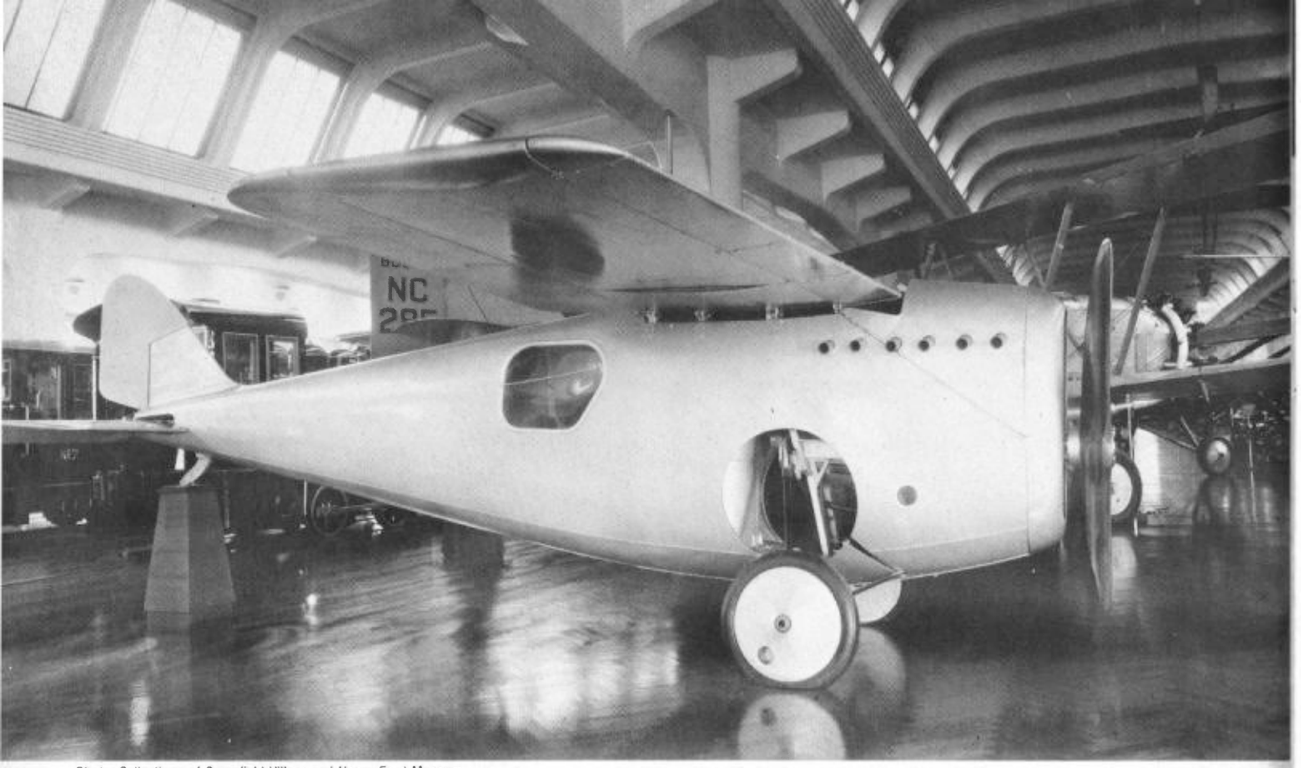


Photo: Collections of Greenfield Village and Henry Ford Museum

1920 Dayton-Wright Racer

by Bob Aberle

It's a funny-looking beast, but it smacks of the era. A 1/2A Stand-Off Scale R/C model of this classic pylon racer spans only 30-inches and takes the Cox Tee-Dee .049 engine.

Just as a little background information, our local club (Long Island R/C Society) held a 1/2A R/C Pylon Race at its November (monthly) contest. Although only a few entrees showed up, many members left the field that day vowing that they would definitely be a participant at the next 1/2A Pylon Race.

