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INSTALLING AND FLYING RADIO CONTROL IN FOUR POPULAR KIT MODELS

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Radio Control Big Four

Contributors....

T. H. Ives	Introduction
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S. Uwins	Frog Jackdaw
E. Webster	KeilKraft Super 60
P. Smith & A. Dowdeswell	Veron Viscount

This book cannot fail to be of value to those choosing a radio control model or in the process of building one of the kits. Each section, dealing with a particular model has been written by the respective designer to enable the modeller to obtain the very best performance from his chosen machine. The Work offers the reader not only an opportunity of assessing the comparitive merits of these designs for his special needs, but should also provide valuable complementary material that can all be of value whatever his ultimate choice.

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Part 1: Introduction

By T. H. Ives

Four Ways to Radio Control

Not so very long ago radio control of model aircraft was a specialist branch of the hobby practiced by a limited number of experts to the amazement of less skilled onlookers. Today, the availability of an ever increasing variety of reliable commercial receivers and transmitters that can be installed in the model with confidence by builders with very moderate skill who are prepared to take a little care, has broadened interest to an extent that all the leading model kit manufacturers now include a radio control model in their selection.

At least four such kits are available and a variety of R/C systems on the market suitable for installation in the kits must make it a little confusing to the newcomer to radio control and we thought that a book dealing with specific kits suitable for the various systems available would be a great help. Apart from assisting him to make a choice it might also help him to avoid some of the pitfalls which beginners always seem to experience.

We hope also that the book will help the modeller who has already tested the thrill of radio control and is looking for something new and perhaps more advanced. For this reason we have not limited our pages to the ultra simple systems and mention of the less complicated multi channel equipment will be found. As a matter of fact some of the multi systems when used for single control are as simple to install and operate as the single channel actuator arrangements although they are a little more expensive.

For those who are competition minded the 3-reed rudder and engine control now qualifies for single control events.

We are accordingly very happy to present the four representative kits with comments on design, points of interest on construction and testing with suggestions for suitable R/C systems to go with a particular design. The full instructions on assembly are already given in the booklets issued with the kits and only parts of special interest are repeated.

Radio installation and testing is also dealt with and we have no hesitation in saying that, provided the instructions with the kits and R/C systems are followed exactly, the book will provide a guarantee of success.

The kits have all been assembled by experienced modellers and thoroughly tested and each section of the book has been provided by the constructor and his comments are based on points of interest arising during assembly.

A number of important points are dealt with by the contributors to each section but we make no apology if some of the matters which now follow are repetition of some mentioned later. Indeed some are repeated by each writer but in the R/C field there are matters which are so important that they cannot be repeated too many times. The correct method of soldering is a case in point and yet in spite of repeated mention of this we have seen some appalling examples of bad soldering with results on the field which are only to be expected. Time spent on making sure that everything is in order is well spent and may save many times that expended, when on the flying field.

Pre-cementing is one thing which falls into this class and if the extra time is taken, readers can be sure that the chances of failure of a structure are greatly reduced. A heavy landing can cause a joint to give but it may not be apparent until the strain of a maneouvre in the air is put upon it. It is then too late.

Another point which often does not receive enough attention is the lining up of the fuselage during assembly and covering. It is not an uncommon sight to see a fuselage which is more like a banana than a model aircraft fuselage.

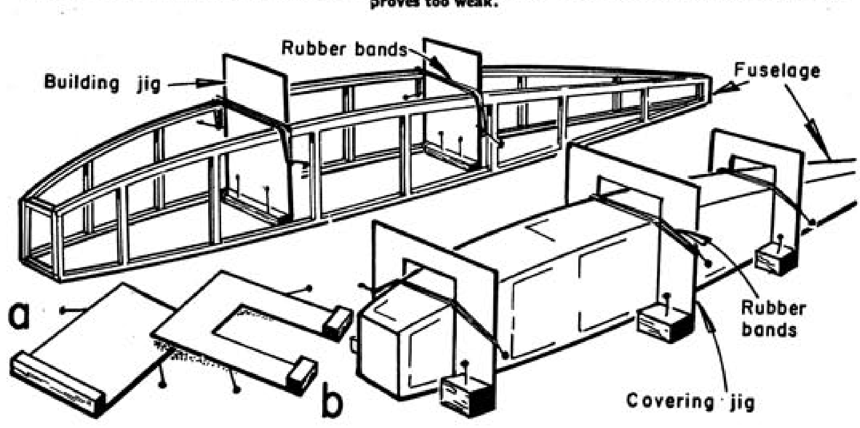
It might be thought that building on the plan provided would automatically take care of accuracy but unless means are taken to ensure that it is square and remains true whilst cement or dope is drying the finished object may be far from true.

Flight characteristics are very much influenced by accuracy of fuselage, wing, tail and fin. Even the setting of the power unit can affect the flying trim and response to control surface movement.

One method which will ensure that the fuselage remains in correct shape at all stages has been used by the writer. Several pieces of stiff card are cut for fixing to the building board at intervals along the length of the fuselage. In height they are greater than the fuselage depth at the point at which they are placed. They are tacked or glued to pieces of square wood and they may be nailed or screwed to the building board. Each card is marked vertically with a line to indicate its centre and this mark can be used for registering with the centre of the plan or a line scribed on the building board.

When fixed to the board the two sides of the fuselage are placed against the cards and held in place by rubber bands which hook on to pins pushed into

Fig. 1: Below is a sketch of the method of fuselage alignment detailed in the text above. In A, the fuselage sides are joined upside-down over the plan, using the card jigs as guides, referring always to the centre line drawn on the plan. B. shows the jigs to be used if the fuselage is covered with silk or nylon. Here these jigs hold the fuselage in alignment while the dope dries. Note that smallpieces of $\frac{1}{8}$in. balsa should be placed under the lower longerons to prevent the wet silk making contact with plan. Jigs may be constructed from ply or balsa i card proves too weak.



the cards at points below the height of the bottom longeron (which is at the top if the fuselage is upside down).

If the plan or board is waxed or greased, formers or braces may be glued to the top and bottom longerons and again held in place by rubber bands hooked on to pins at each point. Any planking at the fuselage bottom is also glued in place and the whole allowed to set thoroughly before removing. When removed, any planking on the fuselage top is glued in place and again held on the board whilst the glue is setting.

If the fuselage has any paper or silk covering to be doped, fresh cards are used to hold it in place whilst the dope is drying out. They are cut much wider than the fuselage and slots the width of the fuselage and a little higher are cut. Small wooden pieces are glued at the bottom and the cards slid over the fuselage after doping and screwed to the board. Rubber bands again hold it down to the board whilst the dope sets. In order to prevent sticking the cards should be greased or waxed at the points where they touch the fuselage.

Held in this way at all stages the fuselage will be absolutely true and remain so. The cards are not wasted and can be used for the next fuselage.

Holding the wing, tail and fin to the board whilst glue and dope sets is just as important and with warp free surfaces success is assured. Time spent on these simple jigs or any other satisfactory method is repaid a hundredfold. In the case of the wing, sheeting supplied with the kit should not be omitted. It helps to retain the profile and stiffens the wing structure.

Another point which should receive careful attention is the fixing of the power unit. It is not unknown for an engine to part company with the model due to the fact that the mounting bolts have worked loose. The method of soldering a wire across two bolts and anchoring the nuts in a similar way after they are tightened plus the use of spring washers is to be thoroughly recommended. The soldered joint should be beyond suspicion and the use of tinmans solder for this job is to be preferred. Do not use corrosive flux unless you clean the joint afterwards.

It is a good idea to protect the front end of the fuselage with a covering of fibre glass, shellac, varnish or other oil proof material.

On the Radio side failures have occurred because the operator has not paid sufficient attention to points which again may seem unimportant but are in fact essential to success.

All soldered joints must be beyond suspicion. A clean joint, a hot iron and quick application of the heat to both parts to be joined will ensure a sound joint. If the solder does not run freely immediately remove the heat and clean the joint again. Some components can be damaged by prolonged heating. This is frequently mentioned in books dealing with R/C but all too frequently is ignored. A tug at the joint should indicate whether or not it is sound.

Anchoring the flex leads after soldering is essential and Fig. 2. shows a method which can be adopted with the assurance that no trouble will occur. Holding the leads to the fuselage with Sellotape or other adhesive will prevent fracture due to vibration, a common cause of failure.

If not already done the receiver tuning slug should be held in the former with core grease or synthetic rubber. Do not use pure rubber as it perishes after a time and the slug will be fixed permanently.

Use only good quality switches or sockets. In the case of the meter socket it is a good idea to solder a resistance of sufficient value to allow the circuit to

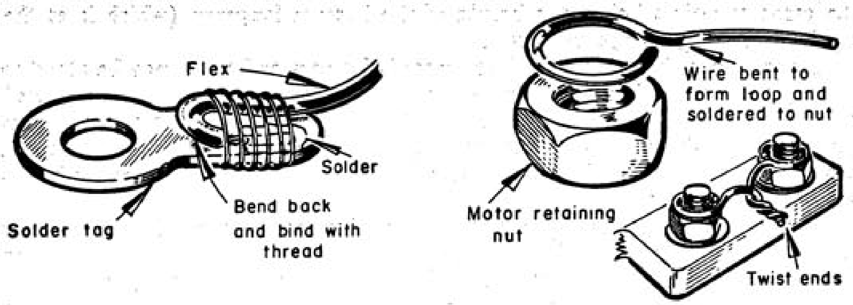


Fig. 2: The importance of sound soldered joints can never be overestimated. Left hand sketch above shows a solder joint bound with thread, the actual joint taking no load. At right is a simple method of retaining nuts on engine mounting bolts. Engine vibration does not loosen the nuts.

work without a meter. The meter when in place will give an incorrect reading but this can be checked with another meter in series with the battery. For an 0.5 ma meter the value would be approximately 200 ohms.

Frequent checking of the batteries is a must and the use of a voltmeter and milliammeter will be a great help. Batteries should be checked for voltage on load (i.e. when they are passing the current which is demanded from them in use).

One more point where trouble can occur and can be difficult to trace is interference from metal linkages (e.g. torque rods etc.). This is particularly so in the case of carrier operated receivers (i.e. receivers which operate on receipt of the Transmitter carrier with no modulation).

Bonding of all metal linkages is to be recommended (i.e. joining them with a piece of flexible wire which will make a continuous electric connection but will not interfere with the working of the link). Alternatively one element of the link can be of insulating material such as fibre, bakelite, tufnol etc.

Battery connections should be sound and if possible soldering the lead to the battery will prove the best and most economical. There is always the receiver plug which can be removed if one wishes to prevent running down of the battery when not in use due to a faulty capacitor etc. Again see that the battery leads are not lying loose in the fuselage.

Range checking of the equipment is a good idea but do not carry it out on the flying field. Other people wish to make use of the ether and with present day receivers only one can operate at a time. Do your testing at home or somewhere away from the flying field if you wish to retain your fellow fliers friendship.

For carrier receivers where a sensitivity control is used a check of this control before each flight is a good idea. If your batteries are not new the setting may change between flights and although the Rx. would respond close to the transmitter the range might well be short. It is a simple matter however to rotate the control a fraction towards its most sensitive point and then in the opposite direction a fraction.

With Tone receivers and carrier operated ones where no sensitivity control is used a check at close range that all is working before each flight is sufficient. Do not attempt to tune if something is wrong. This will prevent other fliers

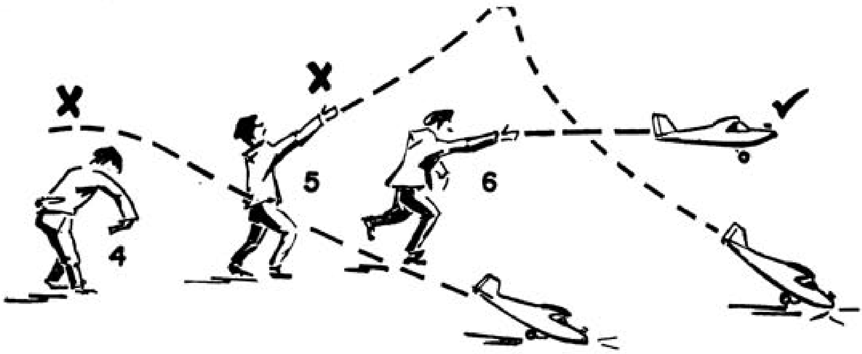


Fig. 3: Only in a prolonged glide will it be possible to determine your model's glide trim. Glide the model over a gentle slope, using the right technique when launching, not as our friends No. 4 and No. 5. The model should not be hurled from the hand. The correct method is No. 6, launching very slightly downward at running speed with a gentle follow-through with the launching hand.

from operating and in any case is best done on the bench at home. DO NOT FLY AT ALL IF EVERYTHING IS NOT FUNCTIONING CORRECTLY.

Launching the model is another matter which seems to bother beginners. It is not difficult however once one realises that launching at the approximate flying speed is all that is required. It should not be hurled into the air regardless but should be launched at the correct speed. A short run and a gentle release will soon show the best method and after a little practice the launch should become quite easy to perform.

The angle of launch should be horizontal or very slightly above and positions 4, 5 and 6 of Fig. 3 show the effect of correct and incorrect launching.

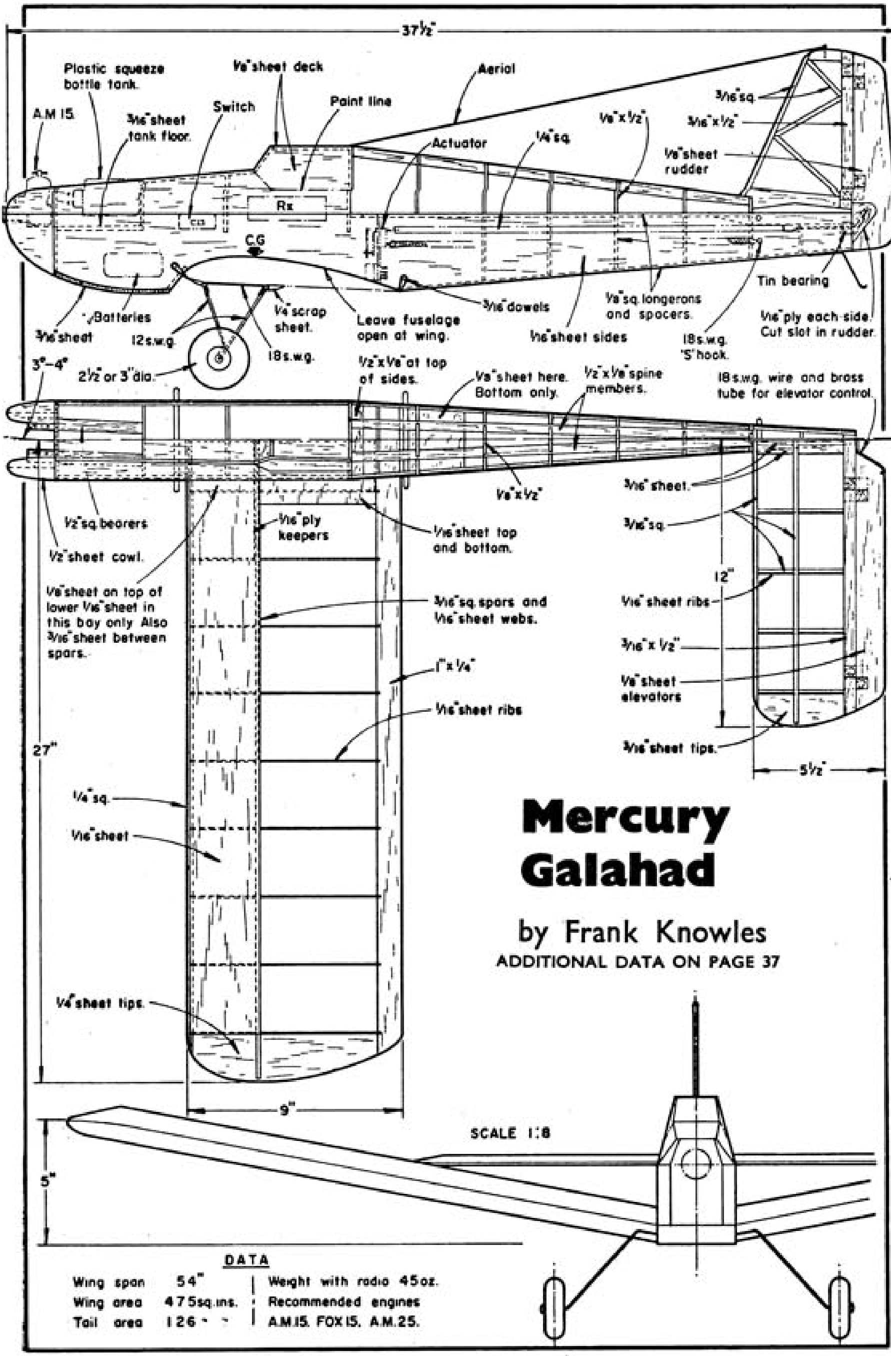
After launching, the attitude of the model should be watched and any fault corrected. An undulating flight indicates that the model is tail heavy and a steady flight towards the ground that it is nose heavy. For the former, the trim may be corrected by shifting the radio gear forward or decreasing the angle of incidence of the tail. If nose heavy shift the load rearward or increase the angle of incidence of the tail. If possible, however, the angle should not be altered if the design is adhered to as the trim may alter when the motor is stopped. The makers have fixed the centre of gravity and this may be corrected by shifting the load.

This may all sound very involved but in fact is not as difficult as it sounds and in any case a radio controlled plane is not a cheap piece of equipment and it deserves some care in assembly and operation.

One word of caution. If any attempt is made to depart from the makers design some experimenting will undoubtedly be necessary and the newcomer would be well advised to leave well alone. He can be certain that before being committed to a finished design the models have been very fully tested and any snags ironed out.

We are sure that the book fills a long felt want and we hope that you the reader will benefit by studying its contents and that it will lead to many hours of enjoyable radio controlled flying.

We cannot conclude without expressing appreciation to the people concerned in providing the material and in particular Stewart Uwins, Frank Knowles, Phil Smith and Ernie Webster for the various sections of the book.



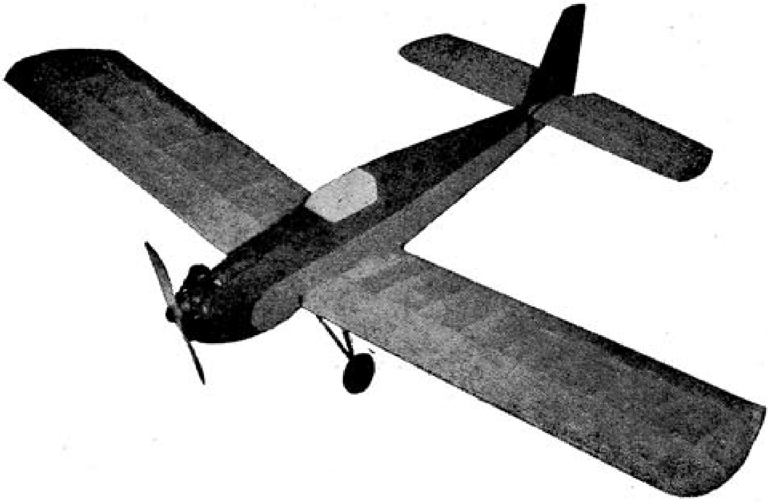
Mercury Galahad

by Frank Knowles

ADDITIONAL DATA ON PAGE 37

DATA

Wing span	54"	Weight with radio 45 oz.
Wing area	475 sq. ins.	Recommended engines
Tail area	126 " "	A.M.15. FOX 15. A.M.25.



Part 2:
By
Frank Knowles

Mercury Galahad

In designing a successful radio-controlled model aeroplane there are several basic requirements which should be met. Despite the introduction of very much improved radio equipment in recent months, it is still possible to have some quite nasty accidents. Wires can still be soldered badly, rubber escapement motors can still snap and it is still possible for someone else to save you the trouble of "pranging" the model yourself by merely switching on his transmitter while your model is airborne! All points which can well be avoided but unfortunately just seem to happen sooner or later.

Therefore, in my opinion, requirements are—a model which is reasonable in price, does not take too long to build, is of robust construction, and is simple to rig for good performance.

The Mercury Galahad was designed with all of these points in mind. Cost at thirty six shillings is certainly economic for a four-and-a-half foot span model, and the building time is most certainly saved by the amount of die-cutting which has been carried out in this kit. All ribs, formers, fuselage sides etc. are die-cut, indeed the only real cutting job involved is the making of the holes for the engine bearers in the front former. These could not be pre-cut as there are such a variety of different engines suitable for the Galahad. Concerning the time taken to build, an average modeller should be able to turn one out in about two weeks. But of course this depends entirely on your building speed and how good a job you make of the model. If you give six coats of primer, rubbing down between each and then apply a polished cellulose finish—expect to take a little longer!

Another point which can decide a potential builder as to the suitability of the Galahad is the engine and/or radio equipment he may already own. Here again, Galahad is capable of taking a good variety of engines and radio equipment. I have flown my own Galahads with one, three, four and five channel radio receivers on board. An old Elfin 1.8 was used on the 1 and 3 channel and a Fox 15 on the 4 and 5 channel. Other members of the Reigate D.M.A.C. have built models powered by an A.M.15 and an A.M.35 for single channel, and a Fox 15, a K. & B. 15 and an A.M.35 for four channels. Several of these modellers used home made versions of the R.E.P. circuits published in *Radio Control Models and Electronics.* To give an idea of what can be carried, a standard R.E.P. Sextone receiver just fits into the fuselage with adequate sponge rubber to absorb the engine vibration.

All of the Galahads built by the members of our club flew well and all had similar characteristics in flight. Two of them were first ever radio models. I myself have built two Galahads. All six in the club were built and flown before the Mercury kit came on the market and some hundreds of flights were carried out by people with various amounts of flying experience. Therefore, I think it is reasonable to claim that the Galahad was thoroughly flight tested before production and by following some of the tips in the next few pages I am sure anyone can get very satisfying results.

Galahad first flew in February 1959. It originated due to the fact that I had a pair of 54 in. by 9 in. wings almost built for a high wing R/C model when I saw the write up in *Aeromodeller* on the Astro Hog. The low-wing idea was very novel at that time and so I was tempted to do what I was assured was impossible and build a rudder-only low-wing model around the wings I had almost finished.

The fuselage and tail unit took just about a week to build. An Elfin 1.8 was used for power and control was via a Unitone Receiver and Elmic Conquest escapement.

Fig. 1: To align the fuselage correctly, use the edge of the building board as a guide. The use of squares to ensure accuracy is shown here.

