ARMSTRONG-WHITWORTH "APE"

Looking more like a dragonfly than an ape, the design has the appearance of an insect about to leap into flight. It is well-proportioned for Rubber Scale. The long nose minimizes the need for extra weight to achieve proper balance. Prop is painted to simulate laminations.

THE CONFIGURATION of the Ape almost suggests that Armstrong-Whitworth had a Rubber modeler on its design staff and told him to have a go at a full-size airplane. The basic frame exhibits a preoccupation with economy. The fuselage is almost without precedent in a full-size aircraft: box-section its entire length, with longerons running parallel to an abrupt, angular taper at the tail. What could be more simple?

The story of the Ape is interesting. In 1922 the Royal Aircraft Establishment (RAE) decided that a "variable geometry" airframe would provide answers to baffling aerodynamic questions—questions that could only be answered through empirical observation. They laid down certain requirements and awarded a construction contract to a somewhat reluctant Armstrong-Whitworth design team. The Ape research airplane is the result.

The plane had a number of mechanical innovations found in no others. The fuselage length could be varied by insertion of box-like components either in front of or behind the center of gravity. The plane's appearance might change from day to day! Wing stagger was variable also, from 0° to 30° positive, and the gap and dihedral could be adjusted. Of course, these changes had to be made on the ground, but there was a unique provision for adjusting the stabilizer in flight, cranking it up to about 30° negative incidence. The only full-size airplane with a dethermalizer! Our model reproduces Ape J-7753 with maximum fuselage length.

Once in a while the Rubber Scale enthusiast is rewarded in his search for a modeling subject that combines all the desired attributes: character, proportion, uniqueness, and ease of construction. This model of a 1926 research aircraft at a scale of ¾ in. to the foot comes close to meeting all the criteria. ■ Bill Noonan

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Three Ape aircraft were built. None distinguished themselves by unlocking aerodynamic secrets. Actually, you might say they were quite a failure. The Armstrong-Siddely Lynx engine proved inadequate for the big, draggy airframe. Top speed was recorded at 90 mph. By 1929 all the Apes had disappeared.

But Armstrong-Whitworth did leave an unintended legacy for Rubber modelers: a delightful design, full of arrangement options allowing a broad range of choices of fuselage length, tail size, dihedral, gap, and stagger. Name another design offering that latitude!

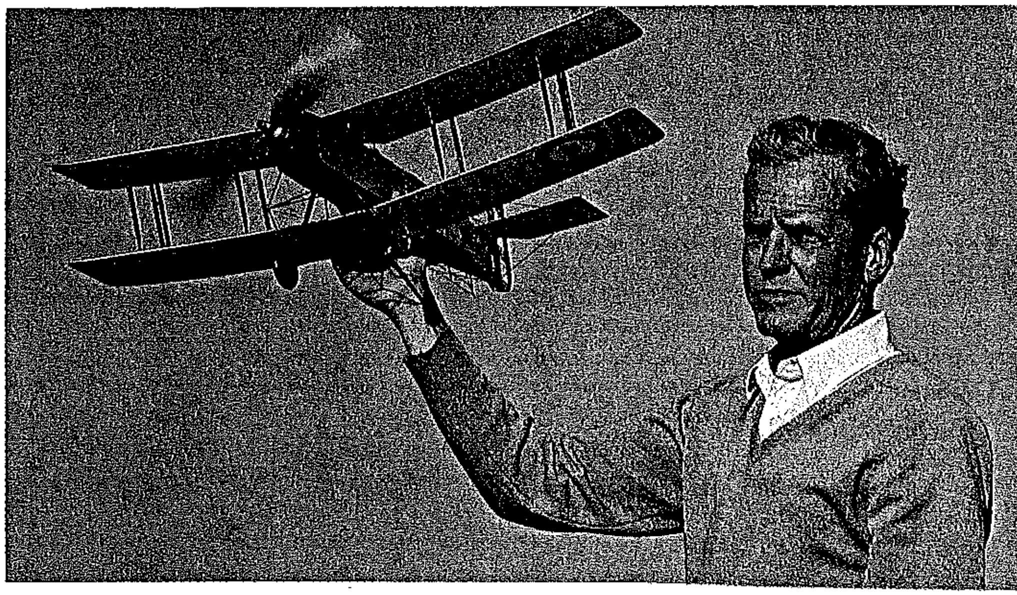
Fuselage. A glance at the plans will show you that the fuselage is easy as pie! We laminated the longerons of 3/16 × 1/32 over 3/32 × 1/16 balsa. See enlarged cross section on plans. This permits the tissue covering to be cemented along the 1/32-in. edge, thereby resulting in a neater covering job. No uprights touch the tissue. If this seems like too much trouble, substitute 3/32 square balsa longerons.

Construct right and left fuselage sides over the plans. When the cement is dry, join the two sides with crosspieces at appropriate stations, working from the nose aft. Carefully cut the longerons where the fuselage makes an abrupt taper at the tail. Cement this wedge-shaped part back in place. Add the 1/16 sheet balsa tapered nose section. Insert Formers D and E, which help align the fuselage cross section (which is absolutely square). Former D is 1/32 plywood and forms a mount for the landing gear. The round holes in these formers act to support the winding tube later on.