In reviewing that contest, it struck me that all of the entrants were flying mid wing configuration planes except one. This one fellow flew a high wing plane called the "*Little Mulligan*" which appeared as a construction article in RMC. The high wing arrangement seemed the right way to go and especially so for fellows just breaking into the 1/2A Pylon game. Since the "*Mulligan*" design was already covered, I started a search for another high wing racing design which would lend itself to the present rules. My club's V.P., George Myers, came to the rescue with a book entitled, "Racing Planes and Air Racers" by Reed Kinert (Vol. I, reference series No. 1, 1909 to 1923). On page 40, appeared a simple three-view of the 1920 *Dayton-Wright Racer*. In addition, on page 41, three good photographs of the original plane were provided with some detailed captions. This reference led to the fact that the original airplane is now on display at the Henry Ford Museum at Dearborn, Michigan. It is interesting to note that this was the first successful racing plane with retractable landing gear. The wing also had a unique adjustable camber feature which provided a thick airfoil at low speeds and a thin overall airfoil at racing speeds. The original was built by the Dayton-Wright Airplane Co., then a subsidiary of General Motors, for the James Gordon Bennett Race. Milton C. Baumann was the designer and, in fact, the plane is also referred to as the *Baumann RB-1*. A final reference was found in the July 1971 issue of American Aircraft Modeler which carried a detailed three-view by Bjorn Karlstrom.

One of the interesting departures in this design is the relatively low wing aspect ratio (shorter span and wider chord). Since the inception of 1/2A Pylon Racing, practically everyone has used the Ace foam wings which have a 35" span and a 5½" chord. Using a suitable scale factor, my *Dayton-Wright Racer* worked out to a 30" wingspan and an average chord of 7". Allowing for tip curvature you end up close to the 200 sq. in. minimum wing area. It was at this point that I chose to depart slightly from the basic 1/2A Pylon rules which appeared in the May 1971 issue of RMC. These rules stipulated a constant chord wing. I just felt that too many good racing designs have to be dropped as model projects because of this one rule. Since my particular club allowed a tapered wing, I selected the outline of the original *Dayton-Wright Racer* wing. Should you want to meet the exact rules, the plans show an outline of an alternate, constant chord wing.

Next item of interest was the use of ailerons. Again I favored that scale look. This meant the wing had to be flat, with no dihedral. A flat wing, of course, necessitated the use of ailerons instead of the usual rudder for turn maneuvers. Although I used ailerons on both wings, you might try a single aileron for simplicity.

One final design consideration was the landing gear. The original had a retracting type. A retract wasn't worth the extra weight or complication on this little plane. But why not a removeable landing gear? The rules state R.O.G. or hand launch at the discretion of the C.D. To date, almost all 1/2A Pylon Racers have been hand launched. If it's hand launched, can I remove the landing gear and fly? It's an interesting question for this new event. To take advantage of this technicality, I mounted the landing gear on the removable lower access hatch of the fuselage. It's very simple to remove several screws and drop off the gear. I placed the gear just about right on the C.G. so that removing the gear would have little effect on the flight performance.

About the only thing difficult in this particular design is the scale fuselage shape. The moments are basically scale, however, I did reduce the depth of the fuselage somewhat. You can see it is still on the "large" side. To achieve the elliptical shape, I was forced to use some block balsa which requires a little skill in carving and in some cases hollowing. Please don't let this one fact discourage you from proceeding. If you're really down on the block balsa, use the plan form and simply build a rectangular box fuselage with the engine hanging out in front of the firewall. Believe me, you will still have a high performance plane that still looks different. Of course, the real scale enthusiast, with the appropriate skill, might construct a molded fibreglass fuselage. This technique would permit an exact duplication of the original shape that would be strong and probably lighter than my block balsa fuselage. It's your choice.

The engine selected was naturally the Cox Tee Dee .049. My brief experience with pylon racing taught me that the Cox runs best on crankcase pressurization. To make life easy for me, I purchased a custom Tee Dee .049 from Kirn Kraft Products, P.O. Box 224, Anaheim, California, 92805. The extra cost is well worth it since Dale Kirn not only provides the crankcase pressure fitting, but also includes a special needle valve containing 128 threads per inch which makes adjustments far less sensitive than the original. This special engine, in addition, had a larger venturi and a special "hot" glow head. Again if your bag is to build and fly and not become an engine expert, invest a couple of extra dollars in this engine.

