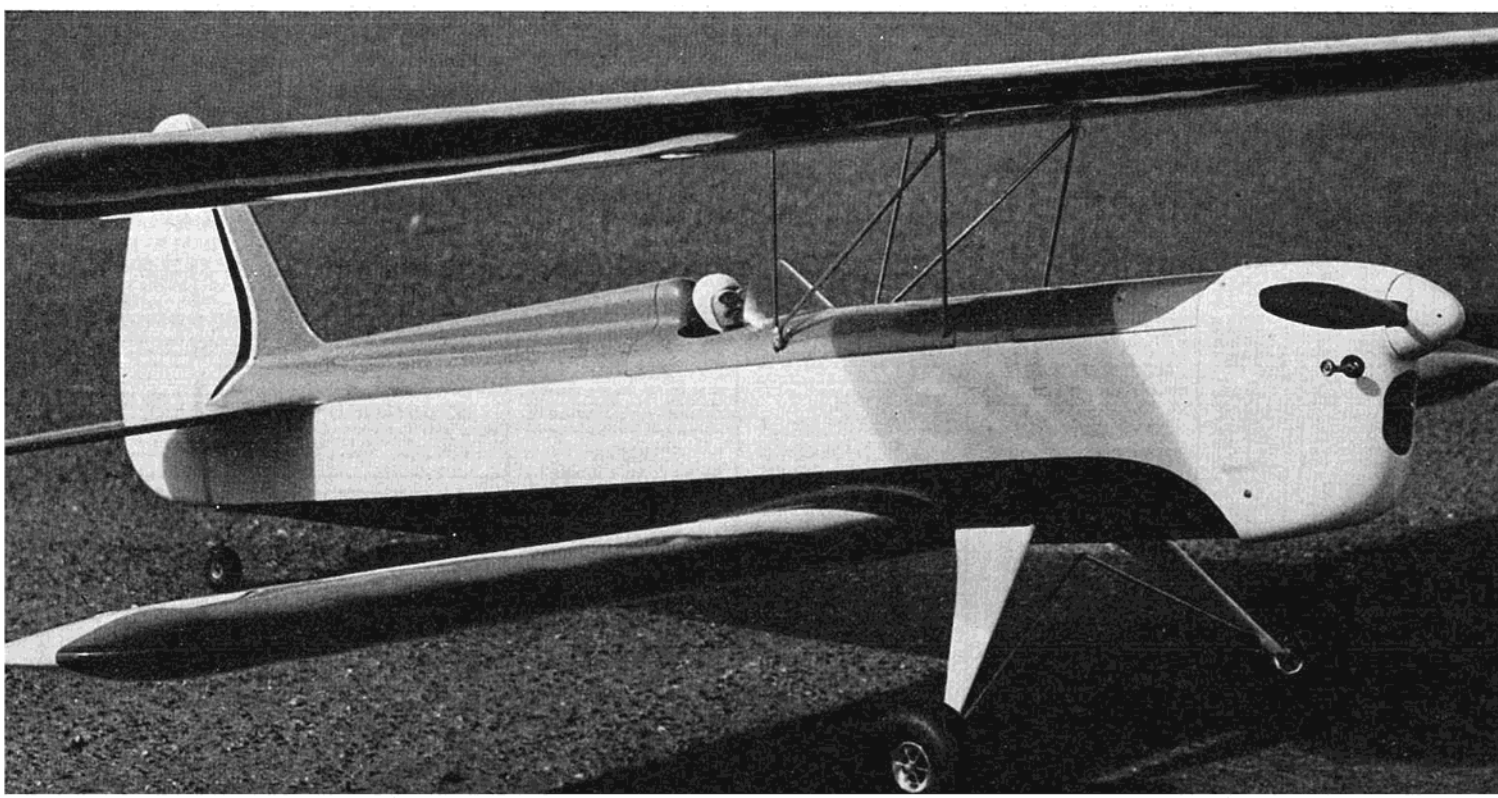


The First Convertible R/C Aircraft

MONO-B1

By Dick Nichols

You can change from monoplane to biplane — right on the field! Your choice of several building options adds to the versatility of this remarkable design.



Design Objectives:

BY far, the costliest portion of a radio controlled model aircraft is the electronics and electro-mechanical equipment involved. Seldom is equipment used for more than one model simultaneously. If a modeler wishes to fly more than one aircraft, he is faced with the problem of transferring equipment from one plane to another or purchasing a whole new system.

In an attempt to offer the sport flyer more versatility at nominal cost, the Mono-Bi was conceived. As the name implies, the Mono-Bi is a convertible monoplane-biplane. Designed around the popular .60 engine, the monoplane is of rather conventional design in the 700 square inch class. Using the same engine, fuselage, and tail assembly, the biplane is in the 1000 square inch class. Conversion is accomplished by changing wings and attached landing gears. Aileron servos could be changed with each conversion, but in the interest of convenience, the prototype will probably have a separate servo for each configuration.

Other design objectives include:

1. Design an aircraft capable of changing configuration that will produce decidedly different flight characteristics and appearance.
2. Additional guidance (radio-servo) equipment necessary to accomplish conversion will be limited to one additional servo.
3. Conversion from one type to the other should require no more than 30 minutes in the field.
4. The aircraft in both forms should be clean and pleasing to the eye. Evidence of compromise due to conversion should be minimal in both appearance and flight characteristics.
5. In both forms, the aircraft should perform well as a sport type aircraft.
6. Construction should follow conventional trends in order to appeal to the average multi-flyer. It should not be unduly complicated.
7. Versatility in appearance, construction methods, and configuration should be available without major re-design in order to satisfy the desires of a large number of modelers.

