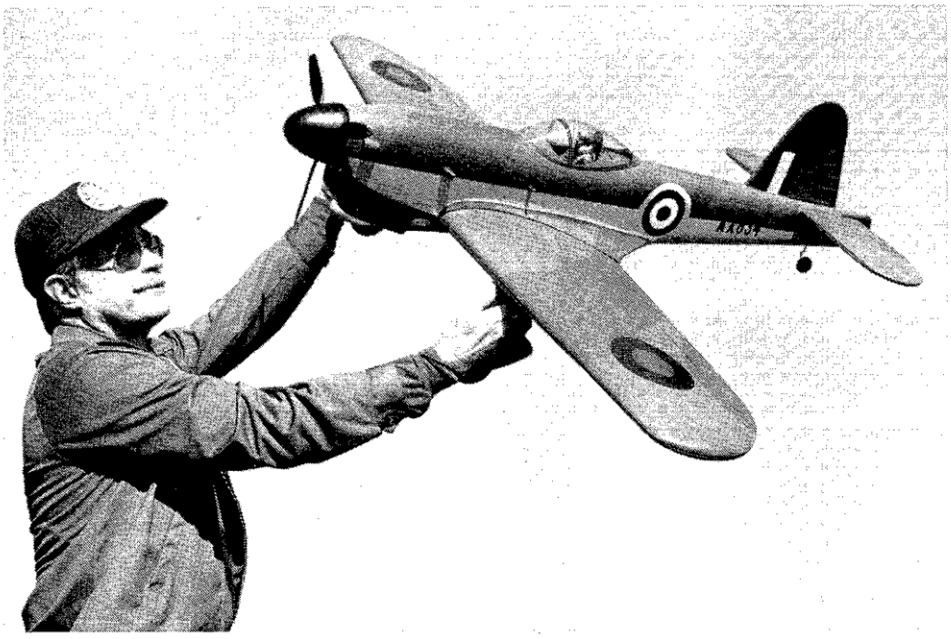
An R/C SOS

Miles M-20/2

It's foolish to put all your eggs in one basket. England had an alternate fighter design which few remember and it happens to make for a superb Stand-Off .60 Scale R/C project/**Stan Hines**



Almost a Typhoon, but it isn't. You'll have to do some explaining for few modelers will recognize it. **Beneath:** It makes an outstanding Stand-Off R/C. A rugged piece of aircraft. Note the big wing fillet.

In 1940, the year of the "Battle of Britain", England had a plane that was by actual test faster, with better visibility, and more heavily armed than the Hurricane and nearly an equal in speed and agility to the Spitfire which it also outgunned. While its more famous sisters were primarily interceptors for striking invading aircraft over England the Miles M 20/2 was a long range fighter capable of attacking the Luftwaffe over Europe just as the Mustang and Jug did so effectively three to five years later.

If such a plane existed why had I never heard of it? One of the nice things about this hobby are the pleasant surprises that happen from time to time. The M 20/2 came to my attention by one such experience. My wife, an avid reader, brought me a book from the local library and while leafing through it saw a most attractive, in fact eyecatching, but unfamiliar plane. I was immediately struck with its potential for a sport scale R/C model even though I had about decided that I did not want to design another military plane. Obviously I changed my mind.

The M 20/2 is one of many forgotten fighters in the history of air warfare, but like so many experimental aircraft it paved the way for improvements in other, later planes. In this case the superior pilot visibility due to the one piece Perspex bubble canopy was seen and praised by test pilots three years before it appeared on the P-51.

