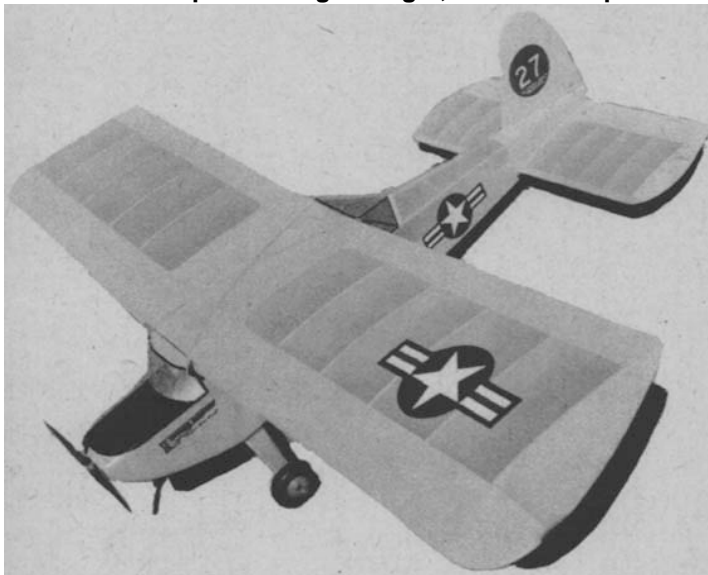


Designed around the Schmidt five-channel radio. Equalizer has left and right rudder, up and down elevators, engine control for fifth.

The Equalizer

Secret of the most successful of designer's multi-control ships is the light weight, minimum airplane.



Built correctly, the ship will weigh only four pounds with radio and batteries (this is correct). Power ample with K & B Allenn .15

By HAROLD by HAROLD deBOLT

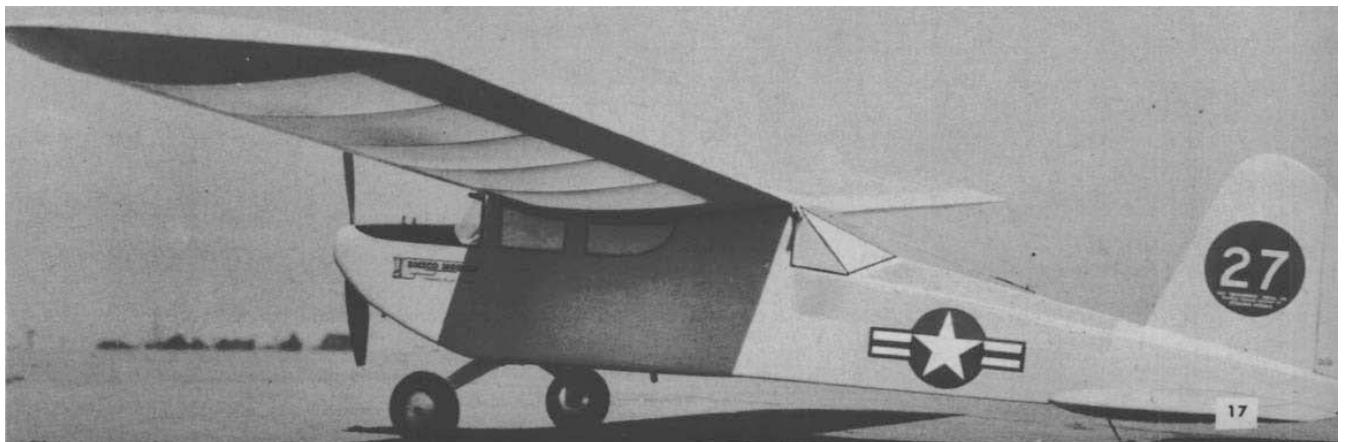
Equalizer, you say? Tis true, performance is very close to being equal whether flying upright or inverted!

Now that so called "symmetrical" models have come into their own, we can dig into the peculiarities of this sort of design. One of the main requirements, if we are to have equalized performance, is that we use a force arrangement which is close to the same both upright and inverted. With this the model's flight attitude will remain the same no matter how we fly it. Other force arrangements will allow inverted flight, etc., but the difference in the model's attitude will be so great as to make the "symmetrical" type by far the most desirable.

After two years of flying this model it has proved to be one of the best approaches to the problem. With the desired features any symmetrical design is going to be comparatively faster in flight than other types. This is, of course, not out of line if the speed is held within reason. However, it was soon discovered that, if we used wing loadings that were average with other models, the flying speed easily shot high. This means a model which is difficult to launch and one that performs so quickly that you may not have time to think. Thus, a reduction of speed would be a big step forward with this type of model design.

There actually are two ways of reducing the speed: one is to increase the angle of attack of the model so that the wing will create more lift at a slower speed and, of course, more induced drag will result. This was the first method tried and it does work. However, you must put up with a sluggish model and one which may fail in directional stability as a result. In these

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The Equalizer

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experiments it was found that a model of this type will perform well through a wide range of angular settings in the stabilizer, considering that the wing is set at a zero angle of incidence. Actual tests showed that a range from zero to -4° could be used without ill effect. The difference is that at -4° the model is rather sluggish and flies at a normal speed.

At -1° the model becomes exceedingly fast, yet it is very responsive and probably has the flying characteristics that we like. Obviously, what we want are the good characteristics without the high flying speed and fortunately this follows from using the second method, which means a lower wing loading.

