ways, show conformity.

For a new Year Book, it would be useful to bring not only plans from as many countries as possible but also short explanations why the boys built their models this way and that way. There are the most phantastic theories afloat among aeromodellers. But sometimes the ideas are good indeed and worth to be known.



Vítězný model kategorie A
Typ RNV 1003,
konstrukce Radoczi Nándor,
Maďarsko.

NACA 25-1.00-10.

A/2 GLIDER

							secs.
1. N. Radoczi	Hungary	180	136	180	111	180	787
2. V. Horyna	Czechosl.	135	144	168	147	180	774
3. V. Kmoch	Yugoslavia	130	180	159	99	155	723
4. I. Georgescu	Rumania	148	123	158	107	170	706

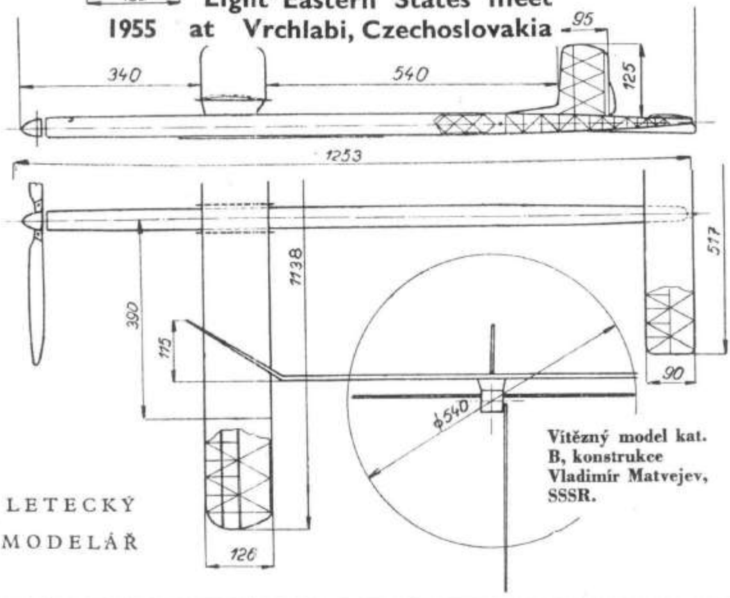
WAKEFIELD

							secs.
1. V. Matvejev	Russia	180	180	180	180	180	900
2. L. Nesic	Yugoslavia	180	180	180	153	180	873
3. G. Krizsma	Hungary	180	137	160	180	180	834
4. G. Nather	E. Germany	158	180	180	180	94	792

POWER

							secs.
1. V. Hajek	Czechosl.	180	154	180	180	180	874
2. D. Zigic	Yugoslavia	174	180	162	147	180	843
3. F. Tilger	E. Germany	145	180	176	90	180	771
4. E. Kiss	Rumania	180	156	115	124	180	755

Eight Eastern States meet 1955 at Vrchlabi, Czechoslovakia



Vítězný model kat. B, konstrukce Vladimír Matvejev, SSSR.

I.M.A.C. MEETING REPORT

Paris—December 1955

(As reported by Mr. A. F. Houlberg, Chairman of the F.A.I. International Model Aircraft Committee)

Items Raised by Belgium

A vote was first taken to ascertain if the Committee was of the opinion that a change in the formulas was desired in 1957. Belgium raised this point in particular because of the results of the Championships last year in Germany. The vote had the following results.

Gliders: No change.

Wakefield: Eight to two votes against any increase in the maximum flight time. Eight to two against increasing the number of contest flights. Nine to nothing against increasing the total weight of the model. Six to one for revising the rules for 1957.

A lengthy discussion then took place on the question, which resulted in the following voting:

Reduction of rubber to 50 grams—five for. Reduction of rubber to 60 grams —two for. No change—one for.

The rubber weight will therefore be reduced to 50 grams for 1957.

Power: Six to four votes for change.