Although I remember much of the period just prior to WW-2 I was not aware until I started research for this piece just how poorly England was prepared for war despite all the warning signs. Most of the Western countries were making do with post WW-1 bi-

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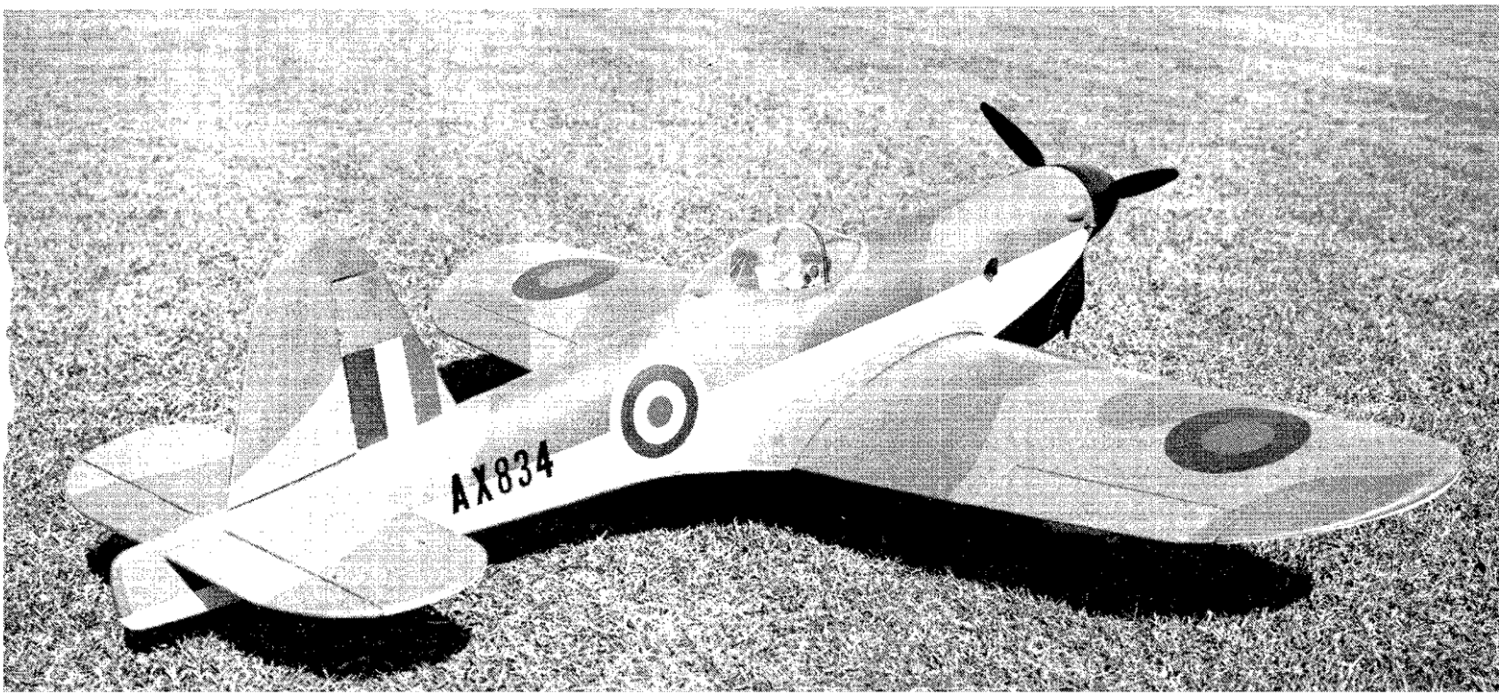


planes while Hitler had rebuilt a strong and modern army and airforce. Thus it was left to private industry to develop new designs and to experiment with new materials and concepts through sport aviation and air racing.

So it was hard to believe that Britain, in spite of Churchill's warnings, had only one operational squadron of Hurricanes in March of 1938 and by August the RAF had received only two Spitfires! Barely eighteen months later German aircraft were trying to destroy the inferior RAF in the now historic and heroic "Battle of Britain".

Air superiority had to be achieved by the Luftwaffe if a successful channel crossing could be made. With this critical situation the British Minister of Aircraft Production, Lord Beaverbrook, was studying how to press every available plane into service should the invasion come. Trainers were being fitted with guns and bomb racks, fighter production was being pressed to the limit of skilled labor and availability of critical materials.

