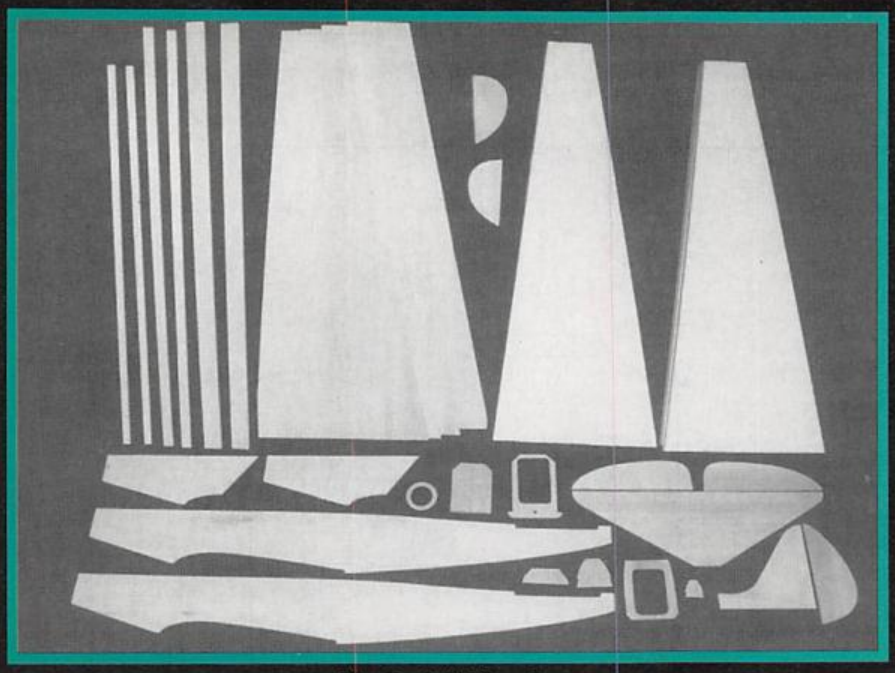
# Mikoyan-Gurevich MIG-7

## A 1/12 Scale Combat Design For .15-.26 Engines

By Bob Wallace



*The Basic "kit" parts.*

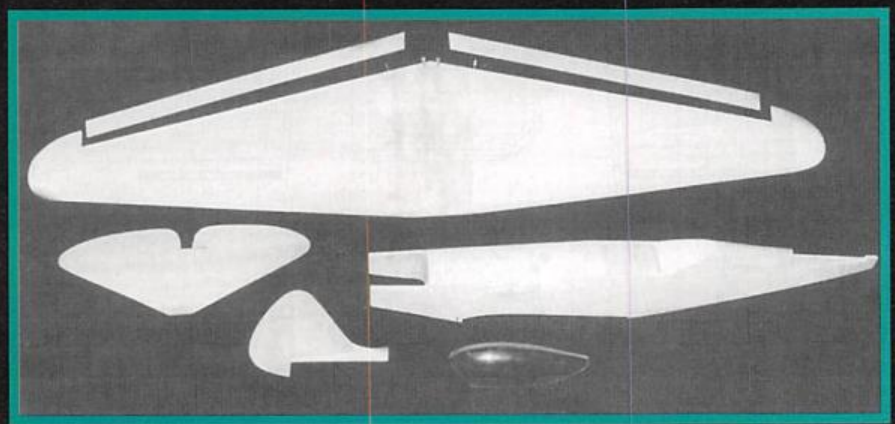
There is little doubt that 1/12 Scale Combat is currently the fastest growing competition event within the R/C aeromodeling community. While still listed in the Academy of Model Aeronautics (AMA) Competition Rule Book as a provisional event (#704), that is destined to soon change. The Radio Controlled Combat Association (RCCA) has been accepted and approved by the AMA as the recognized Special Interest Group (SIG) for this competition category, and 1/12 Scale Combat will become a full-fledged AMA Rule Book event.