Technical Description:

The Mono-Bi is a convertible monoplane-biplane designed to convert from one configuration to the other in the field with a minimum of effort. While the design offers many construction variables, the prototype was constructed using the more complicated choice in each case. The builder felt this was necessary in order to prove the design under the most adverse conditions. This resulted in a rather heavy monoplane, although performance is not hindered to an excessive degree by the additional weight. A simpler airplane could be built by sacrificing some appearance or versatility.

The biplane is moderately slow in flight. It feels light but has no tendency to float. It has a very gentle straight ahead stall. It cruises at about half throttle. It is very maneuverable though somewhat slow in response. Inverted flight and outside loops are particularly easy.

The monoplane is an average performer for its size and type. Despite its heavy wing loading, it is not particularly fast. It is very

responsive and quick. Roll rate is average with links in outer holes. Stalls are very gentle. Landings are easy.

The ship flies well in any configuration. It could well be considered an advanced trainer or intermediate type aircraft.

Specifications:

Monoplane:

Span	.....66 In.
Chord	.....12 In.
Area	.....680 Sq. In.
Airfoil	.....18% Full Sym.
Aileron Area	.....114 Sq. In.
Incidence	.....0°
Weight	.....8 Lbs.
Wing Loading	.....1.7 Lbs/Sq. Ft.

Biplane:

Span, upper	.....64 In.
lower	.....56 In.
Chord	.....9 In.
Area	.....1000 Sq. In.
Airfoil	.....18% Full Sym.
Aileron Area	.....114 Sq. In.
Incidence	.....0° Both Wings
Stagger	.....3 In.
Gap	.....9 In. Clear
Weight	.....8.5 Lbs.
Wing Loading	.....1.2 Lbs/Sq. Ft.



Common:

Length	.....50 In.
Stabilizer Area	.....114 Sq. In.
Incidence	.....0°
Elevator Area	.....56 Sq. In.
Fin Area	.....25 Sq. In.
Rudder Area	.....36 Sq. In.
Engine	.....Enya 60 II T.V.
Equipment	.....Digitrio-4

Configuration Variables

(Prototype configuration boldface)

Size:

.30 to .45 engines or **.60 engine**
(510 Sq. In. mono & 750 Sq. In. bi or
680 Sq. In. mono & 1000 Sq. In. bi)

Type:

Monoplane or biplane or **convertible**
Open cockpit or enclosed or **convertible**

Landing gear:

Conventional or tricycle or **convertible**
Engine mounting:

Upright or **inverted**, or side mount

Miscellaneous:

Any configuration may be built with or without fairings and/or round fuselage bottom.

Construction Variables

(Prototype construction boldface)

Wing

Covering: **Sheeted** or silked

Spar: **Twin spar** or **egg crate**

Tips: **Tapered** or block or plated

Attachment: **Bolted** or banded

Other: Adapt existing wing for monoplane

Cowl: **Balsa** or **fiberglass**

Landing Gear: Biplane — **dural** or **wire** (conventional)

Control System: Push rods or **flex cable**

Biplanes have a way of stirring excitement from deep within. Yet, observing the biplane in flight gives rise to a flood of questions. Watching a biplane is one thing, owning a biplane is something else. How long before the novelty wears off? Will it satisfy my needs and desires or will I be saddled with a monster? How about windy days? Will a biplane limit flying to calm weather, particularly one with conventional landing gear?

The obvious answer to this dilemma is a second radio rig. But who can afford it? Usually the first (and only) rig places a strain on the family financial situation that makes audible sounds for months and months.

Yet, despite the negative reasoning, there comes a time in every modeler's life when he must build a biplane. Biplanes and modelers are just that way.

Mono-Bi is an attempt to satisfy the longing from deep within without sacrificing the thrill of a fast and efficient sport or contest-type airplane. As a monoplane, its performance is lively and thrilling. It appears to be a mid-thirties sport plane. One would never suspect that by removing the wing and a hatch and replacing them with another wing and a hatch, a slick biplane would result. The change in appearance is startling. Equally different are the flight characteristics of the two ships. Truly, Mono-Bi is two distinct airplanes for slightly more than the price of one.

