Kathie Wickman of Greenbelt, Maryland, showing off the Dart.

CULVER DART

Tom Mountjoy is the same born again tail-dragger who gave us the Seabee Amphibian construction article in our January 1977 issue of R/C Modeler. Tom has again wrought the unusual with this rendition of the relatively unknown "Culver Dart." While the Dart has been overlooked for years by the sophisticated model builder, its high wing factory companion, namely the Monocoupe, has enjoyed immense popularity.

Photos By Tom Mountjoy

To you fans who are following the current fad of looking up your ancestors, let me say right here and now, the little Dart has its share of "Roots". Back in 1935, Al Mooney, then Chief Engineer of the Lambert Aircraft Company in St. Louis, Missouri, created the Dart as a low wing stablemate to their Monocoupe. Al is the same Mooney who followed with such well-known designs as the Culver Cadet, Mooneymite and the current line of Mooney Mark 20 and 21 airplanes. All are high performance low wings and are direct descendants of the "Culver Dart".

When the Dart was originally designed in late 1935 at the Lambert factory, it was known as the Monosport "G". Towards the end of 1937, sportsman Knight Culver Jr., then a salesman at Monocoupe (name changed to Monocoupe Corp. in October 1936), took the opportunity of buying the manufacturing rights to the Dart for $30,000.

CULVER DART
Designed By: Tom Mountjoy

TYPE AIRCRAFT
Stand-Off Scale Low Wing
WINGSPAN
59 Inches
WING CHORD
12 Inches
TOTAL WING AREA
576 Square Inches
WING LOCATION
Low Wing
AIRFOIL
Semi-Flat Bottom
WING PLANFORM
Constant Chord
(Elliptical Tips)
DIHEDRAL, EACH TIP
4½ Inches
O.A. FUSELAGE LENGTH
38¼ Inches
RADIO COMPARTMENT AREA
(L) 9½" X (W) 6½" X (H) 3"
STABILIZER SPAN
18 Inches
STABILIZER CHORD (incl. elev.)
7½" (Avg.)
STABILIZER AREA
135 Sq. In.
STAB AIRFOIL SECTION
Flat
STABILIZER LOCATION
Top of Fuselage
VERTICAL FIN HEIGHT
9½ Inches
VERTICAL FIN WIDTH (incl. rudder)
6" (Avg.)
REC. ENGINE SIZE
.35 — .45 Cubic Inch
FUEL TANK SIZE
8 Ounce
LANDING GEAR
Conventional
REC. NO. OF CHANNELS
4
CONTROL FUNCTIONS
Rud., Elev., Ail., & Throt.
BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	Balsa & Ply
Wing	Balsa, Ply, Spruce & Basswood
Empennage	Balsa & Spruce
Wt. Ready-To-Fly	96 — 112 Oz.
Wing Loading	13 — 18 Oz/Sq. Ft.

ABOVE: Full size "Dart" owned by David S. Foulke of Spring House, Penn. He has spent about 2 years on this major restoration. It is pictured before its final paint scheme.

For the transaction, he was given the prototype airplane, parts for three more, plus all the tooling. Culver incorporated as the Dart Manufacturing Company and moved the whole works to a hangar factory at Port Columbus, Ohio in the spring of 1938. It was rumored that Culver lured Al Mooney to Columbus with a deal he could not refuse.

In early 1939, the Dart firm changed its name to Culver Aircraft Company. The forty-ninth, and last, Culver-built Dart was delivered in 1940. By this time, Mooney had completed certification of another revolutionary design — namely, the Culver Cadet (RCM plan #454).

While I have never owned a Dart, your author did own a Culver Cadet back in 1945. It was the many enjoyable hours of flying in the Dart's offspring that spawned the inspiration resulting in this construction article.

Back in July of 1938, there was an epic 50 thousand dollar race between a

Culver Dart and a Monocoupe 110 Special, but that is another story. (What a great idea for an R/C old timer event!) It was a photo finish with both planes averaging 163 miles per hour — an unheard-of speed from a 145hp engine in the 1930's!

If model builders are reluctant to tackle a scale airplane design, there is usually a good reason. In the case of the Dart, I believe the reason was basically that the airplane is short-coupled and, therefore, somewhat tricky to fly. Rumor had it that the real Dart suffered from the same characteristic, which also accounted for its outstanding aerobatic ability. The popular Pitts Special is a prime example of the same type configuration, with world aerobatic trophies to prove the point.

In order to make this model of the Culver Dart a good R/C flyer that anyone can enjoy, and without detracting from its appearance as well as aerobatic maneuverability, I have lengthened the fuselage by 3.5" and added 1/2" on the height of the vertical tail. This is the only deviation from a true two-inch scale version of the real Dart. If anything, the airplane model takes on a more graceful and pleasing appearance. I am certain there were times when the Culver people wished they could have done the same thing without going through the expense of getting a new type certificate!

Constructing the Fuselage

This model has been carefully designed in order to keep the overall construction basically the same as that of the real Dart. You will find balsa sheet to represent metal covering back to the aft cockpit bulkhead. From there on, you have fabric covered stringers.

The first step after cutting out all the bulkheads is to glue each one in its proper position on the 1/2" square balsa rod. Make certain the rod is straight and from rather hard balsa. The rod acts as a jig that controls how true your fuselage will be when you finish.

When gluing the 1/8" x 1/4" stringers, do the side ones first, alternating from side to side in order to hold the proper alignment. Notice that the side stringers run the entire length of the fuselage. Also, that from the aft cockpit bulkhead to the firewall, there is a 3/32" relief cut made on the outer side to each stringer to accommodate the balsa side panels to be added later in that area.

The aft (top) stringers are positioned next. Be sure to use hard, but good bending, balsa in order to maintain the proper curve to this section of the fuselage. These stringers are secured right on top of the bulkheads and are equally spaced as shown on the plans. The top one goes on first.

Using 3/32" medium grade balsa, cover the outside of the forward section of the fuselage. The inside of the cockpit from the firewall to the aft cockpit bulkhead is lined (between bulkheads) with 1/16" plywood sheet. This forms a strong box-type construction to protect your radio gear from unscheduled landings.

In fabricating the cockpit and firewall bulkheads, you will see that the plywood in each case is backed up with balsa. This is done to save weight, to have the thickness required for the proper scale appearance, and to give a more secure glue joint. Stay away from warped plywood.

After framing up the fuselage, you are now ready for the test of your balsa carving ability. The bottom section between the firewall and the leading edge of the wing is made from balsa block. Use a good grade of carving balsa, not too hard or soft. After carving the outside of the block to the desired shape, hollow out the inside to a wall thickness of about 3/8". The last major step is to cut the relief radius for receiving the leading edge of the wing center section. Your receiver and batteries will fit snugly in the hollowed out area when you come to the home stretch.

Do not glue the above masterpiece in place until the last stage of total construction. Having it removable will allow you to install your fuel tank and engine mount with a minimum of difficulty. In addition, this block controls your wing alignment.

You will probably wonder about that 1/2" balsa rod going through your cockpit. Leave it there until the fuselage is complete, then cut out as shown. Leave just enough in the rear cockpit area for mounting your pilot platform, which is made from 1/16" plywood.

Wing Construction

One of the interesting features of the Dart is the wing, which is truly a thing of beauty. In the good old days, the Dart was known as "that handsome little plane with the elliptical wing."

It is a good idea to study the wing plan carefully before starting construction. There are two areas that require special attention. One is the center section (because of the landing gear mounting structure), and the other is the taper on the bottom surface of the outer wing panel. Note that the top surface of the wing is a straight line.

After cutting out all of the wing ribs, you are ready to assemble them on the front and rear spars which are made up of top and bottom beams. The front beams are made from 1/4" x 3/8" spruce and the rear ones are the same size in hard balsa. Since the lower beams are rather complicated, a full size layout of the spar assembly has been included in the plans.

Assemble the ribs to the lower beam first and then add the top beam, thereby completing the spar structure. The Dart wing is purposely designed strong because it is fully cantilever as well as aerobatic.

The wing tips are cut from a light grade of balsa block with hard balsa used on the leading and trailing edges. After the wing has been fully framed, you are ready to join the two halves. If the spar beams have been accurately cut, the proper dihedral will be automatic. However, it is still advisable to measure the dihedral against that shown on the plans.