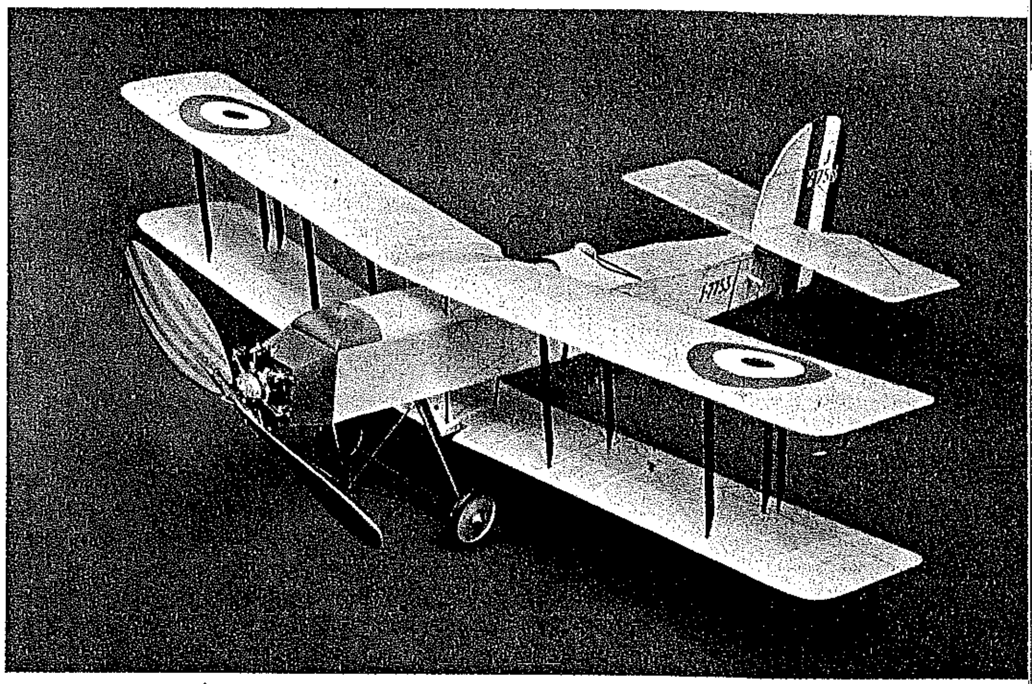
Cut the top formers from soft 1/16 sheet balsa and cement in place. These receive no stringers, but have straight-grained 1/32 sheet balsa covering. Trace cockpit patterns on the balsa with a soft pencil and cut with a sharp, pointed knife, maintaining symmetry of the openings. The rear cockpit fairs in nicely with the square turtle-back. Cut a soft balsa block "entering edge" at the nose, and carefully fair into the 1/32 sheet balsa. Drill a 3/16-in. hole in the uprights at the rear of the fuselage that receive the aluminum tube rubber anchor. The tube should fit snugly when inserted.

Add gussets and 1/16 sheet balsa mount pieces for later installation of control horns and ladder. Insert wedge-shaped pieces between longerons immediately below the stabilizer. Drill two holes in both. This allows passage of stab hold-down hooks and rubberbands. Bamboo slivers passed through extended rubberbands at the fuselage bottom will hold the bands in tension. A method of keying the underside of the stabilizer with the fuselage will be necessary to prevent misalignment of the tail surface. A small balsa block may be cemented in place once flight adjustment is satisfactory.

The landing gear is not as complex as it looks. Bend the main (oleo) legs from .032 wire, using the front view as reference. The

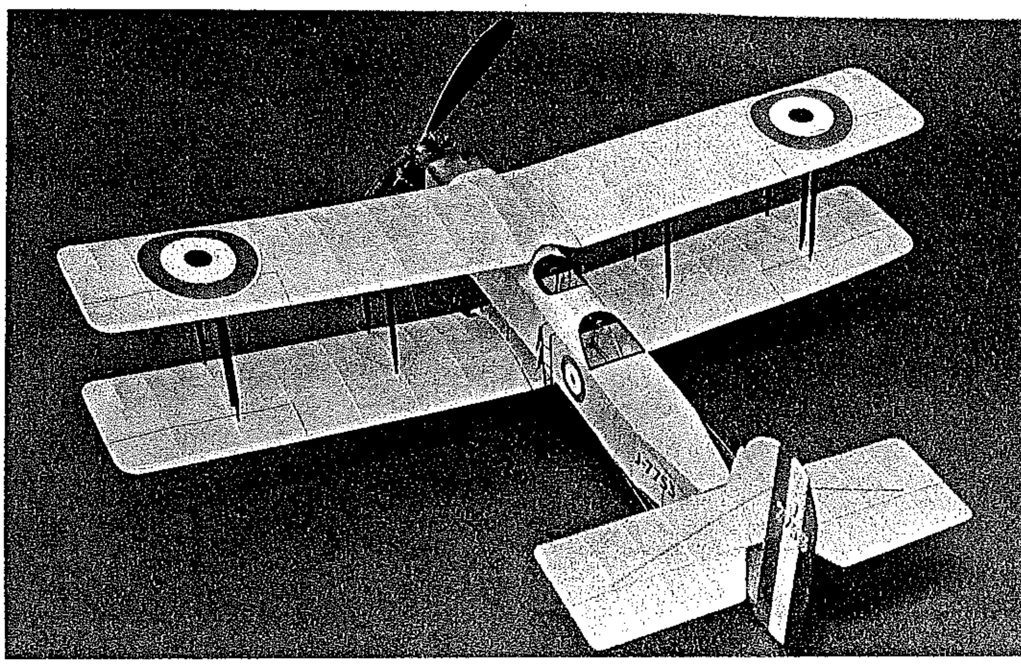


The author, Bill Noonan, holds the model to show the underside to good advantage. Holding the model by the lower wing center section is the safest way for hand-launching. Lee Noonan pic.

