



By Paul F. Denson

Livesey D.L.5

A MINIMUM HOME-BUILT AIRCRAFT

FOLLOWING THE DESIGN OF ITS FULL-SIZE COUNTERPART, THE D.L.5 IS A SIMPLE, QUICK BUILDING AIRCRAFT FOR .25-.35 ENGINES.

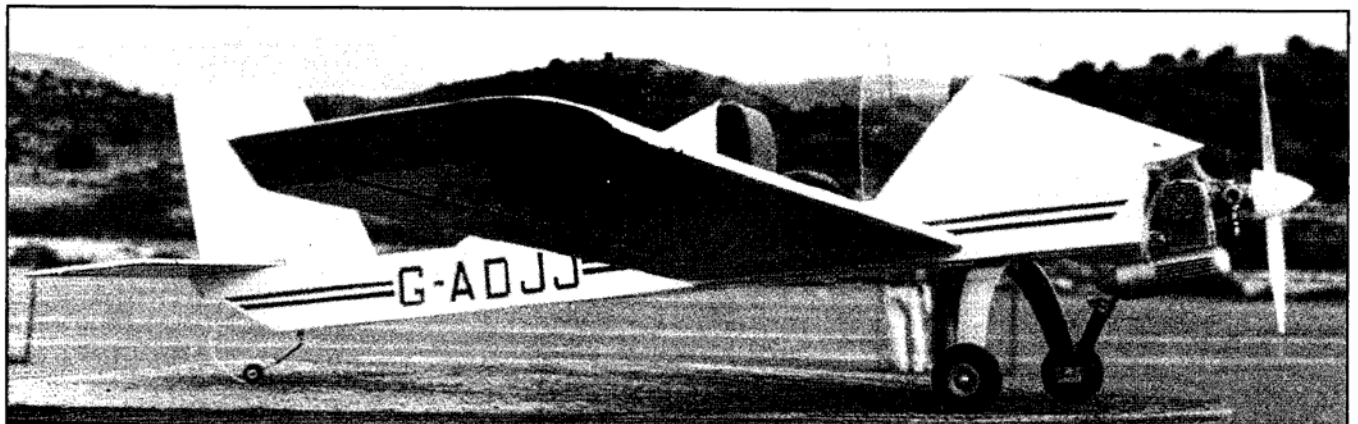
The D.L.5 is an aircraft proposed by D.M. Livesey, an English home-built designer. It first appeared as a design in the July-August 1971 issue of Popular Flying which is the journal of the Popular Flying Association, the British equivalent of our United States Experimental Aircraft Association.

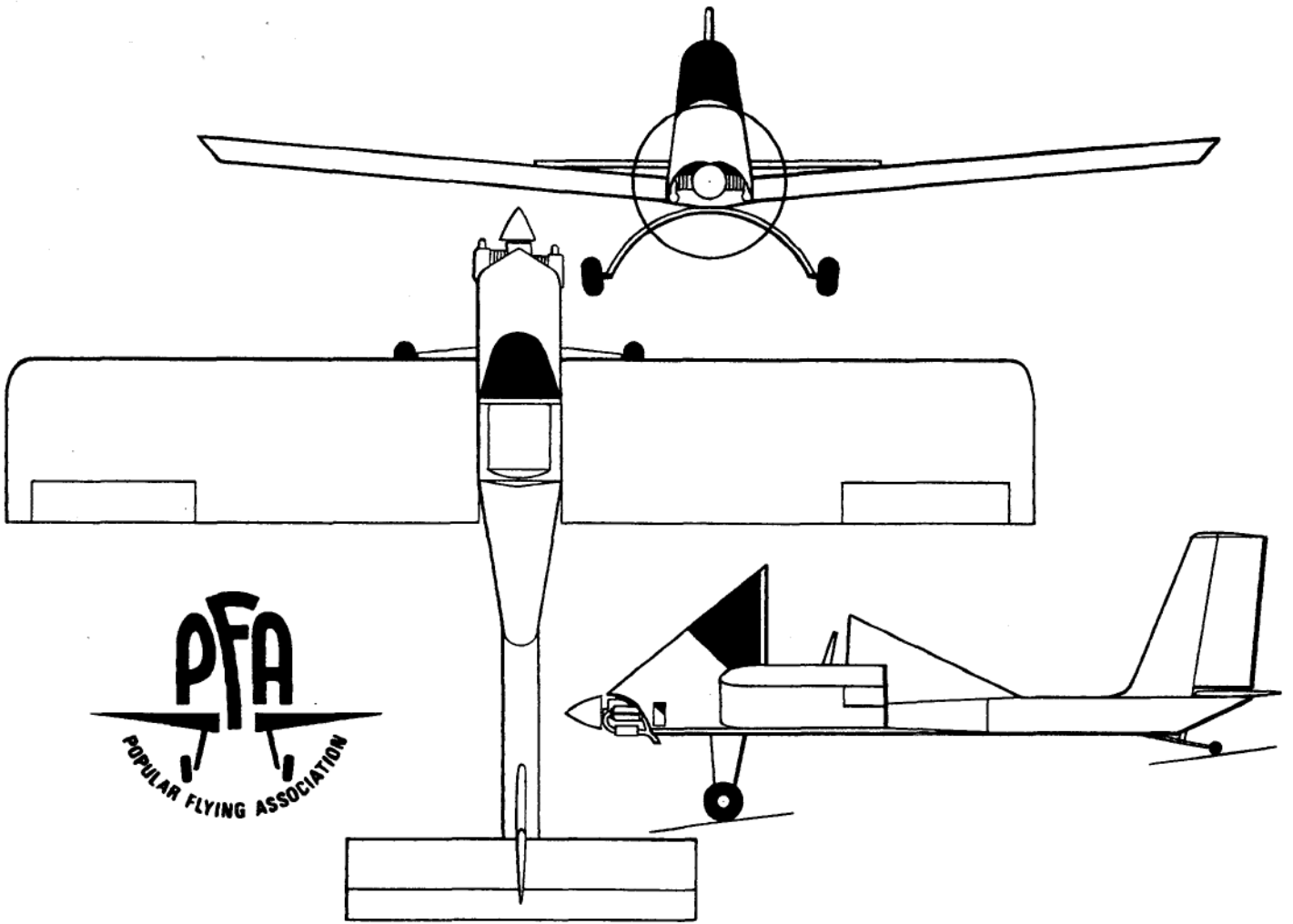
A Minimum home-built (quoting Mr. Livesey) is one that can reduce the building time of from 1500 to 2000 hours by removing the making of jigs, deciphering unnecessarily complex plans, and eliminating the innumerable hours running around looking for specific unobtainable aircraft supplies. And with spruce and birch ply becoming more and more rare, the use of standard marine ply.