A discussion took place on the question of increasing the power loading to 300 or 400 grams per cubic centimeter of displacement. When put to a vote, there were five votes for and three against 400 grams. The voting was the result of the majority feeling that if any change was made, it should be an appreciable change or else the Committee would find itself in exactly the same position again by the end of 1957.

The President pointed out that these were drastic alterations and that the meeting could either pass them then and there or refer them back to the National Aero Clubs for ratification.

The Committee considered that as each delegate held a mandate from his National Aero Club, the Committee was authorized to make a final decision. When put to vote, six were for making a spot decision and two against.

The power loading for 1957 will, therefore, be 400 grams per cubic centimeter (or double the present power loading).

Championship Jury

It was agreed that it was the prerogative of an organizing National Aero Club to appoint a Jury or Stewards Committee. It is preferable that two of the three members be of a nationality other than that of the organizing nation, and preferably chosen from among members of the International Model Aircraft Committee.

Official Languages

It was confirmed that the official languages were French and English, and that the rules of all international contests were to be in these two languages. The text of the rules is to be sent to the F.A.I. Bureau for a check and approval of the translation to avoid misunderstandings.

R.O.G. Requirement

It was agreed by six votes to two to abolish the rise off ground requirement for 1957. This does not affect the requirement that hydroplanes must take off from water or the requirement that control line models take off the ground.

Sporting Code Annex B

After a detailed discussion, it was agreed that it was advisable for the whole of Annex B of the present Sporting Code to be incorporated in the Rules when the Code is reprinted in 1957. This applies to such points as requiring competitors to provide templates of lifting surfaces, requiring competitors to vacate the starting position immediately after a flight, forbidding metal propellers, allowing only the competitor and one assistant at the take-off area, etc.

1955 WORLD CHAMPIONSHIPS

INDIVIDUAL RESULTS FOR THE SWEDISH CUP

			1	2	3	4	5	Total
1.	R. Lindner	Germany	180	180	180	180	166	886
2.	R. Gilroy	Gt. Britain	160	180	180	180	180	880
3.	R. Hagel	Sweden	176	180	180	164	177	877
4.	E. Giusti	Italy	156	180	180	180	180	876
5.	J. C. D. Esvelt	Netherlands	163	180	137	180	180	840
6.	H. W. Thomann	Switzerland	166	180	180	180	130	836
7.	H. Kòthe	United States	143	180	145	180	180	828
8.	V. Horyna	Czechoslovakia	180	180	133	180	152	825
9.	H. Hansen	Denmark	180	180	158	106	180	804
9.	M. Vilchair	France	118	180	180	180	146	804
11.	H. Ege	Switzerland	174	116	180	144	180	794
12.	C. Varetto	Italy	130	180	180	180	114	784
13.	C. Goetz	France	135	100	180	180	180	775
13.	B. McElwain (P) Kurth	New Zealand	104	180	131	180	180	775
15.	G. Overlaet	Belgium	147	180	180	180	85	772
16.	L. Murtagh	Ireland	138	180	180	93	180	771
17.	A. Cavlevski	Yugoslavia	171	165	128	125	180	769
18.	L. Gustafsson	Sweden	141	180	180	90	168	759
19.	J. O'Donnell	Gt. Britain	96	180	180	180	114	750
20.	L. Feron	Belgium	150	139	180	180	97	746
21.	D. Mackenzie	Canada	130	99	180	156	180	745
22.	V. Spulák	Czechoslovakia	166	95	180	116	178	735
23	Eduardo Vich	Argentina	110	128	180	147	167	732
24.	F. Sussdorf	Saar	157	180	159	127	106	729
25.	S. Pedersen	Denmark	128	180	139	101	178	726
25.	L. Olsson	Sweden	114	180	72	180	180	726
27.	R. Berthe	France	108	144	180	180	110	722
28.	P. Petrovski	Yugoslavia	180	124	125	108	180	717
29.	C. Boscarol	Italy	140	146	158	178	122	716
30.	J. Lock	France	126	180	90	172	143	711
30.	A. C. LeBreton (P) Mussig	New Zealand	165	180	180	80	106	711
32.	J. Harápát	Czechoslovakia	143	180	180	87	114	704
33.	W. Etherington	Canada	180	151	72	180	115	698
34.	B. Jones	Canada	105	180	101	180	129	695
34.	H. Rau	Saar	133	180	180	127	75	695
36.	P. Nironi	Italy	180	84	180	70	176	690
37.	J. Fraquelli	Argentina	132	147	180	153	75	687
38.	M. Newnham (P) Barth	Australia	110	109	99	180	180	678
39.	M. Vuletic	Yugoslavia	150	180	78	100	167	675
40.	R. Knoll	Saar	92	180	128	180	83	663