In the United States (and also in Canada), there are presently two 1/12 Scale Combat classes being flown, and both will become a part of the AMA Rule Book. Only engine size and scale fidelity latitude factors separate the two events.

One class (704) which is now called 2105 utilizes any engine up to .15 cu. in. for any inline engine powered fighter and up to .21 cu. in. size engines for radial engine powered aircraft. A 5% scale deviation is permitted in all aircraft designs. The other 1/12 Scale Combat class is 2610, which allows any engine up to .26 cu. in. of displacement to be used in all aircraft designs, and a 10% scale deviation factor. Interest in the two categories is about evenly divided and all 2105 type aircraft are legal for use in 2610 competitions.

As my model of the MIG-7 has been designed within a 5% scale deviation limit of the full-size aircraft, it is legal for use in either 1/12 Scale Combat event.

While the MIG-7 is intended as a 1/12 Scale Combat model, it serves very well as a compact, sport-flying aircraft.



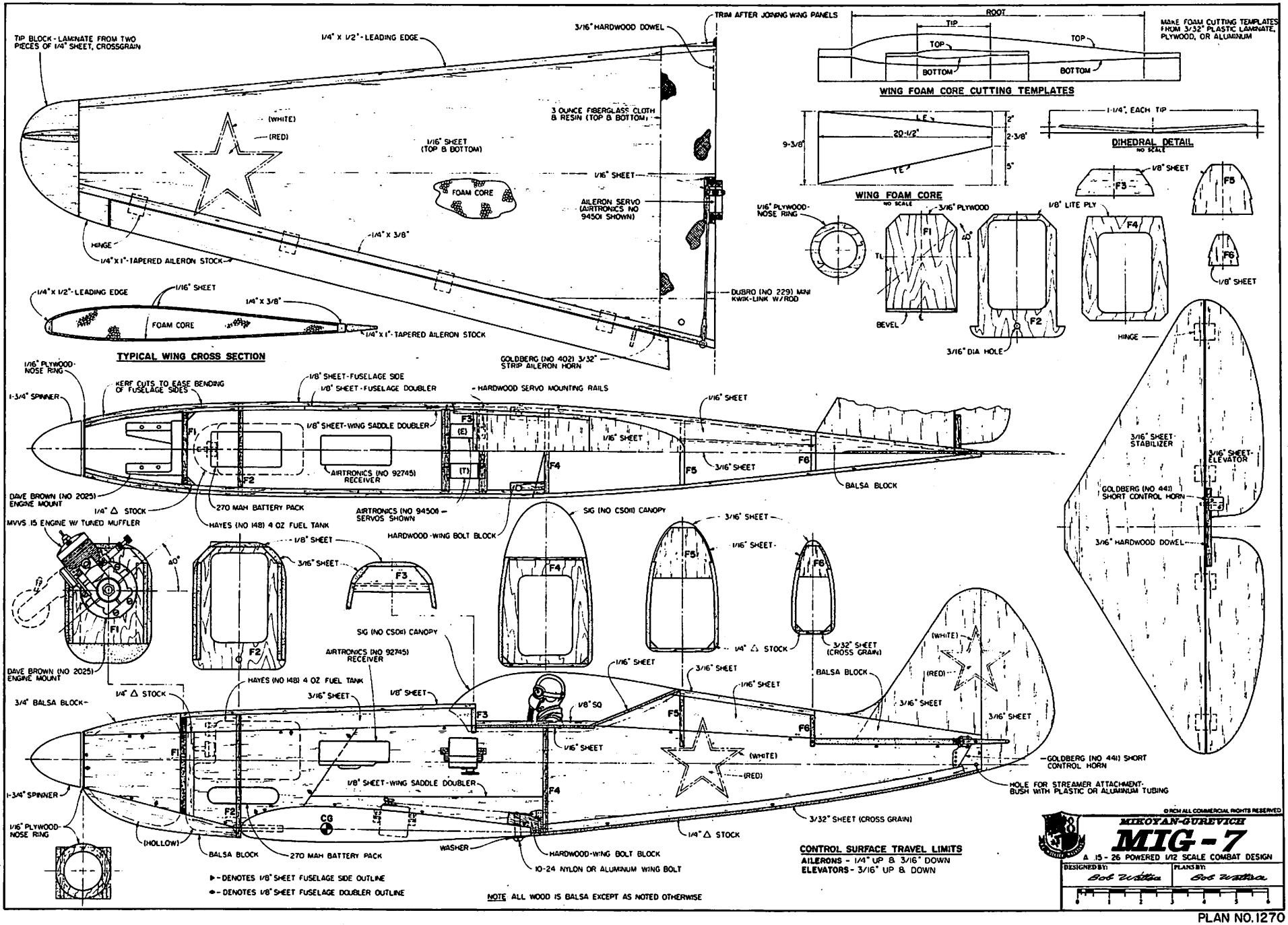
*Completed sub-assemblies ready for fitting and final sanding.*