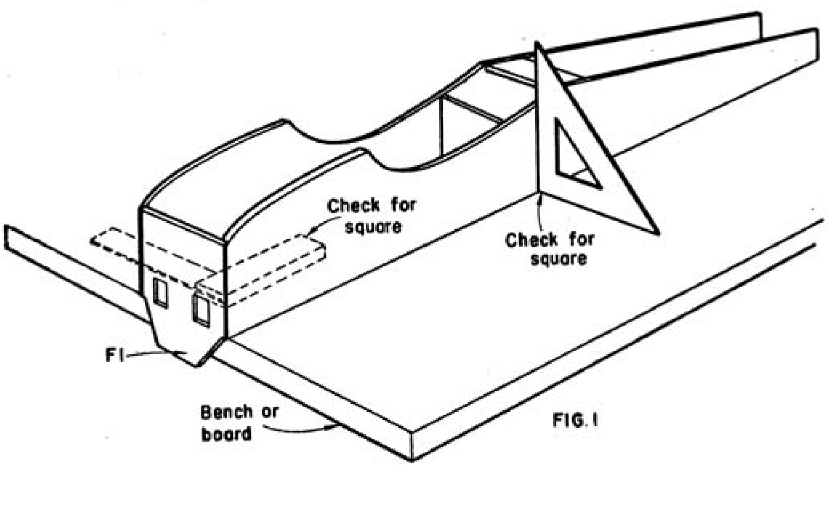


FIG. 1

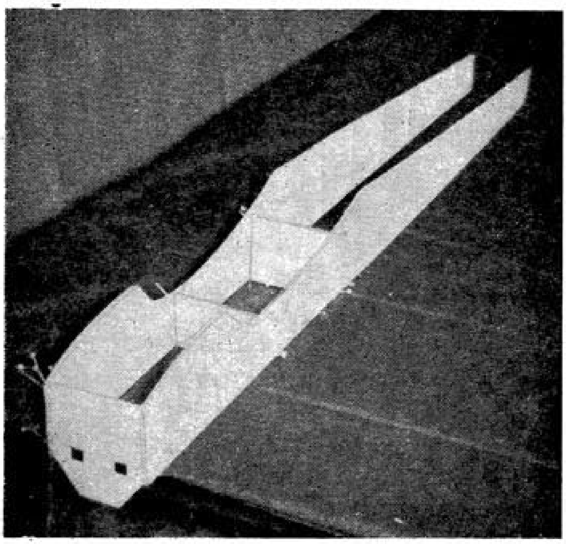


Fig. 2: The fuselage under construction on the edge of the building board. The two fuselage sides are here assembled to the main formers and pinned in place while the balsa cement sets.

With some misgivings the model was taken to Epsom Downs (on a quiet day from the point of view of onlookers!) and hurled into a stiff breeze. The model was badly over elevated but much to my relief the rudder response was normal except for a tendency to hold turns. This seems to be normal for low wing models. Left to itself the Galahad went into a natural left turn but occasional blips of right rudder were all that was necessary for straight flight.

Regarding construction, this is well covered in the leaflet with the kit but it won't harm to repeat some of the directions here. The heading picture gives an idea of the finished model.

The aim, as stated above, was to build a model which could be turned out fairly quickly with accurate line up being simple to achieve. The cross sectional shape of the fuselage gains considerable strength from the inclined sides but does not entail any laborious planking.

The fuselage sides are built from 1/16 in. sheet with a frame work of $\frac{1}{8}$ in. square to the rear plus an $\frac{1}{8}$ in. sheet doubler at the front. This can be constructed either by building an $\frac{1}{8}$ in. square framework as in the instructions and then cementing the sides and doublers to the framework, or, if you prefer it, by joining the two pieces of the fuselage side together first and then cementing the doubler on, weighting the whole lot down and allowing it to dry thoroughly. Then mark the framework on to the rear part of the fuselage sides and cement the uprights and longerons into position. Either method works well. A very important point here is that the top edge of the fuselage side must be absolutely straight. The entire line up of the model depends on this. Also make sure that you have a left and a right hand side! Formers F.2, F.3 and F.4 come flush with the top edges of the fuselage. This makes it possible to cement F.1, F.2, F.3 and F.4 into position with the fuselage laid upside down on the building board, F.1 hanging over the edge (Fig. 1 and Fig. 2). This helps to build the fuselage without twist. Also as the fuselage is parallel at the front the formers can be checked with a square. Having cemented the fuselage sides to the formers and made sure that the entire assembly is square and flat to the board allow it

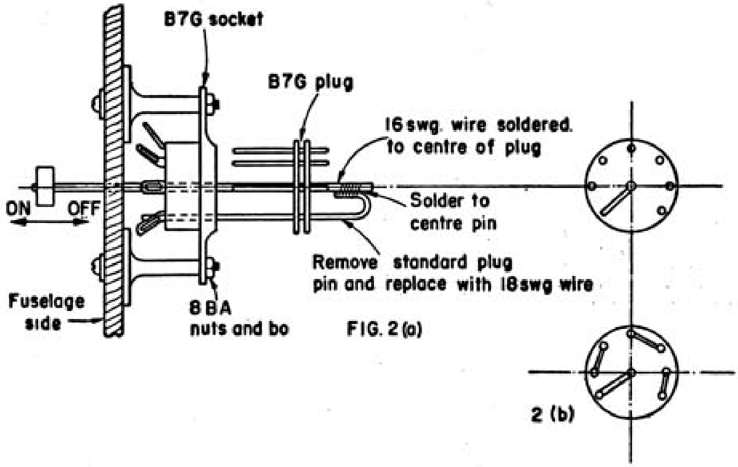


Fig. 2(a): Frank Knowles' home-made switch is mounted to the side of the fuselage. The supports are fuel can spouts. Fig. 2(b) shows the alternative wiring to the switch.

to dry thoroughly. Then cement in the $\frac{1}{8}$ in. by $\frac{3}{16}$ in. cross members to the rear of the fuselage in the conventional manner. At this stage the fuselage should still be able to lay flat on the board.

The engine bearers can be fitted at this stage, again laying the fuselage on the board upside down. But a word of warning, don't work directly on to the plan at this stage to put in the side thrust; remember, your fuselage will be upside down so you won't get right side thrust—you will get left! Goodness only knows how the model will fly then! If you want to build over the plan, trace through with carbon paper on to the reverse side, then the side thrust will be the correct way. This side thrust can always be adjusted a little either way if necessary by twisting the engine a little in its mounts. But DON'T build it without the side thrust because, believe me, you will need it!

Now cement on F.7 and F.8 and add the two spines of $\frac{1}{8}$ in. by $\frac{1}{2}$ in. Fill in the uprights and cross members of $\frac{1}{8}$ in. by $\frac{1}{2}$ in. cutting the parts to fit individually. The fuselage construction can now be completed by adding the tank floor, formers F.3 and F.5, the shaped fuselage sides, the fuselage top and the cowling pieces. The joint between the inclined sides and the vertical sides must be a good secure one. Indeed, I would suggest smearing an extra layer of cement inside after the first layer has set. Fig. 3 shows the basic fuselage complete.

The tailplane is quite straightforward. Remember to keep it pinned to the plan until it is thoroughly set. Although the tailplane is lightly built I have found this layout quite satisfactory. The fin is mounted on the tailplane after both have been covered and doped.

The wings are of conventional construction. The $\frac{3}{16}$ in. square spars top and bottom are joined for a good deal of their length by $\frac{1}{16}$ in. sheet webs. This adds a tremendous amount of strength to the wing. Do not remove the wing from the board until the cement is thoroughly set and remember *the wings can only be as true as the board on which they are built.* Some reinforcement (fibre glass?) could be arranged at the point where the undercarriage fits if desired, but watch the weight. My Galahad did about 200 flights before I had to renovate this point.

The undercarriage is very simple to build and install. You may be able to afford the luxury of air wheels but I don't think they are any advantage in the small size needed for the Galahad. I prefer the sponge rubber type of wheel.

For a model the size of the Galahad I prefer to cover with heavyweight tissue. This should be given three coats of clear dope.

When it comes to the decoration of the Galahad this is entirely a matter of choice. The fuselage can carry a coat of colour dope without worrying about the weight but I prefer to leave the wings clear. Also repairs look much neater on clear doped tissue than on colour. A tip you may find useful—when painting decoration on the fuselage, the joint between the vertical side and the inclined side is the thrust line of the model. I always arrange for a join in colour or a trim line to come at this point. This is a great help when it comes to rigging the airframe as you have a datum line painted right along the fuselage.

Radio Installation

Many words have been written on installation of radio in a model and I shall most likely be repeating what others have said when I say that there are three essentials—cleanliness of components, neatness of wiring, and an ability to solder. *Bad soldering probably leads to more failures in the equipment than any other factor*. Neat wiring makes for a much better job as it is possible to trace faults quickly. Also wires braided together and tucked neatly into the fuselage don't suffer breakages as do wires running in all directions. Cleanliness of components is a very important factor too. Not just the fact that all soldered connections should be cleaned and tinned but things such as plug pins and slide switches. You have probably spent at least £15 on radio equipment so don't go and wreck the lot for the sake of a dirty switch. A switch that has managed to get filled with oil from an engine exhaust isn't very good for efficient radio work. I think that as soon as a switch or plug starts to give trouble it's worth the expense of a new component at once. Indeed when it comes to slide switches I am none too fond of any of them. The most dependable switch I have had is the one shown in the sketch (Fig. 2a) using a B7G plug and socket. I also prefer not to use the plastic cap with which plugs are fitted but usually mould fibre glass paste (obtainable from Holts as "Cataloy") straight on to the plug top. This cuts the chance of a broken wire to an absolute minimum. Another point in favour of this switch is that only a small hole has to be made in the fuselage instead of a large slot. Also of course the switch is a six way one. When you have installed the switch make sure that there is a good loop of slack so that there is no strain on the wires. If you don't require a six way switch and three are sufficient then the plug can be wired the alternative way shown in Fig. 2b. Wires from components should always be supported so that there is no strain on the soldered joint. Remember that when you have run a thick blob of solder on to a piece of bared flex then it is no longer "flex"-ible but a very brittle piece of metal. To prove this, tin a piece of flex and see how easily it can be snapped.

The foregoing applies to any radio controlled model but the notes below relate specifically to the installation of radio equipment in the Galahad. The first method of installation was exactly as shown on the plan. The receiver box was lined with sponge rubber (not synthetic foam) and the receiver was dropped into the box with about (Fig. 3*a*) $\frac{1}{8}$ in. clearance all round. A further piece of

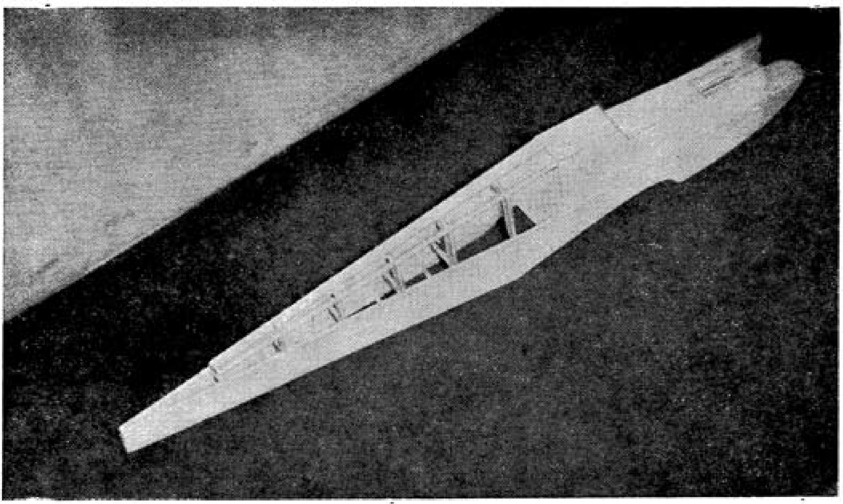


Fig. 3: Here we see the basic fuselage complete. Tank position can be seen just to the rear of the engine firewall. This view shows well how the fuselage backbone is made up.

sponge was laid over the receiver and retained with a rubber band. The leads were taken via a plug and socket to the extra former fitted behind F.6. A pair of wires were run off to the escapement and then the main cable of wires all braided together, were run forward to the fuselage front end where the batteries were carried. These I packed in pieces of synthetic foam. Connections were made via press studs. Many people do not like press stud connections but I have used them for ten years without any real trouble. Solder them as shown in the sketch however as this prevents broken wires. Fig. 4. If you prefer it connections can be made by twisting the leads together and covering the joint with sleeving.

I have found the Elmic Conquest an excellent escapement but like all of them it has to be mounted carefully. The small clip provided for attachment to the torque rod is very useful as it permits easy removal of the escapement. When I fit an escapement my method is as follows:— Attach the escapement to its former and fit the torque rod in the fuselage. Attach the tail unit with the control arm connected in the rudder slot. Then slide the escapement former into the fuselage and pin in the approximate position. Fit the rubber motor and put on a few winds. (Only a few or the escapement will disappear into the rear of the fuselage!) Then move the pins holding the former until the position is found where everything is free moving. Then cement the former into this position.

The batteries carried in my Galahad were one B.122 for H.T., one pen cell for L.T. and three pen cells for the escapement. Batteries should be checked frequently on load. I found that a B.122 battery lasted about four hours of average use and the L.T. I replaced after about two hours use. The B.122 I think should be replaced at about 20 volts on load and the pen cells at about 1.3 volts on load. Actually I have found that the Unitone operates on 18 volts H.T. but don't think it is worth going below 20 for safety's sake.

The escapement batteries I treat differently. I checked with my Elmic

Conquest that it *just* worked perfectly on a fresh 3 volt battery so I use three pen cells giving 4.5 volts and allow them to drop to 3.5 on load before discarding them.

The aerial is taken through a hole in the cabin roof and back to the fin. Leave some slack between the receiver and the fuselage top.

Most people building a multi-channel version of Galahad will have had some experience of radio already. There are some for whom the first radio model will be a multi-version, however, and if you do intend to start with a multi-channel layout I would recommend that you first of all use only the steering control and trim the model as for single. Otherwise I fear you will have grey hair before the end of the first day's flying.

When installing multi equipment most of my remarks concerning single still apply. But of course, position of components is a little different. The receiver for instance, is going to be considerably heavier than the single channel and will require a lot more room. So I install mine in the position shown in the diagram Fig. 5. With this heavy receiver you will find the C.G. moves forward but this can be balanced with the heavier type of multi servos. These will want fixing towards the rear of the radio compartment. I used two Olsen-Remtrol servos on my model, screwed one to each side of the fuselage with an aluminium plate on the outside of the fuselage to take the strain. Another member of the Reigate D.M.A.C. used two Bonner Duramites, mounted the same way. This was for a four channel system and the average weight was around 3½ lbs.

When I converted to ailerons I replaced the Remtrol servo on the rudder with a clockwork escapement to save weight. (This control only being required for take off and spinning) and I made up a rather crude but effective servo for the ailerons. This was necessary as the Remtrol servo projected a little too far above the wing for my particular model. As I was now using a sextone Receiver H.T. voltage was increased to 30 and the size of batteries was also increased due to the fact that I was now getting a form of simultaneous control which took a lot more current. So weight was getting a little high but nevertheless Galahad still flew well.

The simultaneous control was arranged as in Fig. 6, thus:— When converting from three to four channels I never envisaged using more than six channels in the future but I purchased an 8 reed unit instead of a six as there was no difference in size or weight. This left me with two spare reeds. So I

Fig. 3(a): The basic layout of radio equipment in a Galahad using single channel gear. The batteries are in the nose compartment and the receiver and escapement placed above the wing.

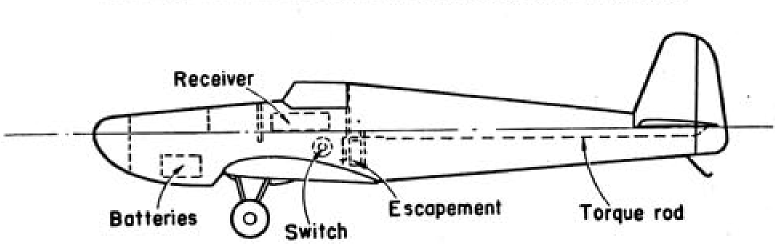


FIG. 3 (b)
SINGLE CHANNEL LAYOUT

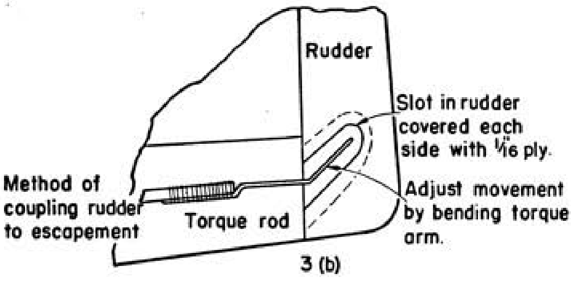


Fig. 3(b): The Galahad has a fairly uncommon method of rudder coupling, all enclosed within the fuselage and fin. The fin and rudder are attached to the tailplane, the rudder slipping over the crank arm when the tailplane assembly is attached to the fuselage.

cut back the longest reed (No. 8) until it was the same length as Reed No. 7. I then connected Reed No. 8 to Reed No. 2 (up elevator) and Reed No. 7 to Reed No. 4 (right rudder). On the transmitter I then set up another tone worked by a spare push button. In use the effect was that the elevator and rudder could be worked in the normal way, but when the spare button was pressed this transmitted a tone which operated the two spare reeds together and so gave simultaneous control very cheaply and efficiently.

I will deal now with the all important question of flying the Galahad. I have already given details of the engines used in the original versions of the model. The power depends to quite an extent on the number of channels used. The A.M.15 for instance, is quite adequate for single channel and is quite capable of taking an extra escapement for engine control. Any other 1.5 c.c. diesel with a similar amount of power to the A.M.15 would do equally well. One version for single channel was even powered by an A.M.35 but this, of course, required a little more skill in handling and trimming due to the extra speed. A good power combination could be a 2.5 c.c. diesel with a larger propeller to hold the power down at any rate until some experience has been acquired.

The CG position of the Galahad should be adjusted to come exactly on the main spar. With this balance handling will be quite pleasant. If you build a multi channel version then you can allow the CG to go back a little which will improve many of the aerobatic manoeuvres but will again make it more of a handful as you will have to use the elevators for correction a lot more.

Control movement should be at least ¼ in. each way at the T/E of the rudder. I use very much more myself. A low wing model will go into a turn from a tiny bit of rudder movement easily enough but it does tend to require a little more to bring it out of a turn. Also, whenever I press the button I like to see the model respond straight away. The movement is adjusted by merely bending the rudder operating arm, *see* Fig. 3(*b*).

Let us assume that your first version of the Galahad is a single channel model. In this case test glide over long grass in the usual way packing the tail plane 1/32 in. at the leading edge to correct a stall or at the trailing edge to correct a dive. I don't believe in too much test gliding. Just make sure that there is no violent stall or dive and then get the model up on a powered flight to get a real idea of its glide in the air. Now we are all set for the first flight. At this point the radio should be checked for perfect operation. I must emphasise "*perfect operation.*" I have seen far too many first flights end in disaster due to skipping escapements etc. causing the modeller to be unsure of which control he is giving and so crashing his model on the first flight. With the radio functioning correctly put about 45 sec. of fuel in the tank, run the motor, check operation with the motor running, make you next control position right rudder and get your assistant to give you a smooth launch straight into the wind.

Now keep your finger poised on the button but don't press it until you have to. The thing most likely to happen is that the model will go into a gentle natural left turn. In this case put the rudder right until the model is flying straight again, release, and give a short "blip" left to make the next position right again. Allow the model to gain a little height and then giving short blips start a gentle turn in either direction. Allow the model to circle round you and try to fly it to a point just down wind. By this time the motor should have about run out of fuel. If not carry on the turn. The object of the first flight is to try and get the model to start its glide just down wind of the transmitter. When the motor cuts and the model starts gliding, turn it until it is heading straight into wind then try not to send any more signals until you have seen if there is a turn on the glide. Now tell your assistant which way the model is turning with instructions to remember! It is surprising the number of people who don't remember whether the turn was to the left or the right. Having noted the glide path now concentrate on gliding straight up wind and note if there is any stall tendency. Now if you have a lot of height you can do a gentle turn but don't worry about landing close by. The important thing to do is to make sure on the first flight that your model lands straight into wind in one piece. Don't go trying to convert it back into a kit of parts by hitting the transmitter. Having achieved this first flight, any adjustments to the trim should be made. Unless the turn under power was a really violent one don't at this stage, adjust the side thrust. First adjust the glide trim and then have another short flight. Having got the glide trim correct adjustments can then be made to the engine side thrust. It should be pointed out, however, that Galahad was designed as a radio control model and as such it has to be "piloted". All the Galahads we have built have had a natural turn to the left. On the few occasions we have had radio failure Galahad has usually gone into a rather tight left turn and stayed there, climbing gently all the time. This we consider a "safe" trim as in the event of failure the model doesn't get

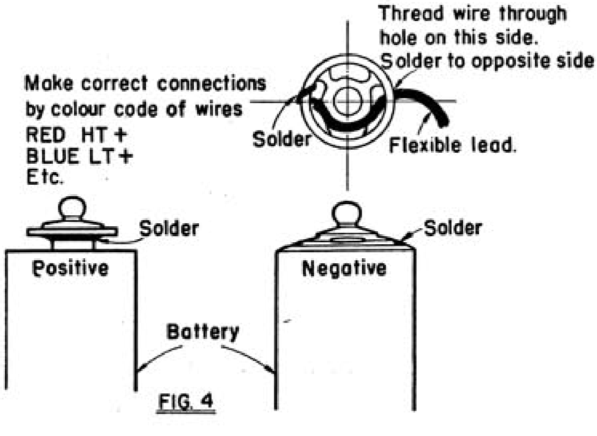


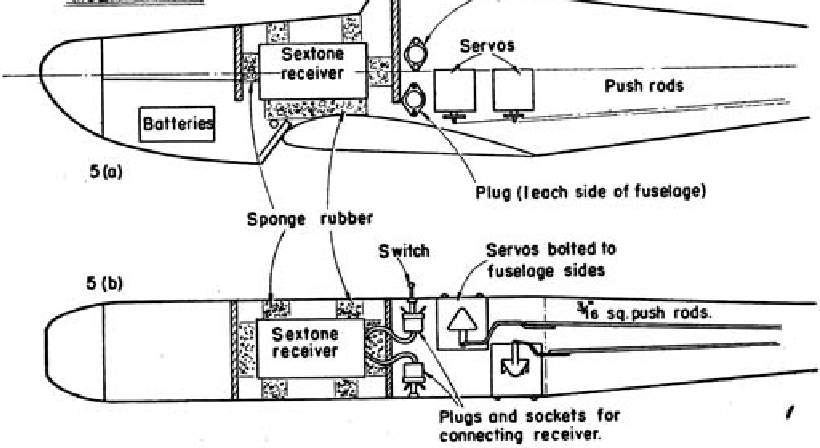
Fig. 4: Battery attachments using snap fasteners. Care must be exercised here to ensure that solder does not interfere with their simple, though rather delicate snap mechanism.

so far away as if it flew in a dead straight line for the horizon!

Having got over these first flights you will by now be getting the "hang" of flying low wing models. You will also begin to realise some advantages. To make a turn you will find that you put the rudder on until the model banks and then release. The turn can then be made using the rudder to give a little more or a little less bank as required and then coming out of the turn by means of opposite rudder. You will have also found that there is a lot less tendency for the model to stand on its tail as it comes out of turns. For flying in windy conditions a piece of packing can be inserted under the leading edge of the tailplane (about 1/16 in. at a time) and the flying speed will go up considerably. Remember, however, that this makes recovery from any dive you may get into a little slower so allow plenty of height if you start "dicing"!