TEAM AGGREGATES FOR THE BELGIUM DAUMERIE TEAM TROPHY

1. Italy	2376	8. Yugoslavia	2161	15. New Zealand	1944
2. Sweden	2362	9. Denmark	2154	16. Ireland	1910
3. France	2301	10. Canada	2138	17. Netherlands	1894
4. Czechoslovakia	2264	11. Saar	2087	18. Austria	1728
5. Switzerland	2191	12. Belgium	2063	19. Monaco	1520
6. Gt. Britain	2184	13. Argentina	2022	20. Australia	1322
7. Germany	2171	14. United States	1968	21. Mexico	623

INDIVIDUAL RESULTS FOR THE F.N.A.F.O.M. CUP

			1	2	3	4	5	Total	Fly-off
1.	M. Gaster	Gt. Britain	180	180	180	180	180	900	313
2.	F. Stajcer	Argentina	180	180	180	180	180	900	175
3.	B. Jones	Canada	180	180	180	180	180	900	000
4.	V. Hájek	Czechoslovakia	180	180	180	180	166	886	
4.	L. Mangino	Mexico	166	180	180	180	180	886	
6.	P. Buskell	Gt. Britain	180	180	180	180	151	871	
7.	G. Vidossich	Italy	180	180	180	180	150	870	
8.	M. Rudolph	Germany	179	180	166	180	164	869	
9.	P. Goss	United States	180	180	148	180	178	866	
10.	L. F. L. M. Bausch	Netherlands	160	180	180	180	127	827	
10.	Antonio Podda	Italy	170	142	180	180	155	827	
12.	J. Partinen	Finland	132	180	158	180	167	817	
13.	H. Gould	United States	180	180	142	180	130	812	
14.	R. Bacchi	Italy	180	180	180	174	87	801	
14.	B. Gunic	Yugoslavia	180	180	81	180	180	801	
16.	J. Parrott	Gt. Britain	180	180	102	180	143	785	
17.	J. Heidemann	Germany	120	180	173	180	176	779	
18.	G. Hormann	Austria	180	169	133	180	102	764	
19.	O. Lucas	Argentina	162	180	60	180	180	762	
19.	J. Thompson	Ireland	150	127	125	180	180	762	
21.	M. Zito	Argentina	180	155	111	180	134	760	
22.	S. Davila	Mexico	180	125	129	166	157	757	
23.	F. Aiken	Ireland	180	154	180	165	74	753	
23.	E. Johansen	Denmark	157	132	104	180	180	753	
25.	G. Rupp	Germany	169	108	109	180	180	746	
26.	E. Fresl	Yugoslavia	180	130	95	151	180	736	
27.	H. Fries	Sweden	144	180	160	180	69	733	
28.	L. Nesic	Yugoslavia	147	76	147	180	180	730	
29.	G. Lippens	Belgium	136	152	180	180	81	729	
30.	P. Schmitter	Switzerland	154	180	123	180	'91	728	
31.	W. Hartill	United States	135	100	180	180	113	708	
32.	B. Baker	Australia	180	153	101	114	158	706	
33.	H. Buhr	Switzerland	118	90	180	180	137	705	
34.	A. Mussell	Gt. Britain	180	156	—	180	180	696	
35.	R. Cerny	Czechoslovakia	159	99	143	110	180	691	
36.	J. McMillan (P) Benkert	Canada	79	180	136	153	139	687	
37.	A. Lundin	Sweden	102	132	180	180	90	684	
38.	T. Morelli	Ireland	115	137	180	142	109	683	
39.	H. Entzeroth	Switzerland	148	119	180	103	104	654	
40.	W. Etherington	Canada	173	49	143	156	131	652	