Against this background a well known, innovative, and highly respected designer, Mr. F.G. Miles proposed to the Air Minister a new fighter that would use a minimum of critical materials, could be built quickly by inexperienced labor, would use many standard components, and yet would be equal to or better than its contemporaries. Even in more normal times that would have been a tall order, but England was desperate and the orders were given to go ahead. The result was an all wood fighter that even though it had fixed landing gear was faster than the Hurricane, nearly as fast and quick as the Spitfire with better visibility and greater range than either. Had this plane ever been needed I feel it would have had a career equalling its wooden cousin the Mosquito.

The Plane

The Miles Single Engined Fighter Aircraft M 20/2 was built to Air Ministry Spec. F 19/40 by Phillips and Powis Aircraft Ltd. Although the original Miles Aircraft Co. had been purchased by Rolls Royce and renamed, F. G. Miles was retained as Chief Designer. While some design work had been done without authorization, the serious night and day work under the eye of Walter G. Capley did not begin until August 3, 1940.

Design and prototype production were carried on at the same time with the amazing result that the first flight was made by Chief Test Pilot Tommy Rose just nine weeks and two days later on September 14, 1940, nearly one month ahead of schedule. However, at least one shortcut nearly cost them the plane and the life of the pilot.

In a later test flight, pilot Hugh Kennedy climbed to 20,000 feet for spin tests and nearly lost it. Unable to stop the spinning craft he was preparing to bail out at 7,000 feet when it suddenly stopped. Somewhat shaken he nevertheless returned home and landed safely. Wind tunnel tests omitted earlier confirmed that the stab blanketed the rudder in a spin making it ineffective in recovery. The fuselage was lengthened and the stab moved eighteen inches aft.

The original designation, U-9 was changed to AX-834 and camouflage added to the previously all yellow plane. At first the line was as shown on the plans and the model, but later it was extended to lower wavy type with which we are more familiar.

All testing of AX-834 came to an end in December, 1940 when she was written off due to a landing accident in which it skidded off the runway and slid into a sand pit. However, by this time the Battle of Britain was over and so was the need for this promising fighter.

Although this ended the first model another was built, M 20/3, in 1940 and in 1941 two more models were completed. The Navy model was built to Specification N1/41 and the RAF unit carried the M 20/4 designation. It was sent to Boscomb Down for trials on April 18, 1941, then to RAE Farnborough September 15, 1941, and was finally returned to the manufacturer on March 19, 1943 where it was canabalized for parts and the entire project written off as of May 21, 1943.

For the statistics buffs a recap of the features of the Miles M 20/2 will help them to compare it with other 1940 planes. As mentioned earlier it was the first (as far as I can determine) to employ a one piece, molded, bubble canopy, it carried either eight or twelve 303 Browning machine guns buried in the wings all firing outside the arc of the Rotol, three-blade metal propeller, (the Hurricane was still using a two blade wooden prop). It was an all wood plane except for the power egg which was borrowed from the Beaufighter. This Rolls Royce Merlin XX, rated at 1280 hp. gave the M 20/2 a top speed of 345 at 20,400 feet and the 154 gallons of fuel carried entirely in the wings gave it a range of 1200 miles or more than three times the range of the Spitfire. Also carried in this thick wing were 5000 to 7500 rounds of ammunition, a truly formidable armament. The normal weight of 5884 pounds and maximum of 8000 was carried on 34'7" wings of 235 square feet area. Length was 30'8", height 12'3", 1½" bullet proof wind screen, and the 9mm armor plate behind the pilot also protected the oil tank. The Dowty fixed gear was spring loaded, arms very similar to the Sullivan gear used on the model as seen in the photographs. By eliminating the retracting gear, its weight, space, and complexity as well as the entire hydraulic system were avoided. A much lighter and simpler pneumatic system operated the flap and brakes. The single flap in the center of the wing reduced the landing speed from 101 mph to 80. The airfoil used NACA 23021 at the root and 23009 at the tip. This means that it was 21% at the root compared to 19% for the Hurricane and 13% for the Spitfire. Although the entire plane was plywood sheeted, all control surfaces were fabric covered.