As you can see, the landing gear main strut is well forward of the front wing spar. This location requires an added box reinforcing structure from the main gear longitudinal back to the front spar. This is done to transfer the landing load back to the wing spar where it is normally found. Because the wing rib cut-outs accommodating the landing gear are sizable, it is recommended that the cuts be made after the wing is roughly assembled. Once the 1/16" plywood reinforcement is secured in its proper location, the structure is quite adequate.

The final steps involve covering the leading edge with 1/16" balsa sheet, prior to adding the capstrips to the bottom and top of each exposed rib.

Tail Surface Construction

If you're in a hurry, and can find just the right grade of 3/8" balsa sheet, the tail surfaces can be made solid. However, because the Dart stabilizer is relatively large, and to avoid tail heaviness, I preferred to build up the various surfaces. To simulate the real fin and rudder, I chose not to cover these surfaces with balsa sheet. Since the stabilizer is large, and to prevent warpage, it should be framed up, then covered with light 1/16" balsa. The elevators can be cut from 3/8" balsa sheet, although here again — to keep them light — I made a core from 1/4" sheet (complete with lightening holes) and then covered with 1/16" sheet. An X-Acto hole cutter blade in your drill motor does a nice job, if kept sharp.

The main spars of both the fin and stabilizer are cut from 3/16" basswood or spruce, as these two members carry the load. The rudder spar can be made of balsa to keep it light. I found the Goldberg hinge cutter works very well with basswood.

As a final step in completing the tail assembly, be sure to sand a well rounded, fine taper, to the leading edge of the stabilizer. This will give a more graceful appearance to an otherwise large flat surface. On airplanes designed in the 1930's, many of their tail surfaces were fabricated from welded tubing, with little effort (or expense) given to an airfoil cross-section.

Engine Cowling Construction

The engine cowling is straightforward and constructed mostly of balsa. The nose section is shaped from two rings of 1/4" balsa sheet stock glued cross-grained for added strength. The inner structure and rear ring is made from 1/8"