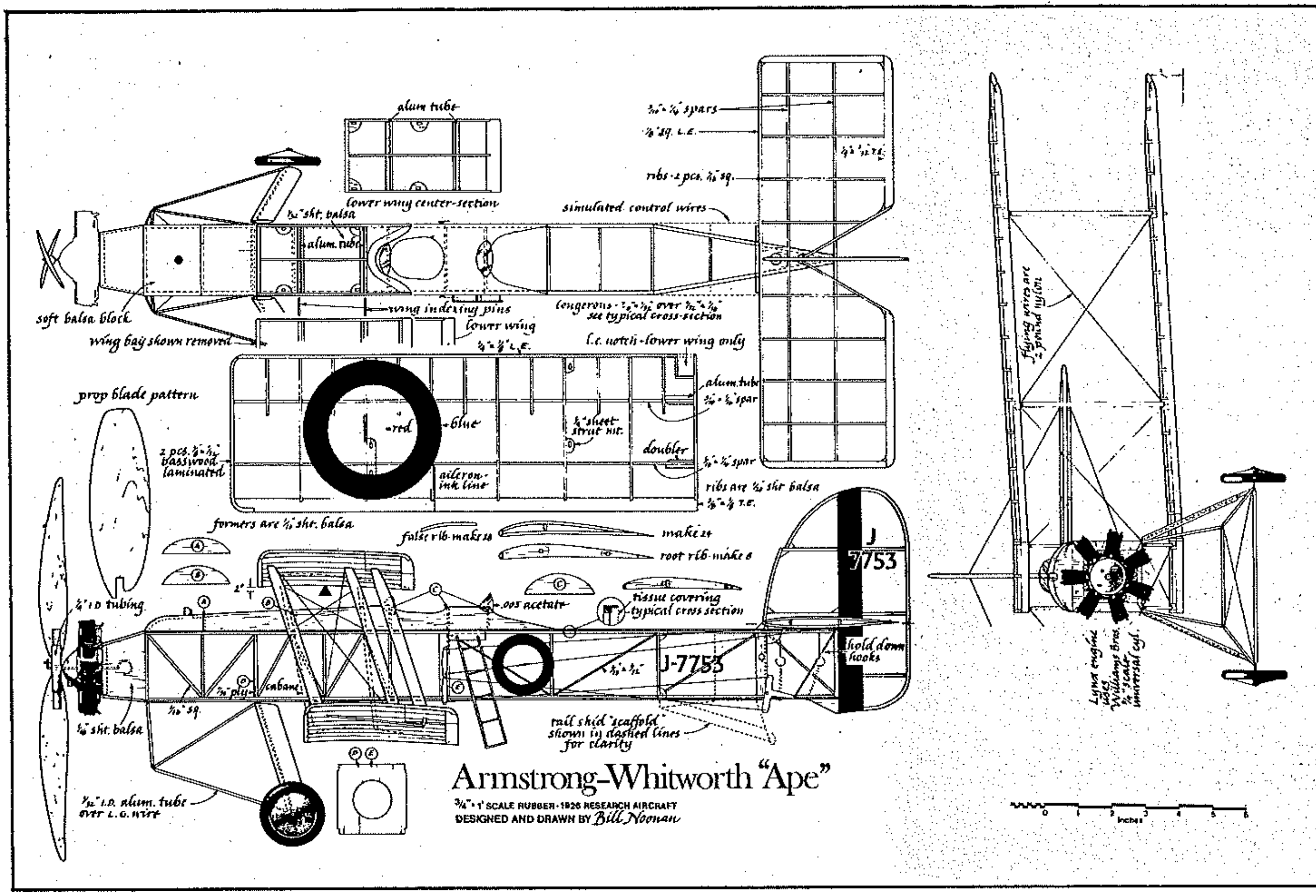


Homey, no-nonsense character of the airplane gives it a certain appeal. The late Frank Courtney, famous British pilot who tested the Ape, called it "the ugliest airplane I ever flew."

Archive info indicates that three different horizontal and vertical stabs were tried. Model incorporates the largest. Fuselage could be lengthened to try out various moment arm lengths.



FULL-SIZE PLANS AVAILABLE...SEE PAGE 164



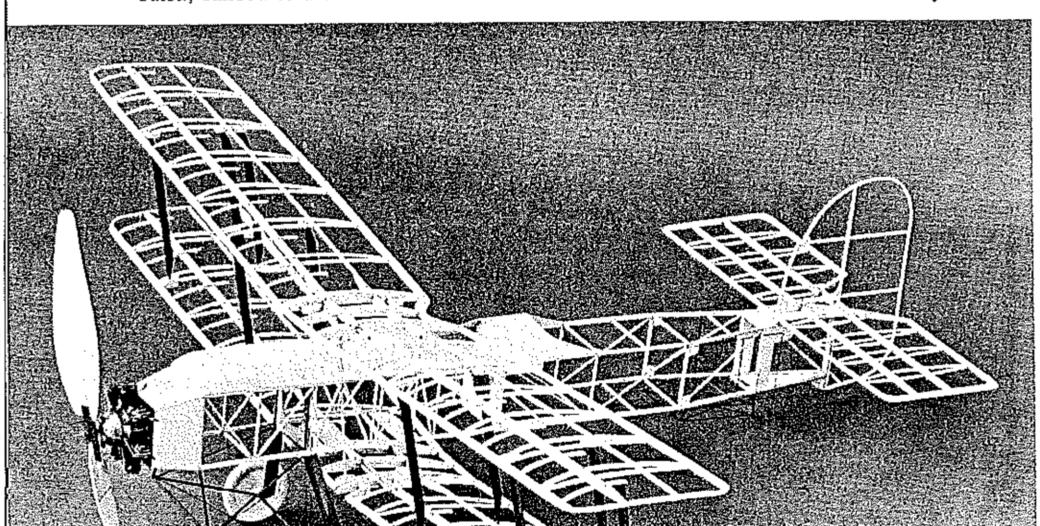
wire should follow the shape of Former D, to which it epoxies inside the fuselage. Bend the rest of the struts from .020 wire, but not before they are brought up to scale appearance with .032-in. inside diameter (I.D.) aluminum tube sleeves. Solder the joints. Fashion oleo covers from 3/16 sheet balsa, sanded to a streamline section.