Credit for this information must be and is gladly given to The National Air and Space Museum of the Smithsonian Institution and to Mr. Dominick A. Pisano, Reference Librarian; to The Royal Air Force Museum, Hendon, London, England and Mr. J. M. Bruce, Keeper of Aircraft and Research Studies, and to the numerous reference articles they furnished.

Perhaps the most interesting to me was the Top Secret War Department Report No. 42095 by Lt. Col. J.G. Taylor of 1/10/41. In this report it was stated that dive tests for strength and stiffness were made at 500 mph without the usual control "freezing". Another interesting narrative of its development was found in an article by Don Brown, a former test pilot for Miles, in the April 1976 issue of Aeroplane Monthly, a British publication, entitled "Last Ditch Defender".

I hope that this quite long introduction to a construction article has given you, even as it has me in preparing it, a better sense of the fantastic achievement represented by this very prolific designer, F. G. Miles.

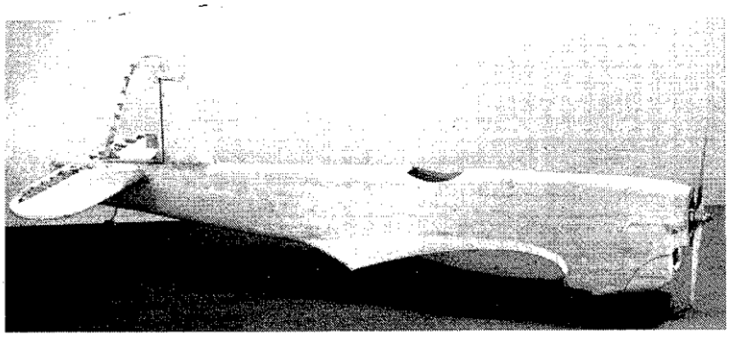
The Model

This is a medium sized model by todays standards, but still a .60 size nevertheless. Wingspan is 58", area 680, length 47½", and weight 8¾ pounds dry. Although powered initially with a standard .60 it now uses an HP-60F and I would recommend either an SR or PDP .60 be used. The thick wing makes for very realistic flight speeds and very stable flight. It certainly is no pattern plane, but it was not intended to be.

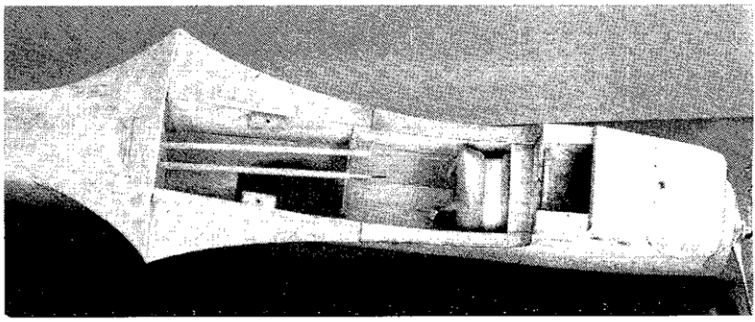
While construction is not unique there may be some things that are not evident on the plans. I'll try to avoid too much detail. The wing and tail are built up, sheeted construction while the fuselage is a combination sheet and plank construction that I have found to be both rugged and relatively easy to make. Some skill with a carving knife and some patience with a sanding block will reduce the large slabs of ⅜" and ¼" inch balsa to the desired shape far quicker than the narrow planking method, will be nearly as light, and significantly stronger. Control surfaces are all built up with the correct number of ribs and are fabric covered. The only change from exact scale that was deliberately made is in the stab. This was done not from a design requirement but rather from an appearance standpoint. The fuselage was slimmed slightly for the same reason. Although this model is an all wood plane, (the original was so, why not the model?), the wing could easily use a foam core construction that would speed things up quite a lot.