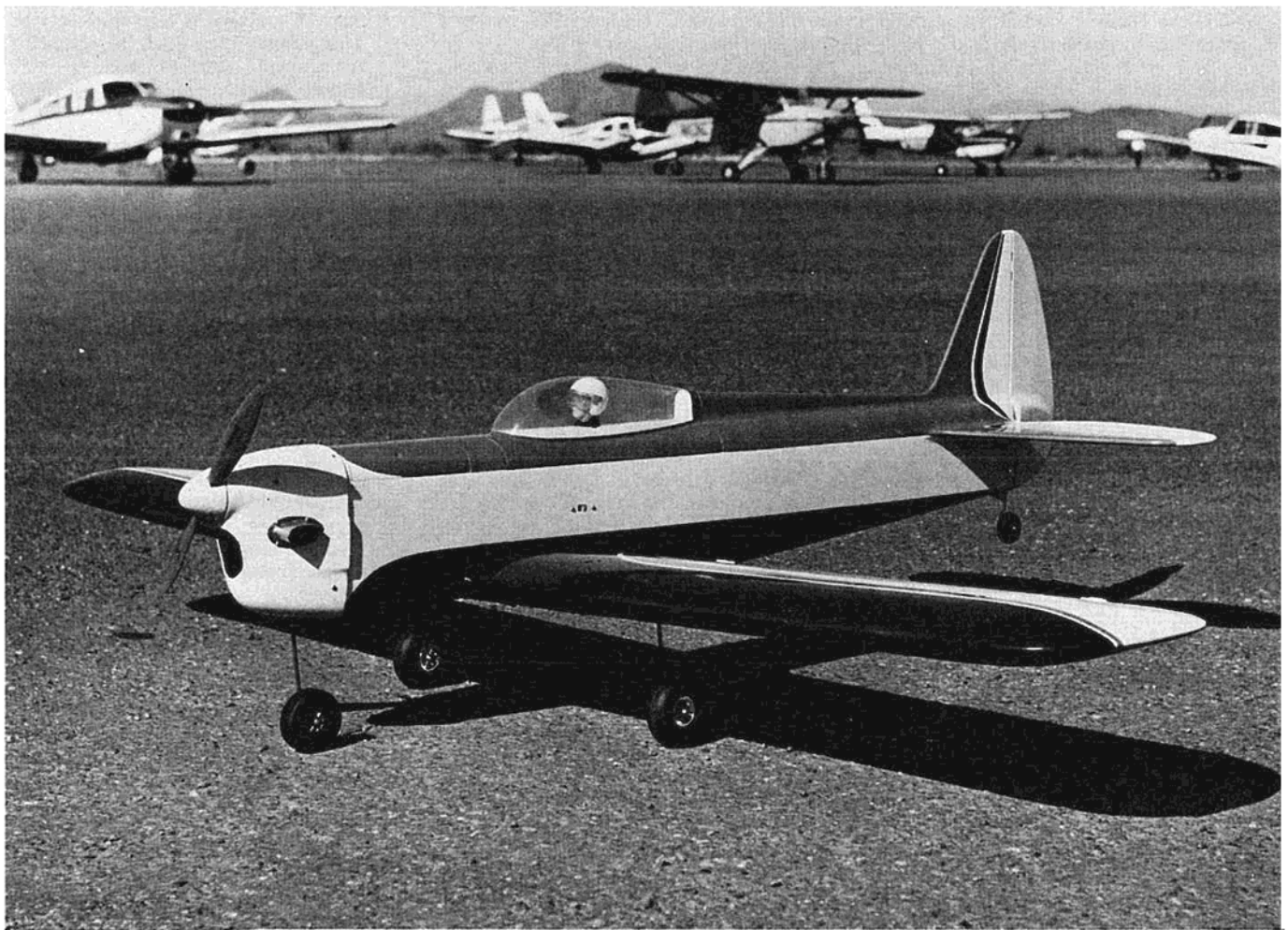
Sound versatile? Only the beginning! Versatility is Mono-Bi's long suit. The plans include details for conventional and tricycle landing gears — choose either one or both. Field change takes about ten minutes. That solves the wind problem, although both ships perform very well on conventional gear in the wind.

The prototype is a rather deluxe version; you know, fully faired wings and deep fillets. Pretty, but costly in construction time.

Provision is made for a less complicated version that will fly every bit as well. Plated or club tips may be substituted for sheeted tapered tips and other fairings may be eliminated entirely. The plans provide many other construction variables and choices. One of the most difficult aspects of Mono-Bi is the making up of your mind. You call the shots all the way through. You see, the modifications are all built-in. Just check the plans and photos if you have doubts.

Mono-Bi will accept three or four channel proportional and perhaps reeds. The original is flown with a four channel Thompson's Folly (Digitrio). The ship should perform equally as well coupled on three channels. Rudder is rather ineffective anyway, except on the ground.

How does it fly? The biplane is fairly slow, but not too slow, depending on where you set the throttle. It has no tendency to float or mush. Stalls are quite gentle and



straight ahead. Loops are very easy, particularly the outside kind. Even at moderate speed outside loops are accomplished by simply shoving the stick forward. You will swear it will never make it, but it does. And very realistically, too. Inverted flight is about as easy upright. Rolls are of the slow variety. Excessive speed isn't required (or even desired) but a definite forward pressure is needed when she rolls over followed by a tad of up as she rolls out.

Takeoffs and landings are a breeze. With a sixty full bore she lifts off in about a hundred feet. Climbs out as fast as you want. Landings are just as easy. Fast or slow, depends on you. Even at very low speeds it will not stall and fall off. Aileron control is solid right down to the ground. It has landed on conventional gear with a ground roll of less than six feet. (Without brakes.) Taxiing in the wind is another matter. It will taxi in one direction only — upwind. And that's with either type of gear.

Generally, the biplane is a sport airplane. Slow and responsive enough to make an excellent trainer, it's just plain fun to fly.

The monoplane demonstrates the same good characteristics as the biplane. It is just faster and feels different. Slow flight is responsive and solid. It tolerates a wide range of throttle settings. Landings are fast or slow, depending on your preference and the type of gear. In the monoplane form, with all the extra built-in goodies, it is somewhat heavy (eight pounds). The extra weight doesn't seem to be detrimental and

certainly hasn't increased the landing speed beyond the desirable point. A good sixty will kick her along quite smartly.