After a considerable amount of single channel flying I changed to a Tritone receiver. I used one channel for left and another for right. But what should be done with the third channel? Well I thought an engine control would be rather fun but it would only be used once or twice in a flight. On the other hand if I used the third channel to operate the elevator in one direction only (up) I could find a lot of use for that. So I installed a servo for up elevator only. With this I had over 150 successful flights without one failure the whole of the time. Galahad could be looped easily merely by doing a 180 deg. turn that was rather tight, straightening up with the opposite rudder, pulling up elevator and over she went. Releasing the elevator just before the model was flying level and then putting it on again straight away gave as many consecutive loops as you liked. Rudder on followed by up elevator and then opposite rudder gave a rapid elevator turn and rudder at the top of a loop could give a passable Immelman turn. Also with up elevator available it was safe to under elevate the model for flying in windy conditions having the elevator available to keep the nose up. Naturally

Fig. 5: Side and plan views of the multi channel installation. Batteries remain as placed for single channel work, though receiver is moved forward slightly. Note how the servos are staggered to accommodate in a relatively narrow fuselage.



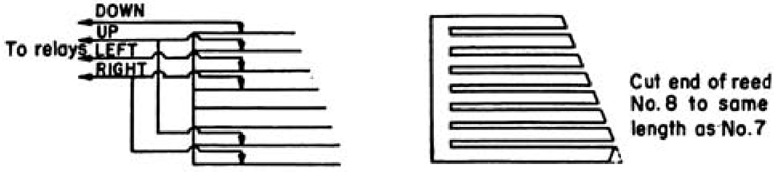


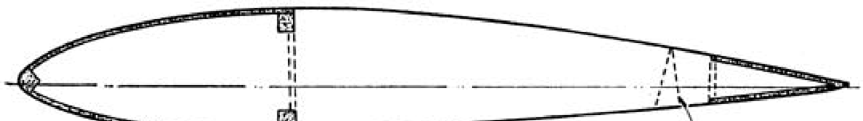
FIG. 6 MODIFICATION FOR SIMULTANEOUS CONTROL

Fig. 6: Modification to the Reed unit to effect simultaneous control, using only transmitter signal. Modified wiring is also shown. Since reeds are most delicate, precision parts any modification must be carried out with the utmost care.

I was not satisfied with three channels so I next went to four, modifying the reeds as I stated earlier to obtain simultaneous. I also increased the engine power to a Fox 15. Again I had a great number of very enjoyable flights using this outfit. With the simultaneous control Galahad would spin very easily and also it could do a form of roll if the simultaneous was applied at the right moment. All that was necessary for spin recovery was a little opposite rudder to stop the turn and then hands off, although I often had to recover with up elevator due to the fact that I did spins at full power and finished them far too close to the ground. Weight of the Galahad was, by this time, up to $3\frac{1}{2}$ lbs. Then I had the idea of adding still more channels and fitting ailerons (Fig. 7). So the Receiver became virtually a standard sextone which just fitted the fuselage. A new pair of wings with less dihedral and ailerons were built. A problem here was that the servo projected too far into the fuselage on the original so I had to make a special servo which was lower than standard. However there are now several on the market that are suitable for the job. An R.E.P. Powertrol or Bonner Duramite would be just right. I also changed the wing section at this time with a view to performing bunts. This worked well too, the Galahad doing quite a reasonable bunt despite the weight which was now 3 lb. 14 oz. With this section, trim was changed to include more positive incidence on the tailplane (2 deg.) and the CG was moved further back.

This caused the model to be very responsive to the elevators and of course it had to be flown all the time. The Fox 15 was just enough power by now. I felt that a 3.5 c.c. engine would have been more suitable. I still didn't have a

To expand the aerobatic performance of his Galahad, designer Frank Knowles, modified the wing section to that shown below, which improved characteristics, particularly for outside loops and inverted flying with multi channel radio. Aileron detail is also shown. Note that this modification is for multi-channel only.



ALTERNATIVE WING SECTION

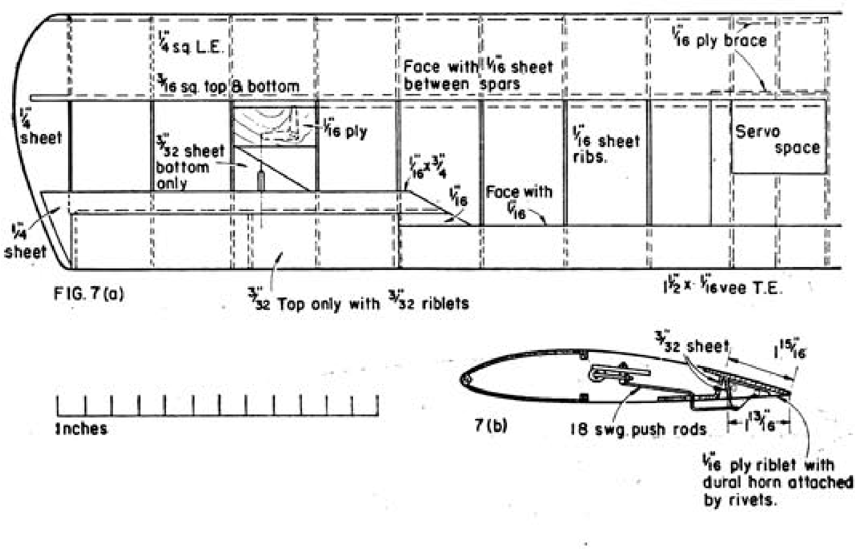
motor control in view of the weight and I also carried a clockwork escapement to operate the rudder for weight economy.

Shortly after this I had the opportunity of using a pair of servos fitted with transistor amplifiers of R.E.P. design in place of relays. These I fitted on ailerons and elevators only. I made up a relayless receiver to Octone circuits and with the small batteries now required the weight came down to $3\frac{1}{2}$ lbs. again. This improved performance considerably. I was able to do most of the manoeuvres in the "book"—rolls Immelman turns, loops, bunts, vertical eights, horizontal eights and cuban eights; not up to expert's standards but I could *do* them. The larger type of model can certainly perform all of the manoeuvres smoother because it is not thrown around by the wind like a smaller model but for learning to fly an aerobatic model the Galahad was invaluable. Fitted with either rudder and elevator or ailerons and elevator it performed satisfactorily. The radio required was only four channel, the airframe cost only about 50s. to build including wheels and dope and the engine used cost about £3 10s. 0d. A considerable saving on a large advanced multi type of model.

Take off performance with the Galahad is good. If you are flying from a runway your Galahad will probably take off unaided. From grass you may have to steer a little more and elevators are useful to prevent the model "tripping up". My Galahad has done a large number of take offs from Epsom Downs where the ground really is quite rough and very often I have had to hold full up until the model was just off the ground. It is, however, rather bad practice to take off with full up elevator unless you have done quite a bit of flying. Otherwise your Galahad is liable to stall at a height of about six feet and . . . well you know the rest!

A final point I would like to deal with is modification. I have listed quite a lot of modifications I have carried out but you will note that I got the aeroplane

Fig. 7: Full plan of the multi-channel wing with ailerons. The extra sheeting around the aileron in Fig. 7(a) is important for strength considerations. Fig. 7(b) details exact aileron configuration and linkage.



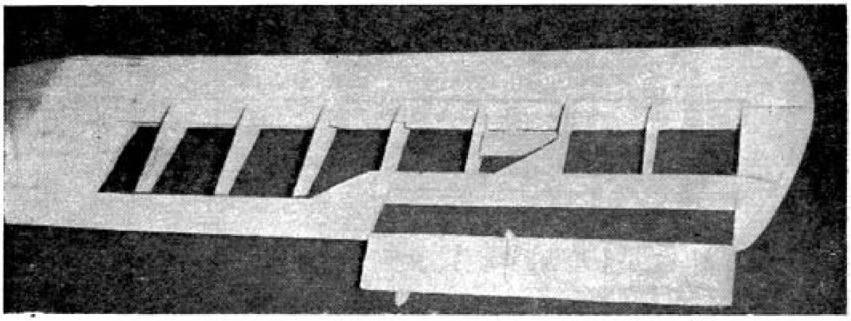


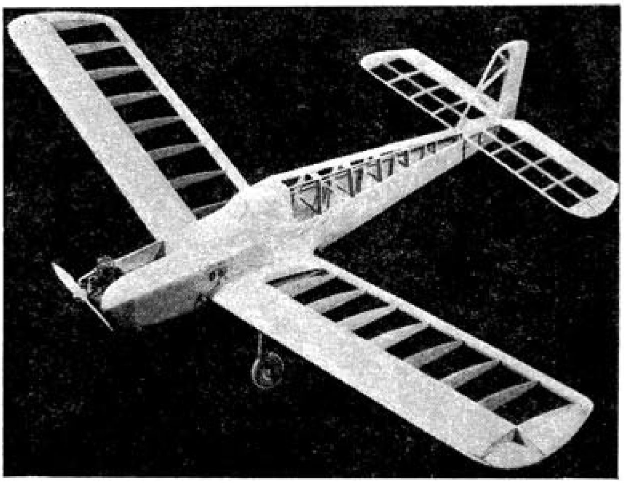
Fig. 8: The multi wing in skeleton before the aileron is attached, with tape on its upper edge. Note that the mainspar is webbed out to the wing tip as is the trailing edge.

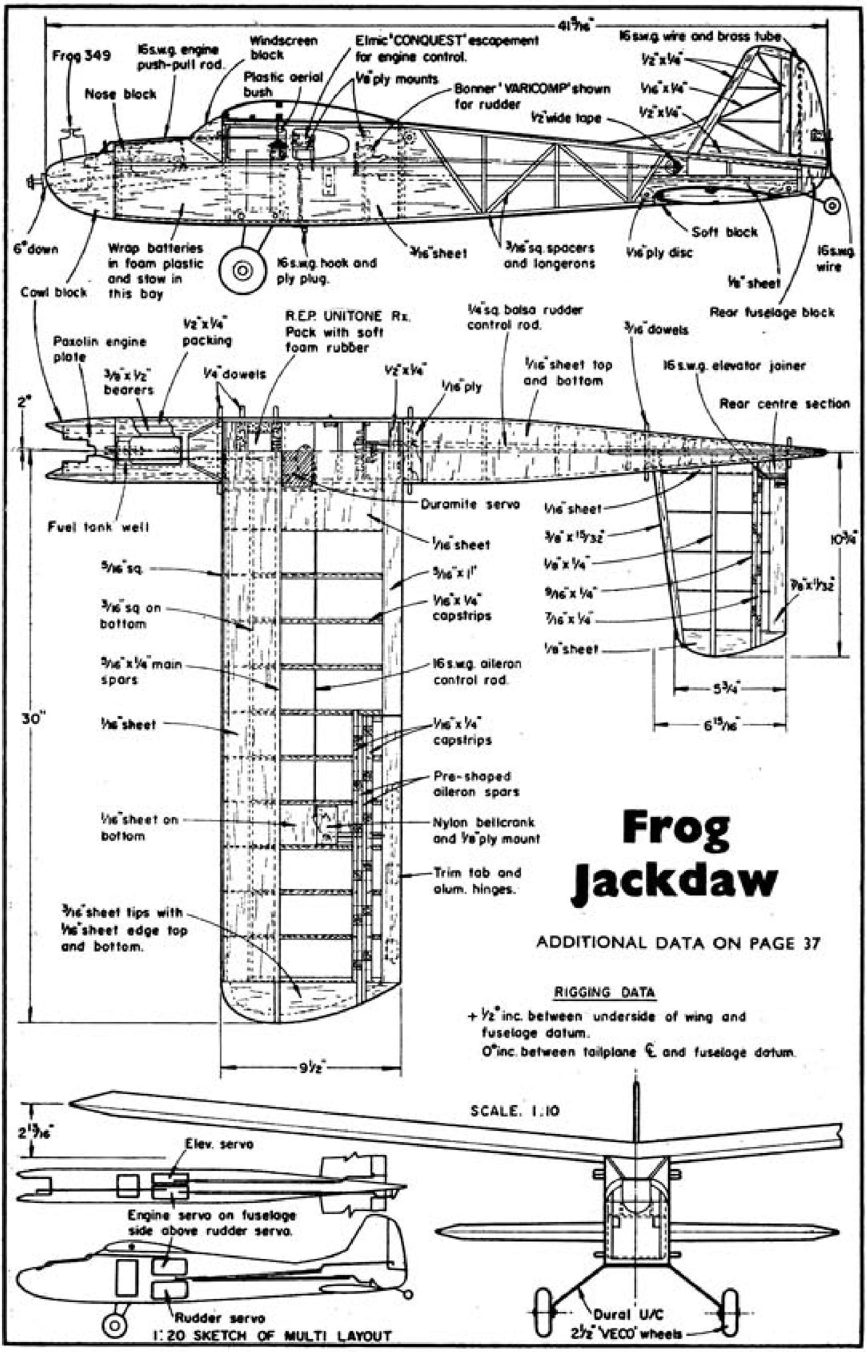
to fly in its standard form first. This I would recommend to you no matter which model you build. Otherwise I am all for trying out variations. For instance, one of the few complaints that I get about the Galahad is that it has too much dihedral. Well with this amount of dihedral the Galahad is quite simple to fly but it can be reduced. The appearance is improved somewhat by doing this but you can expect the rudder to be a little more sensitive. If you have flown a radio model before and are used to handling responsive controls then by all means reduce the dihedral but you may find you have too much of a handful! Of course when flying with ailerons this problem does not arise.

In conclusion I would say that if you are careful about radio installation and trimming the model Galahad is capable of giving many hours of entertaining flying. My Galahad completed 304 flights before a broken wire finished it off. So take warning from that and see if you can better my record!

Good luck!

The framework of a standard Galahad, built from the kit, can be seen here for rudder only flying. Engine is a Fox .15. Silk covering adds extra strength to the airframe at the cost of little extra weight.



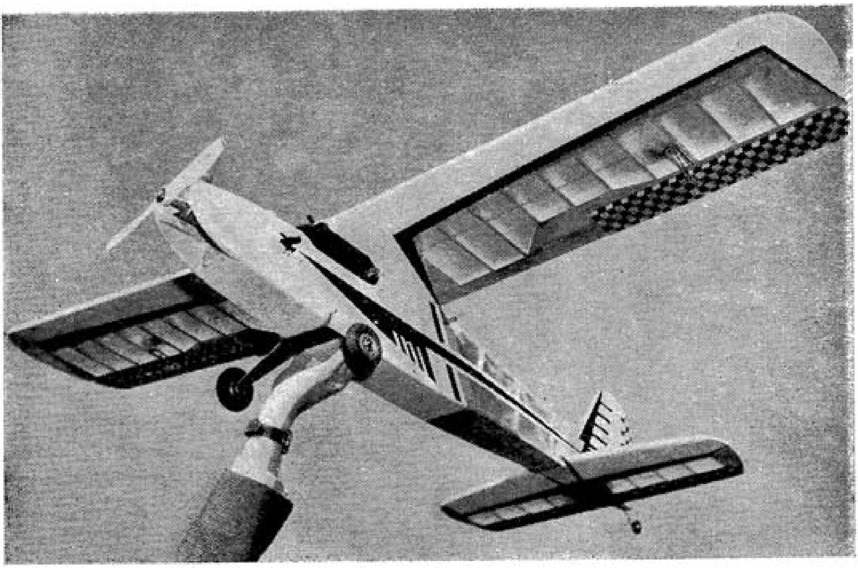


Frog Jackdaw

ADDITIONAL DATA ON PAGE 37

RIGGING DATA

+ 1/2° inc. between underside of wing and fuselage datum.
0° inc. between tailplane ℄ and fuselage datum.



Part 3 :

By Stewart Uwins

Frog Jackdaw

This new design from the Frog stable has already proved to be a powerful contender in Contest circles. The design characteristics are such that the aircraft is very smooth in flight and easy to handle. However, the Jackdaw can be made highly aerobatic even in its rudder only form by increasing the movement of the rudder.

Building instructions supplied with the kit are very explicit. It is felt, however, that perhaps a few further notes from me would be of assistance to those who have little experience in the construction of a radio control model. My notes, therefore, should be read in conjunction with the kit instructions and I have attempted to point out any parts which may cause difficulty, mostly those concerned to the adaptation of the multi version. Do not fall for the temptation of separating all the stamped parts from their supports. They easily get mislaid this way. Only remove those parts required immediately for construction.

Examination of the kit will show a high degree of prefabrication of superb accuracy. You will be surprised at the rate with which the model takes shape.

As is suggested in the building instructions included in the kit, let us make a start on the fuselage. Don't forget to cover the plans with a piece of grease-proof paper before starting, a very important point. The building of the first fuselage side is quite straightforward. However make sure that the outline is followed accurately, especially at the cabin top and the tail (Section F.3) in order that the correct incidence angles are obtained. Check by placing over the plan. Alter if they are at all out! These angles are most important.

The second side is built directly on top of the first side, after the first has been turned over. Pin the side plates (F1, F2 and F3) into position, push these pins through into the building board to form a key, complete the outline and leave to dry. Fig. 2 shows 2nd side being built on top of 1st. Note separating grease-proof paper!

Whilst the sides are drying, you can get on with glueing the balsa and ply formers together, as detailed in the instructions.

At this point you may wish to fit a tricycle undercarriage and you should, therefore, make a new front bulkhead from $\frac{3}{16}$ in. ply as it is this to which the front wheel must be fixed. The nose-wheel in Fig. 1 is of a very simple type. It consists of 2 torsion-bar type legs which can be simply bent up from 12 S.W.G. wire. The legs are fixed to the front bulk-head with J bolts as shown. A more elaborate method is to bend up a one piece undercarriage then make up small retaining brackets as shown. Solder the retaining nuts to a piece of tin plate and fix this to the back of the bulk-head with a contact adhesive. This allows the front leg to be removed at will. The torsion-bar action of this leg is dependent on the positioning of the final horizontal bends exactly at the bottom of the bulk-head.

Returning to the construction the next few steps concerning the fitting of the engine bearers are quite straight forward and should be carried out in the sequence shown. Fig. 3 shows completed sides ready for joining.

Joining of the fuselage sides is also straight forward but should be done

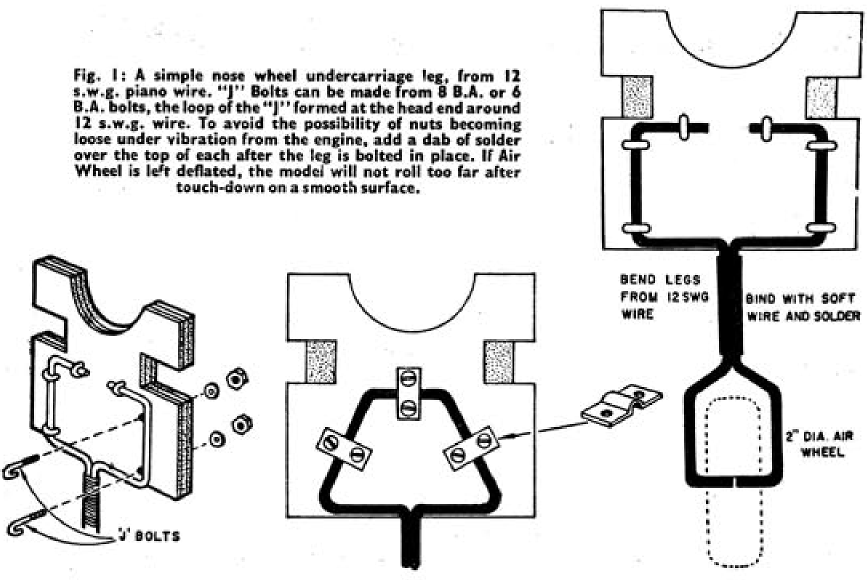


Fig. 1: A simple nose wheel undercarriage leg, from 12 s.w.g. piano wire. "J" Bolts can be made from 8 B.A. or 6 B.A. bolts, the loop of the "J" formed at the head end around 12 s.w.g. wire. To avoid the possibility of nuts becoming loose under vibration from the engine, add a dab of solder over the top of each after the leg is bolted in place. If Air Wheel is left deflated, the model will not roll too far after touch-down on a smooth surface.

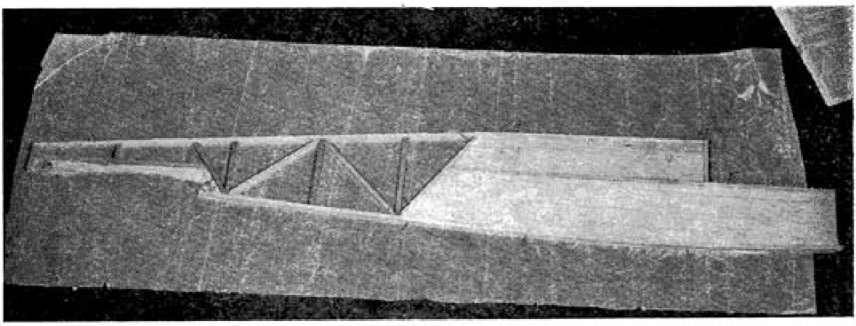


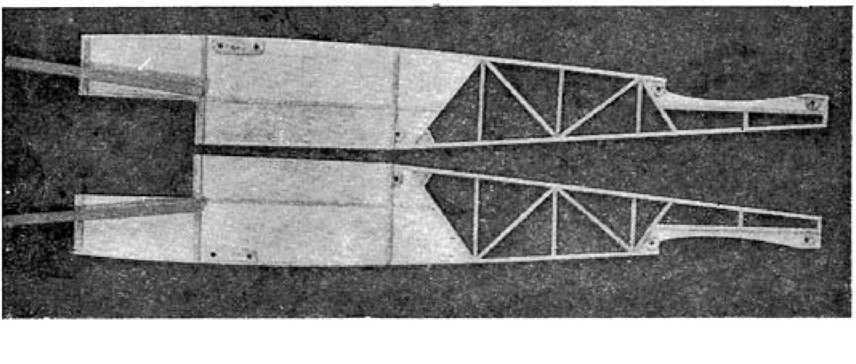
Fig. 2: Here we see the second side completed over the first. Building the two sides in this manner ensures uniformity. Translucent grease proof paper prevents the two sides from accidentally sticking together at each joint.

accurately using a set square to see the bulk-heads are at right angles to the sides. I find it helpful here to invert the fuselage on to the cabin top as this is quite flat and allows the sides to be positioned accurately opposite one another. If this is not done, when the two ends are drawn together they will not line up, and any pulling at this stage will result in a twisted fuselage. The fitting of the cross spacers together with the top and bottom sheeting is adequately covered in the instructions.

If you intend to fit a bigger tank move the sides (F.18) further apart to accommodate this and of course cut a wider hole in the nose block. Should you be fitting a Trike U/C the ply re-inforcing plate for the main legs (F.9) should be moved back $\frac{3}{4}$ in. Fig. 4 shows joined sides and tank platform in place.

The addition of the nose and windscreen blocks and the finishing of the fuselage is quite straightforward and does not need any comment from me, nor does the construction of the fin and rudder, which although sounding complicated is not. The reason for the balanced rudder is to assist the rubber powered actuator and to take some of the load off of it. For Multi operation a conventional rudder attached with tape can be built as an alternative. In the

Fig. 3: The inside faces of the two fuselage sides can be seen here after parting. $\frac{3}{16}$ in. sq. vertical supports to former F.4, F.6 and F.8 are in position, together with the engine bearers and F.9 and F.10 dowel supports. Great care must be taken to line up the engine bearers at equal heights, otherwise the engine mount plate will not sit horizontally when the fuselage is completed.



