Building the LINCOLN BIPLANE

Performing in the same fashion as a modern commercial ship this time-tried lightplane design is the editors' answer to the requests of readers who have wanted a "hot performing" one-place sport biplane.

PART I

This article takes up the general layout and constructional features of the Lincoln Standard Sportplane, a biplane of diminutive proportions which has been on the market as a knocked-down set of construction parts for several years. The makers, The Lincoln Standard Airplane Co., of Lincoln, Nebr., have sold several hundred sets of parts, and the writer has seen and personally inspected the ship built to these specifications by Fred Trump, formerly of Minneapolis, and now connected with the Keystone Aircraft Works, Bristol, Pa.

The ship is eminently safe, with a factor of safety of 11 to 1, or about 100 percent in excess of the U.S. Department of Commerce present day specifications for type certificated airplanes.

Though the ship was designed several years ago, and stands today a time-tried design of from four to five years of age, it has back of it the designing experience of the firm which built the famous Lincoln Standard war-time planes. Powered with the new Henderson 35 hp F-head air-cooled four-cylinder motor, the ship would have between 70 to 80 mph speed, would fly a useful load of about 225 lbs., and have a ceiling of about 8,000 ft.

With the three-cylinder 35 hp Anzani, which swings a big prop at a comparatively low speed, the ship will have about a 100-mile speed and about twice the climbing power and ceiling with the same useful load.

Frankly speaking, this article is not for the rank novice. It contains completely dimensioned plans, in this and the following two installments, and general hints on the building of the ship. To tell exactly every move to be made would require a book the size of this issue of The Flying Manual, and even then would presuppose some knowledge of aircraft construction on the part of the builder.

However, any bright lad who has access to the experience of a licensed pilot can build this plane with the occasional help he is able to receive from the pilot, and the completed ship will be safe and reliable in the extreme if the plans are followed to the dot. For those who wish blueprints, a five dollar bill sent to Lincoln Standard Aircraft will bring a neat, complete set of prints, which though they give no more information than shown in the working drawings here, may help when it comes to actual shop layout. This article, then, furnishes all working dimensions needed for anyone fairly familiar with airplane construction to build his own plane. It is not an a-b-c how to build article, nor is it intended to be such.
SHOWING THE SMALL SIZE OF THE LINCOLN SPORT PLANE, HERE COMPARED WITH THE WELL-KNOWN LINCOLN SPORTPLANE
The Lincoln Sport built by Fred Trump sports an Anzani engine.

This blueprint shows the layout of the Lincoln Sport Biplane, which will travel 100 mph with a 35 hp Anzani, and which can be built by anybody from the plans published in this series. The main dimensions are given herewith with the details of the stabilizer ribs.
In general the layout of the ship is interesting.

Here are the main characteristics:

Span, ft.—20
Wing section—U.S.A. 27
Length o. a.—16 ft.
Stagger—15½ in.
Weight empty—370 lbs.
Weight full load—600 lbs.
Wing loading—51 ½ lbs. sq. ft.
Power loading—17 lbs. hp
Power—28-35 hp
Max. speed—90-100 mph
Cruising speed—75 mph
Range—250 miles
Climb—800 fpm

This article covers merely general procedure. As there is not enough room to run the full set of plans in one issue of Flying Manual, with this installment some of the drawings for the details are included, together with the plan layout. This will enable the reader to get a good fundamental idea of the ship. Each succeeding article gathers up the remarks and details of what has gone before until with the last the reader has the full set of plans.

It will be seen that the gauge used in the fittings of this ship is readily obtainable at the ordinary tinsmith's or blacksmith's shop. The fittings for the most part are very simple and are made of cold rolled sheet steel. When working these in the vise, the proper method is to cut them to shape, drill them and then do the bending. There are some holes, of course, which would be best to work into the bent shape and then drill so that the holes for bolts are in line.

You can see from the wash in the front of this article that the size and general layout of the Lincoln Sportplane are diminutive and conventional. The plan drawing as shown in the blueprint gives, to scale as far as layout is concerned, and the location of the parts, the overhead layout. The fuselage is of wood and wire construction, with 7/8 by 7/8 longerons trussed with number 14 wire. Forward the trussing is the usual 1/8 flexible wire. The fuselage tapers both in plan and form, and instead of the usual vertical tail post, the post is horizontal. This makes for finer streamlining and a ship which resists the torsional effects of rough handling a little better.