What we need is a plane that is easily built. may be constructed in a standard garage. a minimum of tools, no fabric, cov-

ering and no welding. All wheels, seats, fuel tanks are to be commercially available, and this aircraft, when completed, will pass through a standard 2' 6" door. Don't laugh, more than one wall has been torn down to get a home-built boat or plane out to the light of day. Just ask me, I built a boat in my basement. Oh! yes I did and it sailed quite well. It must be trailerable and can be stored in the above mentioned garage.

Our model is 1/5 stand-off scale, well not too far off. We did make modifications





which conform to Romney Bukolt's Basic R/C Model Design Parameters as published in Jan. '80 RCM in Ken Willard's column. An appropriate engine should be from .25 to .35. Controls are 4-channels; ailerons, throttle, rudder, and elevator.

The only thing that varies from full-scale are the lack of Warren type wing ribs as you can see in the cutaway drawing. The fuselage is a constant section 2" tube made up of four longerons. We found this made the fuselage easy to construct but, unlike the full-size plane, we needed room for non-scale servos and a fuel tank in the lower area. To find a place for them, it necessitated removal of the top center longerons from

the seat back forward to the fire wall. The 1/8" lite ply sides more than made up for any loss in strength. The plans have been modified to show this change. Flaps were not used due to space limits.

CONSTRUCTION

We have found (and so has RCM's Chuck Cunningham) that the very inexpensive small size knives with the sliplock break-off blade is fantastic for all phases of modeling. They are available for around 75¢ in most hardware stores.

Fuselage:

Cut all formers from the materials indicated. It will be necessary at this time to

construct the combination of formers F-4 and F-5. They must be filled top and bottom with 3/16" aircraft ply, leaving the center vacant for the insertion of the 3/36" ply wing tongue.

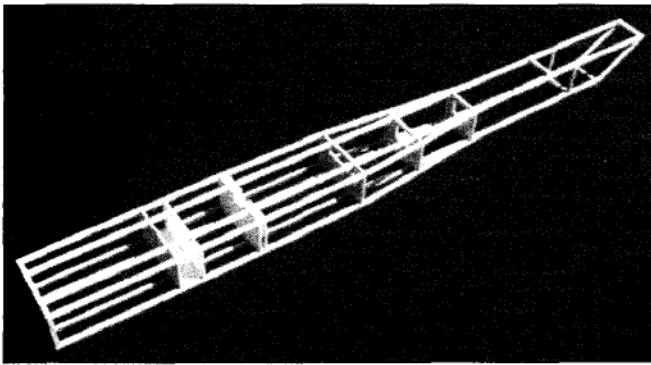
Here might be a good place to mention that the only adhesive used on our prototype was UFO Thick and UFO Thin odorless instant glue from Satellite City, which we recommend highly.

The four longerons may be cut from 3/16" x 36" spruce. Cover the plans with wax paper, pin the bottom center longerons over the plans through to the workbench. Add the bottom outer spruce longerons from the fire wall back to former F-6, then

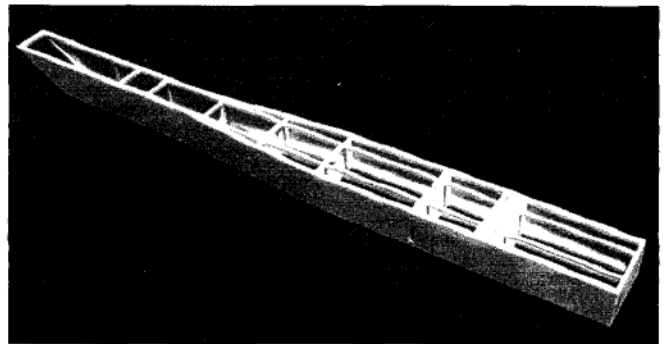
NAME
D.L.5.
Designed by:
Paul F. Denson
TYPE AIRCRAFT
Stand-Off Scale Sport
WINGSPAN
60 Inches
WING CHORD
10 Inches
TOTAL WING AREA
600 Sq. In.
WING LOCATION
Low Wing
AIRFOIL
Flat Bottom
WING PLANFORM
Constant Chord

DIHEDRAL, EACH TIP
4 Degrees or 2-1/4 Inches
OVERALL FUSELAGE LENGTH
37 Inches
RADIO COMPARTMENT SIZE
Ample
STABILIZER SPAN
19 Inches
STABILIZER CHORD (inc. elev.)
5 Inches
STABILIZER AREA
95 Sq. In.
STAB AIRFOIL SECTION
Flat
STABILIZER LOCATION
Top of Fuselage
VERTICAL FIN HEIGHT
7-1/2 Inches

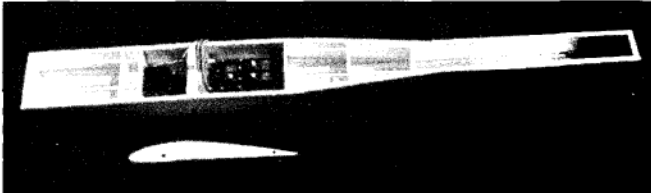
VERTICAL FIN WIDTH (inc. rud.)
6 Inches (Avg.)
REC. ENGINE SIZE
.25-.35 2-stroke
FUEL TANK SIZE
6-8 Oz.
LANDING GEAR
Tail Dragger
REC. NO. OF CHANNELS
4
CONTROL FUNCTIONS
Ail., Elev., Rud., Throt.
BASIC MATERIALS USED IN CONSTRUCTION
Fuselage Balsa, Ply, Spruce
Wing Balsa, Ply, Spruce
Empennage Balsa
Wt. Ready To Fly 64 Oz. (4 Lbs.)
Wing Loading 15.36 Oz./Sq. Ft.