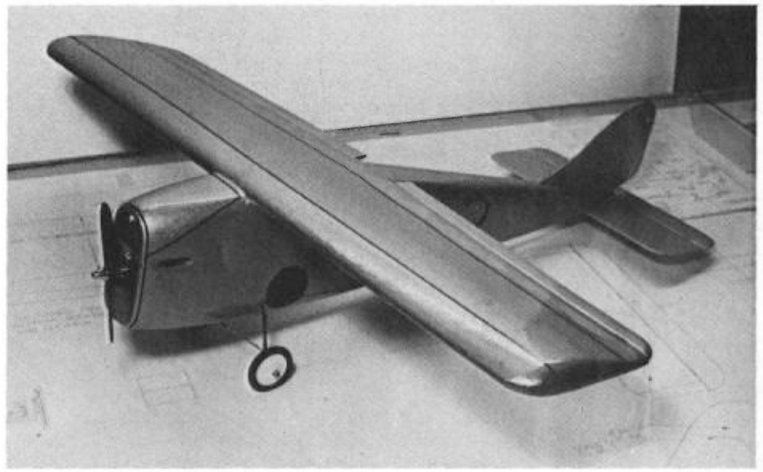
A little trick was devised in the mounting of the engine. Most of the 1/2A Pylon Racers today are using radial mounts (either Kraft or Tatone) because they are easy to install and for the most part lighter. By using a radial mount, you also obtain more clearance directly in back of the firewall for the fuel tank. The problem, however, is that the Kirn Kraft/Cox engine has the pressure fitting project directly rearward. If radial mounted in the normal fashion, you would have some plumbing problems with the pressure line running back to the tank vent. My little scheme was to add a spacer (F1A) of 3/16" plywood directly in front of the firewall. A slot is cut in this spacer which permits clearance for a piece of medium size silicone tubing. The technique then is to install the silicone tubing on the crankcase pressure fitting. Then bolt the Kraft-Hayes radial mount to the firewall, allowing the silicone tubing to come up and around in a loop where it can easily be connected to the tank vent. The 1 oz. Sullivan Pylon Brand round tank was fitted with extra long fill and vent tubes which actually protrude about ½" in front of the firewall. It is then an easy job to connect the pressure line to the vent and the fill/pick up line to the engine. Normal procedure to fill the tank is to first disconnect the pressure line at the tank vent, then disconnect the engine fuel line at the engine, and fill at that point. This works out fine and also prevents excess fuel from entering the pressure fitting, thereby flooding the crankcase. Believe me, if you try this approach several times you will realize it is easy. The spacer I used could of course be eliminated if someone came up with another pressure fitting which makes a 180 degree bend and ends up facing forward. Something for the manufacturers to think about.

I mentioned the type fuel tank used. Please don't try one of the so called tank mount units. Their fuel capacity is very small. The problem being that you can't complete a regulation ten lap race without running out of fuel. The 1 oz. capacity recommended is the minimum size. When assembling the Pylon Tank do not use the "clunk" mechanism. I have found this very impractical on the small tanks. Instead substitute soft brass tubing. Run the pick up line to the rear, lower center, portion of the tank. The plane will normally make sharp banks in the pylon turns which means the fuel will be forced to the bottom of the tank, not the outside as in Controline flying. As I said before, provide extra lengths for the pick up and vent tubes so that they will project into the engine compartment. On my particular tank the soft brass tubing extended 1" beyond the cap end of the tank. Passing these tubes through two separate holes in the firewall also prevents the round tank from rotating due to engine vibration. Think of the fun if your tank revolved 180 degrees after the fifth lap of the race. One final item on the tank. Before installing, insert a small piece of ¼" foam rubber over the pick up and vent tubes. By doing this any engine oil that penetrates the firewall will be caught or absorbed by the foam and eliminate a messy situation. Even at this it is a good idea about once a month to pull out the tank, clean it, replace the foam rubber and reinstall.