Interested in building? Before you start, here's a few words of advice. Study the plans **carefully**. Make your choices **now** — **before** you start. Write them down and stick with them. Mark your plans. Cross out the rejected alternatives. Choices you must make:

Configuration Variables

Type: Monoplane or biplane or convertible

Open cockpit or canopy or convertible

Landing Gear: Conventional or tricycle or convertible

Engine: Upright, inverted, or side mount

Construction Variables

Wing: Covering — sheeted or silked

Spar — Twin spar or egg crate

Wing Tips: Tapered, club and/or plated

Attachment: Bolted or banded

Other: Adapt existing wing for monoplane

Fuselage: Faired or simplified bottom

Cowl: Balsa or fiberglass

Landing Gear: Dural or wire (biplane conventional)

Control System: Flex cables or push rods

Some of the alternatives may need explaining, so we will run right down the list.

The convertible airplane is a lot of fun. Fly one a while, then the other. It's a crowd pleaser. **But** it's a whale of a lot of airplane

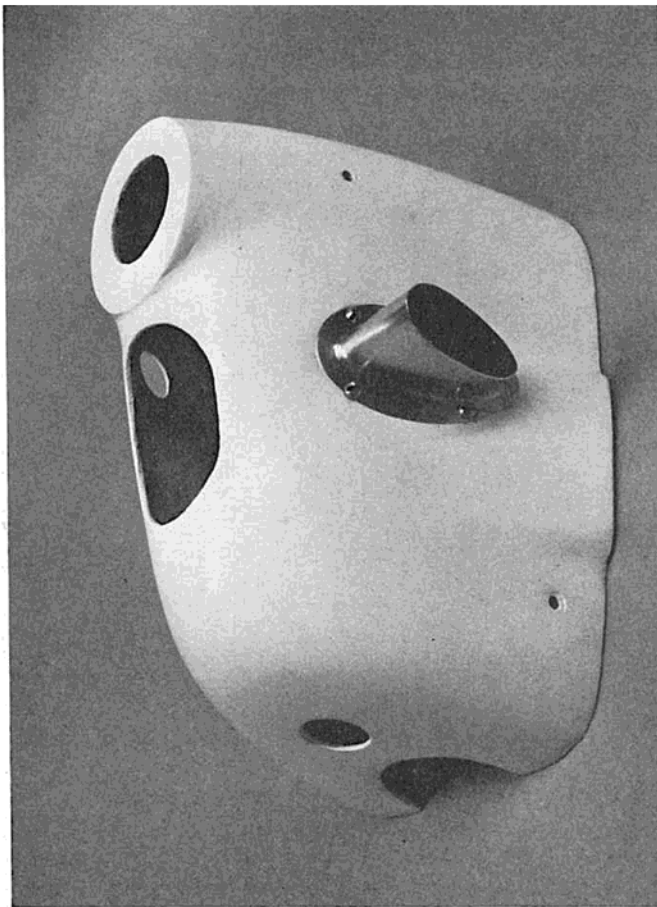
to build at one time. Just think, three wings, seventeen hundred inches! May be better to build one then the other. One hint, build **both** wing saddles while they can be sanded against the fuselage.

The tricycle landing gear just doesn't do much for the biplane (see pics). I prefer conventional. For a little extra weight and work, you can have both and change them as you choose.

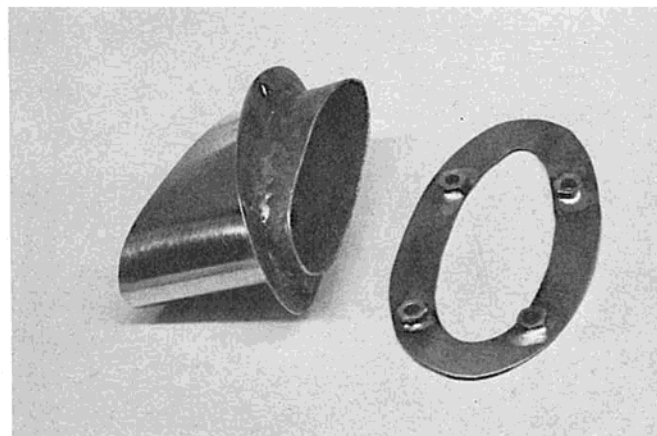
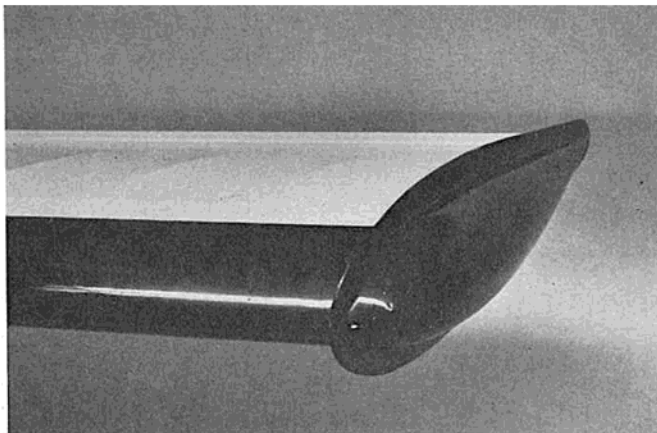
It would be a crime to stick the engine out through the top of that deep cowl, yet there have been times when that inverted engine has tried my patience. Make your choice, looks or convenience. Or maybe you know how to handle inverted engines.

If you are still with me and determined to build, let's consider the construction variables. The wing may be completely sheeted or partially sheeted and covered. The prototype was sheeted. Count the sheets of $\frac{1}{16} \times 3$ — count again. That right . . . 24 sheets for the biplane — yipe! On the other hand, count the yards of silk. Still with me? A beautiful biplane would result from carefully applied colored silk finished clear with polished colored dope over the wood. The same treatment on the monoplane would be very much in taste for a 1930's sport plane.