The fuselage longerons are bent to shape in a jig which is made out of rough lumber. It takes the form of a bow with the top side curved to the shape of the bottom of the fuselage. To this the longerons are clamped. Then the fittings for the struts are installed, the struts themselves fastened, and then the top longerons are bent down to the fittings placed on the top of the struts. They are fastened and then with the use of the turn buckles the whole fuselage is trued up. It is faired with pads along the struts and small strips of spruce running along the pads.

Now in this installment you will notice a drawing which shows the peculiar and clever interplane strut which is a Lincoln feature. Not only is it aerodynamically good, but because it is a solid piece, with the 1 ½ deg. decalage built in, the ship requires practically no truing other than the tightening of the flying and landing wires. This strut, two of which are required, is made up of spruce as the drawings indicate, and before gluing all the parts are carefully fitted and sanded. Use Curtis cold water glue for this strut, clamping with the well known type of shop clamp until the job is good and dry, after about a week's setting.

You will notice from the plan view that there is a ¼ in. dowel running through the wing ribs. This is to steady the ribs and keep them from vibrating between spars.

Note the respective directions of the grain in the struts.

With the fuselage done and the struts made, according to these and subsequent details, the landing gear struts can be made.

![Fittings of the wing clips for fitting the wings to the fuselage are shown in half part here. The article gives hints on bending of sheet metal.](image-url)
These are of steel tubing and can be worked as shown in the long vertical blueprint, which gives all the details of the parts for the landing gear, short of the wheels and shock cord, which can be installed by anybody. These wheels, by the way, can be purchased from the Lincoln Standard people.

Near the ends of the tubes triangular cuts are taken as shown, using the hacksaw. The ends are bent together and are oxy-acetylene welded.

The wing ribs are built as shown, to the standard U.S.A. 27 wing curve. This comes on a further sheet of the plans, as does the wing curve, and shows the ordinates to use for the curve. The drawing shown with the relative sizes of the woods used gives a clear idea of the type of wing rib used. This is the old, time-tried, strong method of making them out of solid wood and lightening them a little. Such ribs are as heavy as those used in the Jennies and Standards of wartime days, and are far stronger in proportion to the loads which will be imposed upon them, so there is little to worry about on this score.

The wing ribs are built by making a master template, and then tacking together all the thickness of wood for one wing, which is 16 thicknesses in the upper wing and 18 in the lower wing. The lighten holes are all drilled through what will appear to be a solid block of wood, and then light cuts are taken where the spars come. This will mark the spar hole both on the top side and the bottom side, but on four points if the cuts are properly made, and then the cap strips can be put on. This is the best way to make them and will require no jig. The little 1-16 in. tabs are put alongside the spar holes where the down rod goes through, and the rib when given a coat of varnish or two after having been sanded, will be ready to slip on over the spar.

The plans for an airplane seem to be so incoherent until they are

Fred Trump ready to go in his Salmson powered Lincoln Sport.

The anchor plate for the flying wires is placed under the vertical and horizontal strut socket.

Photo by Fred Trump
The better way to make the wing ribs is to cut one to shape as taken from the ordinates, making a template which can be tacked over a group of ribs so they may be cut to one uniform size.

all together in one spot, that it is extremely hard to run a how-to-build in split up fashion. However, several details are run in here which must be considered in the building of the ship, and the cutlines will classify them for the subsequent part of the story. Until next time then, gang, make yourselves familiar with the details here presented, getting a clear conception of them, so that next part they will fit into the scheme of things.

As regards motors for all the light planes which have been published in Modern Mechanics, much may be said. There are several types of motors from which the builder may make his choice — V-twin, two-cylinder opposed, etc.

The use of the motorcycle V-twin is not particularly commendable as this writer sees it. When you stop to consider that the average V-twin motorcycle engine develops under ideal conditions on a test stand but 25 hp, and that for but short periods, it is unreasonable to ask these little motors to develop more than 15-20 hp under ideal flying conditions. For one thing, the valves are shielded from the air stream in most designs. The fact that they run hot is also well known. Then, turning up rather high, the propeller efficiency is cut about 10 percent. As the best of props rarely deliver better than 75 percent efficiency, it can be seen that the best the propeller can deliver to pull the ship around is about 12 hp. The motorcycle motors are a bit light for anything save the lightest of ships, such as the Irwin Meteorplane. The Lincoln Sportplane is considerably stouter and needs a stronger motor. The Heath, the Russel, and the Lincoln will not fly well with the V-twin motorcycle types.