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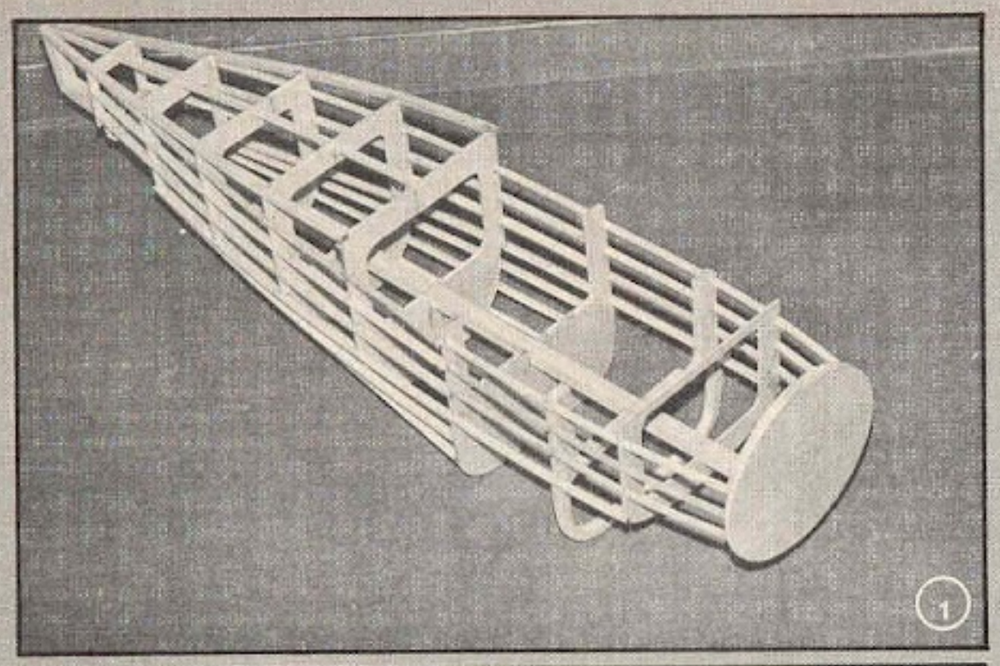
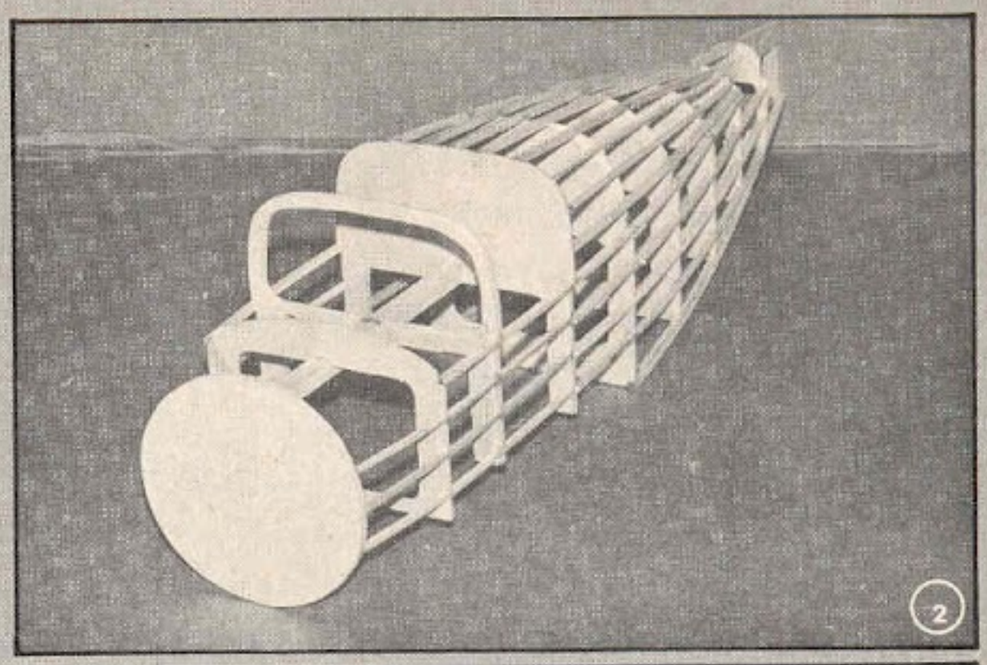
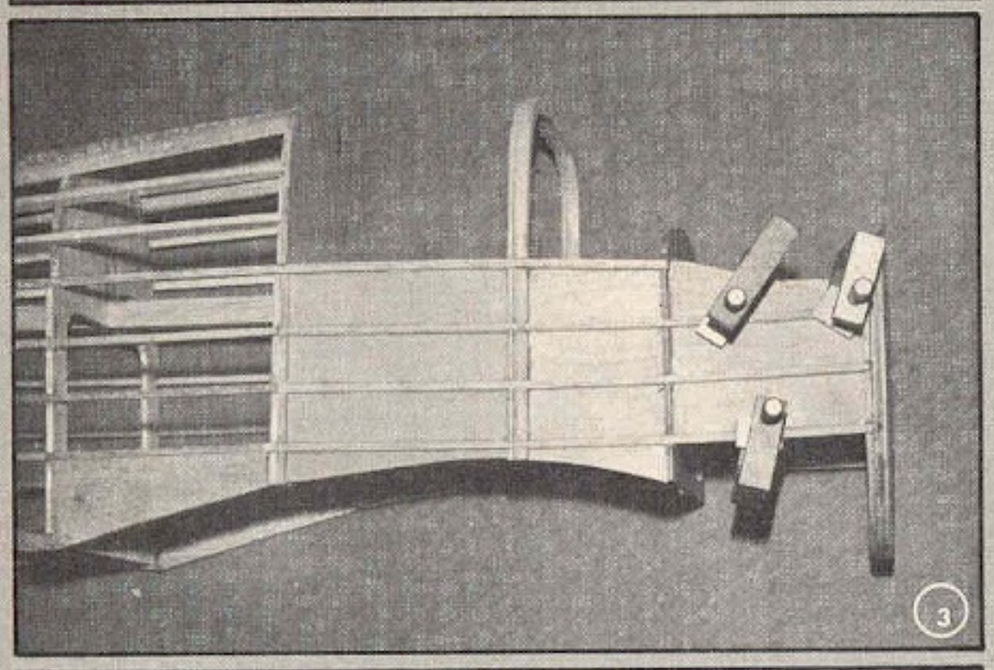
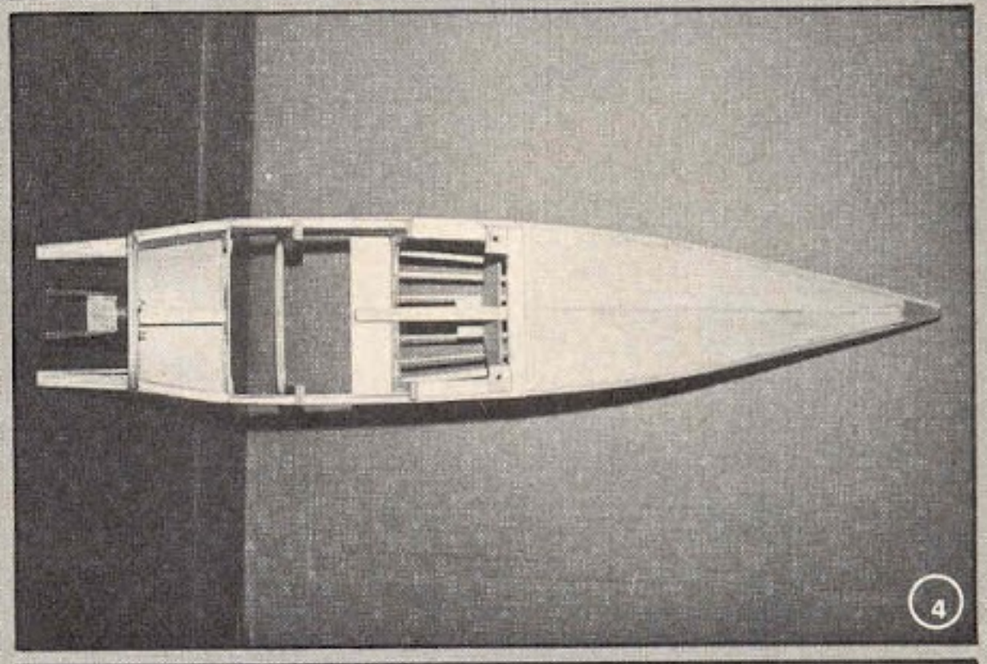
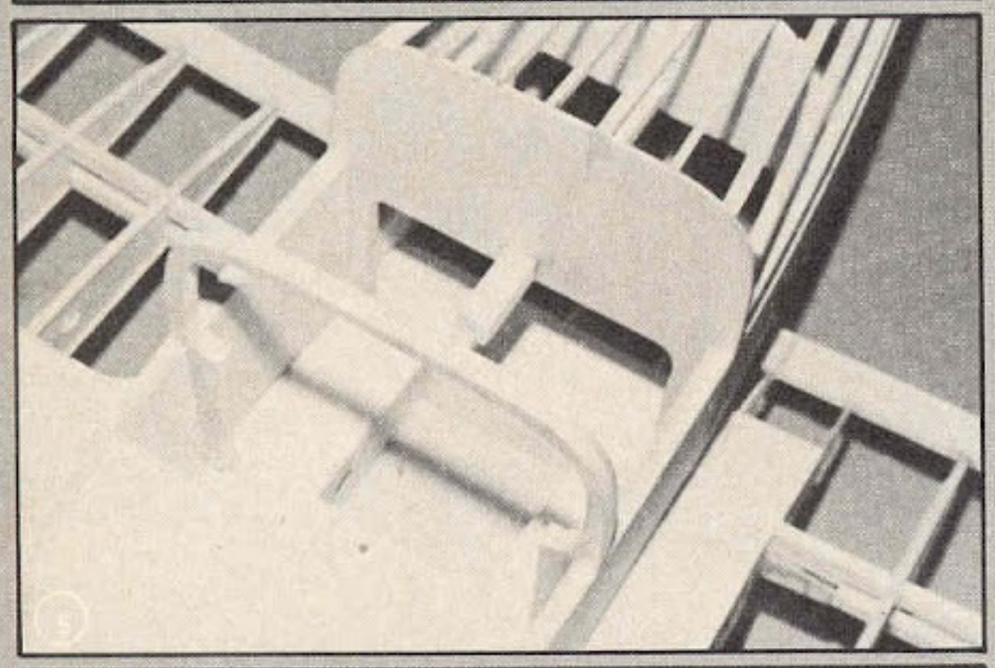
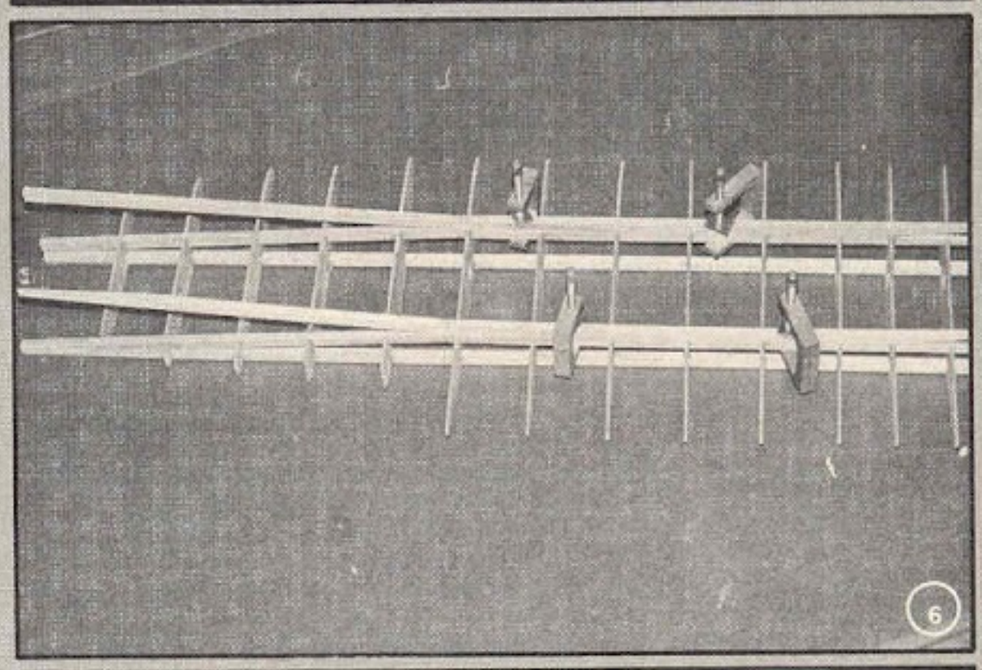