Construction

The wing is of course the standard, constant chord Ace foam variety. I first joined the two halves using Hobbypoxy Formula II glue. Masking tape was used around the joint to hold the halves together while the glue dried overnight. Since there is no dihedral simply place the wing on a flat board. When dried, I first cut the chord to an even 5". This means approximately a ½" piece is removed from tip to tip at the trailing edge. I used a steel straight edge and an X-Acto knife. Next the wing tips were trimmed by 2½", each side, to reduce the total span from 35" down to 30". Save these scrap pieces, they will be referred to later. Next item is to add the wide balsa trailing edge. I used ¼"x3" Sig Contest Balsa on the original. As you can see in the photos this produced a somewhat awkward airfoil shape. The 5/16" balsa called for on the plans is recommended. It is suggested that you first glue the balsa to the foam with either Hobbypoxy Formula II or Titebond. We used both glues with success. When dry, cut the balsa to the final shape using the steel straight edge. Then sand an airfoil shape as if you were sanding the wing of a hand launched glider. After this, mark the wing tip radius as shown on the plans and cut the tips accordingly with an X-Acto knife. Round off the tips with first coarse (60) and then fine (220) sandpaper.

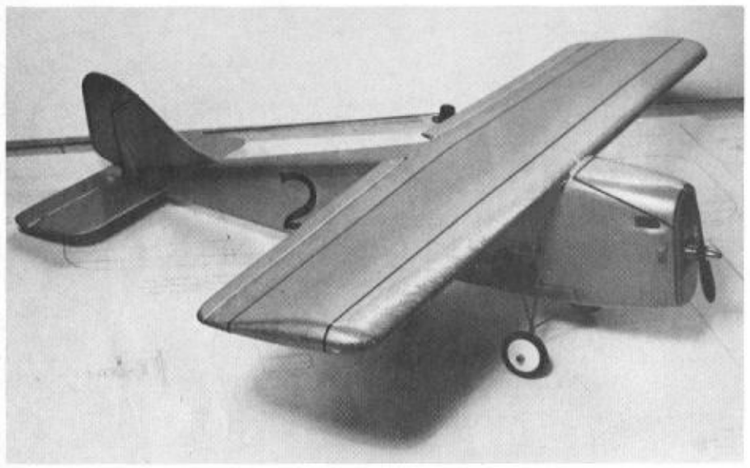
Photos by the Author



It makes a very competitive aircraft. A roomy fuselage, rugged structure. Ailerons and elevator. **Facing Page:** Full scale prototype passes the ages in the Henry Ford Museum, Deerborn, Michigan.

Only now will you cut out the ailerons from the completed wing. Again the use of a steel straight edge is essential. Final step is to pre-fit three small Klett hinges on each aileron, along with a DrBro aileron horn. The small center piece of balsa remaining between the two ailerons should be removed and placed aside until the final assembly operation. The resulting wing is extremely strong. The combination of the short span and the wide balsa trailing edge provides sufficient strength. I did not see any reason for adding reinforcing tape underneath the wing as is usually done with the Ace wings.

Next is the fuselage. Begin by cutting out the 3/32" balsa sides. Use a medium weight balsa for this. Next cut out and install the 1/4" balsa doublers that essentially border the inner sides of the fuselage. Again I selected contest balsa for these parts to save as much weight as possible.



Silver Solarfilm skins it. It's all you need over the wooden fuselage, and all you need over the Ace foam core on this shrimp-sized aircraft. Outline is 1/16" wide black trim, DJ Multistripe.

In the interest of saving time I used Hobbypoxy Formula IV quick setting glue for the entire fuselage construction.

Next cut out the 3/16" plywood firewall (F-1) and the firewall spacer (F-1A). Glue these two plywood parts together as shown on the plans. Locate the Kraft-Hayes radial mount holes. Drill clearance holes for 3-48 hardware and temporarily install the mount using "T" nuts or blind mounting nuts as they are sometimes called, on the rear of the firewall. Spot glue these nuts with epoxy, being careful not to get the glue on the inside of the threads. You can now remove the radial mount. It would be advisable at this time to drill out the beams of the Kraft-Hayes mount for the Cox engine. Please read the instructions supplied with the mount. I didn't and ended up shearing off one of the sheet metal screws, flush with the mount. Since I couldn't remove it, the mount was ruined and $2.00 went down the drain. Best bet is to mark the holes, drill them out, then insert the screws using oil and tighten down. Once this is done, you can remove the screws and then mount the engine.