I recommend that construction start with the wing since the wing saddles in the fuselage can be cut later with greater accuracy than from a plan. Observe that ribs 1 and 2 are double sheeted and are therefore 1/16" undersize, (for those of you who have learned to check for such things). For the same reason the notches for the ⅛"x ½" spar caps are only 1/16" deep here but are ⅛" deep on all the other ribs. The main spar and building jig is one continuous 3/32" tapered and alternately notched piece spliced as shown. The top and bottom spar caps can be either spruce or hard balsa and are also one piece with the splices made near the tips. While a little awkward to work with at first the result is a strong and lighter wing than one spliced at the center. The airfoil used is a modified RAF-34 section with each one individually calculated to the desired thickness, camber, and length. As stated before foam cores could be substituted using ribs 1, 5, and 11 as templets for an inner and an outer panel for each side. The only dihedral is due to the taper of the profile with the top of the wing being flat. This aids in building since much of the work can be done with the wing inverted on a flat surface. With all spars and filler pieces in place the structure is quite strong and resists warps when sheeting is added. Sheeting is 1/16" and of course is spliced or butted at the center, except for the double portion between ribs 2r and 21, where the first layer is continuous.

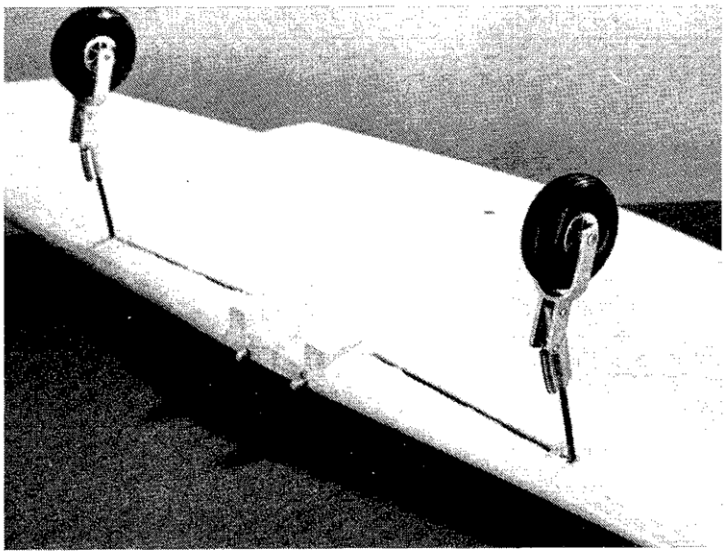
The sequence of assembly is very important, so before doing any covering be sure to have installed the aileron torque rods, landing gear blocks, and the plywood pieces for the dowels and the wing bolts. It would be easier at this time to also make the aileron servo box in the #1 rib. This is not shown since your servo and choice of location may differ from mine. The wing bolts are accessed

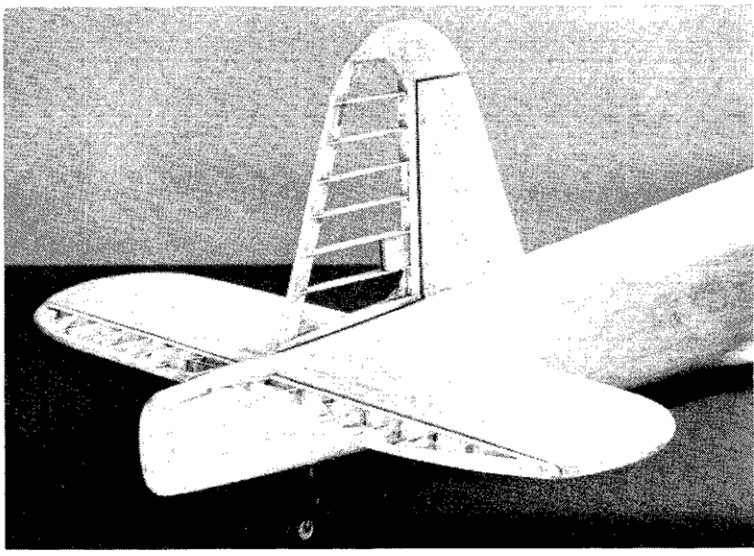


The Miles M 20/2 is not a tough aircraft to fabricate, pattern-like in all respects. The wing fillet is visible here, it's not difficult. **Beneath:** The Sullivan gear is quite ideal, provides some shock action, typically mounted.