The peculiar "scaffolding" at the tail is the main support structure which allowed the exaggerated stabilizer incidence change in flight. Bend the parts from .020 wire, and solder them together (see sketch). The entire "cage" is slipped on the fuselage after it has been covered and doped. The T-shaped control arms found on both sides may be made of 1/32 plywood. Note that the tube right below the stabilizer leading edge is larger in diameter than the other parts. This can be a short length of soda straw slipped over the wire. The bottom portion of the scaffolding forms the tail skid, and this is integral with the unit.

The simulated Armstrong-Siddely Lynx engine is made from Williams Bros. ¾-in.-scale universal cylinders. The cylinder barrels are rather tall, and they require the addition of four fins at the top. We made the seven finned heads of hardwood and added details like valve springs, rocker arms and pushrods from scraps of wood and metal. The exhaust pipes are .032-in. I.D. aluminum tubing. The crankcase is hard balsa, turned on a small lathe. The seven flattened portions are cut to accept the cylinders. Drill the crankcase to receive the thrust button. Incorporate about 2° downthrust and a little right thrust. Test flying may dictate some changes in the thrust line. This is easily accomplished by shimming the firewall where it plugs in the fuselage.

Wings. The planform is the same for top and bottom panels. The only conspicuous difference is the notch in the leading edges of the lower wings. These notches allowed the wing stagger to change without touching the landing gear oleo strut cover.

Sliced ribs save weight, but they are a little more trouble. Cut 24 undercambered (lower) parts and 24 upper. Make the root ribs from solid (hard) sheet. These resist distortion from tissue pull. Cut the ¼ × ⅛



The framework is lightweight, strong, and easy to build. Flying prop made by laminating blades over a helical pitch block. Tubular hub allows pitch change or blade replacement in the field.

leading edges to length along with the ⅜ × ⅛ trailing edges. Rough-taper the trailing edges, and file ⅛-in.-deep notches to receive the ribs. This produces a much stronger wing than just cementing rib ends to the trailing edges.

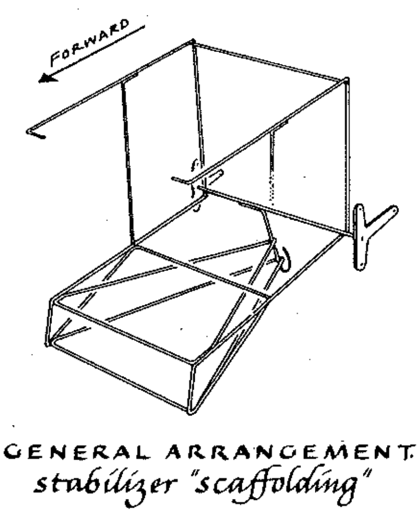
Force the lower rib components into the notches, assembling the frame over the plans. Omit root ribs at this time. Position leading edge against the rib noses, making any trim adjustments necessary to ensure that all ribs contact the leading edge. Cement all joints with cyanoacrylate (CyA) glue. Repeat the procedure with the rib tops. Slip the front spar through either end of the wing frame. It passes through the rib maze easily if laid flat and then rotated (once it is in place). Do the same with the rear spar.

The wing tips are made by bending two pieces of ⅛ × 1/32 basswood (that have been soaked in hot water) around a waxed cardboard form. Apply white glue sparingly between laminations, and allow it to dry overnight. When dry, cut off surplus, and fit carefully between leading and trailing edges, fairing in with sandpaper.

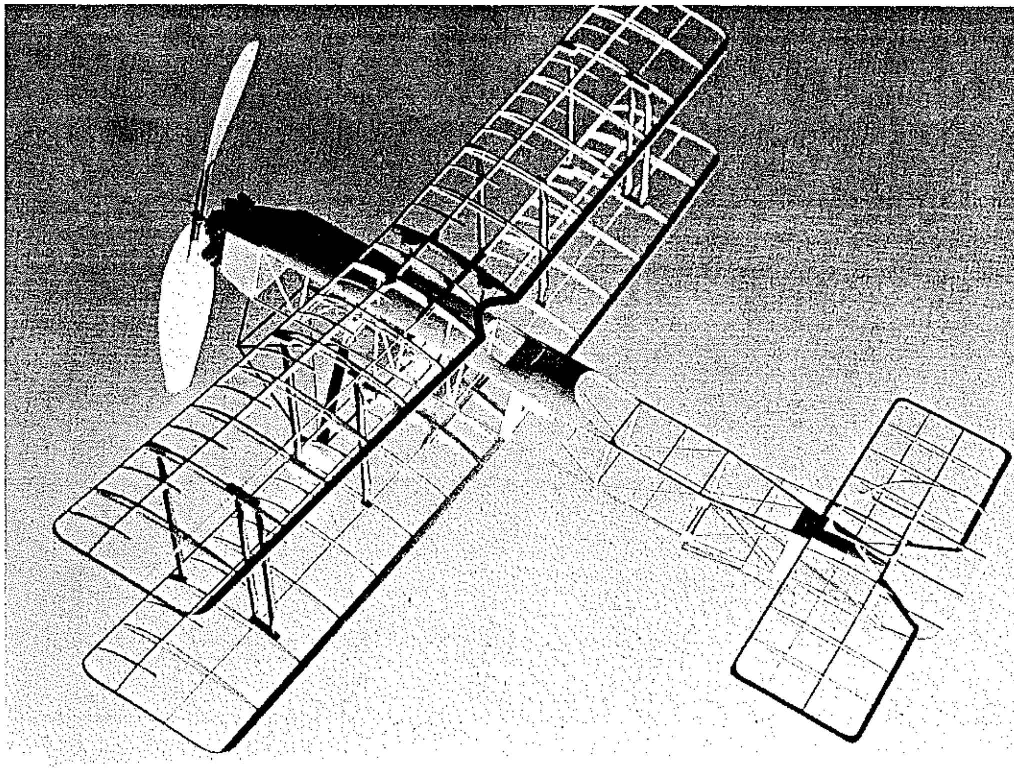
Add false ribs and strut mounts, which are drilled with 3/32-in. holes to receive the struts after covering has been applied. Finish the panels by installing root ribs and aluminum tubing which receives loose indexing pins for wing bay removal.