**MIG-7**

**Designed by:**
Bob Wallace
**TYPE AIRCRAFT**
1/12 Scale Combat
**WINGSPAN**
44-5/8 Inches
**WING CHORD**
7 Inches (Avg.)
**TOTAL WING AREA**
310 Sq. In.
**WING LOCATION**
Bottom Of Fuselage
**AIRFOIL**
Semi-Symmetrical
**WING PLANFORM**
Double Taper
**DIHEDRAL, EACH TIP**
1-1/4 Inches
**OVERALL FUSELAGE LENGTH**
32-7/8 Inches
**RADIO COMPARTMENT SIZE**
(L) 7-3/4" x (W) 2-1/2" x (H) 2-5/8"
**STABILIZER SPAN**
14-1/2 Inches
**STABILIZER CHORD (inc. elev.)**
4-5/8 Inches (Avg.)
**STABILIZER AREA**
62 Sq. In.
**STAB AIRFOIL SECTION**
Flat
**STABILIZER LOCATION**
Upper Fuselage
**VERTICAL FIN HEIGHT**
4-3/16 Inches
**VERTICAL FIN WIDTH (inc. rud.)**
5-7/8 Inches
**REC. ENGINE SIZE**
.15 Cu. In. (2105), .26 Cu. In. (2610)
**FUEL TANK SIZE**
4 Oz. (2105), 6 Oz. (2610)
**LANDING GEAR**
NA
**REC. NO. OF CHANNELS**
3 (4 If Flaperons Are Used)
**CONTROL FUNCTIONS**
Ail., Elev., Throt. (Flaperons Optional)
**C.G. (from L.E.)**
2-3/4 Inches
**ELEVATOR THROWS**
3/16" Up — 3/16" Down
**AILERON THROWS**
1/4" Up — 3/16" Down
**SIDETHRUST**
0°
**DOWNTHRUST/UPTHRUST**
0°
**BASIC MATERIALS USED IN CONSTRUCTION**
Fuselage ..... Balsa & Ply
Wing ..... Foam & Balsa
Empennage ..... Balsa
**Wt. Ready To Fly** .... 36 Oz. (2 Lbs. 4 Oz. w/ Thunder Tiger .25
34 Oz. (2 Lbs. 2 Oz.) w/ Conquest .15
**Wing Loading** ..... 16.7 Oz./Sq. Ft. w/Thunder Tiger .25
15.8 Oz./Sq. Ft. w/ Conquest .15