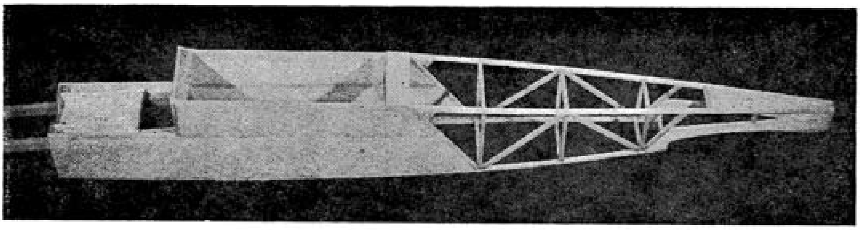


Fig. 4: Above is the basic fuselage skeleton. At nose, the side cheeks, upper nose block and cockp,t have yet to be fitted.

final sanding of the fuselage try to make as smooth a job as possible, starting with a fairly coarse grade garnet paper and reducing to a fine one to finish off. It should be remembered that to obtain a first class finish the frame must be really smooth as the nylon or paper covering will show up all defects by following the contours of the under surface.

The wing is the most important part of the air-frame and the more accurate you can produce it the better. Warps are the curse of the model builder causing many a crash on the first flight before the modeller has a chance to trim out his model, so beware! The method of construction is quite straightforward. However before commencing, select the four main spars and see that they are straight. If a spar is warped it can be straightened by holding in the steam from a kettle and then bending the spar back to shape. It is most important to use the temporary packing strips as shown on the plan. Without this, no lip is left for the under side cap strips to fit against the trailing edge spar.

Joining of the wings is not difficult by the method described. The space between the top and bottom spars at the centre section can be filled in with $\frac{1}{4}$ in. sheet to strengthen the joint.

It is essential to keep the wing pinned down whilst adding the top leading edge sheet as the wing is still very flexible at this stage so it must be held rigid. You will see in Fig. 5 how the position of the ribs are marked on the under side of the leading edge sheet. This enables you not only to coat the ribs with cement but the under-side of the sheet at the appropriate place and so form a very good joint. The cement on the sheeting will take some time to dry properly and I found that whilst this was happening it was possible to add all the top cap strips and half the centre section sheeting. The same can be repeated for the other wing. It is also advisable when building the multi channel version to fill in the spaces at the back of the main spars with vertical grained 1/16 sheet as far out as the ailerons as shown in Fig. 6.

Construction of the ailerons can now be started. The initial work of location has already been carried out in the positioning of the spanwise cap strips. These are best located by measurement from the trailing edge. Install the extra riblets and an extra 1/16 riblet to fill the space between the last complete wing rib and the beginning of the aileron. The Fig. 7 shows how the ailerons can then be removed by sawing through the trailing edge, ribs and wing tip. The addition of the pre-shaped aileron spar completes the aileron with the exception of the installation of the control horns.

After assembling the bellcranks as shown in the sketch and completing the bending of the connecting rods, the bellcrank mounts W.9 can be cemented into the wing. It will be found useful here to cut short lengths of 3/16 in. square strip to place either side of the mounts where they meet the ribs. See Fig. 8.

Tailplane construction is slightly more difficult than a standard flat bottom section but the design of the aircraft requires this type of section.

The method of building the elevators in the vertical plane is clearly shown in Fig. 9 and in the subsequent Fig. 11 you can see how the elevators are pinned in position to allow the 16 S.W.G. wire joiner to be bent and fitted.

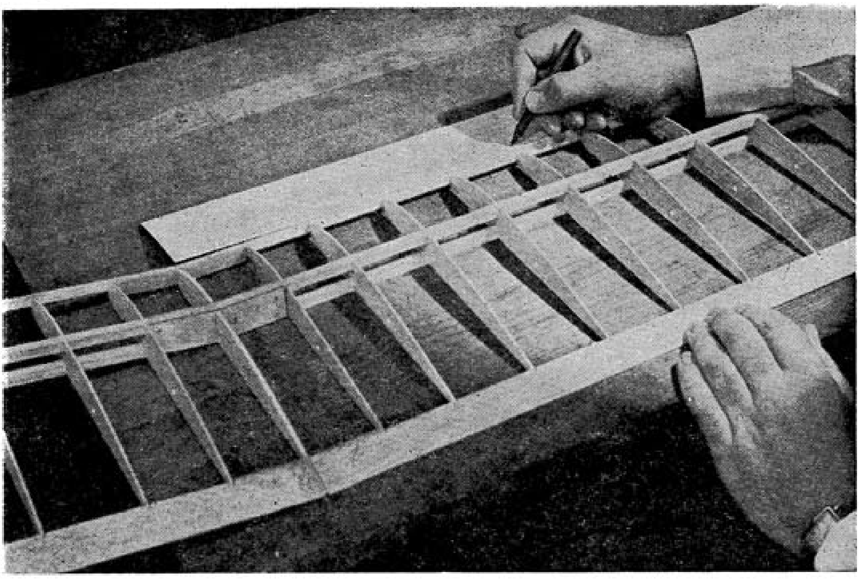
Covering and finishing of the model are both adequately covered in the paragraph concerning these operations, and I do not think it necessary therefore to extend this.

Radio Installation

This should be looked upon as one of the most important sections. Remember to take your time and make a really neat installation. Do not have wires floating loose inside the fuselage, bind them together and where possible, glue them to the fuselage framework. Also support all joins with sleeving which helps to spread the load along the wire.

Most commercial receivers are supplied with a series of wires coming from them ready to connect to the Servos. The choice is now yours, whether you

Fig. 5: To add the wing leading edge sheet, first mark the rib positions. Apply cement and pin in place. Balsa cement dries quickly however, and the modeller may find difficulty in working fast enough to position the sheet before the cement has set. In such a case, it is advisable to use a slow drying P.V.A. white glue, which will give far more than ample time in which to work. For the same reason, P.V.A. white glue is also used for laminating wood.



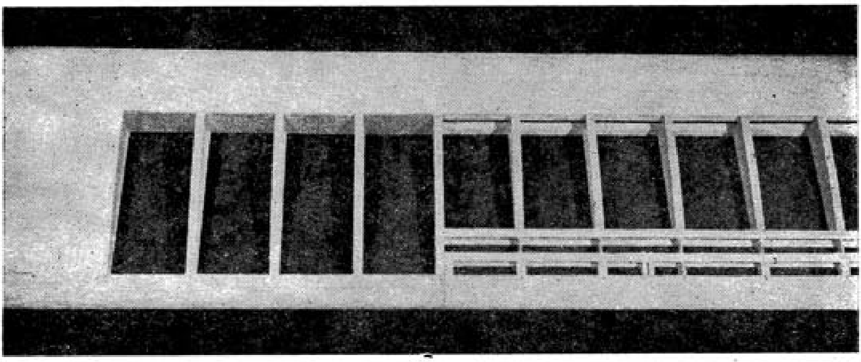


Fig. 6: Observe the wing before the aileron is separated. All cap strips and sheeting are in place, together with the optional mainspar webs. Note that the grain of the webs should be set vertically for greatest strength.

connect direct and make a permanent installation, or whether you install a panel of plugs and sockets, so connecting all the Servos individually and allowing you to remove them simply at will for maintenance or other purposes. If you have no reason to remove them, for say transfer to another aircraft, I would strongly recommend a permanent fixture. The reason for this is that you are doing away with a further set of joints which could cause trouble. Switches should be placed on the opposite side to the engine exhaust. It's surprising how much oil gets inside them! Also, another tip, place the switches so that they work in a horizontal position. This stops you accidentally pushing them up and "off" as you hand-launch.

Following my practice of a permanent installation, I solder my Rx batteries direct into the radio circuit. Again this does away with a plug and socket. I of course pick adequate size batteries that will give me a long life rather than the smallest possible. This is more of a personal fad and could get me into trouble on the flying field, a risk I'm prepared to take. However, you may prefer my other method shown on the plans and this I do use for the Servo batteries, (DEAC cells) in order that I can remove them for charging. On the plan you will see that the receiver is packed in with soft foam rubber. Please note *Rubber* and not foam plastic. Foam plastic does not absorb vibration but merely transmits it to the relays with disastrous results!

Make the receiver a loose fit in the rubber, as this also helps in the damping. To avoid the possibility of vibration from the engine affecting the reed bank of your receiver, if possible, you should mount the receiver so that the reeds are vibrating in a PLANE at *Right Angles* to the travel of the piston.

The installation of single channel equipment is shown very clearly on the plans, and the layout has proved to be very reliable. Do however, make sure that there is absolute freedom of movement of the control rod, the most important item. Any binding and—trouble! If you find the "JACKDAW" too responsive to the rudder, then move the yoke of the rudder downwards and the movement will be decreased.

Fig. 12 shows a three reed set in position, operating rudder (2 reeds) and engine control. (Fast and slow in sequence). This is another method of mounting that can be used for light receivers; two pieces of foam rubber are stuck to the bottom of the receiver which, in turn, is stuck to a piece of $\frac{1}{8}$ ply which runs between two vertical runners in the fuselage. This allows the receiver to be lifted out for any necessary adjustments. This method of mounting has been successfully used for a six channel receiver but it should be packed round with more foam rubber to stop it jumping about.

Another method of mounting 8—10 channel receivers is illustrated in Fig. 13. Here the receiver is packed in rubberised hair. This material completely absorbs any vibration and does not transmit it to the Rx. Servo mounting as shown on the plans is a very satisfactory method and will certainly stop all vibrations affecting Servos which can cause them to operate slowly due to wiper bounce. The piece of rubber mounting is an added precaution and may not be found necessary in your particular installation.

Control rods made of Balsa have been found to be quite adequate in strength. They also have the advantage of breaking before all the teeth are torn off the Servo gearbox! The wire clip-ends described have also been found to be very reliable and useful with their quick release mechanism.

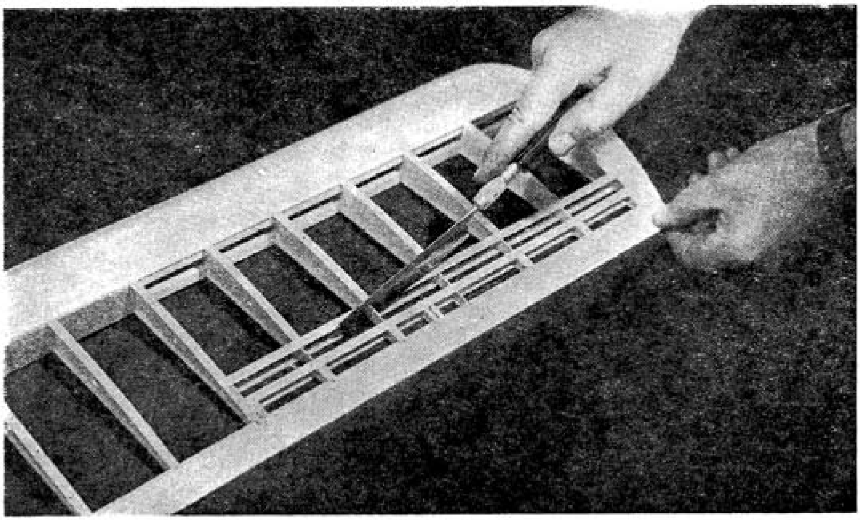
Testing of Radio before Flying

Again one of the most important sections of your project, and time spent on pre-checking will be amply rewarded. This section lends itself to a list of Do's and Don'ts. So here we go:—

Before leaving home:

1. DO check your batteries under load.
2. DO *Tune the receiver to the Transmitter*—with modern sets, a distance of 25 yds. is usually adequate (with aerial on the transmitter collapsed if it is

Fig. 7: To separate the aileron from the wing an X-acto Razor Saw is an ideal tool. If one does not possess a Razor Saw, then a fine Hack-saw blade could be used. When the aileron is separated, the two worked edges must be prepared to receive the bevelled strip edge pieces provided. The main spar webbing can be seen in this view also.



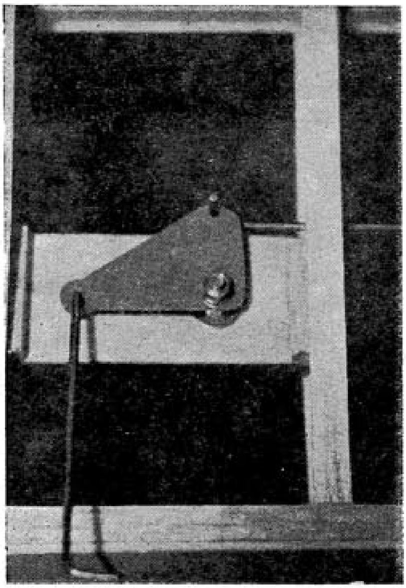


Fig. 8: Particular care must be taken with aileron linkages. The bellcrank must not bind on its pivot bolt. Greatest care however must be exercised to see that the lead-in to the appropriate servo at the wing root does not bind with any of the wing ribs through which it passes. The bellcrank platform is supported with $\frac{3}{16}$ in. sq. balsa stock.

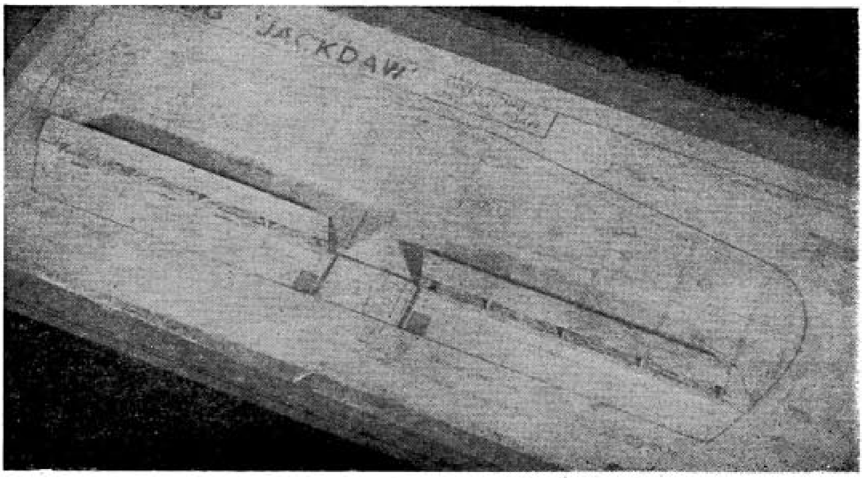
crystal controlled). But check! The first time at a greater distance! This operation not only saves a lot of time but keeps your friends for you. Remember, as only one person can fly at a time (unless you all have superhet receivers) if everybody tunes on the flying field there will be no flying!

3. DO *Check all Controls for correct operation*—If this is a new installation run the engine and see all controls still work. This could save you a fruitless journey to the flying field (and more friends). No control? but it worked without the engine. You have found the arch enemy:—vibration. Check all plugs, sockets, wires, relays—try again. Controls move, but slowly. This could be one of two things:—Relay chatter or wiper contact vibration on the actuator.

Remedy:

(*a*) Remove receiver from plane and hold in your hand. If you now run engine

Fig. 9: Build elevators vertically over the plan as the illustration depicts below. The front spar is set over the plan and the ribs added, followed by the trailing edge.



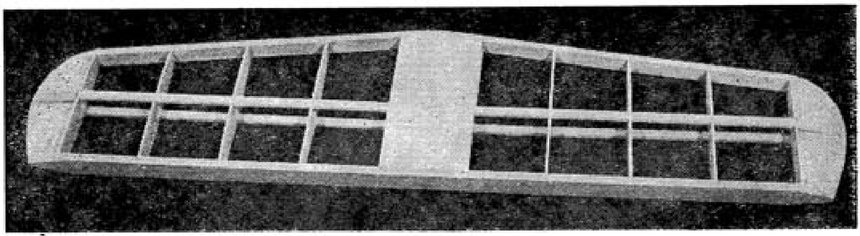


Fig. 10: Above we see the completed tailplane structure minus the elevator. The centre section has been sheeted. Note the manner in which the leading and trailing edges and the spars terminate at the tips. The trailing edge here is not rounded on its rear face, but is left flat.

and everything works correctly, vibration is affecting the receiver. Repack or remount and try again. If still intermittent, examine relays and adjust according to makers instructions. Further adjustments should not be made. The cause may well be electronic and the receiver should be returned for servicing.

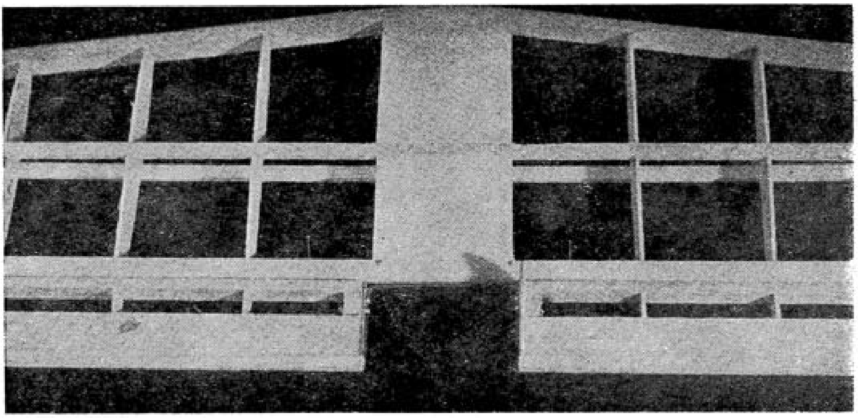
(*b*) If when you remove Rx from plane, the Servos operate slowly, it is probable that the fault lies therein. Wipers are affected by the engine and you may find it necessary to increase their contact pressure on the printed circuit board. If this is not effective an extra layer of rubber should be placed between the Servo and the floor of the model. Further, check motor brushes to see that they are in proper contact with the commutator.

4. DO make a check list of tools you require and check your tool box.
5. DO take a spare set of good batteries!

DON'TS

1. DON'T fly unless you are insured.
2. *DON'T fly without a Radio Control Licence.*

Fig. 11: Here we see the tailplane complete with elevator. The two elevator halves are joined at their centre with piano wire, bound to ply faces. In this picture the elevators are actually pinned to the tailplane preliminary to taping permanently.



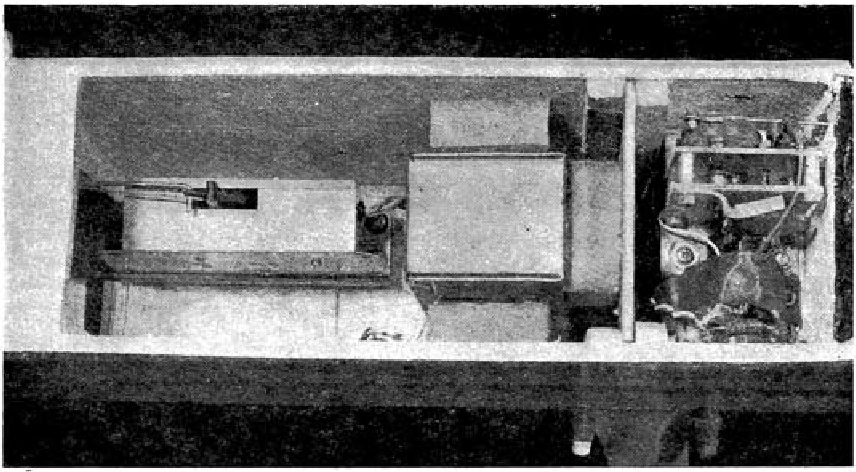


Fig. 12: Three channel installation in Jackdaw. The receiver in this case is an R.E.P. Tri-Tone. Observe the way in which the receiver is protected by foam rubber. One piece is stuck to the receiver underside(receiver mounted vertically) and then to the sliding bulkhead as can be seen, with two extra wads of foam, one each side of the fuselage. Use Impact Adhesive to secure rubber. In front of the receiver is the throttle servo (one channel) and behind, the Bonner Duramite servo for Rudder control (two channels).

3. DON'T attempt to fly unless every control is working properly.
4. DON'T switch on whilst other people are flying!
5. DON'T fill the tank completely on the 1st flight.
6. DON'T launch straight at a crowd of people. Remember the model flies at nearly 40 m.p.h. and weighs about 4½ lbs. and that's a lot of energy to hit anybody!
7. DON'T fly without warning other R/C modellers you are about to launch.
8. DON'T try to land the model at your feet if surrounded by people.
9. DON'T fly over the crowd.

Trimming and Flying

This section is covered in the instructions; however, due to space limitations it was not possible to give a fuller account and point out a few more useful tips.

It is not possible to over emphasise the importance of a correct C.G. position, failure to locate this properly can result in a poor performance, if the model performs at all! A C.G. position forward of that shown will produce a sluggish model which will need an increase in the incidence of the wing or more negative incidence on the tail to improve it. This is not such a bad fault as a rearward located C.G. which will cause the aircraft to stall and build up into a series of stalls with disastrous results!

The rearward location will also cause the model to nose up under power and with a really rearward C.G. the model may well loop into the ground. The moral therefore is locate the C.G. position correctly.

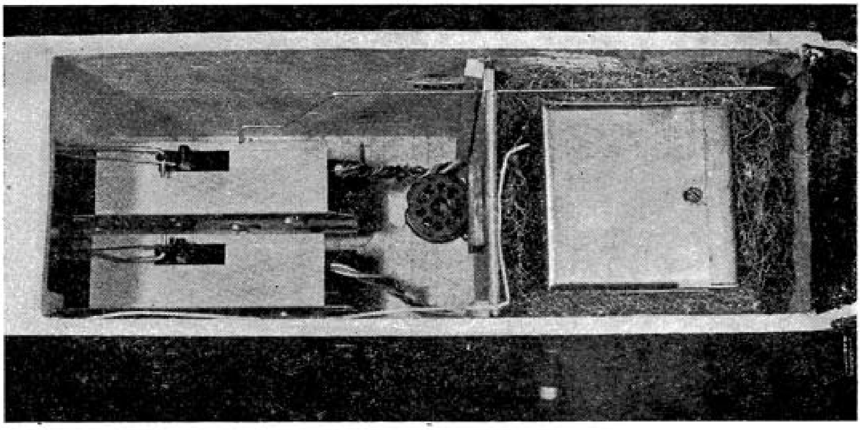
For first flights I would advise you to pick a reasonably calm day (wind up to 10 m.p.h.) with a gentle breeze. This gives the model a chance and you to get used to it, and if you are unlucky enough to have a Radio failure the model will not travel far, providing of course that you have taken my advice and only put in enough fuel for about a one minute flight. Don't be in too much of a hurry to give a signal, allow the model to gain height. Remember; there is no substitute for altitude! Contest flying demands that you should be able to fly your model and make headway under most weather conditions. This is the first mistake made by the beginner. He only flies his model in calm conditions, and invariably, on the contest day there is a howling gale which immediately blows his model backwards downwind and out of range. Here then is the answer:— trim for calm and windy conditions and make a note of your settings. For instance, you may find that to gain any height on a dead calm day, you will need a piece of 1/16 balsa between the leading edge of the tail and the fuselage. (Increase incidence). On a windy day this setting would produce a terrific climb but the model would be blown downwind. Therefore add packing between the trailing edge and the fuselage, (Decrease incidence), in effect giving down elevator and so pushing the nose down and forward. You want to adjust so that the model still makes headway into the wind. It may need as much as $\frac{1}{8}$ in. packing to do this, I used this amount several times last season. Be warned however, that this procedure does increase the rate of descent when the motor cuts, so do not turn too far down wind to make your approach, or you will undershoot. Under normal conditions the approach is easier although it is difficult to judge the point of landing. I prefer to come in too high and then give short signals of left and right rudder to side slip the model to a satisfactory position.

The basic manoeuvres possible with a single channel "JACKDAW" are described adequately and do not need further comment from me.