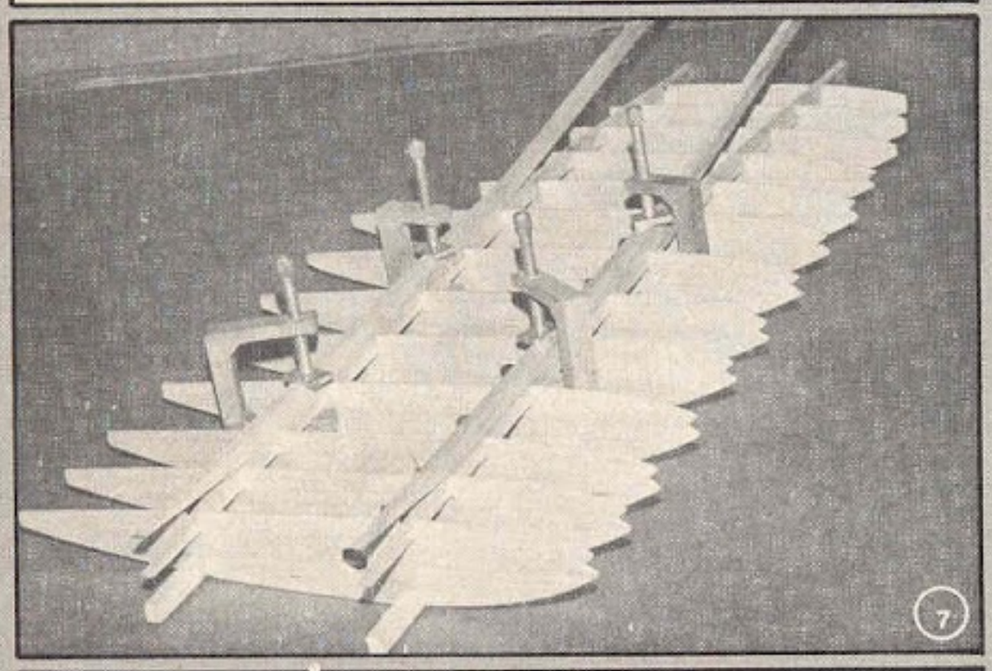


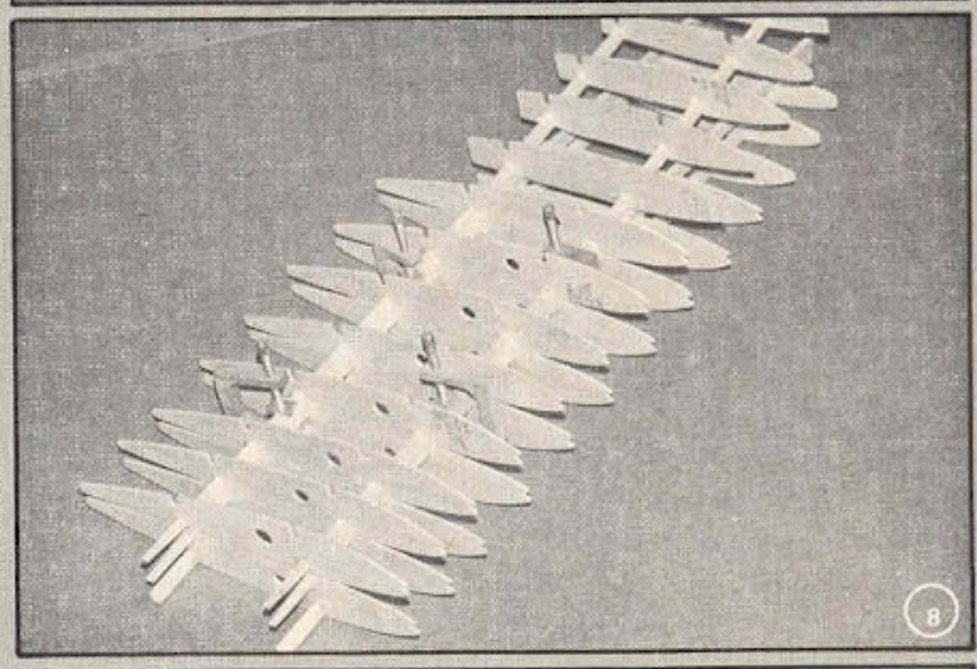


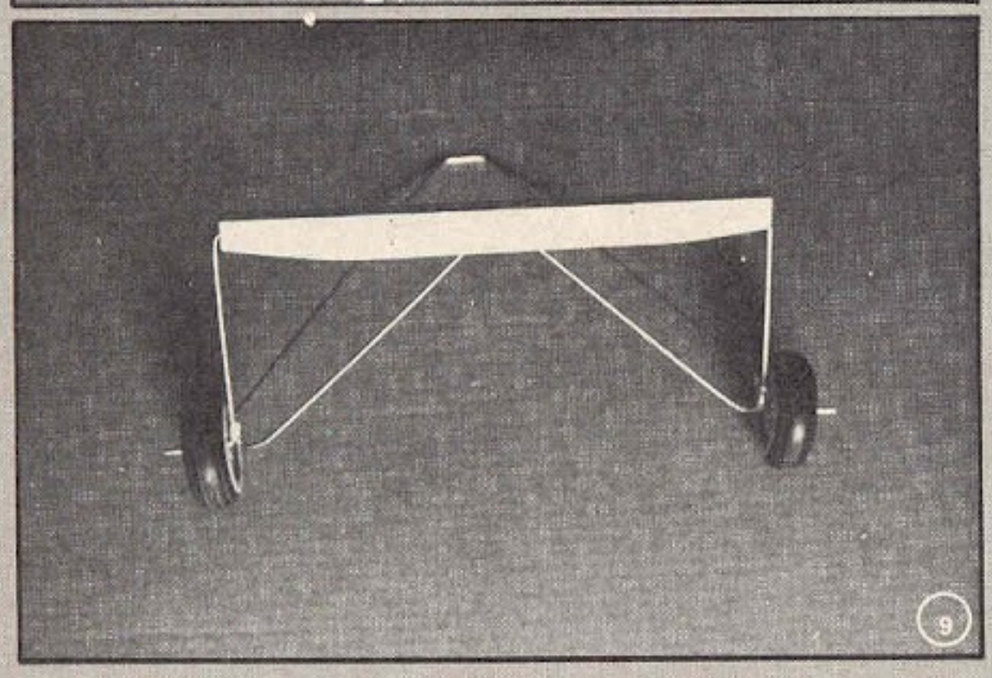






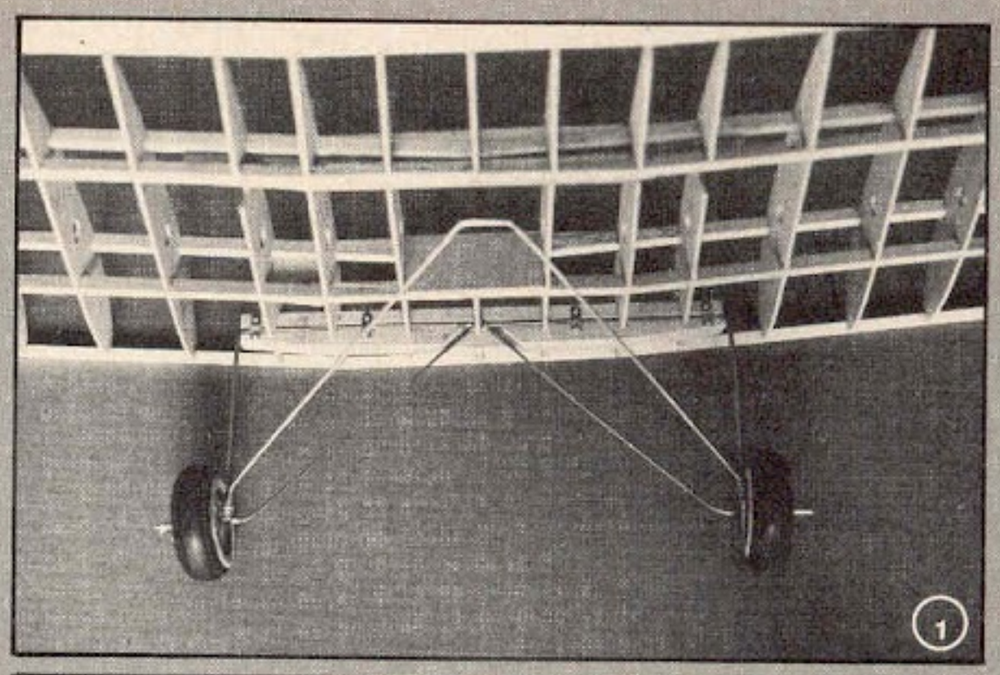


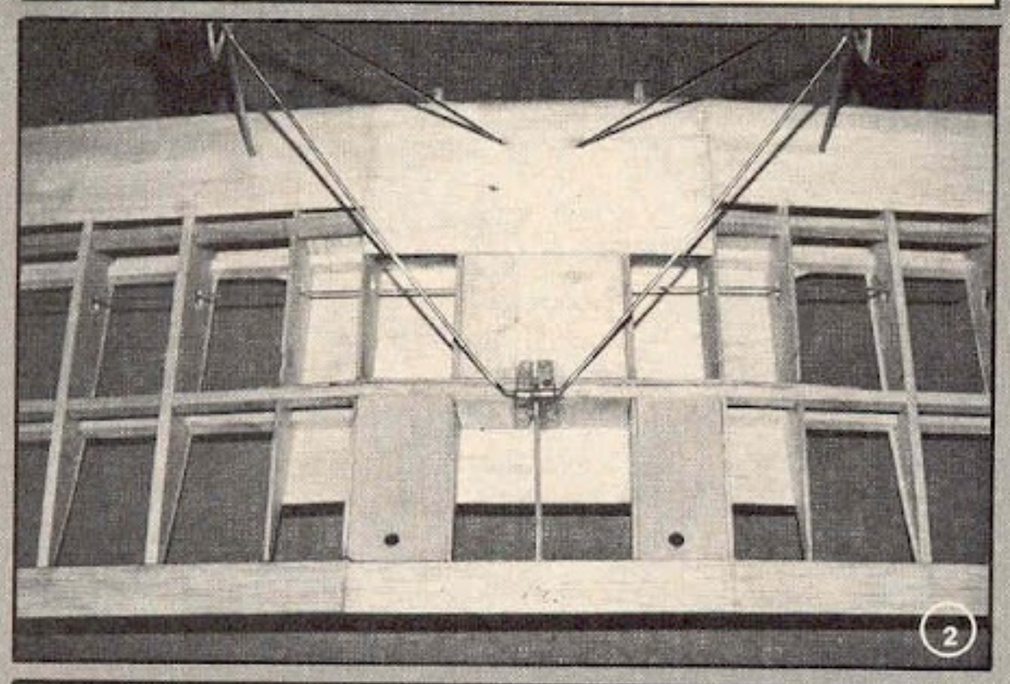


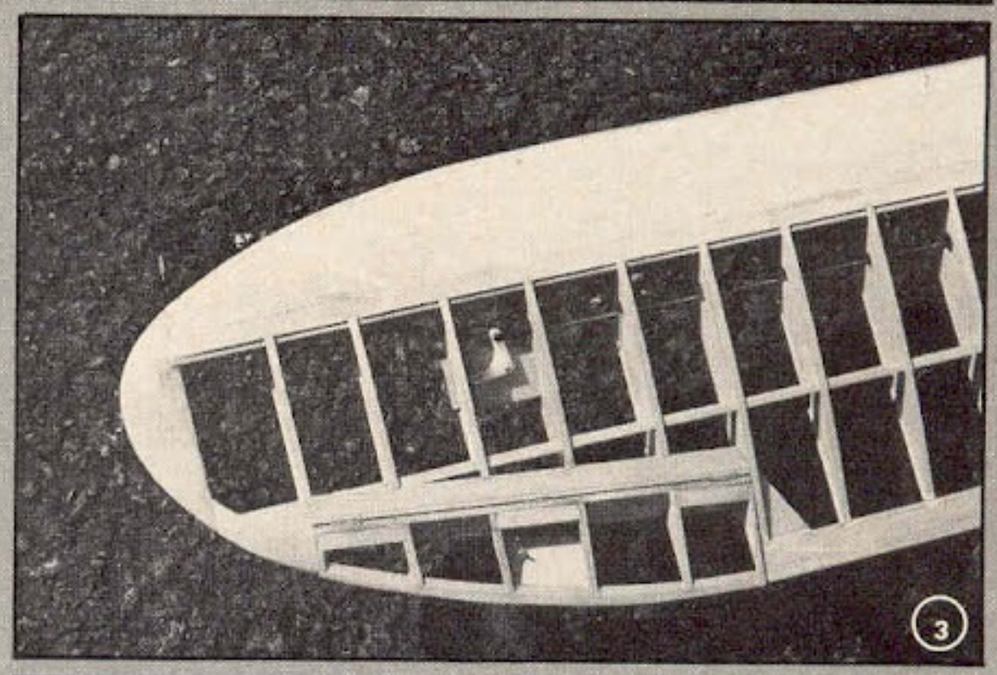


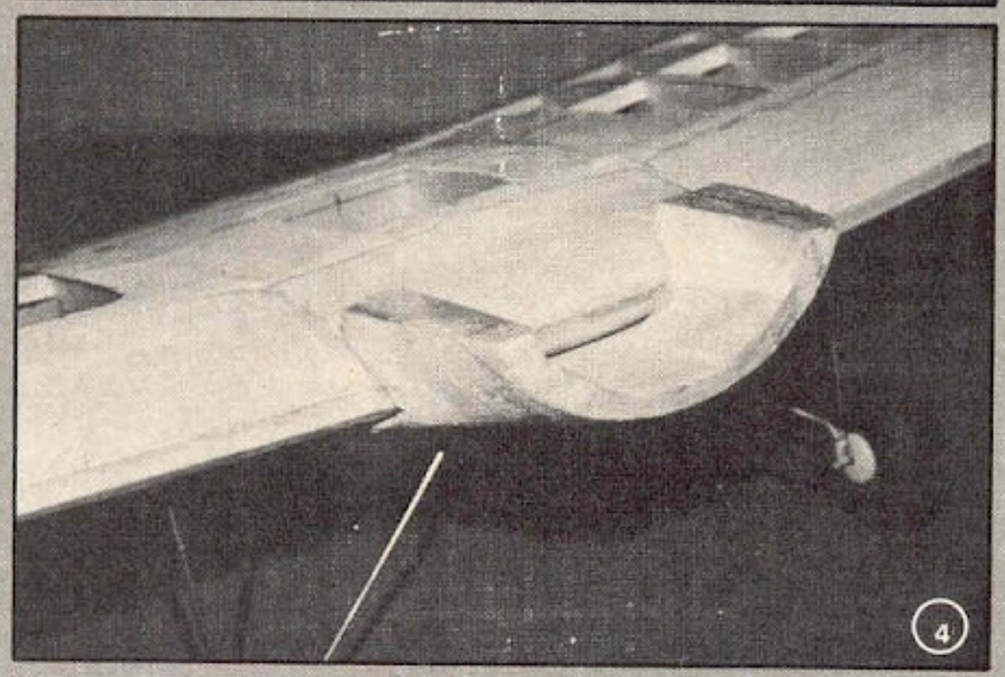
(1) Bottom view of basic fuselage structure. (2) Top view of basic fuselage structure. (3) Glue 1/16" ply doubler inside fuselage. (4) Bottom view of fuselage showing 1/16" balsa sheeting (5) 1/2" sq. balsa & bulkhead cut out in cockpit area. (6, 7, 8) Wing panels built by clamping spars together. (9) Main L/G block ready for installation.

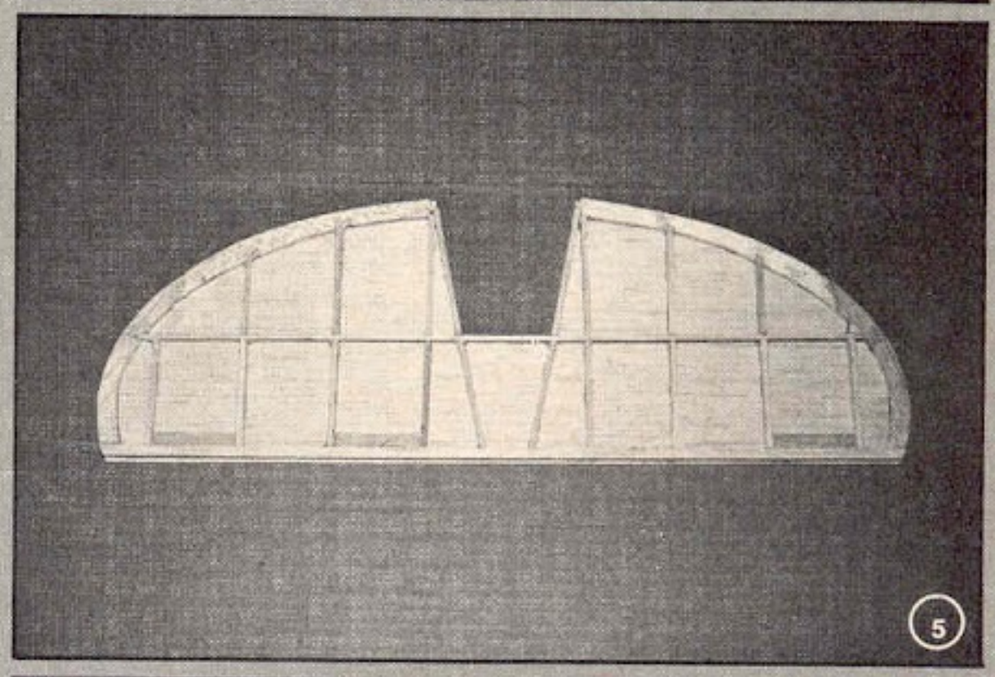
(1) L/G block installed (2) Rear leg of L/G in place. (3) Completed wing showing bellcrank & linkage. (4) Lower nose block is part of wing saddle. (5) Stab saddle showing top side sheeted. (6) Tail surfaces pinned in place before sheeting added. (7) Completed cowl & mounting beams. (8) Cowl in place. (9) Basic framework (not completed).