The choice of wing spar type may be dictated by the equipment available for your use. The slotted or egg crate spar would be my choice provided a jig saw were available. Cutting slots in $\frac{1}{8}$ " hard balsa is difficult without one; however, this type spar presents less problems in the long run. But for those who like to build over



Left: Trike-geared, canopied version of Mono-Bi. Above: Completed cowl showing cut-outs and flange around spinner area.



Top, right: Plated club wing tip. Below, right: Exhaust stack and flange ring.

the plan and don't mind cutting out lots of little pieces, twin built-up spars are provided.

And now the wing tips. This is the hard one. Those tapered sheeted tips aren't really hard, but they do take more time than club or plated tips. I can't imagine Mono-Bi with square tips, but if you can — build them that way. Club tips and tricycle gear would move the airplane into the post-war era.

The plans detail only the bolted wing attachment. So you don't like bolts — forget them. Cross out all reference to lower wing bolts and provide standard dowels. As was stated earlier, you call the shots all the way through.

Here's something to consider. By chance do you have a Cherokee wing handy? Make a wing saddle to fit, bolt it on, and band on the wing. Or, glue the saddle to the adopted wing and bolt the whole mess on. If you want to experiment, bolt the tail on. Think of the possible combinations of wing, stab, and rudder. You might even develop a contest-type monoplane.

Take a good look at the fuselage. The rounded fairings are great for looks but add nothing to performance. Once again, my vote goes for looks. Mono-Bi is the type of ship you will fly for a long time, and believe me, it will attract attention wherever it is flown. Here's a touch of the romantic era when airplanes looked sporty. Mono-Bi is no swept back swish nor is it a box or barn door. It doesn't take a long look to see a little Ryan ST and Howard Ike, and Waddell Williams Racer in her.

Has the jet age produced prettier airplanes than these? But — if you insist — cut everything on the broken line and save yourself some work.

Unless you are allergic to epoxy resin, the fiberglass cowl is by far the best bet. It's not hard to make — see construction details.

The prototype sports a wire and fiberglass conventional gear. Not that it looks particularly better, but wire I had and dural I didn't. Besides, since we are mixing fiberglass anyway. . . . The wire gear may be a little more costly in time, so. . . .

My last two ships (counting Mono-Bi as one) were equipped with flexible control cables of the World Engines variety. They work very well and are a joy to install. They should be kept as straight and in line as possible. Naturally, the aileron cables must have a 90° bend, but no short kinks. A little play or sloppiness is inherent and cannot be eliminated. Some vibration may result. This situation will not worsen with age. With their faults, they are not all bad. The good part is a free-working, easy to install, trouble-free system. But . . . if you like push rods, feel free.

Got your plans marked up and your mind made up? One last discouraging thought, Mono-Bi ain't cheap! It will soak up an enormous bundle of wood and glue and dope and wheels and time — time — time. But when you are through, two beautiful ships.

Mono-Bi is recommended for construction by the sport flyer with some multi experience. Though the biplane makes an ex-

cellent trainer, it's just too much airplane to horse around with. Good trainers are plentiful that are cheaper and easier to build. A pranged Mono-Bi is a sorry sight, believe me!

If you are an experienced builder you have already decided to skip over this part, so go your way and leave the gory construction details to the less experienced.

Before we start construction a few words are in order about tools. A most useful tool in building Mono-Bi, or most any other model for that matter, is a metal straight edge three to four feet in length. A good tri square is a must. Several sanding blocks about two inches wide and the length of a sheet of sandpaper with a couple of grades of garnet paper attached are essential. Quarter and 1/2" dowels about a foot long covered with sandpaper are quite useful. Of course, the general run of modeling tools will be required also. You probably already have the tools listed above and I mention them only to encourage you to use them. And now, on with the tedious part.

Construction details are not complete to the extent that each and every step is covered. There are just too many variables; and besides, if you are building Mono-Bi you should have enough experience to build from the plans only. But since Mono-Bi is different, the troublesome areas will be discussed.

Wings

With three wings to build, you may want to start here and get them out of your way. Accurate metal or plywood rib tem-

plates are highly recommended, not that the airfoil is critical, but absolute uniformity is desirable. False ribs in the biplane wings are optional. The prototype had none and the leading edge sheeting pulled down somewhat between the ribs. The scalloped appearance isn't particularly objectionable, but I prefer the looks of a straighter wing.

If you have chosen the twin spar version, build the wing directly over the plans or follow your own favorite method. The sheet spars require a little different technique. Cut all spars from $\frac{1}{8}$ " hard balsa. Be sure they are straight along both edges. Lay out the position of all slots and ribs. Care must be exercised when placing the cap strips over the rib slots. The purpose of the strips is to provide a means of straightening the spar. When the slots are cut, the spar will have a tendency to warp. Straighten the spars, glue in the cap strips, and the spars will remain straight. This straightening process should be done before the ribs are glued. Of course, the ribs must be in place before the strips are installed. The sheet spar version lends itself readily to building in the air, or off the board. No need to worry about warps or twists as long as the spars are straight. Just exercise reasonable care to keep everything fairly well lined up.

When ready to apply the tips, place the wing panels over the plans and correct any misalignment. The tips should hold the ribs square to the spars. The dihedral angle is identical for the monoplane and the biplane lower wing. It is exactly $\frac{1}{32}$ " vertical for each 1" horizontal. This information may help you in cutting pieces that fit around the wing saddles. The biplane top wing is straight, or bend it if you prefer, but you will have to work out the details.