Continuting with the fuselage, drill the two clearance holes in the firewall for the 1/8" O.D. brass vent and pick up lines. Start the assembly procedure by locating the firewall between the two sides. A large "C" clamp was used to hold the sides against the firewall. Since no formers are used, it is advisable to install a temporary former in the area of the wing trailing edge. You can determine the width at this point by scaling off the top fuselage view. Again clamp the fuselage at this point, then bring the sides together at the rear and glue. Next, add the 1/4" contest balsa top and bottom sheets. Apply a liberal coat of epoxy around the firewall area. When dried, remove the clamps and the temporary former.

Next step is to prepare for the block balsa lower fuselage. First install the 3/32"x 1/4" spruce stiffeners on the inside of the 1/4" balsa doublers. Use the fuselage section views as a guide. Now prepare the block itself. Instead of 1" balsa I chose two pieces of 1/2" soft balsa, epoxied together. The two cuts which would allow the hatch portion to separate later were made on a radial arm saw, although the model type jig saw could still be called on to do this job. Glue the block to the forward, lower fuselage. Use epoxy on the two pieces which will remain permanently bonded to the fuselage. On the removeable hatch portion, use model cement and only spot glue. After shaping and sanding this portion will be cut away later. Just prior to sanding, I installed the 1/8" plywood tray which mounts on top of the removeable hatch. This tray not only braces the hatch (which supports the landing gear) but also aligns it always in the same position. You can pass the tray down into position from the wing opening on top of the fuselage. Be careful that the glue does not run out on the sides, otherwise the hatch will become permanently bonded to the fuselage. Add the top, front, 1/2" balsa block, forward of the wing leading edge.

Now proceed with the carving and sanding. The X-Acto long carving blade works the best. For sanding I started with #60 production paper followed by 150, 220 and finally #400. After the sanding is complete cut a slot in the top, rear of the fuselage, 1/8" wide, to accept the rudder. Also cut away the doublers that may have obscured the stab slot.

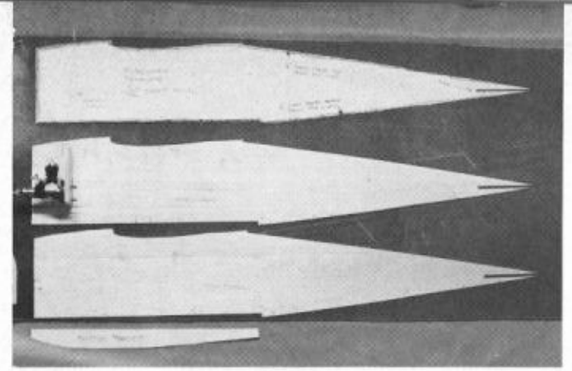
The landing gear is the next item. Bend up a main gear from 3/32" diameter wire. The two supporting wires are made from 1/16" diameter wire. Remove the lower access hatch by carefully cutting the spot glue joints. The idea is to assemble the main gear first to the hatch using a strip of 1/8" plywood and sheet metal screws. Next cut out two pieces of small hardwood approximately 1/4"x3/8"x3/8". Leftover beam engine mounts would be fine for this purpose. Provide cut-outs for these pieces in the access hatch. Glue both in place so that they are flush with the outer surface of the hatch. To these blocks you will anchor the two supporting wires. Use a small aluminum strap and sheet metal screws for both wires. Now arrange the support wires against the main landing gear. Wrap these joints with thin, tinned copper wire and silver solder. If you want to silver solder easily try "Stay-Brite" obtained from J.W. Harris Co., Cincinatti, Ohio, 45242. This kit ($1.89) enables neat silver solder joints using only a regular 25 watt pencil type soldering iron. With the landing gear mounted, try placing the hatch back into position. To do this you will have to cut or file a round clearance hole on each fulelage side to accept the main landing gear wire. Drill out and tap for a nylon hold-down bolt. Last step is to hollow out the hatch as much as possible to reduce weight. If you choose to fly without a landing gear it is suggested that you add a small (3/32"x 1/4") spruce skid to the bottom of the hatch.