Wing removed, all the access you could hope for. The strong wing saddle and hardwood hold-down blocks follow standard practice. **Below:** The tail surfaces are visible here, a sheeted stab and fin. Adequate control areas.





through holes in the bottom skin which allows the use of shorter bolts and avoids unsightly bolt heads protruding from the wing. The leading edge is fitted with ¼" dia. dowels to match the holes in former 3A. For profile appearance the underside of the center-section is fitted with fairings to match up with the cowl. These are only about one half inch wide so that the engine cooling air exit is not restricted. Note that the landing gear blocks must accept 3/16" dia. wire to avoid problems with a too soft gear. The drawing of the wing is the bottom view, uncovered. The front view shows a series of cut-aways to try to clarify the details of the spar, spar caps, and double sheeting of the center-section.

The wing fillets are 1/16" balsa. The trailing edge is ¼" balsa set at an angle as shown so that the front top edge is flush with the 1/32" ply wing fillet saddle.

There are at least two schools of thought on how to present information on drawings. The most common is the "outside" view with various dashed lines to show internal detail. The other is the "section" view looking from the center outward, as though the subject were sawn in two. In order to clearly show the outlines of the sides and doubler I have chosen this section technique for the fuselage.

A special dashed line is used to show all centerlines. These are important on this plane because the stab is *not* set parallel with the thrust or centerline of the fuselage as is usually the case, but is set parallel to the top line of the fuselage. This means that the wing must also be set at the same or slightly greater angle to avoid negative incidence. The total effect is to give a slight down thrust without offsetting the engine. If this sounds confusing don't worry, it works, and what's more that's exactly the way the real plane was rigged. In the model the combination of a semi-symetrical airfoil and downthrust gives nice handling characteristics at all power settings, (small trim adjustments) and also gives superior inverted flying qualities.

Because of the location of the tail wheel relative to the rudder post this is an area that needs some attention. Formers 7 and 8 are the last to be installed after the sides have been pulled together and glued at the tail. As you study the drawing you will see that both must be completed as a sub-assembly including the rudder post, wire pushrod, and with both rudder and tail wheel wires "J" bolted in place. Not shown on the plans but necessary is a small washer or collar soldered to the tail wheel wire under the lower J-bolt to prevent it from being pushed up into the plane where it might bind or restrict the rudder movement. They are installed as a unit but only 7 is epoxied first. When set, 8 is epoxied and positioned such that the rudder wire and tail wheel wires are both centered before the epoxy sets. When completing the rear part of the fuselage I found it advisable to install the pushrods before adding the planking. The bottom plank goes from 5 to 7 and the piece from 7 to the tail can be a piece of scrap. The top shoulder 3/8" planks stop at the leading edge of the stab.

The stab and elevator are built and assembled prior to being fitted to the fuselage. This is necessary if you use the hidden control horn since it must be connected before final assembly and glueing takes place. Be sure to check everything for freedom of movement to see that nothing binds because all these controls are permanently hidden from now on. For ease of construction the top plank stops at the rudder post and the part over the stab to the tail is made from scrap ¼" contoured to fit over the stab. The fin is constructed on the plane taking care to point it straight down the fuselage. Add the tail block and this end is complete except for final carving and sanding which must be done later.

The forward section is completed in the usual manner except for a couple of things. The fuel tank should be installed as well as the throttle cable before the cooling duct is added. The bottom chin piece should be added with the grain across to make it possible to cut out the removable nose piece later. When all the carving and sanding are complete the curved cut-out for engine access is made. I found the curved cut-out easy to make and it gives slightly better working room than a straight diagonal cut. The dummy air scoops and finished cockpit add greatly to the realism of the model.

A 4" spinner is, to say the least hard to find, but with larger models becoming more popular they may be available soon. If not, you may have to find a friend who has a vacuum forming machine. Mine was drawn from 1/16" plastic and fastened to a ¼" ply disc with eight number 2x3/8 screws. Two were made,