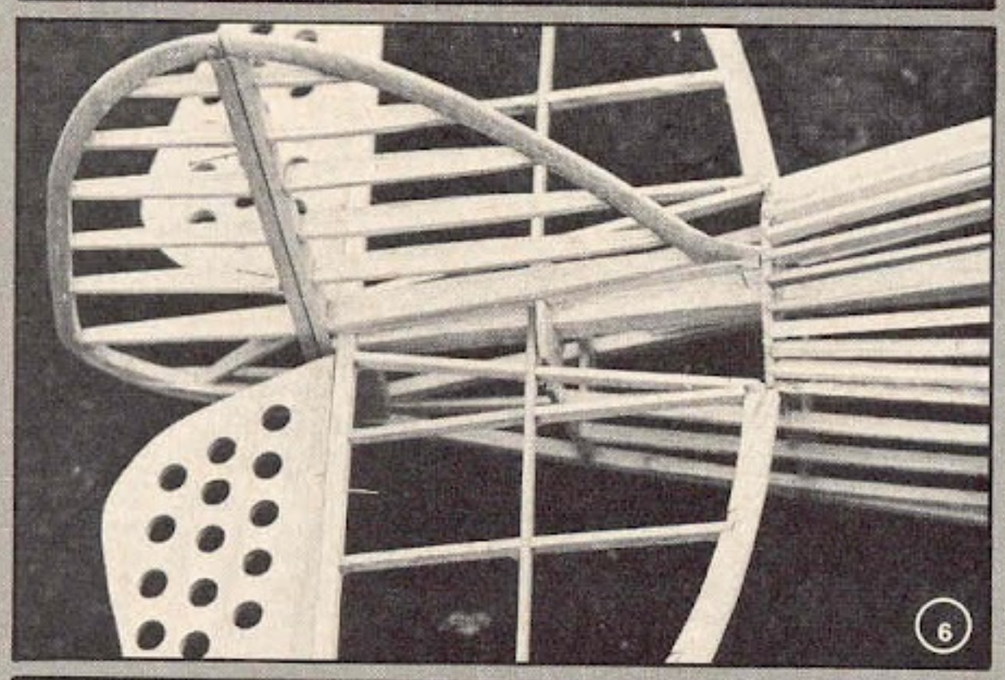


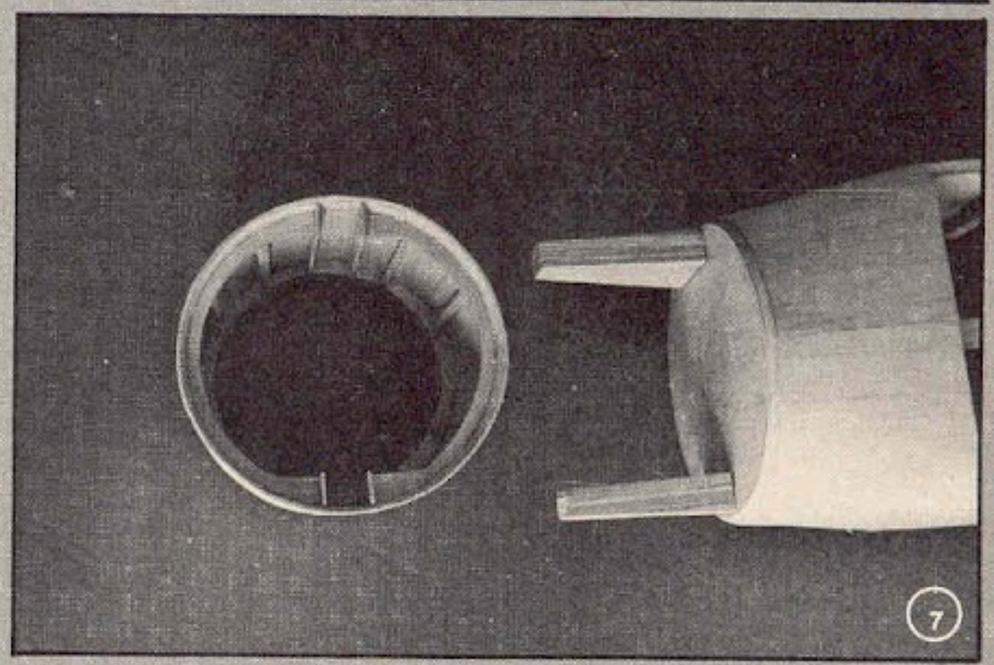


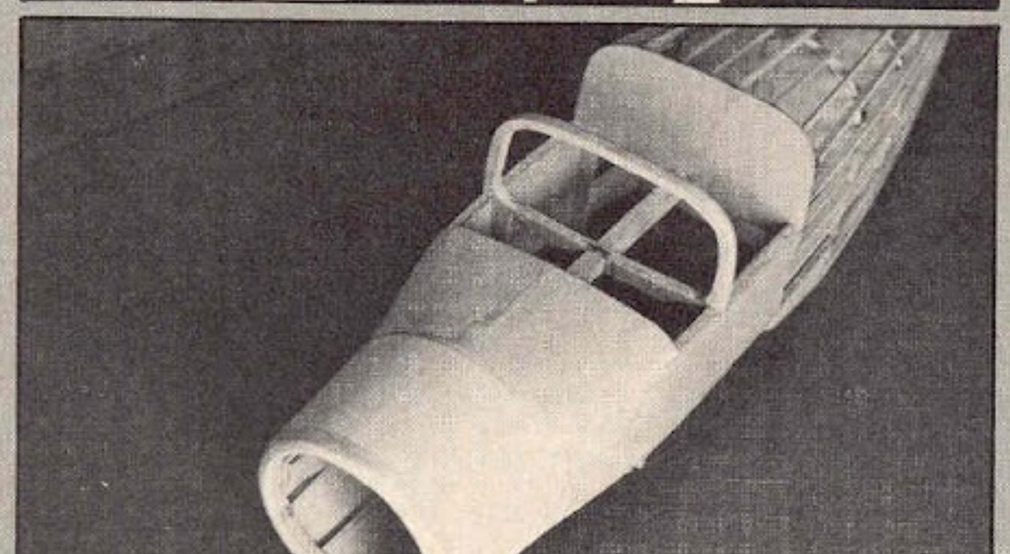


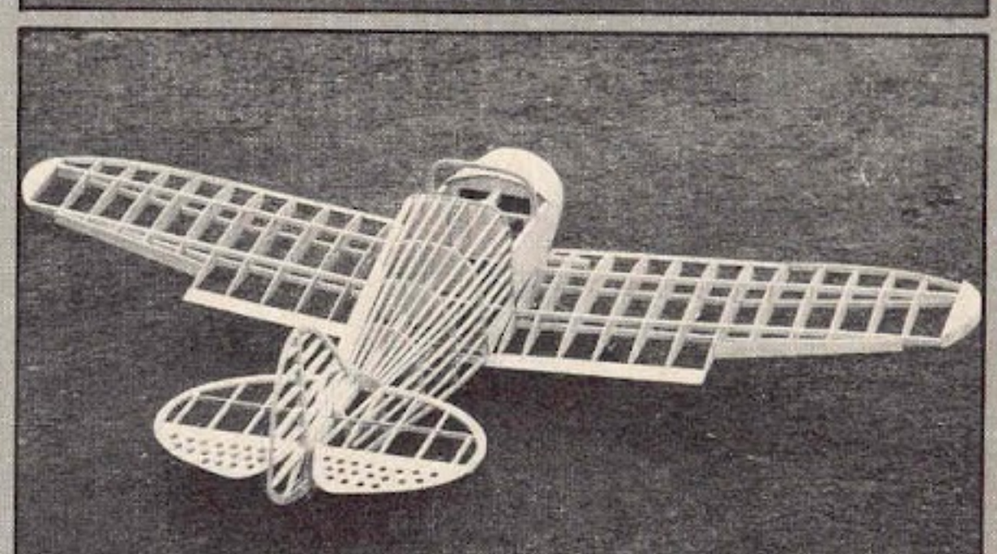


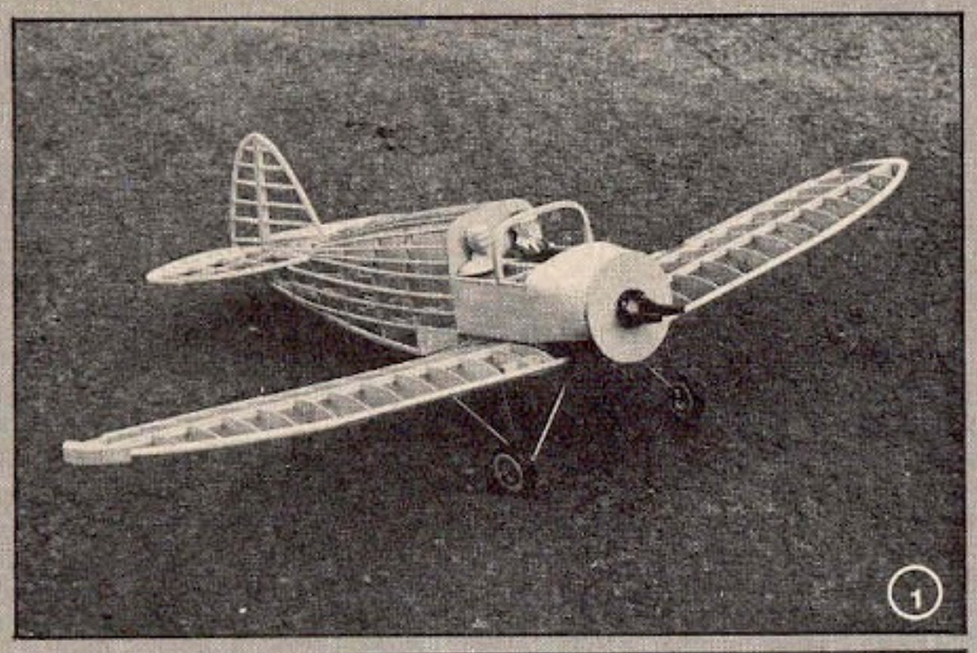


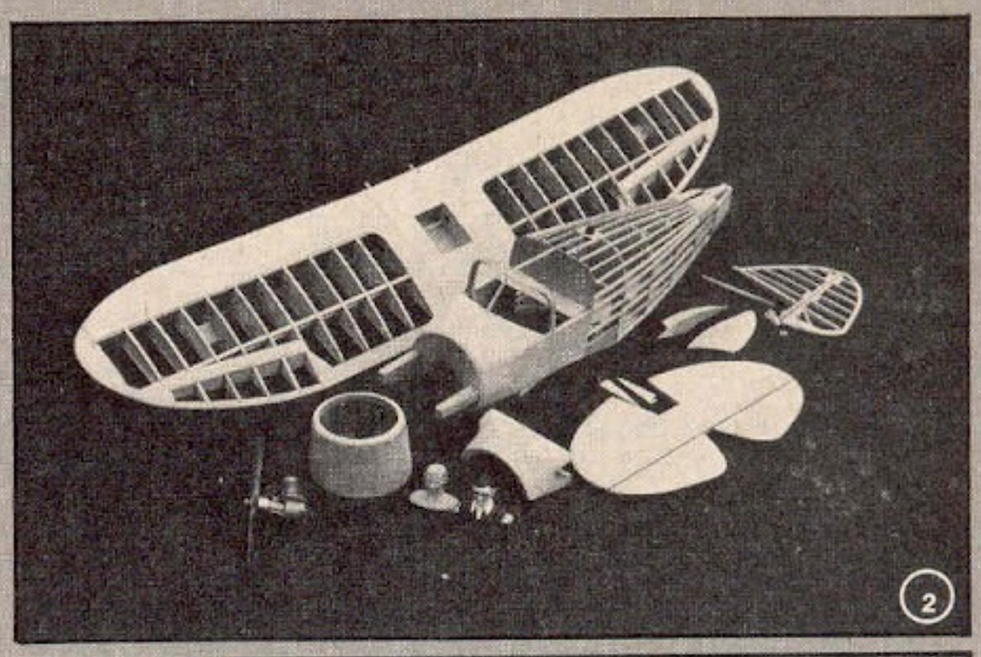


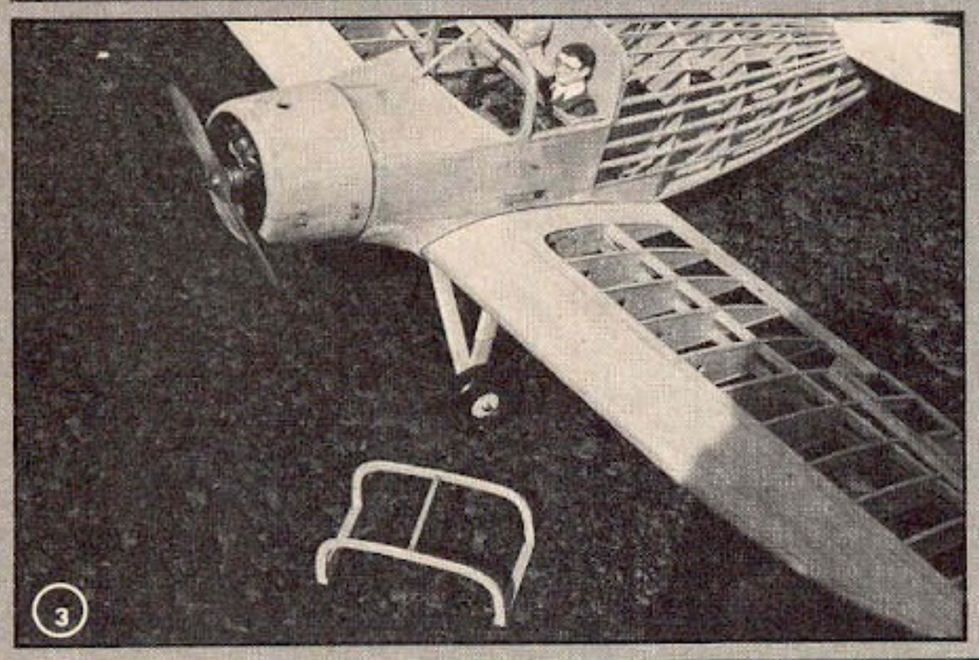