Construct the center sections of both wings in the same manner as the wing panels, angling the root ribs to accommodate the dihedral angle. Make sure the center section tubing mates accurately with the wing panel tubing, or you will have trouble plugging in the wings later on.

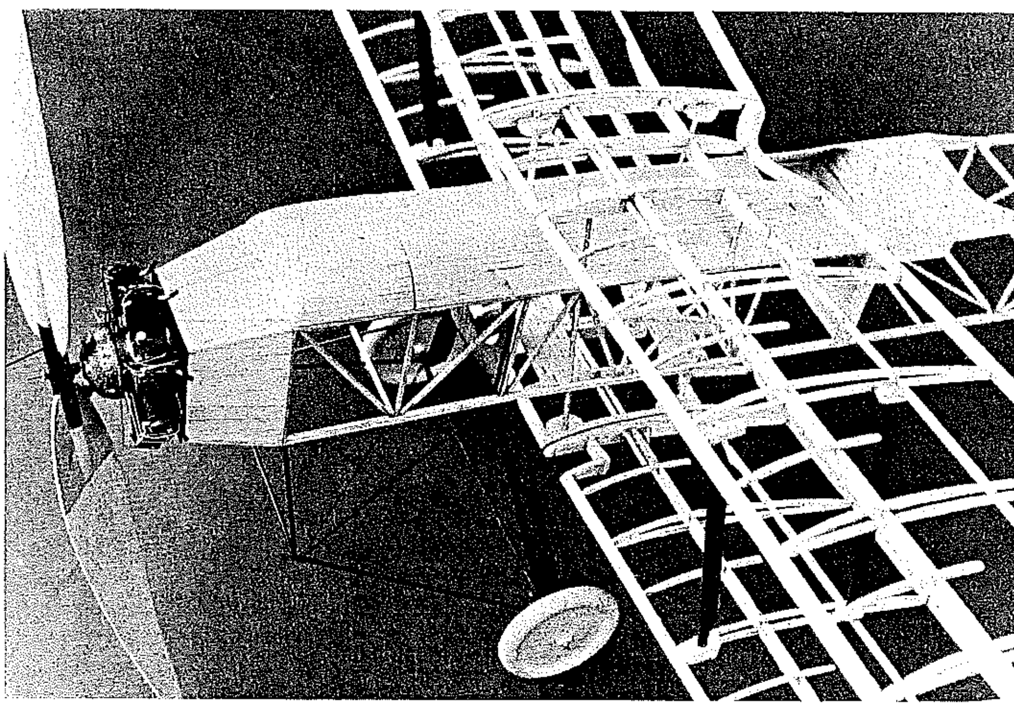
After you have finished the top and bottom wings and their respective center sections, cut the four cabane struts to the length shown on the side view of the plans. Note that these pierce the fuselage top and bottom. Use oval-section bamboo for greatest strength of these struts. These have to align with the two center sections, so accuracy is critical. Test-fit by pushing the four struts through the sheet covering of the fuselage



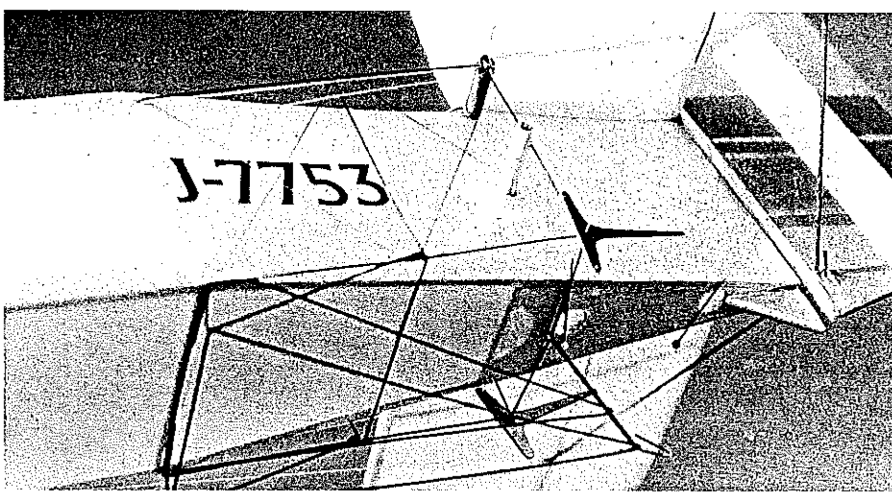
Unusual "scaffolding" provided support for the horizontal stab; incidence could be changed while in flight. Boxlike unit is bent from light wire, slips over end of the finished fuselage.