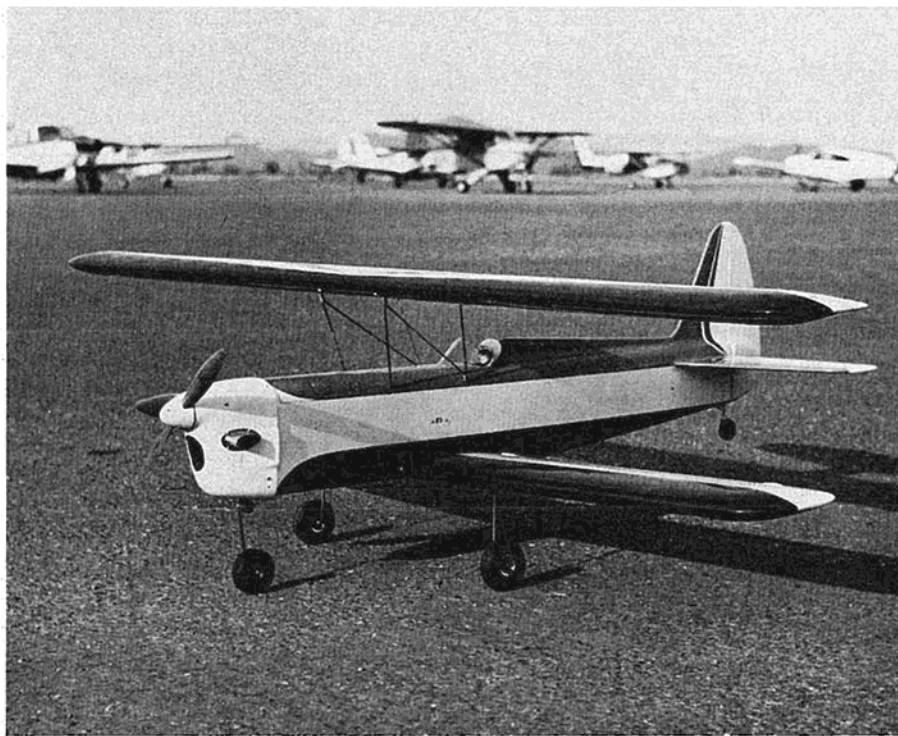
The biplane lower wing saddle is installed after the panels are joined and before they are sheeted. The monoplane wing is sheeted before the saddle is installed.

Install control cables or push rods, all blocks and braces, and the wings are almost ready to sheet. At this point, drill vent holes in all the ribs if you failed to do so earlier. Also, drill holes through spar webbing to allow cross venting. Be sure there is no entrapped air anywhere in the wings. Vents must be provided to the atmosphere. The lower wings may be vented through the rear spars under the ailerons. One or two holes will do. The biplane upper wing must be vented through the sheeting. Install a couple of brass grommets under the center section. Changes in temperature can pop or loosen sheeting unless it is vented.

If you are building the tapered tip version, it will be necessary to fair the tips before covering. Bend a piece of $\frac{1}{16}$ " sheet over the tip and note the high spots. Sand them off with a long sanding block. Remove only enough material to allow the sheeting to seat properly and form a smooth contour. The laminated tips will be triangular in cross-section near the trailing edge when properly faired.

It is most important that the wings be jigged during the sheeting process. It will be impossible to completely remove warps and twists after the sheeting is glued in place. But on the other hand, a properly sheeted wing will be highly warp resistant.

Wing jigs need not be complicated. A



Trike-gear version of biplane. Building the Mono-Bi takes only half as long as deciding on which configuration!

very simple jig can be made by lightly nailing a straight strip along the edge of a piece of $\frac{3}{4}$ " plywood. The strip should extend above the plywood $\frac{3}{4}$ inch for the biplane wings and one inch for the monoplane wings and should be beveled to fit the trailing edge of the wings when placed upon them. The whole works should be carefully checked for trueness. Be careful to keep the trailing edge of the biplane upper wing straight, as any warp or curve will be very apparent.

It was stated earlier that the sheeted tapered tips are not particularly hard to make. Start all sheeting at the center of the front spar. True each sheet before it is applied. All joints must fall over spars even if two sheets must be glued together and trimmed before they are applied. Use Titebond glue throughout, but don't smear it around. Dope will not stick to it as well as wood. The first sheet is roughly trimmed to length and shape at the tip. Wet about six inches of the tip end with water. Apply glue to area to be covered. Securely pin sheet to spar and leading edge from the first inside rib out to the last full length rib. Work the leading edge of the tip down first using straight pins and clothes pins. Proceed around the tip. Notice that the back of the sheet has extended itself to behind the spar at the tip. Trim the excess back to the center of the spar. If glue dries during this process, add more glue and pin down securely. The second sheet may require a little trimming at the rear spar. The clothes pins will leave rather deep indentations in the wet sheeting but they are easily filled.

Since the biplane top wing is straight, cross joints in the sheeting should be staggered. That is, they should not all occur at the center and no two should be in line.

The club tips are soft balsa block in case you have been discouraged by the

description of the tapered tips. The tip plates are not detailed because I detest them. I only mention them because Ed Thompson likes them. If you want details on tip plates, write to Ed.

Wing saddles and building sequence are on the plans.

Fuselage

Start by building the fuselage crutch over the plan. Be sure cross members are vertical or square to the board. The plywood servo deck is assembled as part of the crutch. While the crutch is pinned down you may want to install a temporary diagonal brace across the front bay to insure alignment when the sides are pulled in.