Temporarily mount your engine and mark the areas where ventilation or access is required. On the original model I made a 1/4"x1-1/4" rectangular opening opposite the engine port on the side where the fuel line attaches. On the needle valve side I made a 3/8"x1" opening closer to the top of the cylinder head. This opening enables a Cox booster battery clip to pass through the fuselage side and connect to the glow plug. Both openings should provide enough air exit for reasonably cool operation.

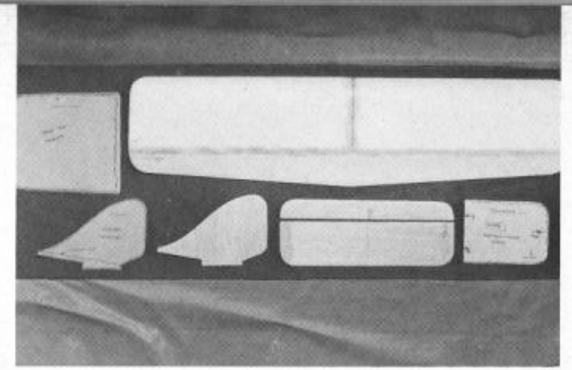
One potential problem was overcome thanks to Dale Kirn. I needed a needle valve extension and did not want to get involved soldering to the existing valve. Dale came up with a plastic extension which slips over the regular valve and works swell. I understand this is made by Cox specifically for one of their plastic Controline models. Kirn-Kraft will supply these extensions if you desire for only 25 cents.

There is not much to be said about the tail surfaces. I chose 1/8" balsa instead of the usual 3/32" because I wanted to use the small Klett hinges. Anybody flying one of these "little tigers" using Solarfilm or MonoKote hinges is running a great risk. Especially so since this has become a great spectators sport where crowds gather easily. So please use nylon hinges, even if they take a little longer to install. Both the stab and rudder are glued into their respective slots at this time with epoxy glue.

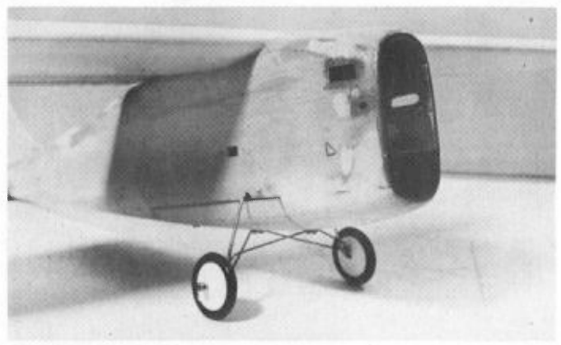
Now we get to the radio installation. I chose my one and only 1969 vintage Kraft 4 channel rig of which only two KPS-10



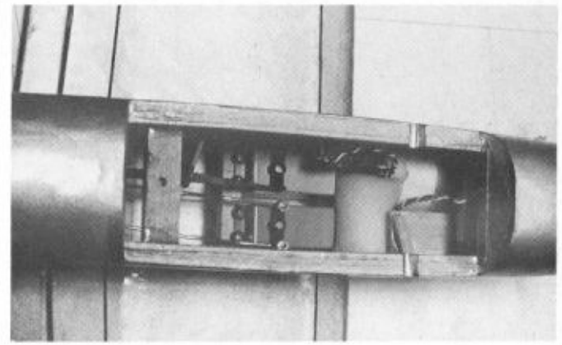
Templates, sides and pieces. No fair complaining about complexity, it's an easy bird to build. Note how the Tee Dee .049 gets lost within cowl.



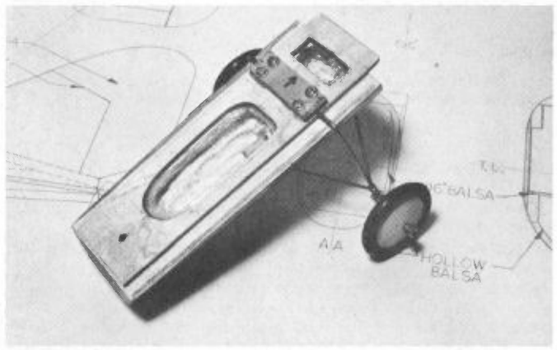
Flying surfaces offer no structural problems. Foam wings are available, easily modified to the design. Sheet surfaces create the tail feathers.