The light engine which is available to everybody is the Henderson. The new Hendersons deliver about 35 hp with their new valve arrangement as presented in the 1929 model motorcycles, and with the Heath base, which allows a lot of oil for cooling the motor in conjunction with its lubricating functions, it will make a very good light airplane motor. As remarked in the December, 1928, issue of Modern Mechanics and in the Flying Manual published by this magazine, the motor can very easily be converted with the addition of a thrust on the end of the crankcase housing and the shaft for coupling the crankshaft to the prop hub. The Henderson will give the light planes published in this series the same performance as most of the OX5 commercial planes, being loaded about the same weight per horsepower.

As to the Lawrence engine, it is not recommended. The motor was built as a hurried wartime design with a single throw crank, and vibrates too much to allow it to be held in a ship for very long. The servicing problem is a bitter one with this engine. However, by building a two throw crank, and substituting a special cam, they can be made into a fairly serviceable opposed motor. By the time, however, that you get them in shape, you will have spent a lot of money.

The Irwin is a fine little two-cycle engine, but costs $650 at the makers' plant, in Sacramento, Calif. It is light in weight and will
fly any light plane. The two-cycle engine seems to be the coming solution to light plane motors.

The Anzani 35 hp motor, with which the ship in this article is powered, is made in France, and imported into this country by Henry Lowe Brownback and associates of Norristown, Pa. There are a number of these in the second-hand market and a well-placed want ad will generally bring the required result. These sell for $700 new — a bit out of reach — and for from $200 to $300 second-hand.

As a matter of interest to those aeronautically inclined, let us say that with the power mentioned the Lincoln Sportplane should perform beautifully with the floats which we have had Sam Rabl design, and which can be used with the Parasol, Baby Bullet, or the Russell Henderson, or the Lincoln Sportplane.

Next part a further series of the unusually complete plans for the Lincoln Sportplane will be published, and until then it's "adios!" The editors all wish that more room could be given the plans and description of this plane, but so many good things were calling for space, and the plans for the Lincoln are so unusually complete we have to put some of this good dish on the shelf for the future.
The Lincoln Sport mounting a radial Salmond engine took on the appearance of a first line fighter plane.

Notes on Strut and Wing Fittings For Lincoln Biplane

Here are some more of the unusually complete set of details on the building of the Lincoln Sportplane — how the wing fittings and sheet metal work is done.

PART II

Hi, there! How’s the Hangar Gang this month? Here we have great summer weather — just the time you feel like getting out on the tarmac and cutting capers with a ship — if you’ve got one. And why not have one? Modern Mechanics, pioneer in presenting plans of all the leading light airplanes of the country, has added another coup to the magazine’s list of publishing scoops in capturing the plans of the wonderfully efficient Lincoln Sport Biplane, which can be built from rudder post to prop cap from the plans now appearing in the magazine.

Frankly speaking, as explained in the last part, these plans are not for the rank novice, for rank novices have no business with the building of airplanes. But interest is at such fever pitch on the light airplane question, and so many of you fellows in the Hangar Gang are versed in plane construction, that the completely dimensioned set of plans presented in this Lincoln how-to-build series will give you who are “in the know” all the details you need. The plans as appear in the series are full and complete, just as the designer, Mr. Swanson, of the Lincoln Standard Aircraft Co., Lincoln, Nebr., laid them out. Of course, to tell exactly every move to be made would require a book the size of this issue of the Flying Manual.

Last part the following detailed plans appeared: Details of fuselage fittings, to scale; blueprint of plan view, to scale, showing layout of the ship and the wing plan in relation to the fuselage; rib plan to scale; interplane strut plan, to scale, and blueprint of landing gear undercarriage. This month further details are set...
forth with a few constructional notes which should be sufficient to clarify how-to-build points for all save rank beginners. The details given in this part will make the set of plans in your possession still more augmented, and in the next part the final details, making the plans complete from start to finish, will be published.

The side elevation calls for attention first. You can get a good idea of the 15¼ in. stagger, which gives the plane very good visibility. The longerons are 7/8 in. ash forward, and are spliced to spruce at the forward cockpit where the notation “No. 14 Wire” is seen. This follows practice which can be seen in any of the wartime production ships, such as Jennies and Standards which may be near your local airport. These are long splices, with the length of the splice about eight inches in this case, securely glued with Curtis cold water glue, obtainable at any airplane supply house, and taped with pinked edging tape which is later doped to bind it.