The flying speed of a model is governed by the total lift of the wing plus the rate of climb desired. In other words, if we increase the lift of the wing, we can reduce the flying speed and still maintain the same rate of climb. With a model of a given weight, added lift results either from increasing the wing area or reducing the wing loading. Either approach will result in the lower flying speed that we wish for this type of model. Like most things these days it is a lot easier to say than to do, but an analysis showed two possible ways of accomplishing it.

First, no matter what the model might be, the equipment weight is fixed; that is, the radio gear, etc. are going to weigh only a specific amount. This leaves the model alone with which to solve the problem. The simple answer would be just to add more wing area. However, with our "minimum" type RC designs, this just cannot be done without upsetting the careful balance which we now have. Thus, if we are to increase wing area, we must also increase the size of the rest of the model. Unfortunately, this can result in a "merry-go-round," for as we increase the model's size, we must add more weight for the structure and usually a heavier, more powerful engine. The result is that we must not only add enough area to reduce the loading at the model's original weight, but some more too for the increase in the larger model's weight. It should not be hard to see that by the time we get through with it all, we may

have a model of such size that it may very well be too big to be usable by most of us.

The Equalizer is a successful attempt in the opposite direction. For this one we used the basic equipment weight needed and added to it the minimum amount of model necessary to get the desired wing loading. Actually, it was made possible as a result of experimenting with lightweight structural design. These experiments had been carried out along the lines of the inertia-mass principle. Formerly in RC design we had built the whole model rugged to withstand abnormal abuse. The experiments showed that if we removed the mass weight and concentrated our strength at points of stress we could reduce the over-all weight of the model without reducing its strength. These experiments proved very successful and of course are the means which made this particular model possible.

The wing loading aimed for was 16 oz. per sq. ft., which seemed a reasonable limit. We had a total equipment weight of 32 oz., Schmidt five-channel receiver with servos for rudder, elevator and engine. All this was mounted in the removable RC unit. To this we felt that an equal amount of weight would be necessary for the model, making a total of 4 lb. At 4 lb. we would need 600 sq. in. of area to get our 16 oz. loading, which seemed within reason under the circumstances. In practice the model worked out well, weighing a total of 62 oz. and in all its many flights it proved to be close to the ultimate.

This obviously is a model for the advanced RC flier, so we will not give detailed building instructions, but rather tips and hints that could not be included otherwise. First, the choice of equipment, because of the inverted flying requirement, the writer used a five-channel type which allowed separated selective controls as well as trimmable elevator. Another choice might be one of the single-channel types which allows the use of elevators or, if you have one, a new two-channel lightweight rig can be used. The simpler equipment would have the advantage of lowering the wing loading and adding to the general

performance.

Choice of power plant is the second consideration. A .15 engine is marginal in power with this model at a 4 lb. weight. Hence, if it weighs that much, use one of the light-weight .19 engines, like the Fox, and reduce the power by plugging it. If you can build lightly, stick with the .15 for its lighter weight and avoid the necessity of altering the engine.

Your engine will need a fuel tank of the "Positive Flow" variety. There is one available that uses an internal swivel and also one of the pressure type. Either will do the job very well and accomplish the same results. We strongly advise the use of the removable RC unit. When you get as much equipment jammed into such a small area as with this model, the removable unit can be a great help with service as it brings every-thing right out into the open. It can facilitate repairs, too. Choice of wood becomes extremely important with this sort of structure for when you reduce the quantity and number of parts, those which you do use must be able to do their specified job. Use a good medium-textured wood throughout, avoid poor quality material and use hard types only in the nose of the fuselage for reinforcements. It is most important to use medium-textured wood to-ward the tail and plenty of sandpaper there also. Using too heavy wood and sanding in-sufficiently at the tail are the main causes of tail-heavy models.

Flying the Equalizer is not much different from normal types. Actually, once you are air-borne, you can hardly tell the difference in upright flight. You should, however, use greater launching speed than normally as this model does fly faster. If you have trimmable elevators, trim in a bit of "up" for the launch. It will help. In normal power-on flying there is nothing you cannot do; as a matter of fact, you will soon notice that the model possesses an ability to recover much more smoothly from abnormal positions. However, with power off, do not stall the

model excessively when close to the ground, for it *will* tailspin when forced into it and you must dive to get out of a spin. Lack of altitude could be disastrous. In all your flying remember that the only way to get out of a spin is with down-elevator—nothing else will have the slightest effect. Spins are new and loads of fun; just use plenty of altitude when doing them. Outside loops are the easiest of all. Just apply full down-elevator and wait—they come naturally.

Inverted flight can be entered in two ways: over the top or down and under. Going over is probably the safest as you are gaining altitude. However, the easier to trim out from is going down and under as in this manner you maintain flying speed automatically. This particular model has flown as far as a half mile before recovery from inverted flight and has at times completed 180° turns without falling out. However, the secret is to work on the rudder trim until you do not have to do any correcting while inverted. Also try to keep the model flying levelly. A high angle of attack will increase the tendency to fall out.

If you have trimmable elevators, landings can be something to behold. Normally the model lands as most others do but you can add considerable amounts of "up trim" without fear of stalling at this point. This results in really flared out three-pointers that are so nice to watch.

Much good flying is in store without elevators or even when using the self-neutralizing sequence types. However, the type and degree of this flying will depend upon just how carefully you trim out the model—perhaps by using more or less trim between flights so as to be able to get the particular performance desired for each flight.

The Equalizer has been a very satisfying model to me and one which possesses a great potential, far more than I have ever had the time to develop. Now you take it from here!