TEAM AGGREGATES FOR THE FRANJO KLUZ TROPHY

1. Great Britain	2556	8. Ireland	2198	15. France	1716
2. Italy	2498	9. Czechoslovakia	2116	16. Austria	1332
3. Argentina	2422	10. Switzerland	2087	17. Denmark	1284
4. Germany	2394	11. Sweden	2018	18. Finland	817
5. United States	2386	12. Mexico	1977	19. Saar	800
6. Yugoslavia	2267	13. Netherlands	1889	20. Australia	777
7. Canada	2239	14. Belgium	1792	21. Monaco	520

INDIVIDUAL RESULTS FOR THE WAKEFIELD CUP

			1	2	3	4	5	Total	Fly-off
1.	G. Samann	Germany	180	180	180	180	180	900	315
2.	A. I. Hakanssen	Sweden	180	180	180	180	180	900	289
3.	C. Scardicchio	Italy	180	180	180	180	180	900	286
4.	J. Altmann	Germany	180	180	180	180	180	900	284
5.	E. Fresl	Yugoslavia	180	180	180	180	180	900	270
6.	Guido Fea	Italy	180	180	180	180	180	900	213
7.	L. Muzny	Czechoslovakia	180	180	180	180	180	900	169
8.	M. U. Blomquist	Sweden	180	180	180	172	180	892	
9.	K. E. Widell	Denmark	180	180	180	180	170	890	
9.	R. G. Ahman	Sweden	180	170	180	180	180	890	
11.	F. Holland	Gt. Britain	180	180	180	180	160	880	
11.	R. A. Champine	United States	180	180	180	179	161	880	
13.	H. H. Kothe	United States	180	180	180	158	180	878	
14.	F. Mursep	Argentina	164	180	180	173	180	877	
15.	H. O'Donnell	Gt. Britain	180	180	156	180	180	876	
16.	E. Balasse	Belgium	180	180	180	149	180	869	
16.	C. R. de Vries	Netherlands	180	180	180	159	170	869	
18.	M. D. Andrade	United States	180	180	180	148	180	868	
19.	G. Maibaum	Germany	180	180	147	180	180	867	
20.	G. J. Schaap	United States	180	180	180	180	146	866	
21.	A. S. P. Balogh van Galantha	Netherlands	180	143	180	180	180	863	
21.	O. de Bare	Belgium	180	180	180	143	180	863	
23.	V. Kmoh	Yugoslavia	141	180	180	180	180	861	
24.	R. Cizek	Czechoslovakia	178	180	132	180	180	850	
25.	H. J. v.d. Geer	Netherlands	148	180	180	177	158	843	
25.	H. Toersen	Netherlands	180	125	180	179	179	843	
27.	E. Knudsen	Denmark	180	174	136	168	180	838	
28.	R. K. E. Johansson	Sweden	180	180	117	180	180	837	
29.	D. Prandini	Italy	180	180	180	114	180	834	
29.	J. O'Donnell	Gt. Britain	180	180	114	180	180	834	
31.	D. R. Mackenzie	Canada	180	159	133	180	180	831	
32.	R. McGlashan (P) Etherington	Canada	175	172	180	172	180	829	
33.	M. Bodmer	Switzerland	162	180	160	160	165	827	
34.	E. Gerlaud	France	105	180	180	180	180	825	
35.	I. Pietralunga	Italy	180	115	180	148	180	803	
35.	R. Miyahara (P) Schulz	Japan	156	164	173	180	180	803	
37.	P. W. Read	Gt. Britain	138	165	136	180	180	800	
38.	L. F. Murtagh	Ireland	125	180	180	180	129	794	
39.	B. R. S. Baker	Australia	180	154	114	180	165	793	
40.	L. Nesic	Yugoslavia	103	180	157	167	180	787	