The brace wiring is of No. 14 wire. The forward struts are 7/8 by 1¾ in. spruce, bellied a bit for strength fore and aft as the drawing shows. The placing of these may be ascertained by carefully scaling the drawing with dividers. As mentioned previously the longerons and fuselage are shaped up in a rough box mold, and wired and trued to shape.

The front elevation will serve to give a very good idea of the trimness of this little ship. The control wires are run as shown in both views, with fittings to correspond to details illustrated on following pages.

**Plane Flies Well**

In the lower left hand corner of this page you will see the plane built to these plans by Fred Trump, an enthusiastic light plane builder. Mr. Trump’s plane is powered with a Lawrence 28 hp motor in which a two throw crank has been substituted to even up the power impulses, thus making the motor a true opposed job. Test flown by Speed Holman, holder of the world’s outside loop record and judge of Modern Mechanics’ Win Your Wings Contest, the little plane behaved well. Considering that Mr. Holman weighs well over 200 lbs., and is about 6 ft. 4 in. tall, the ability of the plane to carry a usual load is well certified.

In the lower corner of this page, a shot of the framework of Mr. Trump’s plane is shown. Rather than cut the lightening holes as per strict specifications in the details, Mr. Trump bored out lightening holes as may be seen in this picture.

Note that the wings are built in one panel, both upper and lower spars being built according to the wing plan in last issue, and having the dihedral built in. Further details on this construction will follow. The motor shown in the drawings is the 35 hp Anzani which will give the ship a top speed of 100 mph.

**Motor Nose Plate**

The motor plate or nose plate is the one for the Anzani 35, around which the ship has been designed, and which should be used to get real performance.

This is of 12 gauge cold rolled sheet steel, which can be cut roughly to shape with a cold chisel or hacksaw, and then filed and bent to final shape. The seam is not welded. The No. 327 turnbuckles, wired to the bay immediately aft, take care of all tendencies for the plate to unfold. Being nearly an eighth inch thick it is solid enough to hold the Anzani nicely. Mr. Trump built a mounting for the Lawrence similar to the one shown for the Alco Sportplane in the previous part. Such a mounting consists of arms of 12 gauge running from either side of the fuselage to the motor.

The wings of the Lincoln Biplane, the plan view of which was shown on page 40 in this issue of Flying Manual, are built in one panel. The dihedral is built in. The spars of the wings are spliced in the same manner as the longerons.

The fuselage of Mr. Trump’s plane before the fairing was built on. Note the lightening holes in the ribs of the tail assembly.
The manner in which the lower wing is attached to the fuselage is plainly shown in this plan. The fittings rest on the spars, and there are two points of contact on the front spar and one on the rear spar. Half-inch steel tube is used for strutting.

cylinders, and a sort of U-bolt clamp around the cylinders for holding the motor thereto.

You will notice that the under wing of this particular design is solid too. The dihedral is built in in the usual way.

The wing is mounted in the same way as the famous Bristol Fighters had their lower wings mounted. The lower wing was blanketed but very little, and on maneuvering, side slipping and so on the ships are still the favorites of many a wartime flyer. The mounting of the Lincoln sportplane lower wing is parallel to that of the Bristol and gives a wing which has little interference. The front edge is cut away in small boxes where the landing gear struts are in the way, but the effect is so small that the advantages more than outweigh the disadvantages.

In rigging the wings the landing wires are first snugged home just enough to keep the wings lined up with the blocking you employ to set the wing panels right. If you set them home too snug the splices in the spars will be apt to weaken. When the landing wires have been tightened just enough to take the load off the blocking, the flying wires can be set against them and the rigging is all done.

The strut fitting details shown on page 48 show clearly all of the essential major dimensions of the fittings which are used to anchor the struts to the longerons, and how the turnbuckles are anchored. The turnbuckles indicated may be purchased from the Heath Airplane Co., The Lincoln Standard Aircraft Co., Lincoln, Nebr., or from your nearest supply house.

Mentioning supply houses calls to mind that Nicholas Beazely Airplane Co., Marshall, Mo., Marvin Northrup, 700 Washington

The sizes of the struts, namely 7/16 by 3/8 in. aft of the cockpit, are shown in this drawing. The actual length of the strut will depend upon the fuselage layout. The way in which the turnbuckles and the fittings are joined is also made clear.

The beautiful little Lincoln Sport Biplane built by Fred Trump to the plans presented herewith. The photo shows the neat cowling job over the Trump converted Lawrence 2-cylinder opposed motor.
Ave., Minneapolis, Minn., and the Johnson Airplane and Supply Co., as well as the Heath Airplane Co., of 1727 Sedgwick St., Chicago, III., all sell parts of the type required for the construction of this plane.