The fuse sides must be straight. As you will note, the edges of the main sides are the reference lines for all of the horizontal surfaces. This is where the long straight edge comes into play.

The ship has a tendency to be tail heavy, so don't select cast iron for the sides. In fact, $\frac{3}{32}$ " sheet would be adequate for the sides if not overly sanded. Add the bottom pieces to bring the sides to full shape and add the doubler. With a ball point pen and tri-square, lay out the position of all the bulkheads and wing hold downs on the inside of the fuse sides. (I trust you have one right hand and one left hand side.) Lay out lines full length of the sides $\frac{1}{8}$ " below the top edges. This locates the top edge of the crutch. When the crutch and sides are mated, this layout work will pay off. The control cable locations are spotted on the bulkheads. Drill holes before bulkheads are in place. Be sure bulkheads are placed on the proper side of the crutch cross members and are square with the crutch. From here on, follow the plans and do what comes naturally.

(Continued on Page 61)

A word of caution about the tank compartment deck. It is designed as a structural member to distribute the load placed on the firewall to the whole fuselage. It should be installed exactly as specified or better. In addition, at least one layer of fiberglass should be wrapped around the outside of the firewall and extended back onto the sides and top and bottom blocks. Shape and finish the fiberglass before the fuel hatch is made.

Covering the turtle back and hatches with sheet balsa may pose some problems if you are not careful. Let's run through the sequence and be sure. We have several hatches to make and all must match.

Sight the bulkheads behind the cockpit and remove any high spots. Cut two pieces of $\frac{3}{32}$ " x 3" medium soft sheet about $14\frac{1}{2}$ " long. Thoroughly wet one side of one piece with water. With the wet side out, place one edge along top edge of the fuse side. Piece should extend from F3 to F6. Pin securely to fuse side and slowly bend over formers. Mark along the approximate center line of the fuse and cut in place using a straight edge. Pin down. Repeat other side except don't trim at center line. Let dry thoroughly and remove. (I hope you didn't glue them.) Glue first piece and pin. Align the second piece, mark and cut to fit against the first and glue in place. The reason the sheeting is not glued while wet is to allow for shrinkage as it dries. Shrinkage causes scalloping. Use the same technique to cover the area between F2 and H6 on the fuse.

Make all the cockpit hatches now you intend to make. Make as many hatch bases per plans as needed. Drill the biplane base for blind nuts using $\frac{1}{8}$ " drill and place in position on fuselage. Match drill servo deck with hatch base. Place remaining hatch bases one at a time on fuse; carefully align and match drill with servo deck. Just to be sure, drop a 4-40 screw into each hole just after you drill it. Enlarge holes in hatch bases and install blind nuts. If you are careful you won't have trouble with misaligned screws and blind nuts. Now is the time to make them fit — before they are covered. Place a hatch base on the fuse over a piece of Saran Wrap and bolt down. Glue all formers in place. Leave about $\frac{1}{32}$ " clearance at ends. When dry, carefully cut covering sheets and follow technique used on turtle back up to the point of final gluing. Remove the base, replace the Saran Wrap with a new piece and proceed as above. Remember the pin holes in the first piece of Saran? Should glue find its way through an empty hole (and it would) the hatch would become a permanent part of the fuse. Take all sub-

sequent hatches through this point before sanding any of them.

The fuel compartment hatch is made similarly to the cockpit hatches. After all are complete, the fuse is sanded to shape. Be careful — you can thin out $\frac{3}{32}$ " sheet before you know it. If all the humps and bumps were removed before covering was applied, you are in good shape. If not, you have some thin spots. The rest of the fuse is easy — just follow the plans.

Cabane Struts

The cabane struts are bent from details on Sheet 2 and the side view on Sheet 1. Be careful to maintain the difference in length as shown on the plans and be sure the long one is behind the short one. If you want to lower the upper wing, shorten both struts by the same amount — and figure out a new diagonal strut.

The struts are assembled in place on the hatch base. It is better to do this before the hatch is completed as damage to the hatch may result and more room is available to bind the lower joints. The joints and the copper binding wire should be thoroughly cleaned before assembly. When soldering use plenty of flux (paste, not acid) and heat. Apply heat to the joint — not the solder. Don't use the little thirty watt pencil you used to assemble your Digitrio. A big gun works well here. Final alignment is accomplished by assembling both wings and fuselage. Sight trailing edges of both wings. They are not in line are they? By applying heat to one of the cabane joints and corrective pressure to the wings they can be aligned. Chances are that one or two of your joints did not come out where you wanted them anyway. By analyzing the situation, you can probably correct at least one misplaced joint while aligning the wings. Be sure to allow plenty of time for the solder to cool before you relax the pressure or even breathe. If the joints move even the slightest amount while cooling, it will crystallize and fail.

While we are soldering, why not solder the wheels on? Soldered washers, in my opinion, are far superior to wheel collars. That is, if they are properly installed. The secret lies in cleaning the washer and axle until they shine and roughing up the axle with a file so the solder can bite. Tie a string around the axle between the wheel and the washer. This keeps paste out of the wheel bearing and provides the necessary clearance. All soldering is done with the axle vertical. Apply enough solder to cover the end of the axle and form a hemisphere the size of the washer. Looks neat and they will not loosen and come off.