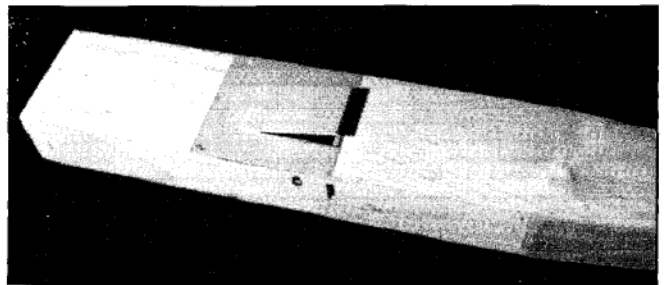
When building the prototype, we made the center top longerons full length as was the full-scale plane. Later, when adding the servos and fuel tank, they were removed in this area. Plans show changes.



1/8" lite ply sides were added back to the first angle, then 1/8" balsa back to the empennage. The hole for the wing tongue shows at formers F4-F5.



Four Futaba servos are installed, the forward one is for the ailerons. The root rib template is used for drilling the holes in the sides of the fuselage. The forward hole is for the aileron pushrod, the rear hole is for the wing stabilization dowel.



The bottom center sheeting is lite ply. The hatch cover allows access to the aileron servo for wing installation/removal.

add the 3/16" balsa longerons from F-6 back to F-8 and beyond.

Drill all holes in the fire wall for engine mount, throttle pushrod, and fuel lines, and insert blind mounting nuts. Glue the fire wall and all formers in place. Add the bottom crosspieces back to the aft end. Glue all top longerons in place and add vertical spacers. Glue in top crosspieces. Crosspieces and vertical spacers are made from 3/16" sq. balsa.

Using 1/8" lite ply, make the right and left fuselage sides which extend from the fire wall back to former F-6. Glue in place. Continue sheeting with 1/8" balsa from F-6 back to the tail.

From two 1/8" x 4" x 36" medium balsa sheets, cut the fuselage top and bottom. Cut the opening for the fin in the top sheeting and add the 3/8" triangular stock gluing doublers. Remove from the plans and add the bottom sheeting. Add all 3/8" triangular stock corner braces behind the fire wall,

even the top one. Place the 3/16" aircraft ply landing gear anchor block between formers F-1 and F-2, and install the throttle pushrod. Add the fuselage top sheeting.

Decide upon the size of your fuel tank and cut the opening in the fuselage top. Insert the tank and allow the brass fuel lines to stick out 1/16" past the fire wall. Add foam around the fuel tank. Replace hatch cover over the fuel tank and glue in place. If in an emergency, it is necessary to remove the tank at some time, an opening may be cut in the fuselage bottom sheet for this purpose. Then replaced, glued, filled, sanded, and recovered.

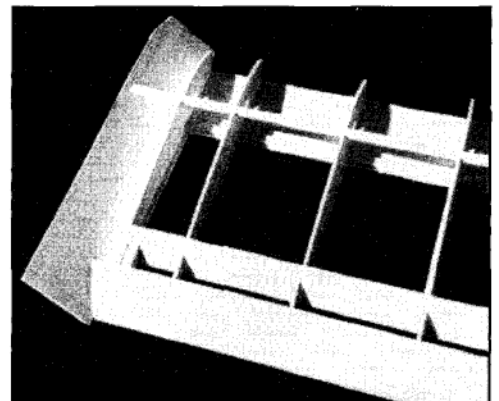
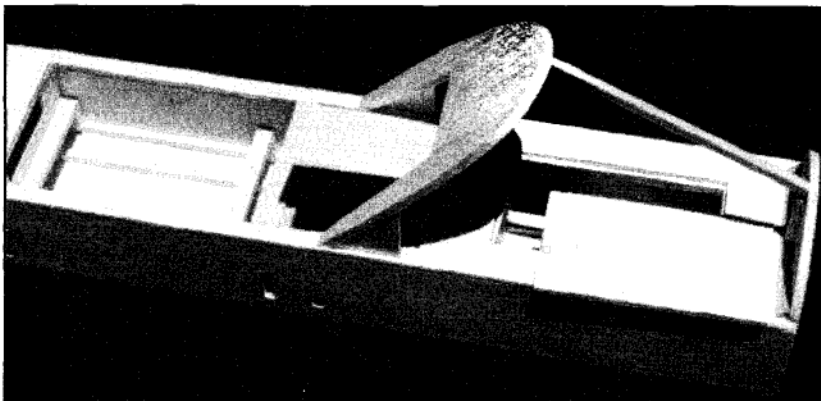
Cut an opening in the fuselage top above aileron servo and install the servo using the plastic mount which came with your radio for this purpose. Install the screws into scrap plywood glued in place. Remove the servo, there will be room enough to insert it later when putting all servos in place. Not shown on the plans is a rectangular hole in

the forward area of this hatch cover. All servo and radio wires from the cockpit area pass through the top of formers F-4 and F-5 and out through this hole into the forward cowl area where the receiver and battery are located.