Multi channel trimming technique can become quite involved to extract that little bit extra and so a winning performance.

The basic trimming technique is described in the booklet. However let me again emphasise the importance of warp-free surfaces for accurate flying. It is

Fig. 13: A more complex multi control system can be seen below. In this case we have an R.E.P. Sextone, six channel receiver mounted in rubberised hair and supported by a sliding bulkhead on runners. Two Bonner Duramite servos actuate rudder and elevator. The throttle linkage can be seen at the top of the fuselage, but the throttle servo has yet to be added, mounted on the left hand fuselage side.



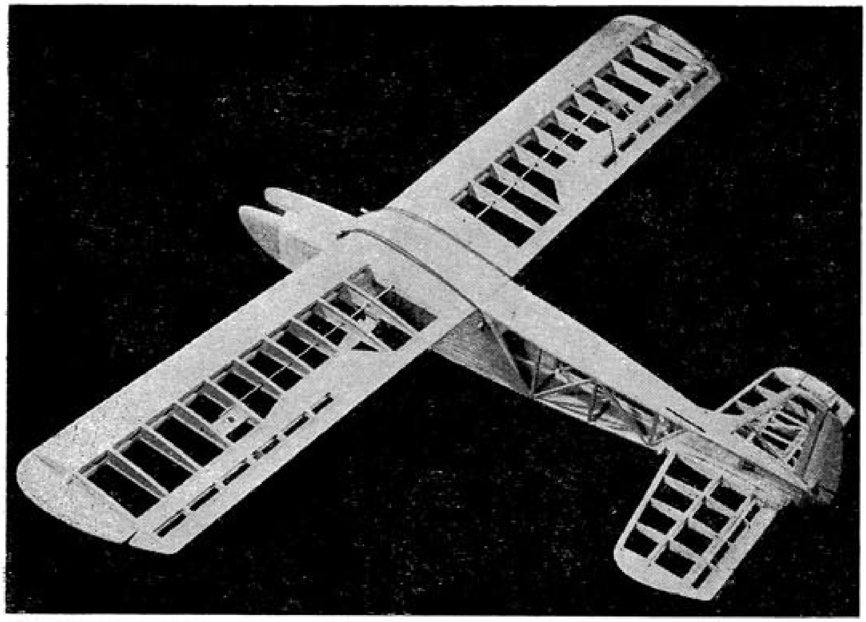


Fig. 14: The uncovered structure of the Jackdaw with ailerons, elevator and rudder. Wide bandage, doped to the wing around the centre section provides extra strength. Silk is recommended as a covering medium, which though more expensive than tissue and heavier too, endows the structure with considerable strength well worth its small weight penalty not very significant on a model of this size.

advisable to adjust the controls separately to avoid confusion of results. Firstly the elevator. On your first flight, you find it necessary to give quick blips of "up" to keep the plane airborne. This requires either a setting of "up" permanently on the elevator, or perhaps better still, packing under the leading edge of the tail and keep the elevator level. Having established level flight, you can attend to the directional and banking controls (rudder and aileron) to obtain straight flight "hands off". This is stage one completed. Now for stage two trimming: Take the loop as our stunt trim manoeuvre. When up elevator is applied to execute a loop, the model "flick rolls" out of the top. This means the model has stalled—the remedy is to cut down the amount of up movement. But if you find that you need all of the up to execute a spin then your alternative is to send out a series of short pulses on the elevator control. This will give you a larger loop and stop the "flick". Again, as you execute a loop, as the model comes out it turns away from the plane of the loop. Here rudder and/or aileron is having an effect and these must be adjusted. Supposing the model turns left at the exit, then apply a little right rudder trim. This may upset your straight flight path; to correct this apply a little left aileron and the model will again fly straight. The combination of opposite controls cancel one another out on level flight, and gives the desired result in the loop. You may consider yourself to have a well trimmed model when you get to this stage.

A word about elevator trim. It is possible to adjust the Servos to give some float about a neutral point. This has two useful purposes (*a*) test flights where you pull on a little up trim as a safety factor and (*b*) for inverted flying. After your conclusion of test flights you can remove the up trim by adjusting the length of the control rod (lengthening it) to give no up trim, but only down (some 2 or 3 degrees). This allows you then to roll inverted and apply a set amount of down to hold the nose up and so relieve you of the trouble of continuously giving blips of down elevator and steer at the same time. Directional control, inverted by the way, is best done by use of the ailerons, whose action is the same way inverted as upright.

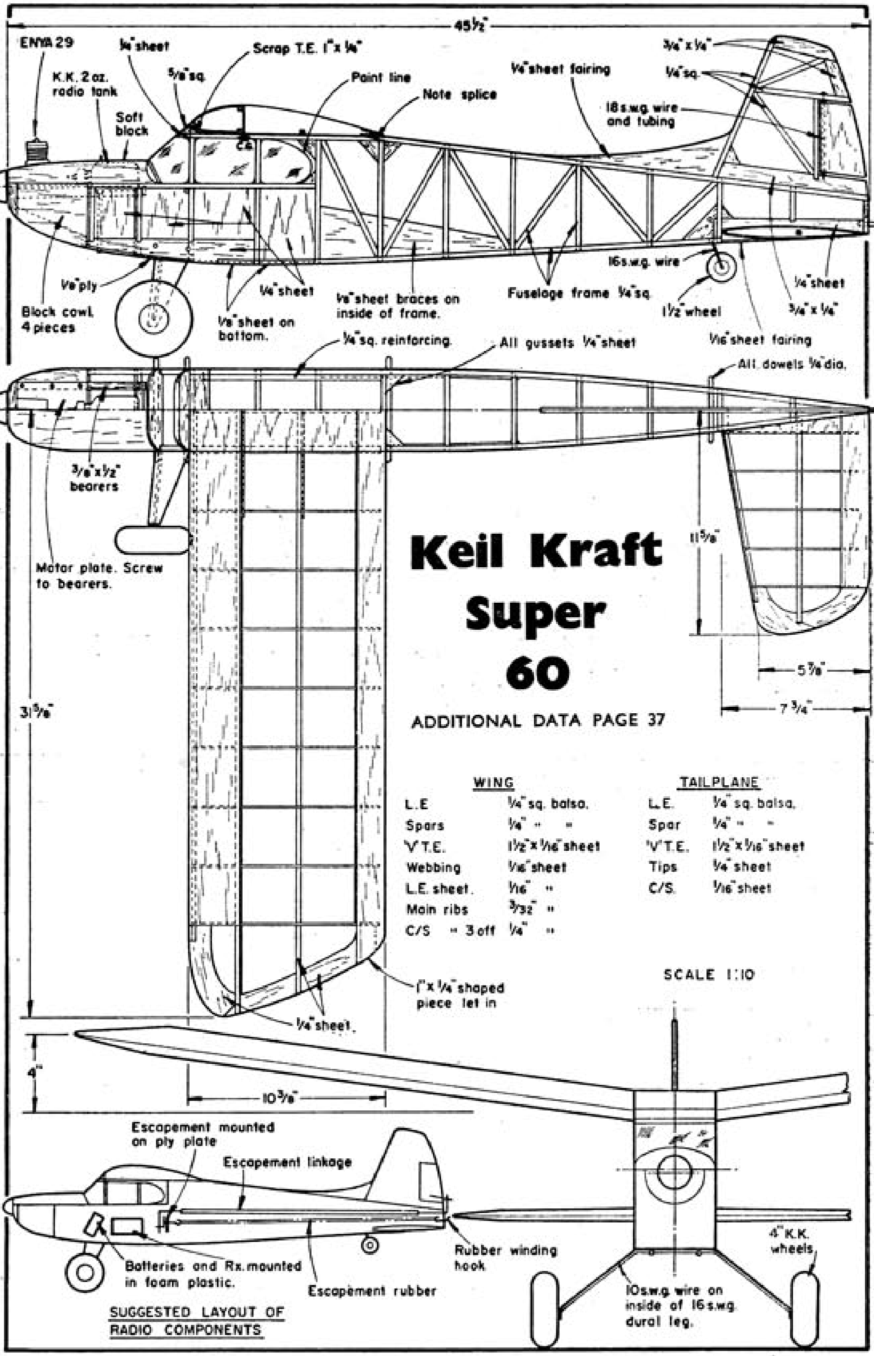
I hope in the foregoing pages that all of the hints and tips will help you along the road to success. It has taken many years of patient building, flying and crashing, to learn all of them so take note for your own sake. Many people are discouraged by their first troubles and that is why I offer these words of advice to you.

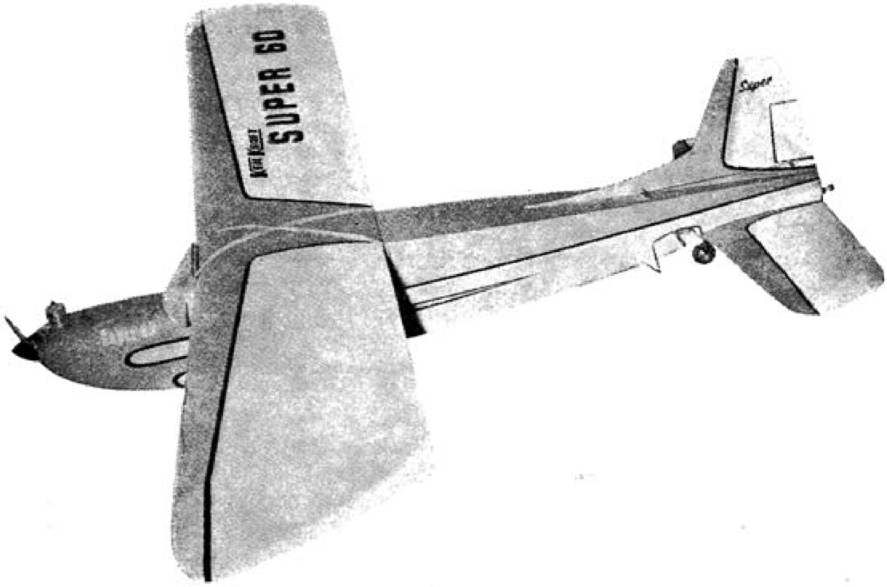
Well, go to it, and remember the Motto of the old National Guild of Modellers "Vola Cum Cura!" FLY WITH CARE!

STEWART UWINS.

ADDITIONAL DATA

	AIRFRAME	EQUIPMENT	COST	DEVELOPMENT
GALAHAD	Wingspan:—54″. Chord: 9″. Wing Area: 475 sq. ins. Length: 38½″. Max. Cross Section:— Radio Compartment 3½ x 2¾″. Weight less R/C: 37 ozs. Wing Loading: 15½ ozs./sq. ft. Airfoil: Flat Bottom.	Engine:— Elfin 1.8 (Single) Fox .15 (multi) Rx. Unitone (Single) Homebuilt (Multi). Batteries:— (Single) B122, and four pen-cells. Control Actuators:— (Single) Elmic Conquest. Weight R/C Gear: 8 ozs. (Single) 19 ozs. (Multi).	Kit plus essential accessories:—36s. R/C Gear (Single):— Rx. £7 7s. 6d., Elmic Conquest Escapement 32s. 6d. Transmitter:—£9 3s. 6d.	Controls:— Multi-Channel, elevator, rudder, engine, ailerons. Undercarriage:— Tricycle. Engine:— 1.5—3.5 c.c.
JACKDAW	Wingspan: 60″ Chord: 9½″. Wing Area: 550 sq. ins. Length: 41½″. Max. Cross-section: 5½″ x 3″. Weight less R/C: 2¾—3 lbs. Wing loading: 14 ozs./sq. ft. Airfoil: Clark Y.	Engine:— Frog 3.49 R/C. Receiver:— Unitone. Batteries:— B122 HT, U12 Pencell LT. 2 x U11's Actuator. Control Escapement(s): Bonner Varicomp. Weight of R/C gear: approx 9 ozs.	Engine: £4 19s. 6d. Kit:—£5 19s. 9d. Nylon 2½ yards 19s. 10d. Prop:—2s. 6d. Kit plus essential accessories: 1½ pts. clear dope 11s. 3d. Colours ½ pt. 5s. 0d. R/C gear:— £7 9s. 9d. Rx. £3 12s. 6d. Vari-Comp. £1 12s. 6d. Conquest Transmitter: £9 6s. 5d.	Controls:—Full multi & trim. Undercarriage:— Steering Tricycle. Engine:— Up to "35".
SUPER SIXTY	Wingspan: 63″. Chord: 10½″. Wing Area: 618 sq. ins. Length: 47″. Max cross-section: 4¼″ x 6½″ (27¾ sq. ins.). Weight less R/C: 3¾ lbs. Wing loading: 11 ozs./sq. ft. Airfoil: Modified Gottingen 549.	Engine:— Veco 19 & Enya 19 R/C. Receiver:— Reptone. Batteries:— 1 x B122 (22½v). 3 x ½ pencells. Control Escapement(s): (with Rx) Conquest Escapement for motor control. Weight of R/C gear:— 8½—9½ ozs.	Kit plus essential accessories:—£5 7s. 0d. Kit £1 12s. 0d. for 4″ airwheel R/C gear:—Reptone £15 12s. 5d. complete with Tx. Rx/Act. only £10 5s. 5d. Tx only £6 0s. 3d.	Controls:— Can be multi-ed. Undercarriage:— Can be modded to tricycle. Engine:— 2.49 to 5.8 can be throttled.
VISCOUNT	Wingspan: 60″. Chord: (root) 10″ (tip) 9½″. Wing Area: 515 sq. ins. Length: 36½″. Max. Cross-section: (radio compartment) 3¼″ x 3½″. Weight less R/C: 59 ozs. Wing Loading: 15½ oz./sq. ft. Airfoil: N.A.C.A. 2412.	Engine:— Enya .15-II. Receiver:— Ivy-AM with Ivistor. Batteries:— 2 x B122 (H.T.) 2 x No. 8 (L.T.) Flat 4.5v. escapement. Control Escapement(s): Elmic Conquest (Rudder). Weight of R/C gear:— 13 ozs.	Kit plus essential accessories:—£5 14s. 0d. R/C gear: Rx. £1 19s. 6d. Ivistor 29s. 6d., Escapement 32s. 6d. Transmitter: Any Carrier Wave type £5—£8. Switch, plugs, sockets 7s. 6d.	Controls:— Cascaded escapements (Quad-Trol, Babcock Hyper-Compound etc.). Galloping Ghost, for Rudder, Elevator and engine. Undercarriage: Steering Tailwheel. Engine:—2.49 to 5 c.c.


45 1/2"
ENYA 29
1/4" sheet
Scrap T.E. 1" x 1/4"
K.K. 2 oz. radio tank
5/8" sq.
Paint line
Note splice
Soft block
1/4" sheet fairing
3/4" x 1/4"
1/4" sq.
18 s.w.g. wire and tubing
16 s.w.g. wire
1/8" ply
Block cowl. 4 pieces
1/4" sheet
1/8" sheet on bottom.
1/8" sheet braces on inside of frame.
Fuselage frame 1/4" sq.
1 1/2" wheel
1/4" sheet
3/4" x 1/4"
1/16" sheet fairing
1/4" sq. reinforcing.
All gussets 1/4" sheet
All dowels 1/4" dia.
3/8" x 1/2" bearers
Motor plate. Screw to bearers.
Keil Kraft
Super
60
ADDITIONAL DATA PAGE 37
11 5/8"
5 7/8"
7 3/4"
31 5/8"
WING
L.E 1/4" sq. balsa.
Spars 1/8" " "
'V' T.E. 1 1/2" x 1/16" sheet
Webbing 1/16" sheet
L.E. sheet. 1/16" "
Main ribs 3/32" "
C/S " 3 off 1/4" "
TAILPLANE
L.E. 1/4" sq. balsa.
Spar 1/4" " "
'V' T.E. 1 1/2" x 1/16" sheet
Tips 1/4" sheet
C/S. 1/16" sheet
SCALE 1:10
1" x 1/4" shaped piece let in
1/4" sheet.
4"
10 3/8"
Escapement mounted on ply plate
Escapement linkage
Batteries and Rx. mounted in foam plastic.
Escapement rubber
Rubber winding hook
4" K.K. wheels
10 s.w.g. wire on inside of 16 s.w.g. dural leg.
SUGGESTED LAYOUT OF RADIO COMPONENTS



Part 4:

By

Ernie Webster

Keil Kraft Super 60

One of the very first power kits to appear on the British market was known as the Junior, on account of its small size—the wing span was a mere five feet! In those days, power plants were usually of the 10 c.c. size, although one or two exceptionally small motors were as little as 5 c.c. and it was for these latter "miniature" motors that the Junior was designed. It wasn't long before the wing span became a part of the name and the Junior 60 became an integral part of the British aeromodelling scene.

With the passage of years, the Junior 60 won its way into the hearts of aeromodellers with its steady, dependable flight. Most power modellers seem to have "cut their teeth" on this model. Then two things happened which changed the face of modelling and toppled the large power model, long regarded as the "ultimate" in model flying from that proud throne.

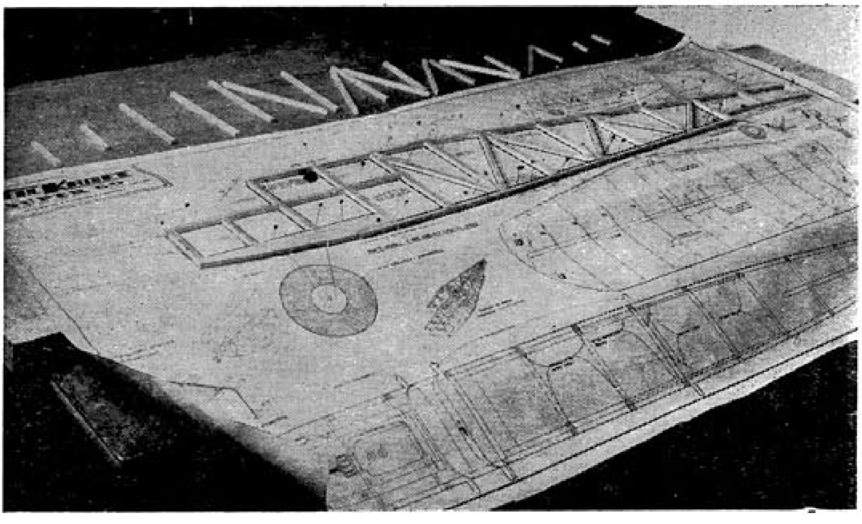
First, with dramatic suddenness, motors became smaller and then the "diesel" motor burst upon the scene. Somehow, in Britain, no-one had made a really commercial proposition of petrol motors, and would-be power modellers had to rely on the small trickle of motors that found its way across the Atlantic Ocean. The new diesel motors began to appear in ever increasing quantities in the model shops, some of the earliest available being French. The writer's first motor was an Ouragan diesel an unusual motor in which the compression was varied by means of an eccentric crankshaft bush rotated by means of a lever which looked for all the world like the "advance and retard" lever on a conventional petrol motor. But the most important point about this motor was that its capacity was a fantastically small .8 c.c. British manufacturers took to the diesel motor like the proverbial duck to water and soon a wide range of efficient powerplants was available to the British modeller.

In other words, the small motor had arrived and with it the small power model. The Junior 60, from being one of the smaller power models, suddenly found itself classed as a "big" plane, but still its popularity continued undiminished. Fitted with a smaller motor than the 6 c.c. petrol engine shown on the plan, and freed by the diesel from the weight penalty of coil, condenser and battery (and all the attendant troubles) the Junior 60 was still to be seen at flying fields all over the country.

The other thing that happened was that numbers of young men who had worked on radio and radar in the forces were putting their war-time technical knowledge to a new usc—radio control.

Not surprisingly, the first radio control units were large, complicated and not particularly reliable. In fact, radio control was one of those things which although much discussed was very rarely seen. Early radio control enthusiasts were trying to produce equipment which would enable the "pilot" to control the plane just as the full size plane was controlled and it was a little while before the virtues of learning to walk before learning to run were realized. In fact it is only in the last few years that the early dream of the fully controlled model

Fig. 1: Lay down the fuselage sides of the Super 60 over the plan, not forgetting the wax polish to prevent the sides from sticking to the plan. One basic side is here complete and a second side will be built directly over it. Remember to pre-cement spacers, for a dry joint at this stage could lead to serious structural weakness later. Leave the assembly to dry overnight before removing from the plan. A close study of the plan in this picture will reveal an elevation of the basic fuselage structure, and will provide a good indication of how the fuselage takes shape



has come to fruition.

At first, of course, all the equipment had to be home built, but soon commercial radio control gear was on the market and this enabled the less technically minded enthusiast to try his hand. The writer vividly remembers building not only receivers, but also escapements, the chief disadvantage of which seemed to be that by the time they were properly adjusted they were worn out!

When looking for a plane in which to install his gear, the radio modeller turned naturally to a model which had proved itself in the free flight field and the Junior 60 seemed an obvious choice. This choice was well justified and the Junior 60 soon became the standard radio model, just as years before it had been the standard power model. In 1955, the model was re-kitted, to bring the plans up to date. An E.D. Racer was shown on the plans and also the installation of radio equipment. Apart from widening the fuselage a little to allow more room for radio gear and showing a suitable rudder, little change was made to the model itself.

However, during the past few years it had become increasingly apparent that some changes were necessary. Firstly, as powerplants have become steadily lighter and more powerful with the passage of time, the nose of the Junior 60 was now too short and either it had to be lengthened, or a considerable amount of added nose weight was required. The problem had been under discussion for some time in the Keilkraft design shop and finally Eddie Keil initiated a full scale attack on the whole problem of the beginners' radio model.

The result is the Super Sixty.

Development

At first sight, the solution to the problem appeared to be a further modification of the Junior 60 and a couple of models were built. The nose was lengthened considerably and whilst this obviated the need for ballast, it was obvious that it was not the right answer. Under the effect of rudder, the Junior 60 had a tendency to drop its nose early on in the turn. This soon built up into a spiral dive. Neutralizing the rudder, or opposite rudder brought the plane out of the dive with no difficulty, but the effect was to make the plane climb steeply. This made smooth manoeuvres very difficult to perform.

Attempting to fly the model on worn transmitter batteries (we all succumb to the temptation at one time or another!) brought to light another feature that needed modification. A really heavy landing (to be honest, we spun the plane in) not unnaturally puts a great strain on the undercarriage, and due to the way in which the undercarriage was built into the fuselage this meant that the fuselage was liable to be damaged at the points of the undercarriage attachment.

All in all, it was clear that the time had come for what is popularly known as "rethinking" on the whole problem. A clean sheet of paper was pinned to the drawing board and work was begun on an entirely new model.

It is time that you met another member of the Keilkraft design staff. Mr. P. Rodgers is the staff modeller; having reddish hair and the name "Rodgers" it is almost inevitable that he is known to all and sundry as "Ginger". His considerable experience of building and flying models makes him a valuable member of the design team and he and I got our heads down and began to argue out the features that we considered the ideal model should have.

An added complication to the problem is that we had to produce not only a good model, but also a good kit. This aspect is one that does not bother the home builder, but in a commercial concern it is extremely important. Loose thinking over quite small design points can lead to the kit being unnecessarily expensive and difficult to produce and pack.

The first thing to decide was what features of the old Junior 60 were desirable to include in the new model. We both agreed that the basic method of wing construction, with one exception, was both simple and sound. The exception was the butting of the leading edge sheeting against the rear of the leading edge. By moving the spars forward slightly, it was possible to carry the leading edge sheeting over the top of the leading edge which makes a stronger and more practical joint.