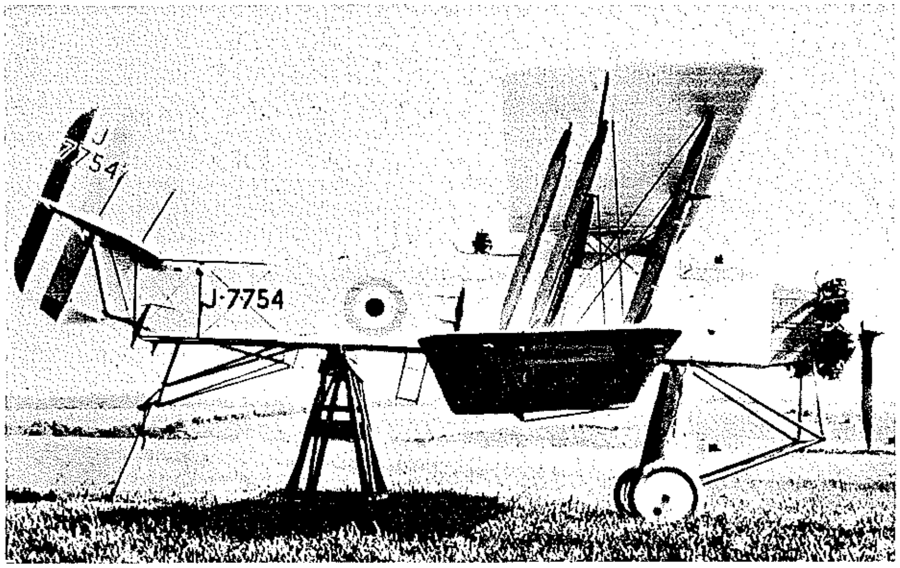


Careful selection of wood sizes holds down duration-robbing weight. Critical stress points, like landing gear and wing mounts, are reinforced with gussets.



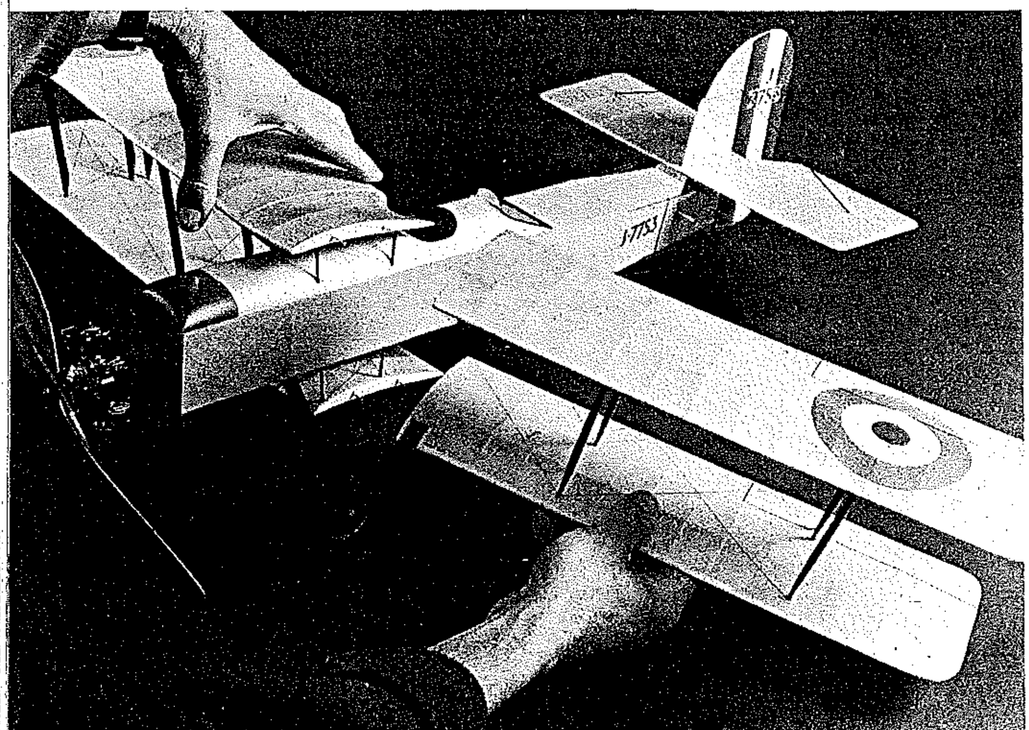
Laminated longerons run parallel for the entire fuselage length. Japanese tissue covering is cemented to the longeron edges, and it doesn't touch the upright parts. Unusual notches in lower wing accommodated oleo struts when the variable-stagger wing was set at zero stagger.





Copy photo by Warren Shipp of the Armstrong-Whitworth Ape from the personal photo album of the late Frank Courtney. It was first flown by Courtney on January 11, 1926 at Coventry, England.

Novel landing gear is made of small-diameter wire sheathed with aluminum tubing. Oleo struts have streamlined fairings.



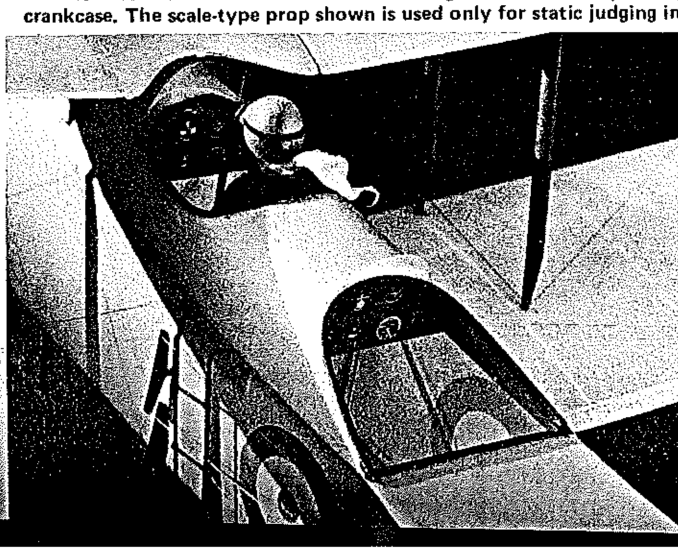
Wing bays can be removed for ease of transportation or storage, held in place with rubberbands stretched between hooks on underside of wings. Flying wires are 2-lb.-test nylon.