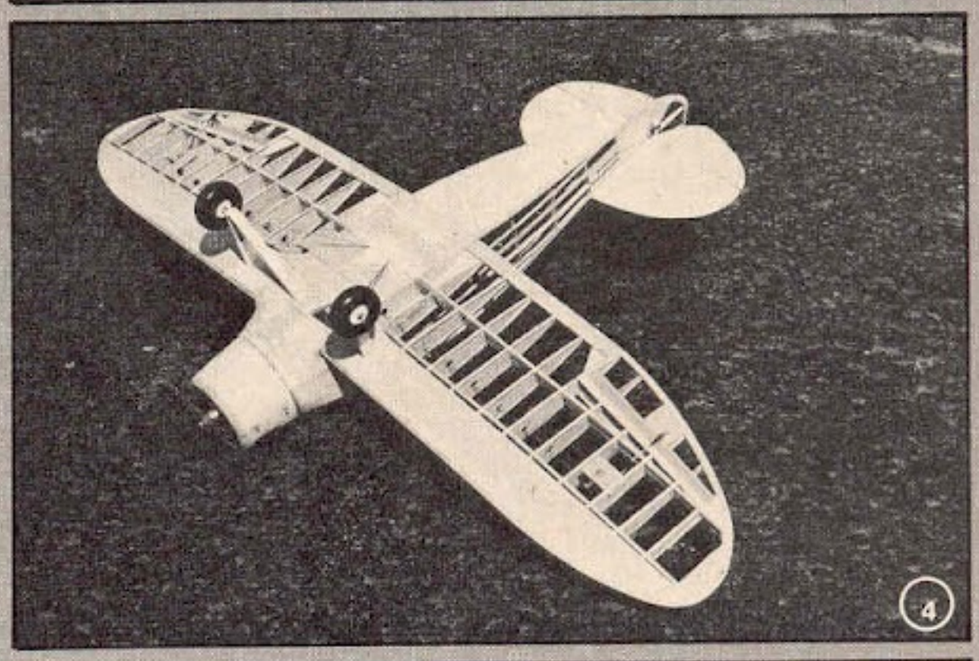












(1) Basic framework (not completed). (2) Completed airframe ready for covering. (3) Completed airframe assembled. (4) Bottom view of completed airframe.

plywood. The sides are made with a double layer of 1/16" balsa sheet for ease of bending and also for added strength.