Cowl

The fiberglass cowl is made over a male balsa mold. Scrap block and rough sheet are struck together to form a hollow block. After it is carved to rough shape, it is tack-glued to the firewall and sanded to final shape against the fuselage. It is then removed and extended with $\frac{1}{4}$ " sheet on the back to provide overlap onto the fuselage. Glue a handle to the back sheet. Forms for the side vents are cut from $\frac{1}{4}$ " sheet and glued in place. Position will be determined by your engine. The block is then cut in pieces in such a manner as to permit removal of the pieces when completely surrounded by fiberglass. Think about that for a moment and you will see that the pieces must be cut so that they will strip

inward. This can be done so that all the pieces may be salvaged and re-used if necessary. Stick all the pieces back together with hot parafin and heavily coat the entire form. Excess parafin can be scraped off with a knife when cool.

Mix and apply a coat of resin followed by layers of fiberglass. I like to work with pieces of glass about three by four inches. All areas are covered with two or three layers of glass and thoroughly saturated with resin. It is allowed to set. When hard, work down with a wood rasp and apply second coat of glass and resin. The area around the spinner should be quite thick. You probably didn't cut enough right and down thrust into the block and it will have to come out of the cowl.

The whole mess is worked down again with a rasp and sanded smooth. The material should appear to be between $\frac{1}{32}$ " and $\frac{1}{16}$ " thick. Check by drilling a hole where a cutout will be made. If it isn't thick enough, have another go at it. Usually though, enough material can be applied in two coats. If it's too thick, work it off.

Complete as much finish work as you can while it is still on the mold. When completed, remove mold by running hot water over the outside. Save the pieces — you may need them. You may want to use a female mold. If you are more familiar with them, then that's the method to use.

The exhaust stack is definitely worthwhile if you have the equipment to silver solder or braze the flange to the stack. If not, consider having it done. The stack should be extended to within about $\frac{1}{16}$ " of the engine exhaust port.

Nose Gear

The BK nose gear was selected for the prototype because it detaches readily. The control arm is placed at the top of the bracket and the spacer collar at the bottom. It is removed by loosening the screw on the control arm and allowing the gear to drop out. A dummy was made from a piece of $\frac{5}{32}$ " wire about $2\frac{1}{4}$ " long with a washer soldered on one end. It is substituted for the nose gear to keep the control cable in place.

Finish

Select your own finish — just keep it light. The original Mono-Bi has a medium gloss butyrate finish that looks nice and is fairly heavy. The entire model was sheeted and covered with lightweight Silkspan. The purpose the Silkspan serves is still somewhat of a mystery and I doubt that it will be used again on any of my models. Two interesting articles containing finishing methods appeared in the July issue of R.C.M. Unless you are expert in this field, I suggest you read them. See pages 62 and 68.

Fillets add a lot to the appearance of a model and Mono-Bi was made for fillets. Most of the fillets are made from soft $\frac{1}{16}$ " x $\frac{1}{2}$ " deeply beveled along both edges. See plans. A razor plane bevels the strips quite easily. They are wet with water and applied wet with Titebond glue. A short length of $\frac{1}{2}$ " dowel is used to press them in place. Very short lengths are applied around the leading edges of the wings. When dry, fill gaps and openings with Supermold and sand with a sandpaper-covered $\frac{1}{2}$ " dowel.

If you are installing Digitrio or other end output servos, one must be converted to top output in order to fit in the aileron servo well. This can be troublesome unless you like to make small metal parts. The plastic case World Engines is marketing solves this problem very nicely as far as space is concerned. I don't know how they work because they were introduced after I had made a bunch of small metal parts. They look good, though. (The plastic cases, that is.) Another answer may be the Throttle-Eze Rocket City Specialties recently introduced. This looks particularly good for reaching around the radio box for the throttle and nose wheel control cables.

Final Assembly

The radio box is a direct steal from the Cherokee. Use it if you like. If not, provide means of access to the forward cockpit hatch screws. You will use them often so don't cover them up. Be careful about routing the throttle and nose wheel control cables over them. Carefully locate the power switch and charging jack away from the hatch screws and on the side opposite the exhaust stack. Remember, inverted engines exhaust on the side opposite upright engines. (I didn't remember.)

Assemble the airplane in the monoplane form without the cockpit hatch. All of the equipment should be in place with the exception of the throttle, rudder, and elevator servos. Control cables or push rods should be in and cut to rough length. Mark the balance point on the fuselage sides. Position the three remaining servos on top of the servo deck. Check balance. Adjust the position of the servos until the proper balance and desired arrangement are obtained. Install servos on the proper side of the plywood deck in about the same position and your ship should be balanced and ready to fly.

Changing configuration doesn't change the balance point enough to notice. A study of the weights, forces and moments show why this is true.

If flexible control cables were your choice, be sure that both ends of all nylon tubes are securely anchored. Rudder and elevator tubes must be supported by a cross member behind the servos. Throttle and nose wheel tubes may be bracketed to the fuse sides. Cut all tubes short enough to allow full cable movement, but no more. In other words, leave them as long as possible. Provide support as close to the end of the tubes as possible. Epoxy tubes to supports at ends. Rough up tubing with a knife to provide a surface epoxy can bite. If tubes can move or slip, controls will be soft — very soft.

Flying

With the ship properly balanced and everything working smoothly, you have nothing to worry about. Whether you fly the monoplane or the biplane first makes little difference. Linkage should be in outer holes on all surfaces and everything trimmed neutral. Take-offs on conventional gear are easy provided you have plenty of room upwind. Just let her weathercock and seek her own heading. She will lift off quickly but gently. Gain altitude and make your first turn gently.

She is all yours.