Another feature of the Junior 60 that it was decided to retain was the use of longerons and cross braces to build up the fuselage. This is not only easier to kit, but makes the installation of radio gear much simpler, as it is possible to work through the openwork structure to attach wiring etc.

Apart from these two points, the only thing to be retained was a general similarity in size. A model of about five foot wing span, whilst large enough to carry any reasonable amount of radio gear and capable of flying under a variety of weather conditions, is not so large as to prove too cumbersome for the average radio modeller to construct, store and transport.

Now began a long series of discussions, and it was established early on that no feature which did not satisfy both of us as well as meeting with Eddie Keil's approval should be included. The first thing to be decided was the undercarriage. This was to be of the "knock-off" type to be found on so many advanced models today on both sides of the Atlantic. A dural and wire undercart, with the wire attached to the dural by means of drilled bolts was tried and proved entirely successful. Attached to the model by elastic bands and dowels, it was found strong enough to stand up to quite heavy landings, whereas anything too violent knocked the undercarriage off without damaging the fuselage.

Quite early on it was decided that the fin should be built on to the fuselage and that the tailplane should be mounted underneath. Apart from the obvious advantage of ease of transport—a large tailplane with fin attached is a most cumbersome and accident prone object—the fin being integral with the fuselage means that the rudder linkage does not have to be disconnected when the model is dismantled. Also it means that rudder settings are not upset by an accidental moving of the tailplane—something that I have seen happen.

The underslung tailplane obviously meant dispensing with an underfin and the more modern tailwheel was adopted. Whilst discussing the fin and tailplane it is opportune to mention why the fin is not built into the fuselage but merely cemented on to the top of it. In the event of a nose-over, caused by hitting a rut on landing (I know flying fields are supposed to be level, but we have to take what we can get) or just plain ham-fistedness or accident in transport, it is much better for the whole fin to fold over than for structural damage to be done to fin or fuselage. A folded-over fin may be cemented back in place on the flying field and all that is caused is a slight delay whilst waiting for the cement to set, but structural damage may lead to major repairs being necessary, or what is worse, a hasty repair followed by an attempt to fly a bodged-up job.

The motor installation was the next item to receive attention. As it was obvious that the plane would be called upon to accept a large number of motors, varying from a 2.5 c.c. diesel up to a 35 5.8 c.c.) glowmotor, it was decided to adopt the plate method of mounting the engine. By spacing the actual bearers wide apart and mounting the motor on a stout paxolin plate, any motor, with any required degree of sidethrust could be easily accommodated without the need to modify the plane in any way. Early experiments with modified Junior 60s had shown us the advantages to be derived from the "clunk" type of tank and it was decided that this could be included in the kit. Suitable containers were found and a special heavy fuel filter was made to provide the weight on the end of the fuel line. The advantages of a built in fuel filter are obvious.

The airfoil section was a matter for much heart searching and the final choice was influenced by amongst other things, the fact that as this was a kit model, many planes would be built for free flight only, and also this would be the very first radio model for many modellers. Something reasonably fast for good penetration and adequately stable was called for and the final result has more than justified our choice. Naturally, the tailplane section was considered in conjunction with the wing section and a symmetrical section was finally decided on.

The tailplane structure called for considerable thought and many and varied methods were discussed. First Ginger would say "How would it be if we . . . ?" to which I would reply "Yes, but what about . . . ?" and then the same thing would happen the other way round. We are quite unable to remember who initiated the final suggestion—if ever there was an example of co-operation, this was it! Our choice of a symmetrical construction was based on a mutual desire to produce something that would be warp free without having to resort to too heavy a construction. Suffice it to say that the original tailplane is still going strong after well over a year of service which includes stripping off the original heavyweight tissue and recovering in silk. It is still as flat as when it was first built.

With the main design points, settled and a waste paper basket full of discarded sketches of the "ideal" model, it was time to start on the drawings. Having drawn a reduced scale plan view to settle the moment arms etc., a start was made on the fuselage side view. For ease of construction it was decided that the $\frac{1}{4}$ in. square longerons should run in straight lines and this was incorporated. The final balancing of the side areas by means of the fin and fin fairing was finally settled by Eddie Keil, Ginger and I. Completing the drawings did not take very long as, by this time, we had a pretty accurate idea of where we were going.

Now came the exciting period when we could see the results of our work beginning to take shape as the prototype Super 60 was built. Careful pre-planning proved its worth here and no building snags came to light. The radio was installed, the model covered with heavyweight tissue and doped and we were ready for test flying.

Test flights are always anxious moments for designers, particularly on a major project such as this. Although you have checked your design figures over and over again and you know that everything should be all right there is always a nagging little doubt in the back of your mind that perhaps . . . Anyway, it was with our fingers well and truly crossed that Ginger and I watched Eddie Keil launch the model for its maiden trip.

We had tried test gliding the machine, but it proved very little beyond the fact that the undercarriage was all that we had hoped. To launch a model of that size, weighing four pounds twelve ounces, designed to fly reasonably fast, at its proper flying speed had proved impracticable. So we put a limited amount of fuel in the tank, started the Veco 19 which we had installed and we were off.

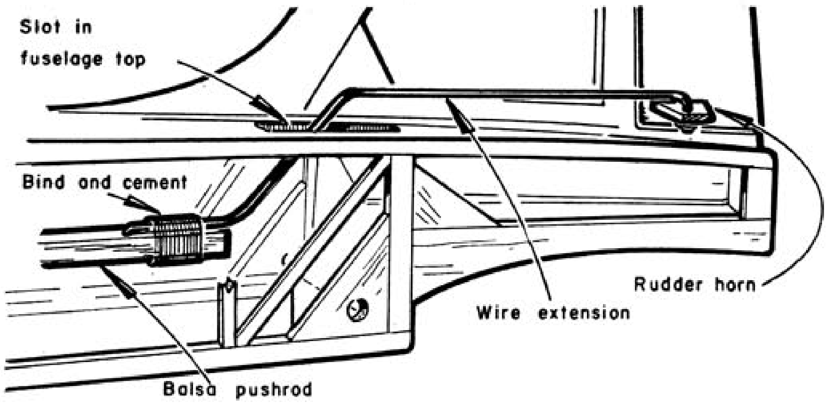


Fig. 2: Above is a "push-pull" rudder control linkage for the Reptone receiver. The rudder horn is connected to the push-rod by a length of shaped piano wire, bound in with thread. The same system applies at the actuator end, but do not fit a full length metal (wire) push rod, as this may well interfere with the aerial, interrupting radio reception

To our joy, the model flew exactly as we had hoped it would. It was one of those rare days without too much wind and the plane flew straight and true into wind, climbing steadily. A touch of rudder and it came round in a smooth flat turn with no tendency for the nose to dig in. After that we started to enjoy the flight watching Mr. Keil turning the model this way and that and continually bringing the model back overhead. Suddenly the same thought struck both Ginger and myself. "What's going to happen when the motor cuts?" But we need not have worried. There was no stall and the model glided round smoothly for what seemed like a very long while before finally coming down quite close to us.

Since bringing out the kit, we have had many reports of Super 60s being flown with many and varied powerplants and radio installations. These encouraging letters help to confirm our belief that the Super 60 is what we hoped it would be—a simple, reliable model that will give the novice every chance of success with his first radio model, at the same time proving worthy of the attention of the more advanced modeller.

Building the Model

Constructionwise, the Super 60 is a very straightforward model to build and anyone who has a little experience in aeromodelling should find no trouble. It can be built on a building board three feet six inches long by eleven inches wide and calls for no special tools. A modelling knife, pliers, tennon saw, drill with $\frac{1}{4}$ in. and $\frac{3}{16}$ in. bits and some modelling pins will suffice, although a razor saw and a tri-square will be valuable additions to the tool kit.

Before you start work please read the instructions. This is most important. They have been most carefully compiled by the designer and by the staff model builder to make your building as easy and trouble free as possible. I have no doubt whatsoever that the other writers in this book are saying much the same thing. We have all had experience of receiving letters from modellers in difficulty which show only too clearly that had the instructions been read the trouble would never have arisen.

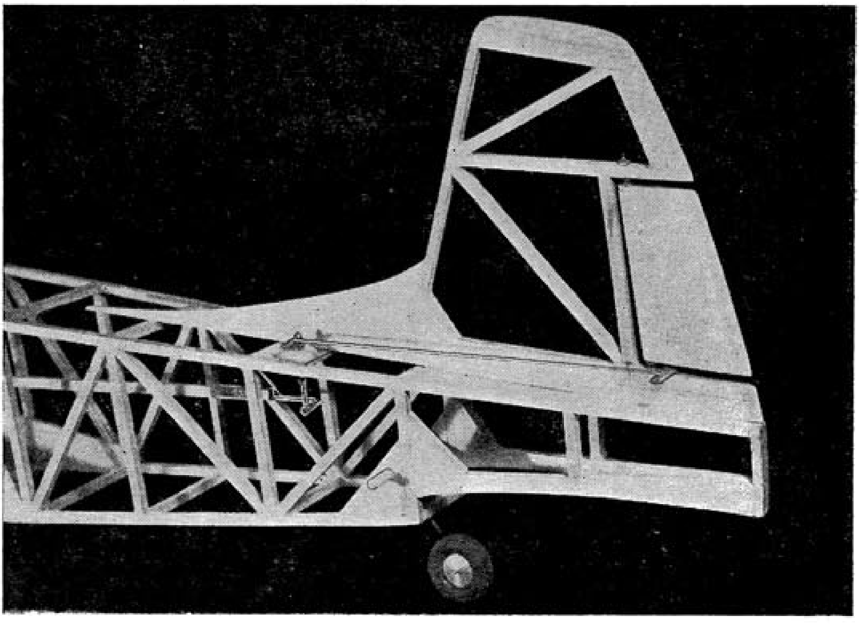
Another point to emphasize at the outset is the inadvisability of modifying the model unless you are very sure of what you are doing. Much thought, experience and care has gone into the design and it would be a pity to spoil it all with a couple of haphazard "improvements".

To prevent parts from sticking to the plan, we at Keilkraft always keep a tin of Mansion Polish in the building shop. This, or any similar wax polish rubbed on to the plan will adequately prevent balsa cement from adhering to the paper without obscuring the plan in any way.

It is best to start off by building the fuselage sides. Once these are built, the building board is free for the construction of another part which can be left to set whilst work proceeds on the fuselage. Build the two fuselage sides one on top of the other, using pins to hold the parts in position. Some modellers do not mind the two sides being stuck together, as the outlines of both can be sandpapered before the sides are separated, thus ensuring that the sides are identical. Others prefer not to have to separate the sides, feeling that they might be damaged in the process. Should your views coincide with the latter, all you have to do is to insert pieces of scrap tissue, treated with wax polish between the sides at the positions where joints occur. Either way, build accurately and carefully. It is when cutting the cross braces to length that the razor saw is most useful.

Pre-cementing is recommended for all joints as it adds greatly to the strength

Fig. 3: Here is an alternative rudder linkage using the Reptone receiver, transferring the link from inside to the outside of the fuselage via a double horned pivot. If such a system is used, care should be taken to ensure that there is no "slop" in the shank of the pivot, which can be a brass bush for convenience



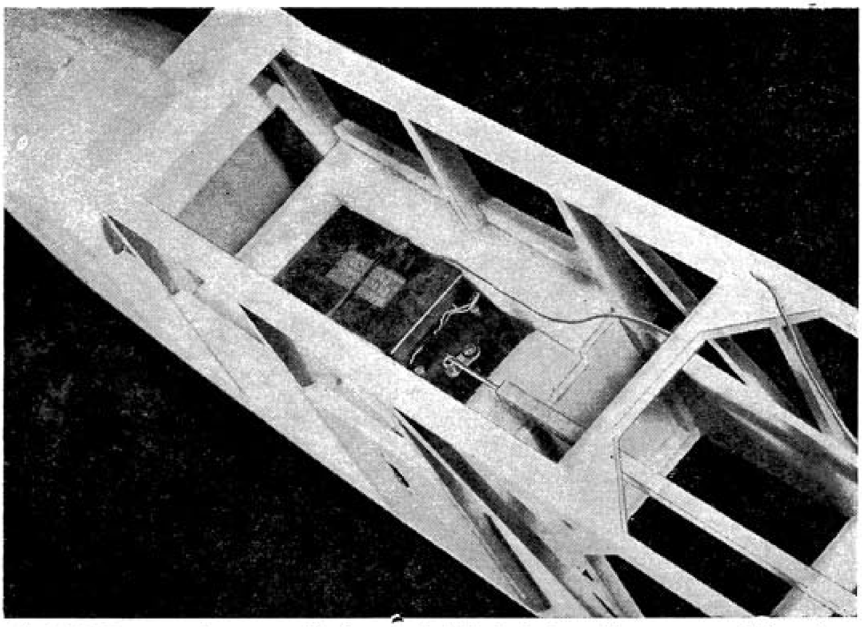


Fig. 4: The Reptone receiver supported by foam plastic inside the fuselage cabin compartment. This receiver incorporates its servo and batteries within one case. Note that the only loose wires are those to the switch and the aerial. If vibration affects operation of the receiver, then the foam plastic could be replaced with foam rubber in an effort to damp it out. In this picture the push-rod to the rudder is balsa, with a wire attachment to the servo actuating arm

of the finished model. Just smear a little cement on the parts to be joined, allow a few minutes for the cement to soak into the wood, then re-cement and join.

When the two side frames have been built, do please allow sufficient time for the cement to set properly. If you can leave it overnight, so much the better. It really is most annoying to find cross braces coming adrift when you are working on the fuselage—you only have to wait whilst the rejointing sets, so there is no saving in time by rushing on with the job.

When the two side frames are complete and set, they should be lightly sanded up on both sides. When doing this, use a sandpaper block that is large enough to span the full width of the sides, otherwise you will not sand them flat and also run the risk of knocking out the braces with the corner of the sanding block.

Now pin the two fuselage frames upside down over the top view of the fuselage. (Only the flat tops of the fuselage sides will be in contact with the plan). Cut the front seven cross braces to length, they are all three and three quarter inches long and cement them and the two front formers in place. It is most important to check at this stage that the assembly is square and true—a tri-square will be a help here.

From this stage on the construction of the fuselage is pretty uncomplicated, joining the rear ends of the sides and adding the rest of the cross braces. Once again, it will pay to allow this assembly to set properly before removing it from the plan and adding the additional members in the cabin position. When adding the motor bearers, although balsa cement will make a satisfactory joint, an adhesive such as Aerolite or Araldite will add even more strength.

The wings are extremely straightforward, the only point to watch is that warps are not built into the structure early on. Check that your building board is really flat—this is often the cause of those mysterious warps that will persist in appearing. Note that the wing is not removed from the building board until after the leading edge sheeting has been added. This is also an anti-warp precaution. Naturally, when cementing the leading edge sheeting in place, take care that you do not cover up any pins, otherwise you may find it difficult to remove the wing from the building board!

Whilst on the subject of leading edge sheeting, it is much better to sandpaper it really smooth and flat before applying it than to try to sand it up after it is in place. Naturally, some smoothing will be necessary after the sheeting is in place, but keep it as light as possible, otherwise you will find that you are producing thin areas immediately over the rib positions. *A coat or two of sanding sealer on both sides of the sheeting before the preliminary sanding up will not come amiss.*

The tailplane should present no special difficulties—indeed, it should look distinctly familiar to anyone who has built a control line stunt model! A little care when building is all that is required to produce a warp free structure. The fin is quite unremarkable, and the only point to note about the rudder is that the tubing which is fitted into it to form the pivot should be kept straight, otherwise the wire which is passed through it will tend to bind and introduce unnecessary friction into the control system.

Everything about the model has been kept as straightforward as possible and whilst this is not a beginner's model, anyone who has had a little aero-modelling experience should be able to make a satisfactory job of it. All that is necessary is to follow the instructions and to exercise a little patience and care. See finished framework in illustrations.

Radio Installation

The installation of the radio gear should, of course, have been considered from the very outset. Indeed, before construction was commenced, provision for switches, plugs and sockets and escapement mounting panels should have been planned. Switches and test sockets are best fitted into the ¼ in. sheet in the fuselage sides somewhere beneath the wing position. If the motor you are installing has an exhaust on one side only, then make sure that your switches

Fig. 5: Below is a method of holding the wings in place while joining the two wing halves to the centre section. Follow the instruction 11, 12 and 13 on page 10 of the Super 60 construction manual provided in the kit. Do not forget the braces and remember to pre-cement all joints. The supports prevent permanent warps from being built into the wing at this critical stage

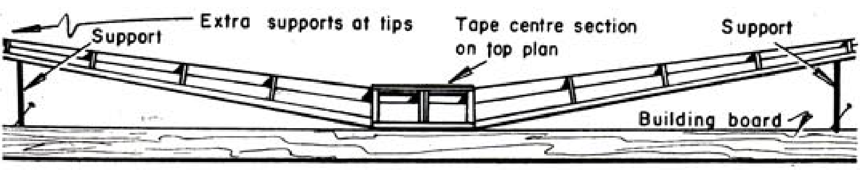
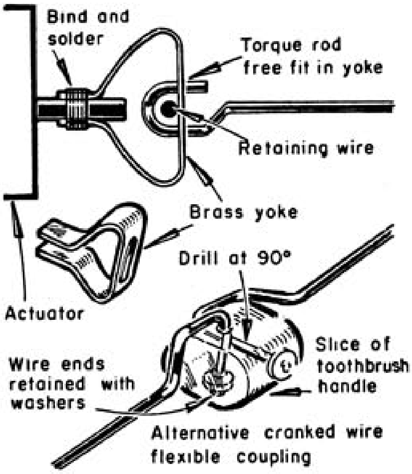


Fig. 6: At right are two suggestions for universal torque rod linkage to escapements and possibly motorised servos. Both methods ensure complete freedom of movement of the actuating rod with no binding. The first is a slot fitment to the torque rod, made from sheet brass or tinplate. Slot the fitment slightly oversize to allow the control rod slight movement out of line at any angle. The second method requires a slice of toothbrush handle. Here the holes for the wire ends must be bored out slightly oversize to allow "slop" and slight movement out of line as in the first method



etc. are fitted to the opposite side of the fuselage. In this way they will be kept free from unburnt fuel. That may sound obvious, but it is easily overlooked. Whatever gear you are fitting, try to plan the installation so that all wiring is as short as possible. A good general rule is to keep the aerial well away from any other wiring. Take it up through one of the gussets in the top of the fuselage immediately behind the wing position and from there it can run either to the top of the fin or along one of the trailing edges, whichever you prefer or suits the length of the aerial best.

At the risk of becoming monotonous I would say once again read the instructions—this time the instructions that come with your radio equipment. Take note of any special features that may require attention and plan accordingly.

Probably the simplest set to install is the Reptone, as it is entirely self contained. All that is necessary is to mount a switch in the side of the plane and arrange a linkage between the rotating arm on the set and the rudder. The switch is quite easily mounted by means of a couple of 8 B.A. nuts and bolts and if the nuts are soldered to the switch, the entire set can be removed by merely undoing the two 8 B.A. bolts.

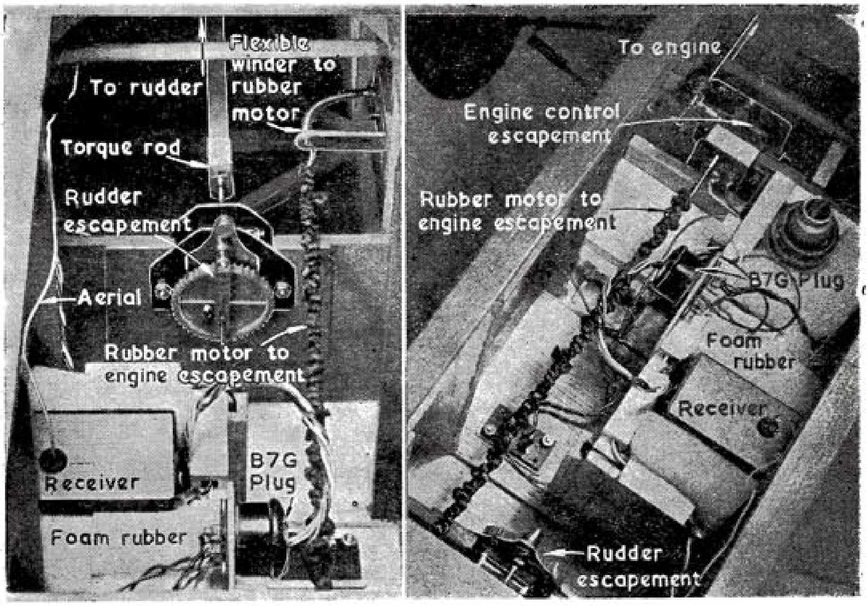
Mount the receiver in foam rubber or foam plastic so that it is a push fit in place. I have heard objections to foam plastic on the grounds that it is not sufficiently resilient, but so far I have found it perfectly satisfactory. One point to watch with the Reptone receiver is the battery contacts. It is possible that engine vibration may cause faulty contacts. This is easily cured by packing a scrap of foam rubber beneath each contact leaf and making sure that the batteries are a firm fit.

Besides left and right rudder, it is possible to work a third control with the Reptone and we have used this in conjunction with a Conquest escapement to control the throttle valve on an Enya 19 R/C motor. The escapement was mounted just behind the dashboard with the rubber motor running vertically down to a hook attached to the plywood plate in the bottom of the fuselage. A direct push-pull movement was taken straight from the rotor arm of the escapement, the other linkage parts being removed. This worked quite satisfactorily, once the knack of timing the three pushes of the control button was acquired. A point to watch here is that as the servo batteries become exhausted, the speed of rotation of the rotor arm becomes less—all of which points to the usual moral of radio control; if in doubt about your batteries—change them or fresh ones. It is simply not worth the risk of losing or wrecking many pounds worth of plane, motor and equipment for the sake of a couple of shillingsworth of batteries.

Where receiver and batteries have to be mounted separately it is prefereable to mount the latter in front of the receiver. This is done as a safety precaution so that in the event of a crash, the battieries with their greater inertia will not crash into the receiver. When using separate batteries, use, if at all possible those which have plug-in connections. They are not only easier to install, but plug-in connections are far less susceptible to vibration and similar troubles. In the case of types without plug-in connections, it is preferable to arrange for a socket in the plane and to solder wires, ending in a suitable plug, to the terminals. A ready soldered spare set of cells should be available in the flying box and used sets can have the leads removed and soldered to fresh batteries in the workshop.