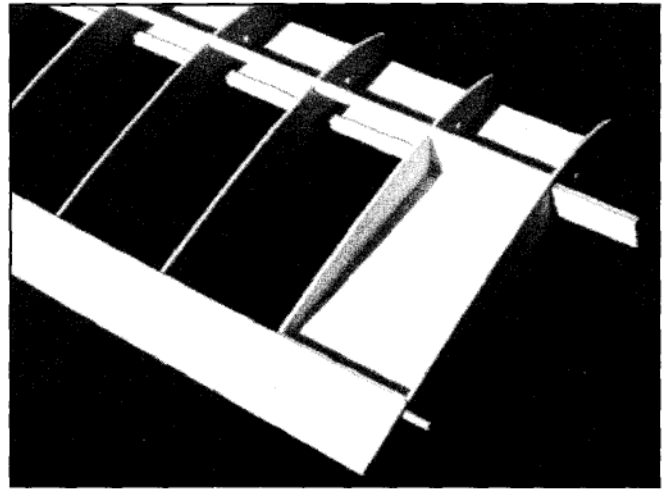
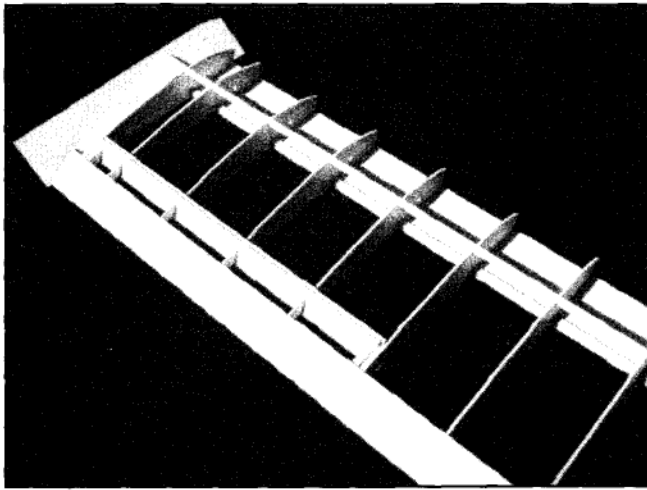
Cut around and remove the hatch cover at cockpit area. We used the servo tray which came with our radio and glued cross braces as shown on the plans as stays. Locate your servo tray and screw in place.

Add all formers to the surface of the fuselage top, make sure to add the triangular stock between the fuselage and formers F-12, as the gluing surface between the down legs and the fuselage is minimal. Run the 1/4" sq. balsa longeron for the cowl. On the rear turtledeck, add the 1/4" sq. and the 3/16" sq. longerons, and glue.

We had to replace both the front cowl and the turtledeck balsa sheet coverings on our model; we used contest balsa which was just too soft, so use a medium grade balsa.



Left: All pieces of the top longerons have been removed for access to the fuselage. Servo mounts are shown in the rear compartment, and front hatch cover is shown. Front cowl formers are in place and sanded to the proper angle. Right: Left wingtip is glued in place. Leading edge spar will be added next so it can be faired into the wingtip.



Left: Aileron is yet to be cut apart. Sheeting over last two ribs out to the wingtip must be added. Note holes in each rib for aileron pushrod. Right: Wing tongue is built into left wing and doubled on both sides with lite ply. Wing stabilization dowel has been added and doubled in place.

There is a dotted line drawing on the plans for the front cowl covering, and another, not to scale drawing that shows how we got the covering out of 1/16" sheet balsa. The glue on this sheet was allowed to dry thoroughly then it was wet down with hot water, bent over the form and held there with masking tape. Remember, the ends of the tape must be attached to dry balsa. When balsa is dry, trim to shape and glue in place.

It was nice of Mr. Livesey to make the sides of the turtledeck flat. Cut the top curved surface to shape from 1/16" sheet balsa, wet and tape in place. When dry, glue then sand the edges flush with sides. The sides may be covered with flat sheet balsa.

Empennage:

Probably the simplest part of the whole plane. Cut both sides of each part of the empennage from 1/16" sheet balsa. Lay one of each down over the plans and pin in place. Glue all the 1/8" x 3/8" and other balsa pieces in place. When dry, remove and sand. The fin and stab are sanded flat, the rudder and elevator are sanded to a taper which extends from the leading edge to the trailing edge. Place each on a flat surface

and glue on the other side. We used small pieces of ply and weights on them until the glue had set. This method sure makes a warp free set of tail surfaces.

Wing:

We made a wing rib template from 1/32" aircraft ply, all ribs were cut from 3/32" sheet balsa using this template. All 22 ribs are originally the same. A second template was made identical to the first except for spar notches and holes for the aileron pushrods and wing stabilizer dowel. Use this template to cut notches and holes in all ribs. Set aside four ribs as ribs W-1 and W-2 and cut a hole for a 3/16" dowel which stabilizes the wing.

Cut ribs W-7 through W-10 as shown for aileron ribs. From 3/16" balsa, cut two each W-12 and W-13 ribs to match the trailing edge section of the aileron ribs.

From 1/16" sheet, cut the bottom leading edge, trailing edge, and center sheeting. If your workbench is long enough, you can build the whole wing at once. Cover the plans with wax paper and pin the sheeting in place. Leave the trailing edge sheeting in one piece. Cut the bottom rib capstrips to

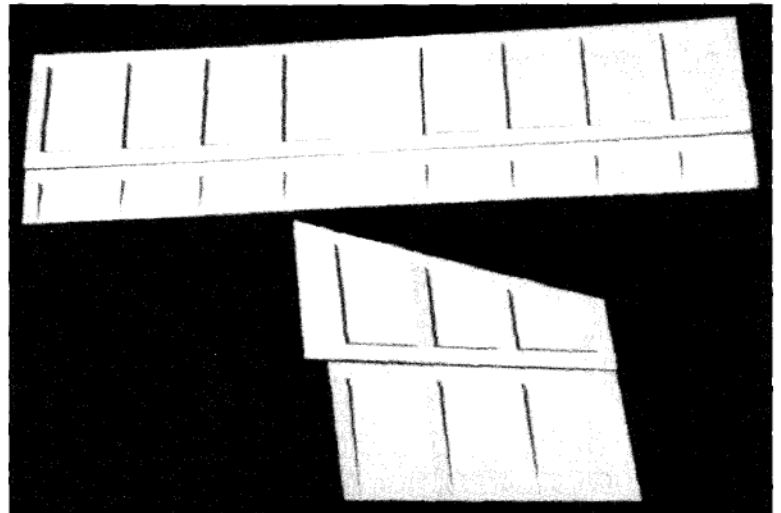
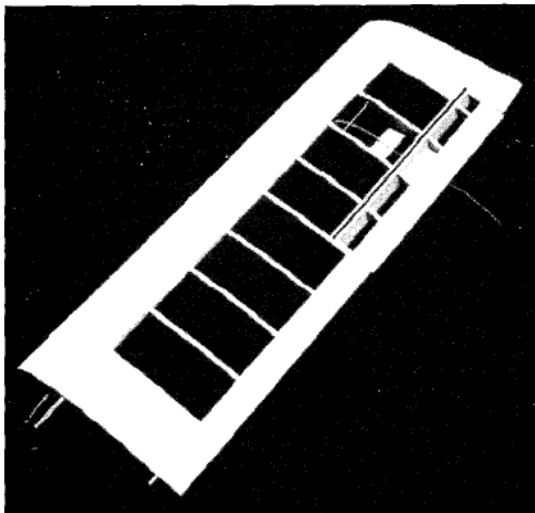
length and glue in place.