It is well to remember in the handling of the sheet metal that goes to make up the fittings of the Lincoln Sportplane no heating must be employed. The metal is cold rolled sheet steel, which is fairly hard, though mild. If it is heated it will lose much of its strength and the result is to invite disaster.

Wooden parts on an airplane such as this are few and can be made in comparatively few hours. It is the metal fittings in which the work to be done is concentrated that takes the care and time. For that reason the attention of the Gang is called to each of these little items as it appears.

Look at the last blueprint in the present article. You will find there the details of the fittings which make up the wing strut anchorages and flying wire attachments, which we have already noted in the remarks and pointers about rigging. You will notice the wing spars are hollowed out on one side, being 1 in. thick at the flange and half inch thick through the channel.

The elevator and aileron pulleys are shown in sufficient detail to enable their construction to be grasped nicely and without any complexity.

It might here be remarked that in anticipating the particular problems which the builder of the plane might encounter, that the mold previously mentioned for the building of the fuselage calls for a word.

As the fuselage is the same on the top as the bottom the mold can be made thus: the sides are formed out of 2 by 12 planks with the outline of the fuselage marked on them. The outline, or sweep from the nose plate to the tail post is sawed out, and on both planks. Then cross braces are put in.

**Spacing of Cross Braces**

These cross braces should be spaced about 4 in. apart, and
may as well be 1 by 2 in. This will allow you to get clamps in between so as to hold the longerons when they are bent to shape which may take a bit of hot, dry steaming to momentarily soften the wood. The longerons are left in the mold until they are such shape as to be readily bent to form when being rigged.

At this stage of the game it is well to be on guard for the parting of the grain of the wood. Do not allow such splits to occur. The reason is obvious.

The small slight split is the fracture of tomorrow, and if difficulty is encountered in bending the longerons they should be wrapped in cloth. They can then be bent without splitting.

A secondary word might also be here interjected concerning the gluing of the spars and the longerons. Glue if properly handled makes the best joint possible and the splice, like a good weld, is almost always stronger than the original weld. Spruce is used in the wing spars of the Lincoln Sportplane, routed as previously explained and the dihedral is built in where the wings are spliced.

It would be impossible to get straight spruce of the span of the wing nor would there by any point in it. Therefore as the spar must have dihedral for stability, the dihedral is built in at the splice at this point. The splice is prepared by sawing the spars, which are solid at this point, at complementary angles, planing smooth, gluing, and pressing in a clamp on a form previously laid out to conform to the 176 deg. required as called for in the front elevation.

This clamp need be nothing more than a guide made by nailing two 2 by 4s at the required angles along the floor. You will use them for but four gluings and they may then be taken up.

This method will assure you of having good glue jobs on the wings. The same care must be taken on the gluing of the longerons as to the facing and joining, and no worry will ever result from these points when you are in the air and are called upon to make the ship whine to get yourself out of a tight fix.

Fred Trump's Lincoln Sport just before its first flight. "Speed" Holman pilot, Lawrence engine.

Photo by Fred Trump.
An excellent idea of the size and appearance of the Lincoln Sport Biplane may be had from the above view of a pilot getting ready to start the Anzani 3-cylinder 35 hp 4-cycle motor. Such a ship is ideal for the amateur and will perform just as capably as a larger plane. Many of these marvelous light airplanes have already been built.

FUSELAGE SCALE DETAILS OF LINCOLN BIPLANE

Details for the immensely popular little biplane are concluded here. This will put the reader in possession of a complete set of detailed plans for one of the best planes of the day.

PART III

As we glide into the last details for the building of the Lincoln Sportplane let us take a summary of the plans which we have laid before us and from which the ship is to be built.

The last part contained the first of the plans, and carried all the dope about the performance and the main layout. The fuselage fittings, the plan view of the fuselage and the wings, the U.S.A. 27 wing section (which, by the way, is obtainable upon application from the National Advisory Committee for Aviation, Navy Building, Washington, D.C.) and the interplane strut and landing carriage details were shown with explanations in that issue. The following part took up the engine mounting, wing mounting, fuselage, strut fittings, stabilizer parts and wing fittings. This issue completes the set of drawings. Anyone at all familiar with the building of an airplane will be able to construct the Lincoln Biplane from the set of details provided through these pages of Modern Mechanics Flying Manual.