In the writer's experience, many radio troubles can be traced to faulty connections, so take care with all joints. See that they are firm and strong and that there are no loose ends projecting from a joint that cause a short circuit. There are some excellent electric soldering irons available nowadays which are

Fig. 7: Below are two views of a more complex single channel radio installation in a Super 60. Dealing with the left hand picture first, this views the radio compartment from the front, looking rearwards. In the centre of the picture we see Elmic Commander escapement with torque rod in place. To the right and slightly above is the universal winding attachment to engine control escapement motor, made from curtain-rod. This rubber motor leads forward to its escapement. At the bottom right hand corner of the picture is the R.E.P. Unitone receiver packed in foam plastic and bottom centre, a B7G, multi-pin plug which feeds the receiver and the escapements. At right is a picture of the same subject, viewed from the rear towards the front. At top right is the Elmic Corpral engine control escapement, with rubber motor feeding it. In the centre is the B7G plug and Unitone receiver, while the Commander rudder escapement can just be seen at bottom left hand corner



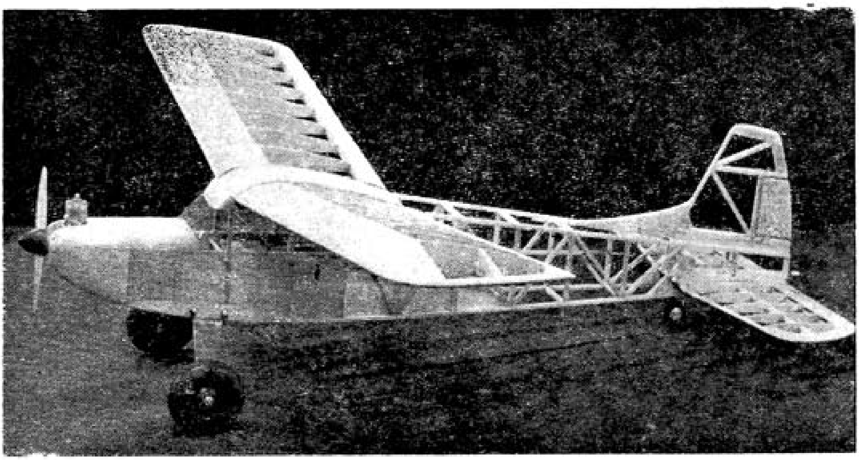


Fig. 8: Uncovered airframe of the Super 60. Large Airwheels are a feature of the design to allow the model to cope easily with rough ground which is probably the case on the majority of flying sites. The engine in this example is an Enya .19

ideal for the radio modeller. Very slim and quick heating they are just the thing when working in the relatively confined space of a fuselage. Trying to get a large soldering iron, a piece of wire and a hand into a small area can be very painful!

Another source of trouble in radio controlled models often turns out to be friction in the control linkage. *This is something that needs careful watching at every stage.* The lining up of the escapement and escapement rubber should be carefully checked before the installation of the rubber winding hook. It's not much good finding that the rubber is pulling out of true after the winding hook has been installed. Fitting a bush in the rear end of the fuselage to take a rudder driving wire *is not*, in the writer's opinion, good practice. A suitable sized hole in a metal plate attached to the rear end of the fuselage is better, as even a slight misalignment of a bush can cause the wire to bind.

All these points are really a matter of common sense, but it is easy to overlook them in the excitement of installing the gear and the natural desire to see something working. Before fitting anything, take just a little time to consider what you are about to do and ask yourself whether this is really the best way of setting about it. Avoid complicated set-ups like the plague—they nearly always bring trouble. There is an old phrase accredited to one of the pioneers of aeromodelling "Simplicate, and add more lightness!" This is not at all a bad point for the radio modeller to bear in mind.

To avoid excessive nose or tail heaviness when installing the radio gear, all that is required is a little common sense. A general grouping of components at or near the balance position shown on the plan will save any headaches on this score. The Super 60 is fairly uncritical regarding the C.G. position—within about half an inch either side of the marked position will have little effect on the model's flying.

Before going out to the flying field make sure that the model is free from warps, that the motor is O.K. and you know the starting and running settings and finally that the radio gear is functioning everytime all the time, both *with the engine running and without*. If you have any suspincions, don't fly until you have ironed out any snags that may be present. Check that your field kit contains everything that you might need—spare batteries, test meter if required, tuning tools in fact everything that your particular equipment may call for. All this, of course, is in addition to the usual field outfit of fuel, glowplug battery and lead (if needed) cement, pins, etc. One last thing. *Is your name and address on the model?* Should something untoward happen, the Super 60 can go an awful long way on a tankful of fuel.

On arrival at the field the first thing is to have a good long range check, adjusting the equipment as found necessary according to the instructions. Once again, be very sure that the gear is working perfectly before going any further.

As has been mentioned earlier, test gliding is not recommended for the Super 60. If you have built your model carefully and the balance point is about right, then it will fly.

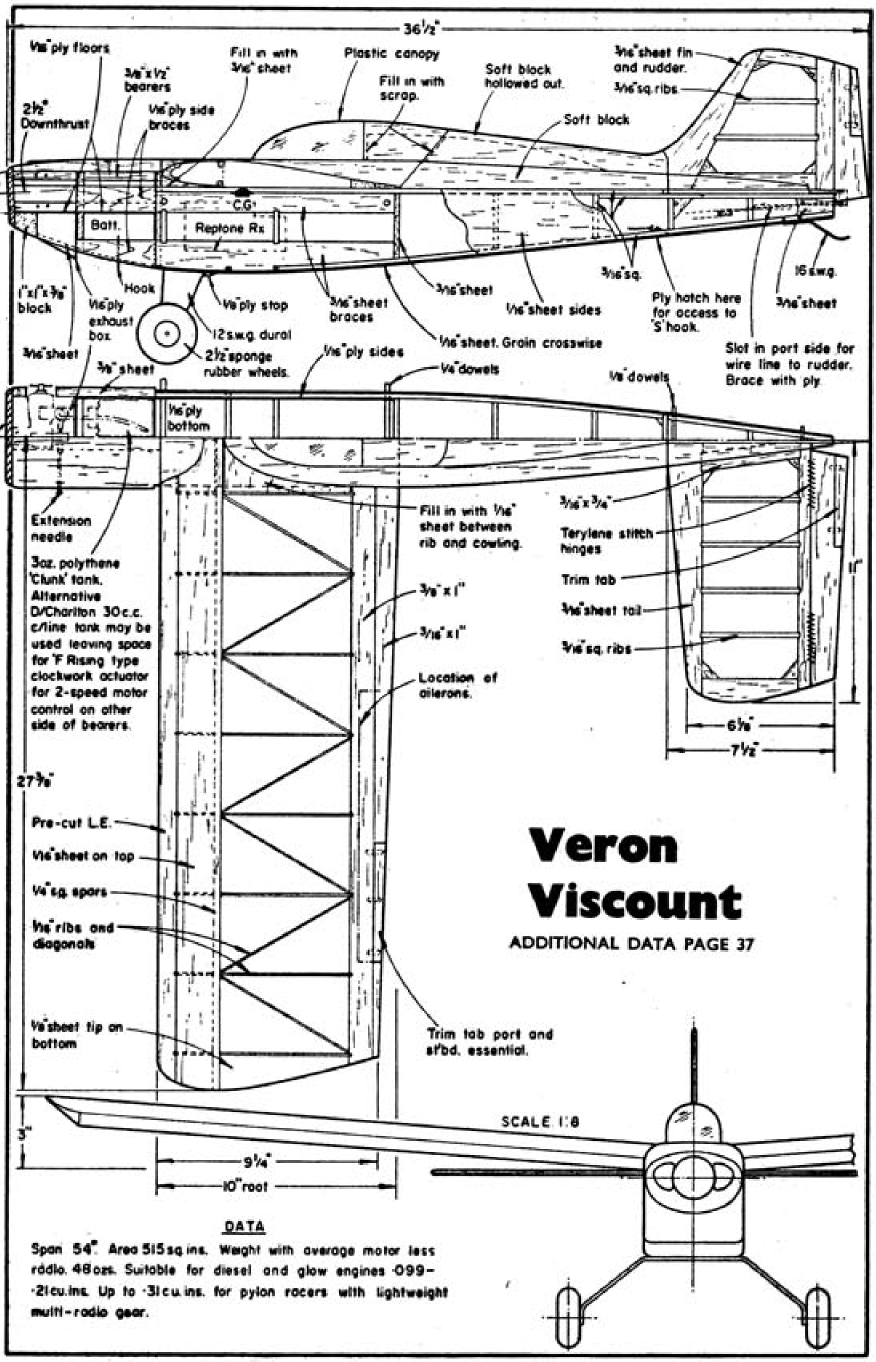
First flights should be made on a limited amount of fuel—enough for about one minute's flight and with quite a small amount of rudder movement—about a quarter of an inch each way. Don't forget to switch the gear on and check that it is working before releasing the model. If your rudder movement is of the sequence type (left, neutral, right, neutral) see that the first movement that you will get is "right" as torque usually make s model turn to the left first of all.

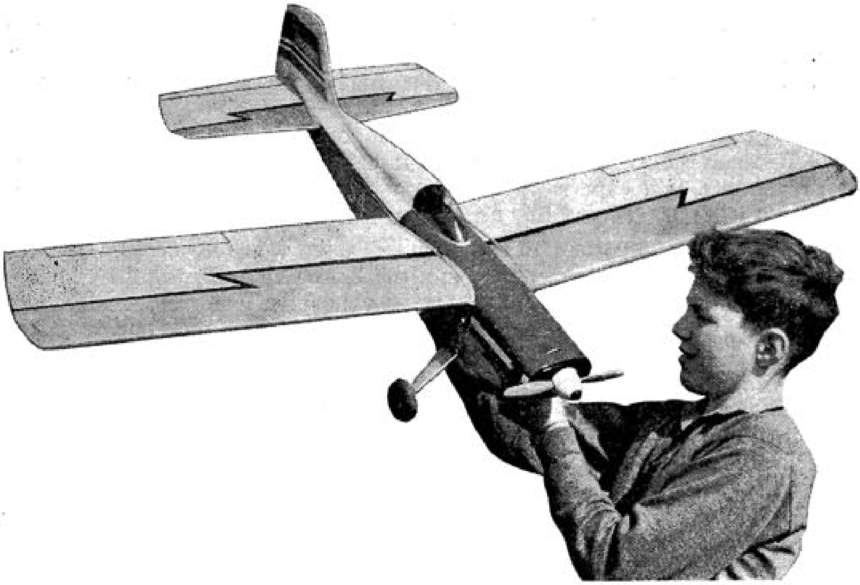
Try to allow the model to reach a reasonable height before succumbing to the urge to push the button. Note what happens when you give a signal, how sharply the model turns, how it reacts when you neutralize and so on. Keep the model upwind of you so that the model can drift downwind a little on the glide without getting too far away. Watch the angle of glide, you will find that although the Super 60 glides fairly fast, it takes quite a long while for the model to lose height. You will have to become very familiar with the sinking speed of the plane so that you will be able to put it down just where you want to.

As flight succeeds flight, you will be able to increase the amount of fuel in the tank and to adjust the rudder movement to the optimum amount. Naturally, the model when under power will tend to turn sharper to the left than to the right due to torque, but if the left turn is too tight, then further engine offset is called for.

Should any slight tendency to stall be noticed, then packing the leading edge of the tailplane down slightly will cure it. Conversely, a shallow climb under power, followed by a fairly steep gliding angle indicates that a little packing is required at the trailing edge of the tail. If you have built and balanced your model correctly, these faults should not be present. However, model aircraft can be highly individual things and it is worth making sure that you are getting the very best performance from your plane.

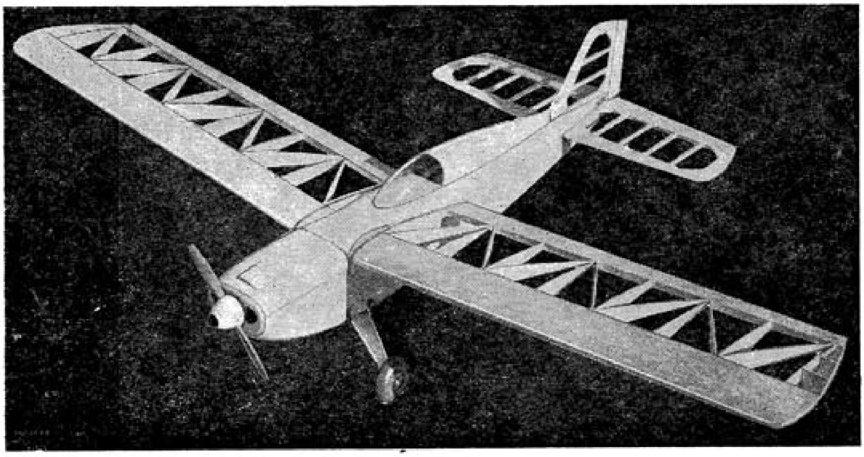
The actual controlling of the model in flight depends upon the particular equipment which you have installed and upon your own skill. This can only be learnt on the flying field and no amount of reading can take the place of experience. However, who wants to stay at home reading when they could be out flying? And quite right too! To have a radio controlled model in the air answering your signals is one of the greatest thrills that this exciting hobby of aeromodelling has to offer. Just try it and you'll see!


36½"
⅛" ply floors
⅜" x ½" bearers
2½° Downthrust
1⁄16" ply side braces
Fill in with 3⁄16" sheet
Plastic canopy
Fill in with scrap.
Soft block hollowed out.
3⁄16" sheet fin and rudder.
3⁄16" sq. ribs
Soft block
C.G.
Batt.
Reptone Rx
Hook
1" x 1" x ⅜" block
1⁄16" ply exhaust box.
⅛" ply stop
12 s.w.g. dural
2½" sponge rubber wheels.
3⁄16" sheet braces
3⁄16" sheet
1⁄16" sheet sides
1⁄16" sheet. Grain crosswise
3⁄16" sq.
Ply hatch here for access to 'S' hook.
16 s.w.g.
3⁄16" sheet
Slot in port side for wire line to rudder. Brace with ply.
3⁄16" sheet
⅜" sheet
1⁄16" ply sides
¼" dowels
⅛" dowels
1⁄16" ply bottom
Extension needle
3oz. polythene 'Clunk' tank. Alternative D/Charlton 30 c.c. c/line tank may be used leaving space for 'F Rising type clockwork actuator for 2-speed motor control on other side of bearers.
Fill in with 1⁄16" sheet between rib and cowling.
3⁄16" x ¾"
Terylene stitch hinges
Trim tab
3⁄16" sheet tail
3⁄16" sq. ribs
11"
⅜" x 1"
3⁄16" x 1"
Location of ailerons.
6⅞"
7½"
27⅞"
Pre-cut L.E.
1⁄16" sheet on top
¼" sq. spars
1⁄16" ribs and diagonals
⅛" sheet tip on bottom
Trim tab port and st'bd. essential.
Veron Viscount
ADDITIONAL DATA PAGE 37
SCALE 1:8
3"
9¼"
10" root
DATA
Span 54". Area 515 sq. ins. Weight with average motor less radio. 48 ozs. Suitable for diesel and glow engines ·099–·21 cu. ins. Up to ·31 cu. ins. for pylon racers with lightweight multi-radio gear.



Part 5:
Designed by
Phil Smith.
Notes by
Tony Dowdeswell

Veron Viscount

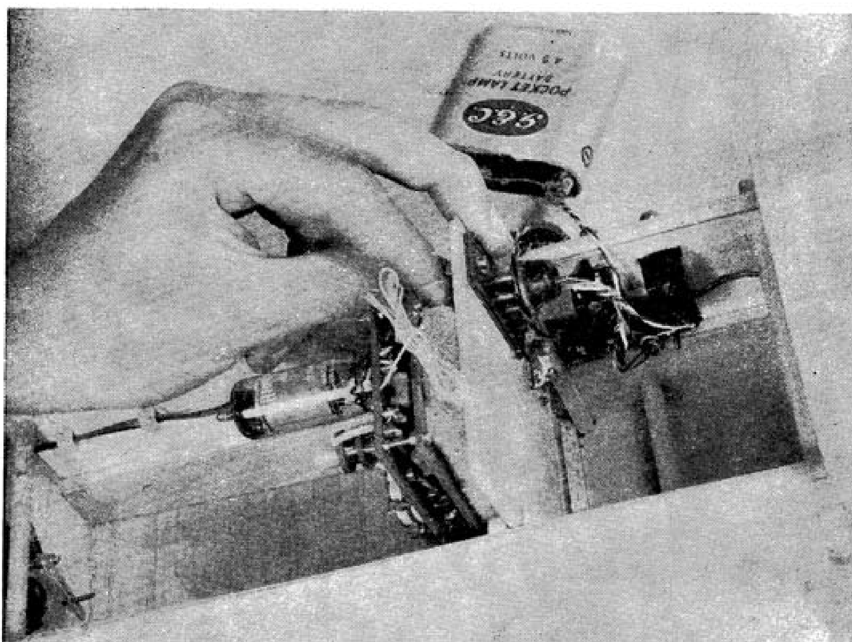


Radio Control models, like any others are specialist designs and such is the Veron Viscount, created by well known and respected model designer Phil Smith. Viscount is a shoulder wing type model, that is to say, the wing sits astride the cockpit, not above or below. Intended mainly to assist the novice (which includes most of us) to gain the all important experience in Radio flying. The Viscount is designed to do just that, rather than be next year's world champ. So remember, it is experience that counts in the radio control game and the Viscount will put plenty of that under your belt if only you will give it a chance.

Size is always important to the novice. Taking well into consideration the old saying " . . . the bigger they are, the harder the fall . . . ", we realise that really large models are cumbersome. On the other hand very small models, for which we all naturally have a great affection in view of their obvious advantages in terms of shorter building time and reduced cost, to say nothing of the novelty angle, do not, for the most part provide the "penetration" (the ability to make headway into a wind of any strength) or the controlability. Viscount is just about the ideal size, having a wing span of 54 in. and 515 sq. in. area, enough to lift a heavy complement of radio equipment, it transports comfortably, being not so big that it takes up all the room in the car.

We all like to see a beautifully shaped model with clean lines and here again Viscount scores. The engine is completely enclosed in the spacious "Lycoming" type engine cowl, the fuselage sweeping back smoothly from the cockpit to fair into the fin.

Fig. 1: Here we see the disposal of switches and receiver in the Viscount fuselage. The receiver is mounted on a bulkhead which slides in and out of the fuselage on vertical runners. It is positioned vertically in order that the valve is not disturbed in its holder



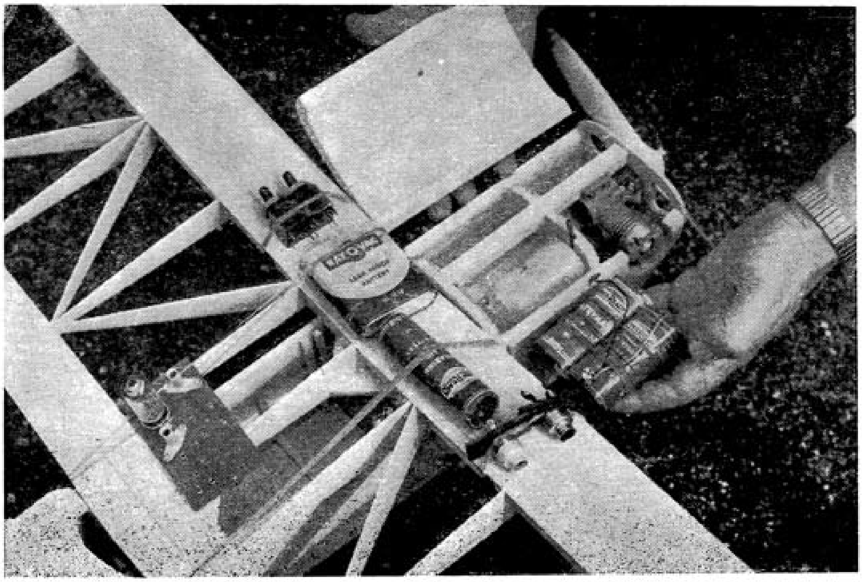


Fig. 2: In determining the distribution of radio equipment about the fuselage one must do so to give correct C.G. position. Above we see how items of radio equipment are first layed over the airframe to determine their best positions. Remember that the balance point can move aft as much as $\frac{1}{4}$ in. during the covering and doping stage and adjustment must be made accordingly

On opening your kit, your first action should be to study the plan to make yourself fully conversant with the construction and layout. Check to see that all parts are included in your kit, which incidentally does not include any parts for radio control other than rudder, rudder horn, battery box, and extra wing ribs. This however should not bother the modeller as one rarely sees two R/C models with identical equipment layouts, so any standardisation here would probably be surplus to the modeller's requirements.

Deployment of radio equipment about the fuselage must be planned before construction and now is the time to do this. Bearing in mind our statement earlier that the Viscount is primarily a sport model, it is reasonable to assume that in most cases the equipment used will be of the single channel type. However, whatever it is, it must be fitted with particular regard to the C.G. position. Basically equipment is in three parts; batteries, receiver, escapement (or motorised servo). Parts for a battery base are included in the kit, but room here is limited and will not accommodate more than the smaller batteries. For this reason it may be necessary to place batteries aft of F.2 on the fuselage floor. Leads to the batteries should and must pass through F.2 to the receiver for which reason a hole ($\frac{1}{8}$ in. Dia.) must be bored in F.2. Mount the receiver as near as possible behind F.2 in a vertical attitude preferably. Reason for this is that the relay armature in similar attitude within the receiver case will be unaffected by "G" forces. A receiver must be shock mounted so strictly speaking, it is best placed in a wad of rubberised hair for not only does this protect the set, but damps out vibration very well. If you are unable to obtain rubberised hair, ("Hairlock"), then foam rubber is the next best thing. Remember though, foam rubber—never, never, foam plastic. To retain the receiver, you will almost

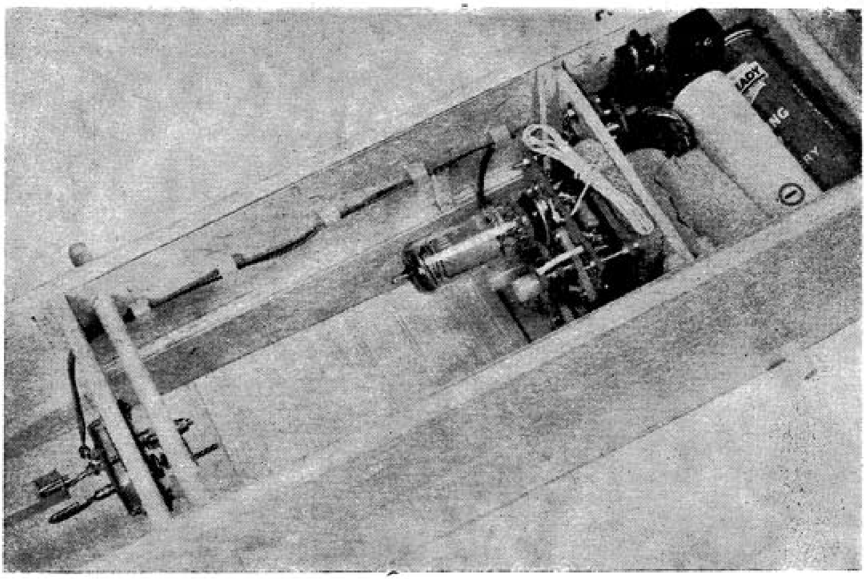


Fig. 3: Another view of the radio layout from the rear looking forward. Batteries are best placed forward of the receiver, so that there is no danger of them breaking loose and damaging the receiver in the event of a crash

certainly need to add a sliding bulkhead to the fuselage aft of F.2 probably not more than 3½ in. aft for such popular receivers as R.E.P. Unitone and Mini-Reptone and E.D. Black Prince/Arrow 1. Preference is for actuators to be on sliding bulkheads, so that they are easily removable for maintenance. This bulkhead should go in front of F.3 some 2½ in. to 3 in. Naturally there will be a switch in your circuit and this should be mounted on the left hand side of the fuselage to avoid exhaust sludge from the engine. Choose a good switch and not necessarily a slide action type. Balsa is not a firm enough mounting for a switch, so 1/16 in. ply reinforcement must be added. The Viscount already has ply braces on the inside faces of the fuselage so you will only have to add a disc to the outside. It is advisable to draw your installation layout on the plan, as this will help you with any little details of construction that may arise. Now study the plan and building instructions, relating the two so that you know just exactly what you are going to build. You will notice that the Viscount has a somewhat heavy structure, with extensive use of block balsa. It makes building speedy and easy, but at the same time it does add weight and the heavier the airframe, the less payload in the form of equipment can be lifted into the air. This is particularly so at the back end of the fuselage, a state which could lead to excessive tail heaviness if care is not exercised.