Cut the 1/8" x 1/4" spruce bottom spars to length, then glue and pin in place on the bottom leading edge sheeting. Glue all ribs in place. Right now, glue only the front sections of the aileron ribs. Be sure to angle the root ribs using the jig shown on the plans. Cut to length and bevel the inner and outer ends of the spruce top wing spar, then glue in place.

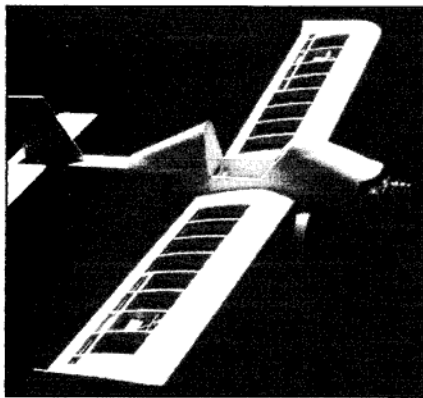
Cut two rectangular wingtips from 3/32" sheet balsa 2-1/8" x 10". Locate wingtip drawing on plans, bevel bottom edge to match, and glue to the bottom of rib W-11 and against the outer end of the main top spar.

The 5/8" x 3/4" leading edge stock is manufactured by Sig and the backside matches the bevel cut on each rib. Sand both ends of the wing; the inner to match the root rib and the outer to match the wingtip. With the bottom edge resting on the workbench against the bottom leading edge sheeting, glue the forward edge of each rib.

Remove the wing halves from the workbench and cut a 3/16" x 3/4" rectangle from the root rib between the spars. Make two



Left: Completed right wing panel. Ailerons are separated from wing, and all surface sheeting has been added. The pushrod (cable) runs through the wing and out the bottom to the aileron. Right: The empennage surfaces are made from 1/16" sheeting, then doubled in the interior with 1/8" sheet strips. Prior to adding the top sheeting, the rudder and elevator were beveled and sanded.



Ready for covering.

wing tongues 5" long and 3/4" wide from 3/16" aircraft ply. Insert one of these tongues in each wing half so they lie exactly between the two spars. If necessary, sand a bit to get a perfect fit. From scrap 1/32" ply, cut four pieces of filler which is glued to each side of the wing tongues. Next, make four pieces of webbing from 1/8" lite ply and glue a pair to each side of the wing tongue between ribs W-1 and W-2.

Cut two pieces of 3/16" dowel 3-1/2" long and insert and glue in the holes in the trailing edges of ribs W-1 and W-2. Allow 1/4" to protrude through W-1. Double the dowel.

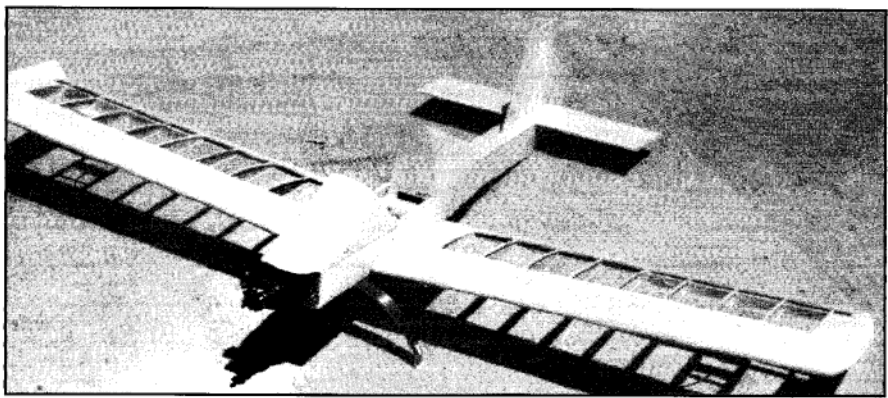
Ailerons:

Work both wing halves at the same time. Cut a piece of 1/8" sheet balsa 3/4" wide to fit between the trailing edges of ribs W-6 and W-11. Glue in place and to the ends of W-7 through W-10.

Cut another piece of 1/8" sheet balsa 1" wide. See the end view of the wing rib, sand or plane the bottom edge of this piece to the angle shown. Cut to length and pin in place. fit the lower capstrips between the trailing edge sheeting and this piece. Add the aileron ribs, trim, sand, and glue in place.

At this time add ribs W-12 and W-13 to each end of the aileron. Plane or sand the aileron until it fits into the wing. Cut the ailerons from wing.

Add the remainder of the webbing using



1/16" x 3" sheet balsa with the grain vertical; glue in place. Glue a piece of 3/32" sheet balsa, W-14, between ribs W-8 and W-9 as shown on the plans. Remove from the plans.

Next, run the aileron pushrod. We used steel cable inside an outer tubing. Run it through each of the rib holes in the forward part of the wing. You will need new holes in ribs W-7 and W-8 so the tubing can go up and pass through a hole in the webbing as close to the top spar as possible, making it have a downward angle when it passes through W-14.

Remove the cable housing and rough sand its full length. Allow 1/2" to extend beyond the root rib and the same for the other end. Glue in place to all ribs, the webbing and W-14. When dry, cut the outer end of the tubing flush with the bottom of W-14. The cable should exit the outer end with an angle that would cause it to meet the last hole on a small aileron horn.