Should the reader wish, he may secure a set of blueprints for the construction of this ship from the designers, the Lincoln Standard Airplane Co. of Lincoln, Nebr. The price of these prints is five dollars, and though no more complete than the set of plans which the magazine has presented, they are shown to somewhat larger scale and possibly might be a bit easier to work from. The Lawrence mounting is peculiar in that there are no points of attachment about the engine such as bolts, etc. The mounts for the old Penguin planes in which the Lawrence engines were used were merely U-bolts attached to the lower ends of the cylinder barrels. Use is made of this...
feature in the Lincoln Sportplane if one wants to use the Lawrence.

The wing may be covered with Grade A cotton cloth. The loading per square foot is not 51\(\frac{1}{2}\) lbs. per square foot as was at first printed, but only 5\(\frac{1}{2}\) lbs. For such a loading, well-doped cotton cloth is ample as to strength and lasting qualities. The wing is covered in the usual way by making the covering a tight fitting sack, putting it onto the wing like a stocking, and then sewing it to the ribs. The sewing stitch is merely a tightly made loop about every four inches along the wing ribs.

Start the stitch on one side of the rib, poke the needle through to the under side of the wing, and then bring the thread up through the top again on the other side of the wing.

The blueprint on an accompanying page shows several details worth mentioning at length. Among these is the splice in the wing spars.

As previously mentioned, the dihedral in this design is built in the wing. The spars are spliced at the centers where the cabane strut is mounted and are glued with Curtis cold water glue. The method of joining the spars is shown in the drawing at the lower portion of the page. In the view which may be identified by the dimension 4\(\frac{1}{2}\) in. showing the length of the splice, it will be noticed that there are ostensively three holes for bolts. The outer ones are used for the fittings; the center one is a dowel pin.

The aileron control horn is a complicated piece of cutting and should be laid out flat, cut, and

If these directions are followed closely, construction and assembly of the control stick will be an easy task and one that the builder will get a great deal of enjoyment out of performing for himself.

Photo by Fred Trump
then bent, and drilled the last thing so that the holes will be in line.

The method of making the center section N-strut, or cabane is shown. The welding had best be done by a man used to the work or much tubing will be wasted before a satisfactory job results. The welding of tubing is in itself an art, and all welders are not tubing welders by a long way. The application of the oxy-acetylene welding flame to light tubing such as this is very apt to thin the metal on each side of the weld and nine times out of ten if failure occurs it is at this point and for the above reason. In all points the skill of a welder will be found well worth while.

The accompanying blueprint also shows the Lincoln method of building the trailing edge of their wings, as will be seen from the cross section of the aileron. Quarter-inch by 22 gauge steel tubing is used for this, and is secured to the wing ribs by copper strips. The copper is soldered to the tubing, nailed to the rib, and the nail heads soldered to prevent their coming loose.

The aileron hinges are simple and are readily made out from the drawings. The method of fastening them together is shown. The clevis pin, a standard 3/16 item is used and anchored with a cotter pin.

It is recommended that the builder of this plane, should he wish to fly it, take time from some accredited instructor. It will be the cheapest in the long run and will enable the student to keep his plane intact until he has acquired enough air sense to instinctively do the right thing when an emergency arises.

Modern Mechanics does not advocate the student teaching himself to fly. If, however, he wishes to try it and risk a faulty move which may endanger his ship, here is the way to go about it.

On the take-off, after the motor is warmed so that giving her the gun will not load her up and kill it, the ship is lined directly into the wind. Choose the early morning or the evening before the sun goes down. The air is then heavy, lifts well, and is not bumpy as a general rule.

The throttle is gunned wide out. The stick is shoved forward so as to lift the tail off the ground. When the nose of the ship is on a line with the horizon the stick is eased back as the ship gains enough speed to keep the nose there, and finally a slight nudge back will lift the ship off the ground, and you are in flight.

Care must be taken not to climb too fast and stall the ship. As a stall approaches the aileron controls become soft. Nose the ship down to regain control.

When about 400 ft. of altitude have been gained head the ship back into the wind for a landing and cut the motor, when flying straight along in normal flight, the air field under you forms a line of vision which approximates the gliding angle of the ship. Cut the gun, nose the ship over into this line, and gently dive for the field. About 10 ft. or so off the ground level off and wait for the ship to begin to settle. Just at the moment you feel the ship begin to settle keep pulling the stick back, settling the tail, until the ship lands on all three points — tail skid and two wheels.