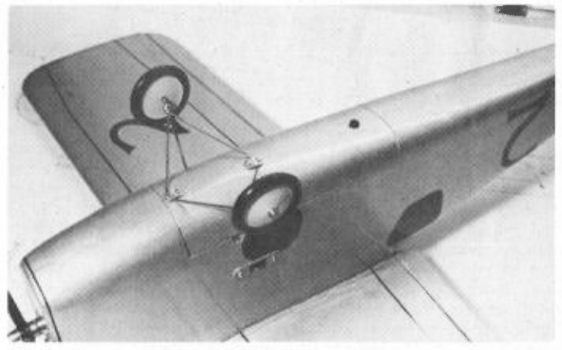
A view of ship just prior to covering. Silver Hobbypoxy has already been applied to the firewall, and cowl area. Sand everything down carefully.



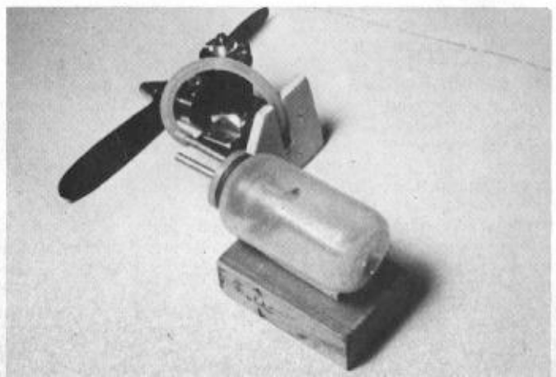
The inner workings. Two Kraft KPS-10 servos in view. Two channel brick radios will fit with a little rearrangement and planning. Space enough.

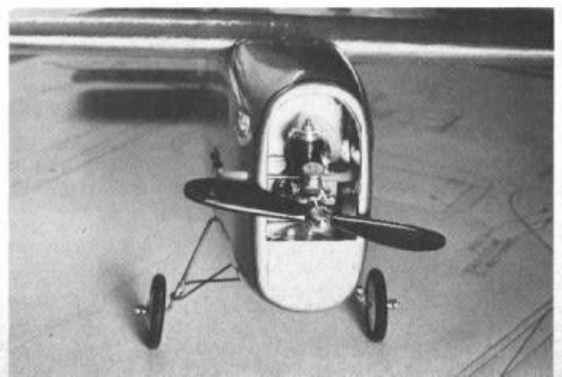


Inside view of hatch cover depicts how balsa is hollowed to save weight. **Below:** A mock-up of the engine and tank assembly illustrating method of connecting the pressure line, using a plywood spacer. System works well.



The gear attachment. If you choose to hand launch, and not use the gear, substitute a landing skid. **Beneath:** Front view shows connection of fuel pick-up and vent pressure line. It should not touch warm cylinder head.





Author's son Tommy has no difficulty starting engine. Note how easily a Cox battery clip fits in neat slot provided on the fuselage side for the purpose. The needle valve extension is described in the article together with other engine details. The Dayton-Wright Racer is eager to depart.

servos were used, one for aileron and one for elevator. The current rules provide for only two channel operation. For the first time I was forced to use a 225 mah battery pack. The size and weight requirements made it necessary to use this small pack. I called Kraft Systems to obtain a shorting plug for my transmitter which would enable me to charge the two packs separately. The message I received was to "please be careful when using a 225 mah pack. Remember you can't stay up in the air all day. Conserve as much energy (where have I heard that before) as possible by turning on the receiver after the engine has been started just prior to launching." The other caution was to "never exceed the 10% rate for charging." In other words, never exceed 22.5 ma when charging or the batteries might easily be destroyed. Please keep this in mind. The two servos were installed directly on ¼"x⅜" hardwood rails. Since the fuel tank is actually very close to the receiver and battery it is strongly recommended that they be wrapped in "baggies" or some type of plastic. Connections to the elevator was made using Pylon Brand, Gold N' Rods (red colorflexible type). The rods outer sleeve penetrates the fuselage at the rear as shown on the plans. At the servo end I found it convenient to make up two 1/16" plywood partial formers (F2 and F3) to anchor the Gold N' Rods. You may have to alter slightly the location and size of these formers depending on the type of servo used.