Return the wing to the workbench and add the top leading edge sheeting. Butt it against the rear corner of the leading edge spar and bevel so it fits flush against the wingtip. Add the center sheeting and capstrips.

The tip sheeting must be assembled by gluing strips of 1/16" sheeting together edgewise. It runs from the top of W-10 out to the wingtip. It also runs from the leading edge sheeting back to the aileron. A small

piece at the end of the aileron is cut and sanded to fit. The curve shown on the plans is approximate and the sheeting must be bevel sanded to fit flush against the tip. Round the front wingtip corners.

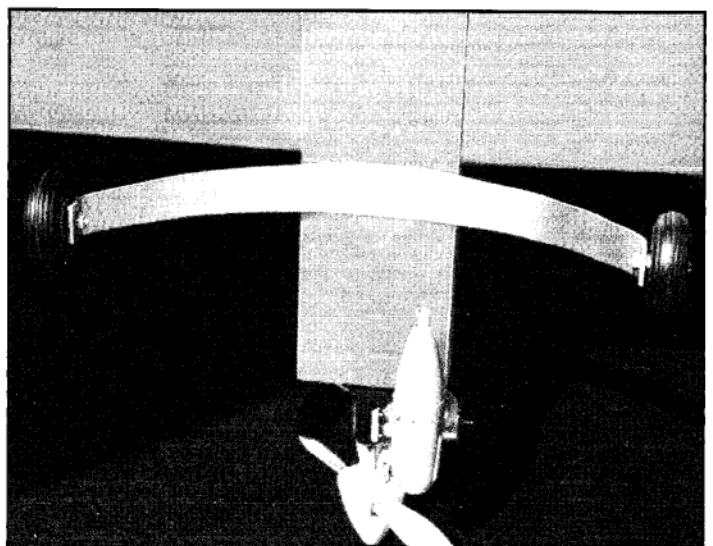
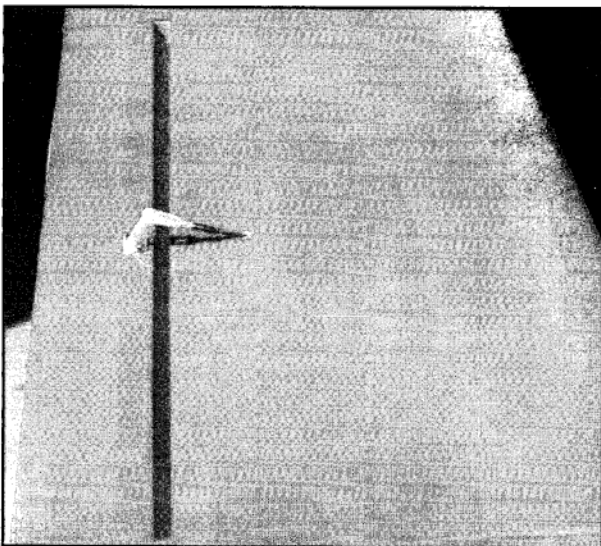
Landing Gear:

We used a standard landing gear 1-1/4" wide, with a 12" spread and 5" high, and added the curve by bending it around a small Club aluminum sauce pan. The wheel tabs were then straightened out using a vise. The flat at the top was not as wide as the fuselage, but the laminated ash landing gear on the original didn't seem too flat on top either. The plane sits 5" off the ground using Du-Bro 2-1/4" diameter wheels.

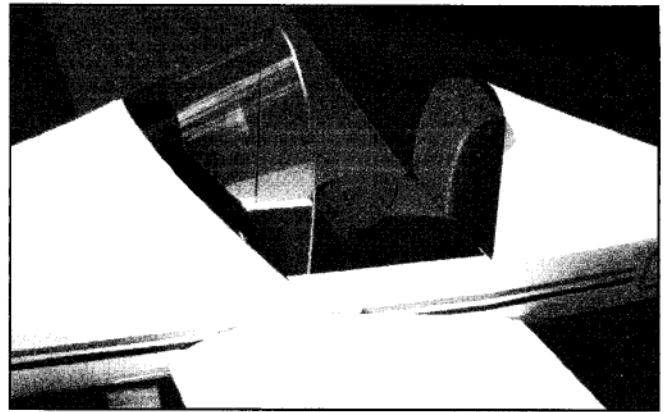
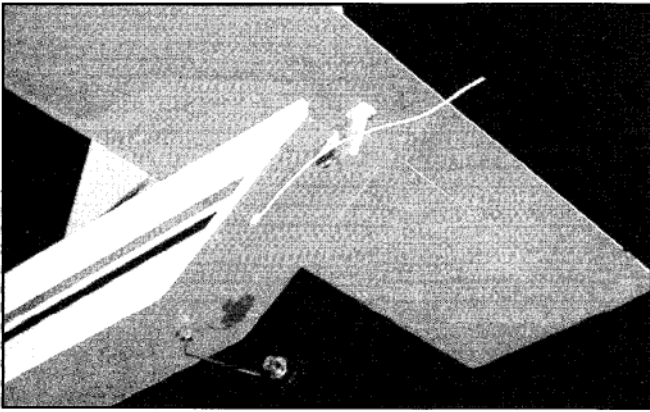
Finishing Touches:

Install the rudder and elevator pushrods. The rudder pushrod exits alongside the fin through the top sheeting, and the elevator pushrod exits the rear of the fuselage. Do not sheet in the rear of the fuselage until you run a piece of tubing for the antenna and balance the completed airplane; we had to add a bit of lead in the tail for balance and this is a good place for it.

Open a 3/16" x 3/4" rectangle in the side of the fuselage for the wing tongue. Drill the holes for the aileron cable and the wing stabilizing dowel. This should allow the wing to be joined to the fuselage. Put the plane on a long flat surface and measure the dihedral. This should be 2-1/4" under each tip. If you can wiggle a wing half up and down as we



Left: Aileron cable and horn. Right: The bowlegged landing gear was bent from a standard landing gear using a Club aluminum sauce pan held in a vise as a jig. The muffler exits on the bottom, keeping most of the plane clear of oil and goo.