TEAM AGGREGATES FOR F.M.A. CUP

1. Sweden	2682	7. Yugoslavia	2548	13. France	2359
2. Germany	2667	8. Denmark	2510	14. Japan	2197
3. United States	2646	9. Czechoslovakia	2509	15. Australia	2007
4. Italy	2634	10. Argentina	2411	16. Ireland	1986
5. Great Britain	2590	11. Belgium	2388	17. New Zealand	1918
6. Netherlands	2575	12. Canada	2374	18. Switzerland	827

CONTRIBUTIONS

NOTES AND LETTERS

Dear Friends:

And I know I have at least 1,000, because that is the number which sent the pre-print orders. Thanks a lot!

The pre-print order idea was planned to ease the financial uncertainty. But it did not seem to work. We sent 14,000 letters.(At a cost of $1,500.00) Percentage wise we were above average. But we had hoped for super-average. It would have made life less complicated, but not as much fun. Future announcements will be more economical as now we know who is interested in our work.

Right now we are not in a mood to talk about new books. This edition was super-imposed on a 50 hour WORK week. And it was a question of time who will win, the virus or the book. Well, I am writing this, floating in penecilin and vitamins and waiting to call on Doc.

Answers to the questionaire were very interesting and encouraging. And we will be guided by them. Of course, we cannot promise anything at this time. A great deal will depend on the sale of this book. No matter what we say or do, what actually counts in the end is the number of people who are interested in our type of model work. And roughly, 5,000 readers would make future very interesting.

I find that I can no longer give time as freely as I used to. I still enjoy corresponding and collecting, but I think I have had done had it as far as drawing plans is concerned. Luckily, I know several model builders around the world who volunteered to do plans at $10.00 each. But when you think of 140 plans, and where the $1,400.00 will come from, you can see why 5,000 readers would make it interesting.

Many things happened while the 1955-56 YEAR BOOK was in production, and we will be glad to talk about them over YOUR tea. But, on the whole, it was a pleasure to collect the material from you, and present it to you in this form. Let us hope that you will have as much enjoyment from it as we had.

Thanks to all of you who helped. Let us hope we can keep this up for a long time to come.---It is fun after it is done!

Frank Zaic

FAI & POWER MODELS

WAKEFIELD & RUBBER MODELS

NORDICS & GLIDERS

H.L.GLIDERS

INDOOR

CONVERSION TABLES

2.54 x in. = Cm.	28.35 x Ozs. = Grams	0.68 x Ft.Sec = M.P.H.
.394 x Cm. = In.	.0355 x Grams = Ozs.	1.467 x M.P.H. = Ft.Sec.
6.45 x sq.in = Sq.Cm	16.4 x Cu.In = Cu.Cm.	.011 x Ft.Min. = M.P.H.
.155 x Sq.Cm. = Sq.In.	.06 x Cu.Cm. = Cu.In.	88 x M.P.H. = Ft. Min.

CONTRIBUTIONS: We are happy to say that this edition is made up entirely from contributions. In most cases, these contributions are the result of correspondence or requests for special information from people who know their business. In this manner a paerticular deficiency in model aeronautical knowledge can be covered when it is needed.----Plans, as a rule, were obtained in similar manner. Since we do not know what goes on all over the world in way of model work, we have to depend on contests and our friends to guide us in selecting the models.-- But we would especially like to hear from those of you who are working on projects and have no way of publishing the material.-- You may present your version this year, and in the next issue someone may find a better way of solving or explaining the problem. The main thing is to do something, right or wrong, and tell the rest of us about it. You would be surprised at what may turn up. When sending plans, see drawings in this book and note the information given. Thanks for your cooperation.

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