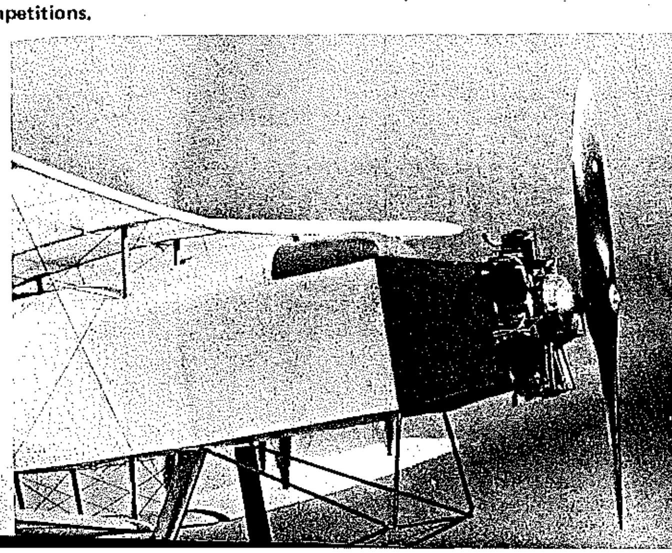
top, letting the bottom kind of hang loose.

Position the top and bottom center sections on the strut assembly, marking contact points with a fine-tip marker. If the struts need trimming, remove and cut. When you are satisfied that all is well, apply CyA to struts where they enter the fuselage. Remove the center sections, and cement drilled balsa mounts in correct spots. The center sections will not be cemented in place until the covering has been applied. When cementing center sections in place later on, set the lower wing at 0° incidence, top wing at 2° positive.

Interplane struts may be fashioned from medium-hard balsa or plastic soda straws. We made ours from the straws which are pinched to an oval cross section and trimmed at each end as shown. A small-diameter bamboo dowel runs the full length of the strut inside the leading edge and provides a means of "plugging in" the strut mounts. Leave about ¼ in. sticking out of each strut end. Paint struts dark brown.

Left: Detailing around the cockpits gives relief to an otherwise rather plain design. Author thinks that any aircraft carrying its own boarding ladder deserves a 10 on the Charisma Scale! Right: Simulated Lynx engine uses modified Williams Brothers universal cylinders mounted on a balsa crankcase. The scale-type prop shown is used only for static judging in competitions.





Tail surfaces. The horizontal stabilizer incorporates a symmetrical cross section. This may be accomplished by laying out the bottom 1/16 sq. rib parts over the plans. Cement the two spars and the leading and trailing edges in place, but not the tips. Now cut matching rib tops from 1/16 sq., and bend these over the two spars. What you are doing is causing both the rib tops and bottoms to set up an equivalent tension, resulting in a streamline airfoil.

Add the 1/16 sheet diagonal pieces where the rudder is free to travel. Add the simple ¼ × ⅛ balsa tips. Contour the leading and trailing edges to conform to the airfoil. Do the same with the tips. Bend two hold-down hooks from .032 wire, and cement them in place on the stab center line. These insert through holes in the top of the fuselage and provide a means of holding the stab in place as described earlier.

It will be necessary to make a special tool to withdraw the two rubberbands which engage the hooks. This tool can be fashioned from .032 wire to also reach into the fuselage and pull the rubberbands through holes in the bottom. While the bands are taut, slip bamboo slivers in place to prevent them from pulling entirely back into the fuselage. Orthodontist's rubberbands are perfect for this application, as they have a diameter of about ¼ in. and are very elastic and light.

The Ape rudder is flat in cross section and 3/32-in. thick. The outline may be laminated or cut from sheet stock. After covering, it is to be cemented on the stabilizer top. The small triangular piece at the fuselage bottom abuts the rudder. On our model, we used this as a means of aligning the rudder when the tail surfaces were set in place. A short piece of dowel in the rudder conveniently indexes with the triangle, which has been drilled to receive the dowel.

Prepare a shallow "cradle" on the fuselage top to seat the stab underside. Incidence is easily adjusted by insertion of a balsa shim. Add a small fairing at the stab leading edge after tests have established the correct incidence setting.

Miscellaneous. We are in the habit of making our props from plywood bent around a pitch blank. The blades plug into a ¼-in. I.D. brass tube hub. Although this method isn't as handsome as a well-carved basswood or balsa prop, it does have a couple of advantages; blades can be replaced in the field, and pitch can be changed for optimum performance.

Two pieces of 1/64 plywood rough-cut to blade shape are bound to a carved pitch block. Apply white glue sparingly between the pieces of plywood before binding the lamination to the block with a length of discarded rubber motor. A coffee can (or similar cylinder of about 6 in. diameter) can be substituted for the pitch block. Bind the blades to the can at an angle about 15° off the can center line.

When blades are dry, sand the edges to proper shape and feather the leading and trailing edges. Cement a ¼-in. birch dowel

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about 1 ⅛-in. long at the hub end of the blade. This plugs into the brass hub which is driven by the 1/16-in. music wire shaft. A free-wheeling dog clutch is easy to incorporate, and it improves the glide once the power turns have been exhausted.

The 2-in. wheels may be purchased commercially, or they may be turned from balsa. Their configuration is pretty standard for aircraft of this vintage.

The flying wires between the wing bays are made from 2-lb.-test nylon fishing leader. We sprayed ours dark gray before threading into the eye of a small needle. Start stitching between strut bases with a 30-in. length, pushing the needle through the strut just above (or below) where the strut enters the wing. Apply a drop of CyA glue at each pass. The stitching pattern will quickly become self-evident. The nylon is extremely strong and resists stretching.

The incorporation of the wires lends realism to the model, but more importantly, strength to the wing bays. The same nylon is used for simulated control wires at the elevator and rudder. The ailerons were activated through a pushrod mechanism found on the underside of the lower wing. This may be made from small-diameter aluminum tube. The control horns are made from 1/32 plywood and painted dark gray.

The boarding ladder found on the port side between the cockpits can be made from thin bamboo, or you may want to try the method we used: layout the ladder over the plans (cover with Saran Wrap) with coarse carpet thread; apply CyA glue liberally to the entire ladder; allow to dry overnight. The result is a stiff, lightweight part.