Left: Elevator pushrod exits from the center of the fuselage, the antenna tube from the side, and the tail wheel from the bottom. The sheet that covers this end of the fuselage is practically the last thing added, even after covering. **Right:** The pilot's seat is cut from a large pill bottle, the cushions are carved from foam with an electric meat slicing knife. The power switch is a map pin and a wire which runs to the main switch.

did, we found we could vary the dihedral quite a bit. We glued tiny strips of 1/64" ply on the top or bottom of the wing tongue until the fit was tight and the dihedral was the same under each tip.

Solder a clevis to the inner end of both aileron cables. The vane with the pin was removed from one clevis. The clevises were linked together then attached to the servo tab. For access at the field when you are ready to assemble the plane, there is an opening cut into the bottom just under the aileron servo. This hatch cover is held in place by a tab and a screw.

Solder a threaded end on the cable where it passes through W-14 and screw on a clevis and attach it to the aileron horn. This should complete the wing. Hinge all moving surfaces. Put horns on the rudder and elevator, then run the pushrods from the servos back.

Temporarily install your engine, muffler, and throttle pushrod, add the wheels to the

landing gear. Push the battery all the way forward into the front cowl and slide the receiver in behind it. Place your fingers under the wing spar and see if the plane balances. If it doesn't, try moving the battery to attain the proper C.G.

We built a battery box from 1/8" and 3/16" sheet balsa up against F-10 to keep the battery in place. A thick chunk of foam was wedged against the battery to hold it in place. The receiver was placed just behind the battery and wedged in place with another chunk of foam. The antenna was routed through the radio compartment and into a tube that runs back under the empennage. Once all of this was located in the fuselage and the balance was obtained, we closed in the rear of the fuselage.

Covering:

All of the underside of the plane was covered with dark red 21st Century Space Age Film, the top surfaces with white Space

Age Film. The trim strips, and letters designating English registration was cut from this same film. Black was used in the cockpit. The fire wall and under cowl were painted with white Space Age Primer and Paint. All of these products were produced by Coverite. If you use Space Age Film, read and follow instructions exactly for a perfect covering job.

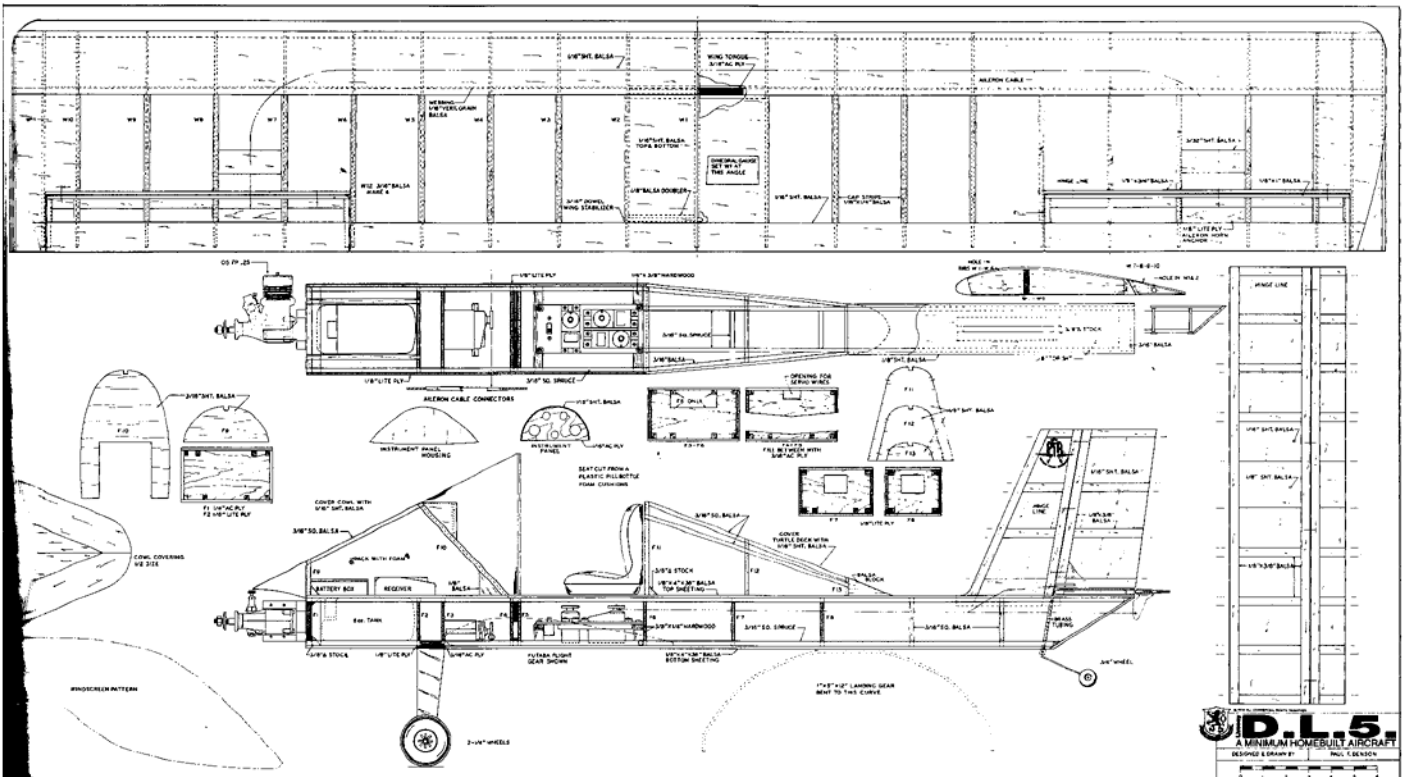
Engine:

We tried three different engines on our model, a Royal 28, an O.S. 32, and an O.S. FP25. Propellers used were Rev-Ups 9 x 5 and 9 x 6. All three engines were more than enough to fly the D.L.5.

For scale flight we are sure you could use a .20. Because of the necessity to change engine mount screws and blind mounting nuts we did not go that small.