The best way to describe the cowl mounting supports is to follow the plans. If you do not mind removing the propeller each time you remove the cowl, leave it in one piece. It will slide on and off the mounting guides with ease.

To get away from removing the propeller, I split my cowl horizontally so that the bottom half remains in place most of the time. For simple maintenance and test flights, I remove the top half by taking out the two bolts on either side. Cut the cowl only after you have it complete and fitted to the mounting skids. I lined the inside with light fiberglass and Hobbypoxy glue, Formula 2. The last step is to provide a 1/2" hole for the glow plug lead and a clearance hole for the Semco exhaust extension.

Landing Gear

The Dart landing gear is what they call a tripod design. It is rather leggy because small doughnut airwheels were used to cut down drag. For the model, make the two front struts from 5/32" music wire and the rear support from 1/8" wire. The front struts are streamlined with a basswood fairing which is held permanently in place with 15 minute epoxy.

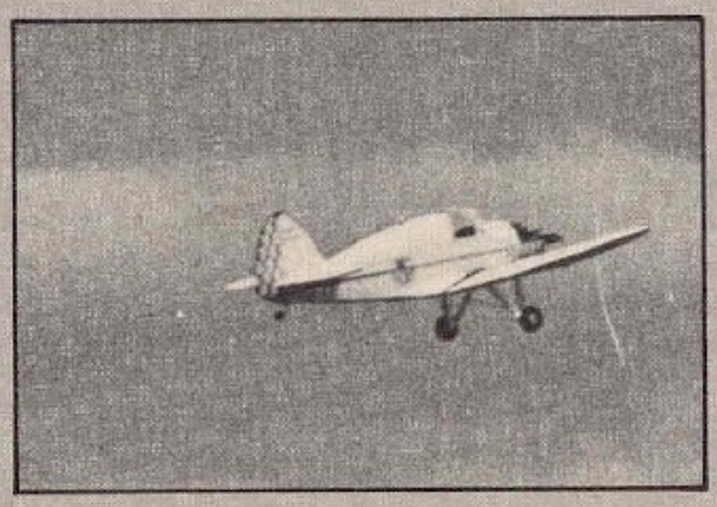
Engine Installation

The selection of engines runs from .35 to .45 cu. in. Anything larger will require a hole in the cowl for cylinder head clearance. The plans show an OS .40 which is a good compromise. I used an ST .35 with a Kraft mount and an 8 ounce fuel tank.

I mounted my engine upright because everything just works better in that position. Also, the fuel tank is then mounted high, leaving the necessary room underneath for your receiver and battery package. One disadvantage is you will have a bite out of your instrument panel for fuel tank clearance, but who cares? There are still plenty of instruments left to fly the plane!

Covering and Finish

Now is the time for making the big decision as to what sort of covering do I use. The real Dart was fabric covered so that is the effect you should want to achieve. I used white Permagloss Coverite and forgot the paint, other than the trim which is a K & B Super Poxy red gloss finish. The checkerboard (rectangular shaped checks) rudder was made by first marking off the white Coverite surface with a red felt point pen. Make certain the ink is washable. I cut the checks from red Goldberg DJ Multi-Stripe, 6" wide material. Be sure you remove the clear protective coating from the top surface of the Multi-Stripe before you cut up the little pieces. Use the rest of the material for cutting out the 5" numbers.



The Dart can be covered with two rolls of Permagloss Coverite, but you will have a seam at about the center rib on the bottom of each wing panel. No problem with a *hot* iron.

Most of the Darts, as they were delivered from the factory, had paint schemes wherein little or no imagination was used. The fuselages were usually dark red or black with light colored wings, such as yellow. The fuselage had from one arrow stripe to three smaller stripes. The scheme I chose was taken from a recently rebuilt Dart which the owner apparently uses for old timer racing exhibitions against such notables as cousin Monocoupe, the Davis D-1K, and others. In other words, it is an authentic paint job for contest judging, not to mention it is attractive and you can see it in the air.

Flight Controls

As you will notice on the plans, even though the Dart is a low wing, I mounted my servos upright. I like to see what is going on down there, and I don't like to remove the wing if I need some adjustment. The Dart cockpit canopy is re-

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movable and there is room for your hand, thanks to side by side seating.

My plane weighed in at exactly 6 pounds ready for contact. The C.G. was right on the noodle, or just a shade ahead of one third of the chord from the leading edge.

You have read the instructions — it's time to start. It won't be long before you'll know why airmen of note have been heard to quote, "It's smart to fly a Dart."

Editor's Note: The following is the actual press release sent to the aero publications in early 1938 concerning the Dart 'Model G' 90 H.P. Monoplane:

With purchase of the design of the two-place, low-wing cabin *Monosport* Model G from the Monocoupe Corp., the newly-formed Dart Manufacturing Corp. of Columbus, Ohio, plans a production program on this plane in the near future. Although the aircraft now bears a Group 2 approval from the Department of Commerce, Dart officials will seek a full approved type certificate under which manufacturer will be conducted. *(Granted April, 1938).*

Structure of the fabric-covered cantilever wing consists of two laminated wood spars, rigidly braced in torsion with deep wood box drag struts and double internal tie rods. The basic airfoil section is the NACA 2315 type combined with a semi-elliptical planform. Dihedral is 5½°. Ailerons are of the full Friese type having a wood structure, fabric covering, and incorporating differential operation. Aileron travel is 30° up, and 25° down.

Welded tubing is utilized to fabricate the fuselage frame, covering consisting of metal forward and fabric aft. Seats are arranged side-by-side on a one-piece base facing dual stick controls and dual rudder pedals with a bungee control placed between pilot and passenger. Deep cushions add comfort for the occupants of the cockpit which features ample width, length and head room. Forward visibility is enhanced by the use of a sloping windshield.

Full cantilever tail surfaces are of metal tubing, fabric covered. Elevator travel is ±30°, and rudder travel is 30° right and left. Landing gear is of the fixed tripod type with one of the legs provided with an oleo strut. Equipment consists of 6.50 x 10 Ebbert Hatch wheels with mechanical brakes and, when desired, streamlined pants. Standard equipment includes a leaf-spring tail skid, although optional equipment provides for a tail wheel with 160° travel.

The 90 hp (2375 rpm) Lambert R-266 engine is enclosed in a full-cowled nacelle and mounted on the fuselage through rubber pads to reduce vibration. Exhaust duct is at the bottom of the nacelle and pressure baffles are provided for adequate cooling. The 2.5 gal. oil tank is

placed in an adequately ventilated accessory compartment, and 25 gals. of fuel are contained in two wing tanks, being metered to the carburetor by an engine-driven pump supplemented by a hand pump on the instrument panel. A stainless steel firewall separates the engine from the cockpit. Standard equipment includes a fixed wood propeller, although a metal propeller may be installed at additional cost.

Specifications and estimated performance figures of the 90 hp Lambert R-266 powered Dart Model G follow:

Wing span	29', 7"
Overall length	18', 7"
Overall height	6'
Wing area	145.72 sq. ft.
Empty weight	967 lbs.
Useful load	583 lbs.
Payload	244 lbs.
Gross weight	1550 lbs.
Max. speed	130 mph
Crusing speed (66% power)	110 mph
Landing speed	40 mph
Rate of climb	800 ft./min.
Service ceiling	15,000 ft.
Cruising range	580 miles