Covering the model follows conventional practice. We used white tissue from Peck-Polymers, which is quite strong. After shrinking the tissue, apply three coats of clear nitrate dope reduced 50% with thinner. The real aircraft is presumed to have been silver, so we added silver powder to the final coat of the clear nitrate. Our preference is a translucent covering, so the silver was applied sparingly. A little experimentation will be required, but our ratio was about as much powder as might be held in the metal ferrule of a common pencil eraser to one ounce of dope. An inexpensive modeler's airbrush gives best results.

Paint the nose section and firewall dark gray. See photos.

The British roundels may be made by cutting colored tissue and doping to the white tissue surface, or by masking and spraying. We have found it easier to do the masking and spraying on the tissue before covering the model, working on a flat surface. If a light application of colored lacquer (blue outer circle, red center) is used, the tissue does not wrinkle. The trick is to align the roundels accurately when applying the covering. When shrinking the tissue, apply water from the underside. The same procedure applies to the rudder stripes.

Flying. Power the model with eight strands

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time the spare tire was packed on top of them and the temperature inside the trunk was 140°.

There is a certain sequence I'd go through when trying to sort out a new model. First, don't try to tune an engine and trim a plane at the same time. Don't overlook the very basics like balance and the correct thrust line. You can usually "eyeball" the thrust line, but if you have a model that darts up or down when the engine shuts off, it might be that you had a lot of opposite control cranked in to keep the model flying level. Minor adjustments can be made by either loosening the mounting bolts and tweaking the engine the correct way or by enlarging the holes in the crankcase slightly.

After the basics, fire up and fly level. Note if the outboard wing is high, low or level. Black tape on the outboard wing helps to see it if it is a very small amount. If there is no problem or only a small droop, then turn the model over and see if the wing hangs. If the wing hangs the opposite way from level flight, you have a warp. Either use a trim adjustment if the warp is minor, or straighten the wing (use heat on plastic coverings, boiling water or steam on doped finishes).

If the model hangs down both upright and inverted, then the most likely cause is too much inboard wing or way too much outboard weight. If the outboard wing is only slightly high in both directions and tends to "pickup" during maneuvers, then you probably need more outboard weight. Clean off the surface of the wingtip and FasCal a quarter-oz. (a 25-cent coin will do) on and refly. Assymmetry between inboard and outboard wings should run ½-1 inch, and the tip weight should be around ½ oz.

There are lots of compromises designed into even the best and most competitive models. One happens to be line rake. The exit position of the lines from the inboard wing has a lot to do with the way the model tracks. In order to have the model stay out on the lines during upwind maneuvers, it is necessary to have a little more line rake than needed during the downwind portion. That's the story with these toys on a string. Compromises or not, they sure are more fun to fly when they're trimmed properly.

Charlie Johnson, 3716 Ingraham St., San Diego, CA, 92109.

CL Carrier/Perry

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"Most people use pipe pressure to the tank, and as nitro is fairly expensive, we don't usually need more than about 20% to get to the high speed previously mentioned. The CG has to be adjusted, as most pipes and headers weigh about 4-5 oz., but this is no real problem. Pipe-length data is available, and motors can be set up quite easily. Obviously this is very different from your methods, but it's better to bear this minor inconvenience than not to be able to fly.

"I've been flying a Steve Dinerman Kingfisher this season, powered by an HGK .40 with AAC piston/liner plus OPS pipe and 9 × 6 Taipan prop. Typical high of 80 plus, and this year lows of around 16 mph. We don't have a 60-degree flight attitude rule (yet), and so we are just experiencing the delights of prop hanging.

"In Scale, I've got a MO-1 (Yes, they're here too!) with K&B .40S and ED pipe plus 9 × 7 Top Flite pylon prop. I placed second at the Nats on one flight 85/24/100 (487 points), beaten by a Guardian 75/19/100 (498 points). [*AMA scoring would have produced scores of 320 and 314, respectively. RLP*]

"The Dumas Crusader is well-regarded here as a first-time model, and we favour most of the published American plans [in Profile], while in Scale a wide variety [of models] have been tried with no one type outstanding. I used to favor the Seamew, and think it has a lot to offer, but I am thinking of a Fulmer for 1983."

A further difference between British Carrier and the U.S. version is the deck used. One of the two decks used in England was built by the Royal Navy and is patterned after the real angle-deck carriers. It has four arresting lines, a landing area which is only about five feet wide, and it is elevated almost two feet above the ground.

As I was preparing the column this month, I happened to see a photo article in *Aviation Week and Space Technology* which adds another eligible prototype to the list of aircraft for our events. The article described secret Navy tests about 13 years ago in which the Lockheed U-2 was evaluated as a carrier-based maritime reconnaissance aircraft! Although the prototype does not lend itself readily to our event, I have to admit that the photo of the U-2 rebounding off the deck with its hook engaged in the wire was rather impressive!

Richrd L. Perry, 7578 Vogels Way, Springfield, VA 22153.

A-W "Ape"/Noonan

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(four loops) of 3/16-in. rubber. The length of the loops should be twice the distance from the aluminum anchor tube to the firewall. Balance the model with the rubber motor installed. See balance point location on the plans.

Make tests with about 250 turns on the motor. Launch the model over tall grass if you have access to such a luxury. Observe any stall or spin characteristics. Make necessary corrections by addition of incidence change in stab, or thrust-line changes. Gradually increase the turns until the motor will accept 900. Don't be in a hurry. Make any adjustments carefully, jotting down what you did on a scrap of paper. It helps later on.

The Ape is an honest, docile design. It is graceful in the air, and it is easy to adjust. Good luck!

Indoor RC Electric/Poling

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don't break is simple: isolate them from the rest of the structure. The Tabloid is