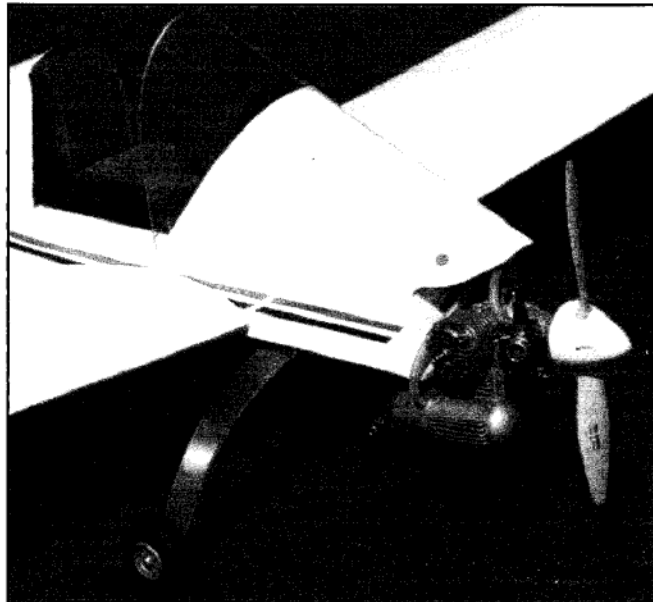
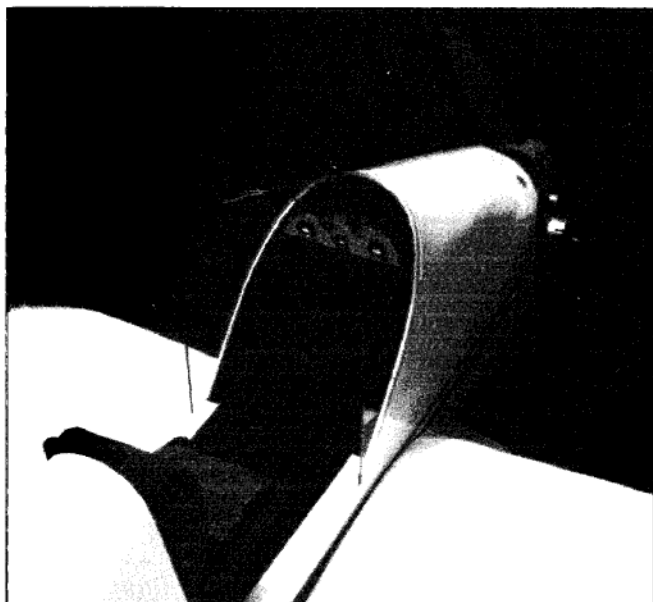
Before you use a 4-stroke engine, it would probably be necessary to move the

Continued on page 60



L SIZE PLANS AVAILABLE - SEE PAGE 205





Left: The instrument panel is 1/32" plywood. Detail as much as you desire. Right: One of the three engines used, an O.S. 32. Beauty patch covers access hole to muffer screw.

Continued from page 57

fire wall back in order to get the plane to balance properly.

Radio:

Our radio is a Futaba FP-5UAP PCM 1024 System using an FP-R129DP receiver and four FP-S148 servos. The servos are located in the cockpit area with wires running forward and up under the cowl. The antenna returns back into the cockpit area

and through the whole fuselage in an antenna tube, and exits under the stabilizer.

We had thought about flaps like the full-scale, but there just wasn't enough room for another servo.

Flying:

We balanced the D.L.5. at the wing spar. The ailerons were set at 5/8" up and down, high rate and 3/8" low rate. The elevator was set at 3/8" high rate and 1/4" low rate. The rudder 3/4" each side of center.

The first group of test flights were done using the O.S. 32 as the power plant. Due to the fairly long aft fuselage moment arm, taxiing was done quite easily. We turned at the lower end of the field and gradually fed in power until the plane lifted from the runway on its own.

When well clear of the ground, we throttled back to about half throttle and flew the perimeter of the field, adding a tad of trim; then a few more turns to become acquainted with the plane. Next we added more throttle and climbed to a comfortable altitude and tried a few maneuvers.

Rolls are a very large barrel type, even on high rate. Loops were acceptable as was our favorite maneuver, a Cuban eight. There was no problem with inverted flight. We are sure the full-scale plane was not intended for maneuvers like this, so we tried nothing more difficult.

Landings were a breeze, the D.L.5. came in over the lower end of the runway and floated up to where we were standing and dropped in light as a feather.

Flights with the other two engines were similar, but where we had flown around the sky on 1/3 throttle with the .32, it was neces-

sary to increase the throttle a bit with the other two. We allowed other members of our club to get in a bit of stick time and all were impressed.

If you have some stick time on a high wing aileron trainer, you will have absolutely no difficulty flying the D.L.5., it has the stability of a high winger. If your time on the high winger was with a trike landing gear, you will need a bit of instruction on how to accelerate down the field without the plane turning left due to torque. Use a bit of right thumb on the rudder.

Conclusion:

The D.L.5. has a few bits of construction which are not standard, particularly hooking cable to the aileron servo and running this cable to barn door ailerons. It is not difficult, just a little different. The wing tongues which affix the wing to the fuselage is also a little different. We did not want to build a one piece wing because too much of the fuselage would be cut away to form the wing saddle. Second, the full-scale plane had a two-piece wing.

We have had a number of comments on the beauty of the D.L.5., in fact, we don't believe the word beauty was ever used, more like repulsive. That is okay with us, we think it is so ugly that it is cute. We love it and are sure you will too.

Editors Note: The PFA International Air Rally is a gathering of like-minded enthusiasts and light aircraft. While it is of special interest to those who would like to own, maintain, or build their own aeroplane, it also provides the visitor, whether by air or road, the opportunity to see the largest gathering of light aircraft outside the USA. Many of the aircraft that visit the Rally are fine examples of home-built or rare vintage aircraft, these will be competing for the various prestigious awards given at the Rally. The event is usually held in July. For additional information, contact: The PFA Head Office. Phone number from U.S.: 011-44-237-461616.



**From
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