A small piece of 3/32" balsa is employed as a tray to support the fuel tank at the proper level. I braced this tray with a scrap piece of 3/32"x1/4" spruce. When installing the radio, start by wrapping the battery pack in foam rubber and insert into position. Next install the fuel tank. Then wrap the receiver in foam rubber and place it next to the fuel tank. Route the antenna out the right side of the fuselage. I ran my antenna first out to the tip of the stab and then up to the top of the rudder. Install the servos next and then the switch. Wrap the servo and all other harness wires in foam rubber and wedge in between the servos and the receiver/tank location.

As you may have already realized, the wing is permanently glued to the fuselage on the original model. With a 30" wingspan it did not seem necessary to bother with any type of removeable wing scheme. The complete plane fits perfectly in the back of my Volkswagen when the rear seat is folded down. If you have a crash and damage the wing it still isn't much of a job to cut away the old wing and glue on another.

Prior to covering, the firewall area and the inside of the tank and battery compartment were given two coats of Hobbypoxy clear, followed by a coat of silver. Solarfilm was used for the covering. About ¾ of a roll will do the job. I used a Selector iron to tack down the Solarfilm and a Polytherm gun (carefully) to shrink it. Use those scrap pieces of wing foam to experiment with the heat control. As a guide my Selector heat control knob pointed to the nine o'clock position, or about 25% of its full range. The color silver was chosen, based on the data we had on the original. I sincerely hope this was the correct choice. Numerals, windows and the simulated wheel wells were added in black (wet or sticky back) MonoKote. Joints and seams were roughly outlined using D-J 1/16" wide black Multi-Stripe. If you have any exposed wood showing after you finish with the Solarfilm you can touch up these areas with some Hobbypoxy silver. Solarfilm silver and Hobbypoxy silver are the exact match and the adherence of one to the other is acceptable. I

Bob's wife Irene is happy enough to hold it at this stage, ship's not greasy yet. Give it time!
Beneath: Be prepared to answer "What's that?" questions with this one at the old flying field.

might add that the ailerons were Solarfilmed separately, then installed to the covered wing. The final step was to glue that small piece of balsa fairing to the fuselage between the two ailerons. Apply a piece of Solarfilm over this area and you are done.

I haven't had the chance in our foul east coast weather for much flying to date. I do believe I will have a very competitive plane in this *Dayton-Wright*. The finished model, less fuel, weighed 25 oz. which isn't bad considering all the balsa used. The rules call for 20 to 32 oz. weight limitation. It's very important to let the Cox engine run fast. Don't load down the engine with a 6-3 prop. I have been using 5-4 props at present but believe the 5¼-4 will eventually be the better choice. When hand launching, don't throw it like a javelin. Run about four or five steps and then give it a throw. I've seen too many crashes due to poor launching techniques. Whatever you do don't hold the transmitter yourself and do your own launching.

As for fuels, we started by using K&B 1000 (about 22% nitro). The Cox engines like high nitro. You will be defeating the intent of this engine if you use your regular 5% nitro R/C fuel. It may be convenient to pump from the same can, but the results will be disappointing. In a phone conversation with Dale Kirn I received some of his recommendations on fuels. For most average pylon racing he suggested Cox Racing Fuel with 30% nitro. Above 30% nitro you will start to use up glow plugs at the rate of one every flight or several flights. The other problem is that as you go higher in nitro you consume more fuel. If you are getting in your 10 lap race on a 1 oz. tank with 30% nitro fuel you might not if you switched to say K&B Speed Fuel with 50% nitro. Be especially careful with these small engines, that you keep your fuel filtered and clean. A final suggestion to the serious flyer is to partially disassemble the engine after each flying session and lightly steel wool the accumulated varnish off the piston and liner.

I've been personally satisfied with this design to the point where I would be willing to try a ¼ midget (.15 power) version next. I hope others will try the low aspect ratio wing approach in future ½A Racing designs. The new Wittman "V" racer, which uses a Volkswagen engine, would be a fine choice for a new ½A Pylon Racer design. How about it somebody?