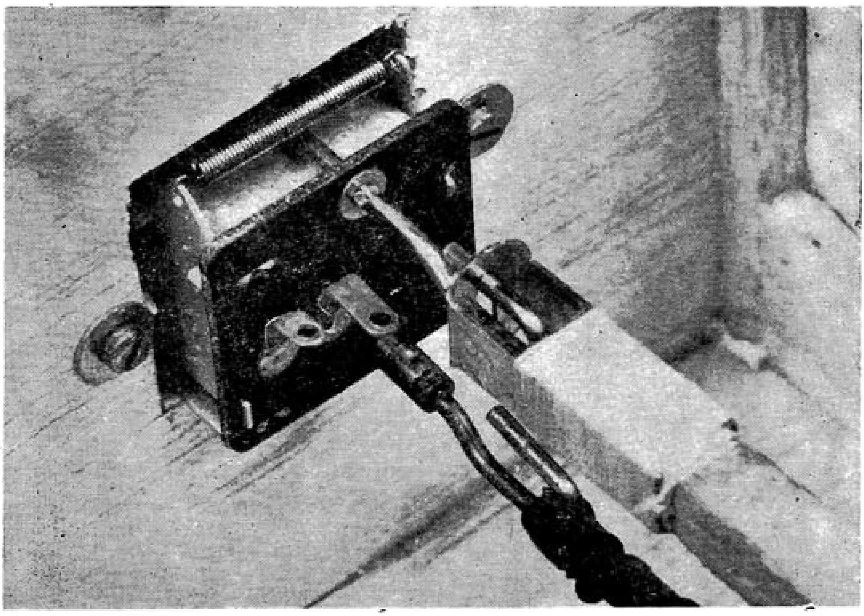
For this reason it is a good idea to sand all parts before adding them to the airframe. We have already singled out the pre-shaped blocks as sources of unwelcome weight. They will already be hollowed out to a certain extent, but really one can go further without seriously weakening the airframe. The decision is with the builder, but the idea is one to bear in mind if the radio equipment the model will be called upon to carry is likely to weigh more than about 8 ozs.

Construction starts with the fuselage, which is intended to be simple. The plan sketches 1 to 3 are self explanatory, but do remember that the instruction to double coat joints is no idle comment as it adds considerable strength to the airframe. It is nothing difficult, all one does, is to coat the two surfaces with a thin application of cement and allow to dry and sink into the wood. Second coats are then applied and the two faces brought together. The result is a joint much stronger than with only one cement coat. At Stage 3, the ply doublers are added to the fuselage. These end abruptly at former F.3. which could result in a weak point, so it is worth filleting aft to the next spacer. While drilling the dowel holes, do the same for the switch. F.3 will have to be relieved to pass an escapement motor (Rubber) and pushrod. In this case F.3 is best faced with 1/16 in. ply in the manner of F.1 and F.2. If you have decided to mount your escapement or servo to F.3, this must be tailored to accept the unit before adding to the airframe. Join the basic fuselage sides with F.2 and F.3, and then leave this to set hard.

Next stage is to pull the rear end of the sides together and add the 3/16 in. sq. crosspieces. Make sure that the structure is built symmetrically about the centre and does not go askew. This is easily done by turning the fuselage upside down, and performing the operation over the plan. It will be wise however to move the whole across the building board so that the nose section overhangs to allow the fuselage to lay flat on the plan.

The next thing is to drill a hole in the stern post for the 16 s.w.g. brass tube bearing for the escapement if used. Adding the fuselage sides presents no difficulty, nor the sheet undersides. Now drill the engine bearers to take the

Fig. 4: Below is a picture of an Elmic Conquest escapement bolted direct to a fixed bulkhead. Should the modeller require the escapement to be immediately removable, he is advised to mount the unit to a plywood sliding bulkhead in the same manner as the receiver



engine, not forgetting that the $2\frac{1}{2}$ deg. downthrust indicated on the plan is no idle thought. A word or two on the engine would not be amiss here. The manufacturers say that any engine of 2.49 c.c. up to 5 c.c. is suitable for the Viscount. I found however, a 2.49 c.c. glow motor to be ample power and my Viscount weighs $4\frac{1}{2}$ lbs. Glow motors tend to offer a lower vibration level than diesel engines and are usually to be preferred by radio fliers.

Drill a hole in F.1 to pass the fuel feed tube. Position the $\frac{3}{8}$ in. balsa cowl checks, best done with P.V.A. white glue and "G" clamps. P.V.A. is also best for the $\frac{1}{4}$ in. ply nose face and 1 in. by 1 in. by $3\frac{3}{8}$ in. balsa block, again clamped until set. Cement in the 1/16 in. ply engine bay bottom, sheet in the underside and add the 1/16 in. ply exhaust guides. At this point the engine bay should be fuel proofed to protect the airframe against fuel seepage. I find that three thin coats of knotting, obtainable from any ironmongers is perfect for the job. The plan indicates a 2 oz. plastic bottle fuel tank, but this you will have to make yourself. You may prefer therefore to use a 30 c.c. Team Race tank.

Building the wing is not difficult, parts being designed to interlock with the notched leading and trailing edges, thus saving time for the builder. See that the notches line up with those ready cut in the leading edge. $\frac{1}{2}$ in. washout at each wing tip is a good idea with the Viscount, so when laying down the wing, pack up the trailing edge tip with $\frac{1}{2}$ in. scrap block. Note that the wing section is not flat bottomed and will necessitate packing up the lower main spar 1/32 in. with ply which will not compress. Open spars are a waste where srtength is concerned, so on completion of stage 18, box in the moulded leading edge and fill in the mainspars to form an "I". Go carefully when working the centre section blocks, if you go wrong you will spoil your work.

Fin and Tailplane are simple indeed, stages 21 and 22 sufficing to show how they are built.

Now add the block to the fuselage and cockpit and here you can go to town hollowing them out.

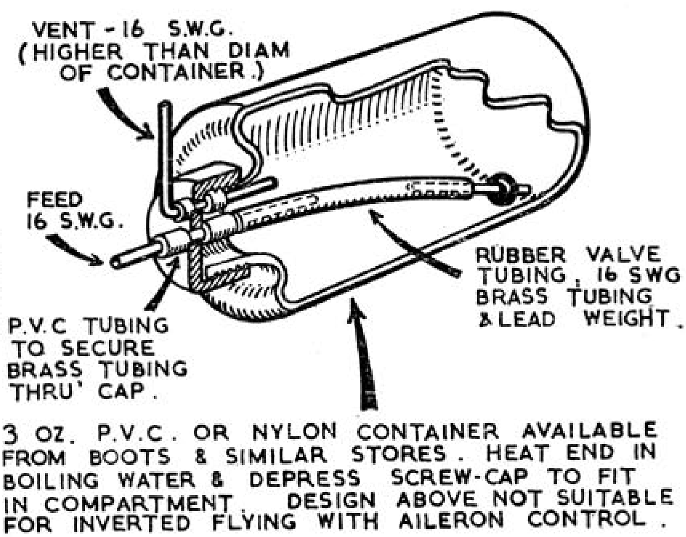


Fig. 5: One of the most popular fuel tanks for radio control work is the polythene bottle type. This is simple to make

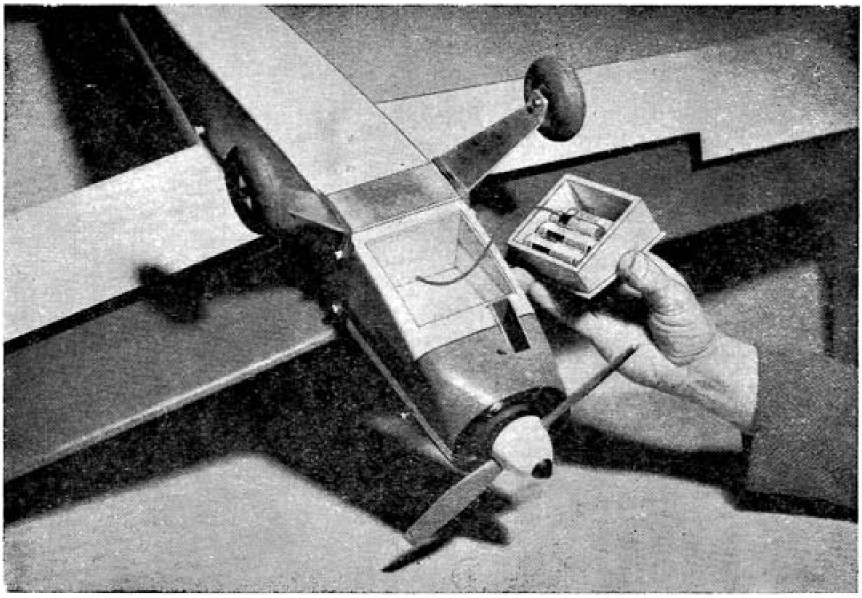


Fig. 6: View of the underside of Viscount displays the removable battery box. Leads to the batteries pass through the bulkhead to the receiver and should be sufficiently long to allow easy extraction of the box

Neatness must be the key when installing and wiring up the radio equipment in your Viscount. Add a ply sliding bulkhead to retain the receiver. Runners for this should be of ¼ in. moulded trailing edge stock. If you mount your escapement on a sliding bulkhead, this will also require runners. It is common practice to take wiring to the receiver through a common multi pin plug. A B7G type (7 pins) is usually enough and is preferable for beginners as it is robust and can withstand the treatment it is likely to receive from an unpractised soldering hand. Avoid miniature plastic bodied plugs, they easily melt with the heat of a soldering iron. The socket for this can be bolted to the side of the fuselage with 6 B.A. bolts, but spaced out from the side between nuts to clear the soldered tags. Stick rubberised hair or foam rubber receiver protection in position with contact adhesive. It is also a good idea to wrap batteries in foam rubber or even foam plastic for this purpose, to make sure they do not move around the fuselage.

Covering and finishing is very much a personal preference but it should be remembered that although silk is not really necessary for the fin and tailplane, it might cause warpage, silk adds greatly to airframe strength and can be used for the wings. The paint job is up to you, but do not dab it on too thick at rear.

A 9 in. by 4 in. propeller is ideal with a 2.5 glow motor. Run the engine up and test the radio operation. It is unlikely that you will encounter any trouble but if vibration causes radio malfunction, then carefully balance the propeller, placing a dowel through the hub and suspending between two razor blades. If this fails to cure the problem, then you must isolate the fault which can be a faulty connection in wiring or plugs, relay chatter if a relay is used, or escapement

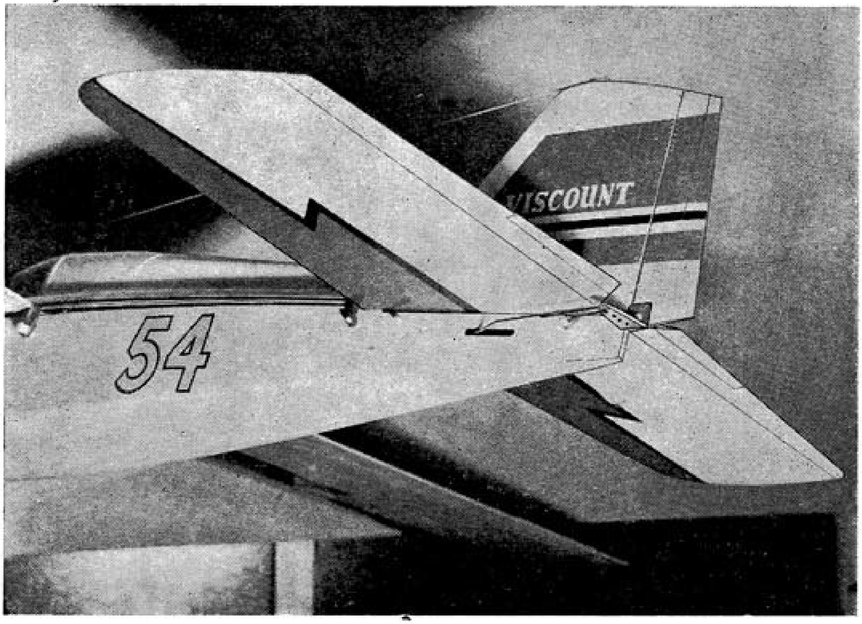


Fig. 7: Above is a picture of the Viscount tail section showing the rudder horn and push-rod linkage as with push-pull actuator units such as the R.E.P. Reptone

chatter (or servo runaway). With the engine running, check the escapement (or servo) disconnected from the circuit and if chatter occurs then a sandwich of foam rubber must be placed between the escapement and its bulkhead. If the trouble is not present, then connect up the escapement, check again and then with the receiver removed from the fuselage. If the set now functions properly, then the relay is affected by vibration and the receiver must be packed less tightly. If however the set malfunctions still, then check your wiring—plugs and sockets, switches and look for "dry" soldering connections.

Give the set a good range check and remember—more haste, less speed.

We now come to the real business of flying the Viscount—or to be more exact, your Viscount. If you have not flown a Radio model before then this is where you will have your work cut out, at least for a time. You see, when you watch an experienced R/C'er flying his model it looks so easy . . . and in fact it is, once you get into it. An experienced R/C'er knows what to expect from his model. He can tell what the model will do next, has a sense of perception, and knows when to apply corrective control. There is no magic in this, it just comes naturally with plain honest experience. You can reckon on having a few (at least) crack-ups in the course of mastering the art, and this is why your Viscount is designed to be a tough model, to help you over those first few attempts. These will be difficult since through lack of previous experience, you won't know exactly what to expect from your model. This state will not last long however.

How to get your Viscount in the air? Well, first trim the model, starting by balancing the model at the point the plan indicates. Should the model prove tail heavy then on no account must it be flown in this state. Ballast added to

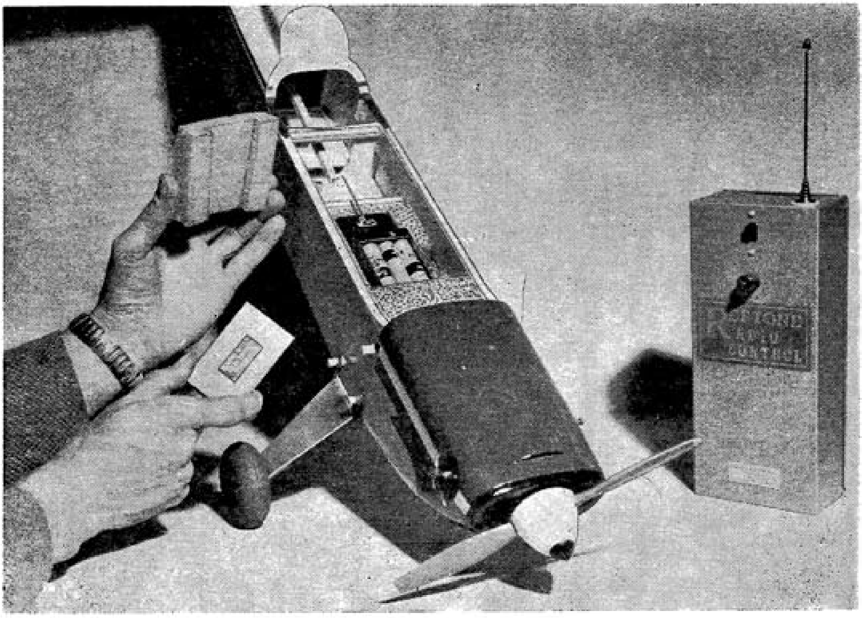


Fig. 8: Installation of the R.E.P. Reptone receiver in the fuselage protected with foam rubber. The push-pull rudder link is well illustrated here. An extra piece of foam rubber is placed over the receiver to hold it in position when the wing is in place

the nose would cure the problem, but this is wasteful, unnecessarily loading the model. Therefore before resorting to ballast, try moving the balance point forward to the correct place by rearranging the batteries if possible. When balanced, commence glide tests. It is so easy to say "do so over a grassy slope", but if this is possible it helps as a prolonged glide will show up any trace of a stall, which should be eliminated by packing up the leading edge of the tailplane in 1/16 in. stages (I prefer plywood which will not compress under the tailplane, held down with rubber bands). Should the model be "nosey", the same process will be required under the tailplane trailing edge. Do not however trim for a "hanging" or "floating" glide since a radio model needs to be able to bore through a headwind. The glide should be quite straight, which helps a great deal during landings. Any tendency for the model to turn on the glide can be corrected by adjusting the position of rudder neutral. However you may find that your model tends to drop a wing, which is quite different to a turning tendency. It is easy to tell if the former is the case by corrective action with the two trim tabs at the wing tips. If however either wing drops viciously, then it is quite likely that the wing has warped, a state that must be corrected. To do this, sponge down the wing with HOT water and bind to a *flat* board.

Engine thrustline is difficult to determine "off the board". The downthrust the plan indicates should be enough. If a 2.5 c.c. motor (ample power) is installed, then two washers under the *front* of each engine lug will provide sufficient *right* sidethrust for a slight *left* turn under power. Yes, left turn because, if you lose control on your first flight the model has much more chance for staying in sight than if its natural flight path were straight.

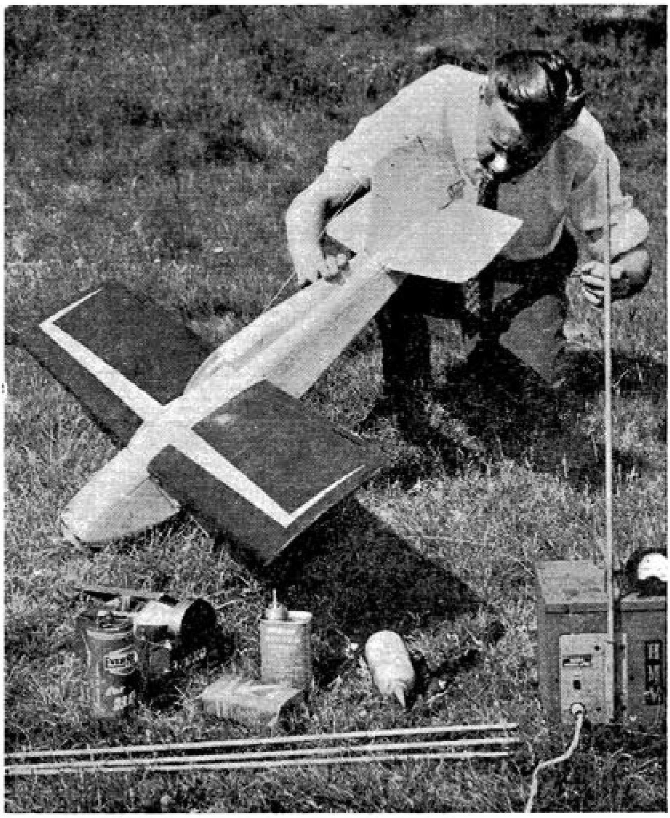


Fig. 9: Before flying the Viscount, check all moving parts, particularly the rudder operation. Look for any control binding, which can easily cause disaster. With units like Reptone, any fore or aft movement of the receiver can alter the rudder neutral position and makes a check on the rudder doubly important

A day's flying should never start without first tuning in the receiver. Start fairly close to the Transmitter (200 ft.) to put the receiver in rough tune, since at such a distance, your helper keying the transmitter will easily be able to hear your verbal directions. Once done, set off across the field with another helper who can call the signals, raising an arm for signal "on", lowering again to instruct termination of signal. Re-set the receiver tuning at range if such is required.

If you are satisfied, return to base and rewind the escapement motor (if escapement is used), and run up the motor to see that all functions in that state. It is the writer's opinion that far too many models are damaged through hand launching and that if suitable ground is available, the model should be made to take off under its own steam. In most cases however the luxury of a good take-off/landing strip is just not available, in which case a hand launch is unavoidable. You may have seen some radio modellers indulging in the practice of personally hand launching the model they intend to fly. They stand well back from the transmitter, run forward to release the model into the air and then make a grab for the transmitter. If a hand held transmitter is used it is possible to carry the unit while launching the model which is not quite so bad as the case when a ground-based transmitter is used and one must reach for the keying lead. Whichever the case however, the writer feels this practice to be decidedly dicey and one to be avoided even if there are those who have success every time. Reason is that the launching of the model is a crucial point in the business of flying and so much can happen in so little time, even in the short mental transition from launching to controlling. You need a person on hand who really can launch a model, and whose method is consistent, and results even more so.

The actual launching sequence must begin with a rewind of the escapement motor (if using single channel radio, which is most probable even in these days of multi-channel). Start the engine and allow it to warm up well, remembering to put only a little fuel in the tank for that first flight. Your launcher must then lift the model and take up a comfortable stance for his part in proceedings. Now take a last check to see that control response is as desired and note which control movement will be next if a sequence self neutralising escapement is used (it should be right rudder). During this check it is as well for the operator to stay with the transmitter a little distant from the model to avoid "swamping" the receiver, particularly if the latter is of the "all transistor" type. If any malfunction results at this point, such as rudder "skip" or "run-away", then do not chance a flight, stop the motor and look for the trouble. If all is well, nod to the launcher and he will send the model away into wind.

You must allow the model to gain altitude after launch or take-off, since it is dangerous to attempt to manoeuvre the model close to the ground. For this reason one should avoid applying control during the initial stage of the climb so as not to disturb same. At the same time however it will probably be necessary

Fig. 10: Your launcher should take up a comfortable position before putting your model into the air. This also gives you a clear view to check control response before launching. The Viscount here weighs 4½ lbs. which is the advisable maximum. Power is an Enya .15 glow

Fig. 11: Test glide your Viscount over a soft slope to gain a true indication of glide trim. Do not be afraid to subject the model to a few heavy tumbles, the air-frame can take it all. Many happy landings!

to apply very short stabs of control to hold the model into wind so go to it carefully. Just how much control will be required and how and when to apply it, only experience can tell, when it will become a natural reaction. The rule to remember however is—"a little at a time". Once the Viscount has climbed to a good altitude (there is no substitute for altitude) allow it to travel further up wind before manoeuvring the model at will.

Assuming that this is your "first ever" radio flight, you will not be very worried with any precise flying. Just hold the model fairly well up-wind and become accustomed to its reaction to control. Never hold a signal on too long because, as well as turning, the rudder has the effect of rolling the model. If you hold on rudder control, the model will therefore build up into a spiral dive.

When the motor cuts, take the model down wind of the transmitter (not too far) and bring her round for a straight run into land. If you have trimmed her for a straight glide, you will now fully appreciate the value of this. Just let your Viscount come straight in to land. Do not worry about any fancy "spot" landings. As long as it is in the field you can be satisfied. You will be amazed at the psychological effect of this first flight. Though it has been simple indeed, you have put your Viscount into the air; you have flown it as you wish and brought it back to the ground under full radio control. That is all one can ask for as yet. That first flight inspires confidence (please not over-confidence) in ones equipment, and that is the way to success in Radio Control flying.