PLAN NO. 1270

FULL- SIZED PLAN AVAILABLE, SEE PAGE 189

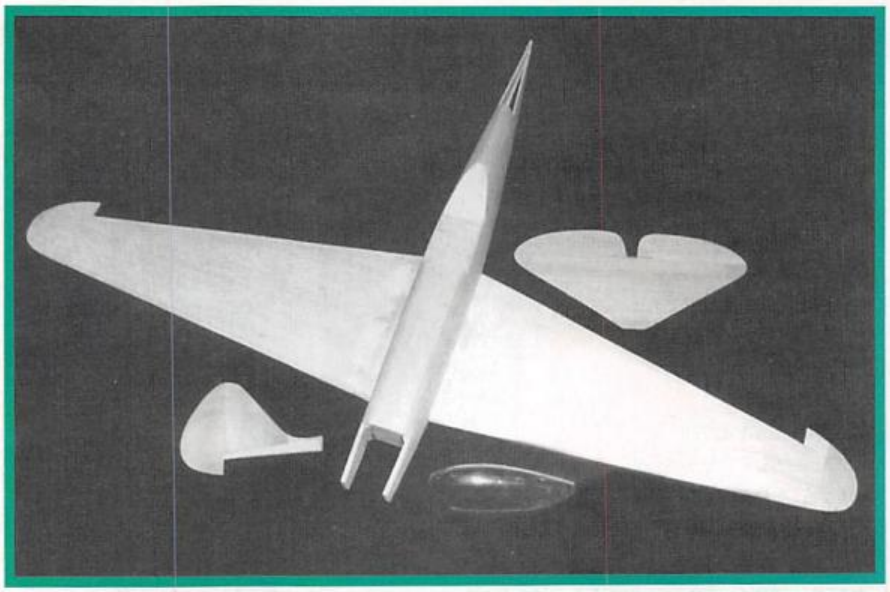



PLAN NO. 1270

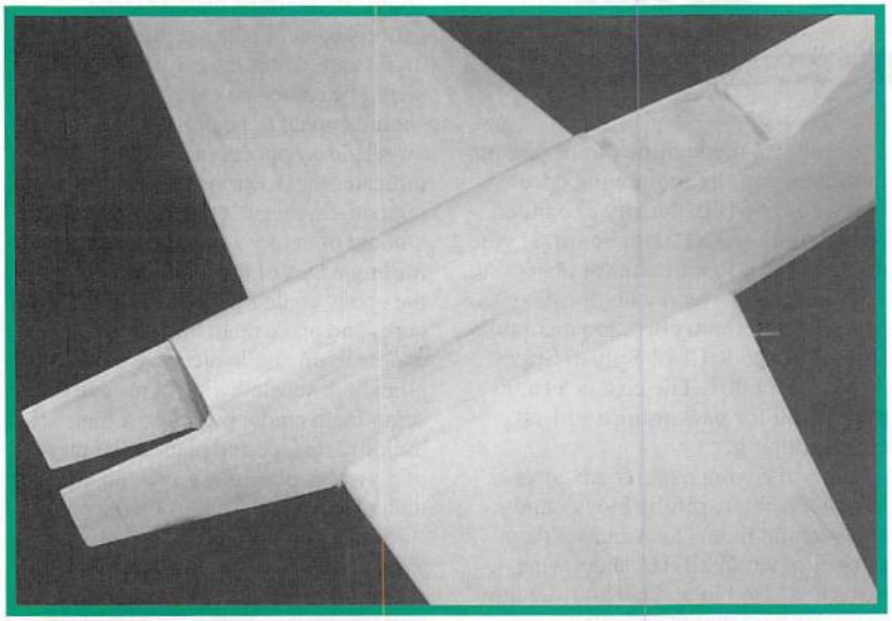
My reason for selecting the MIG-7 as a 1/12 Scale Combat model was based on several factors. First, I wanted to model a fighter that was different from the horde of Mustangs, Corsairs, Zeros, Me-109s, etc., that already exist. Second, it had to have a more generous amount of wing area than most other World War II fighters and overall general dimensions that would render it to be well-suited for 1/12 scale use, and third, I just liked the looks of the MIG-7.

**History:**

The Mikoyan-Gurevich MIG-7 was a fighter designed to intercept German high-altitude reconnaissance aircraft. It was an all-metal aircraft with a very large wing and a pressurized cockpit. Powered by a 1700 hp Klimov M 107A, V-12 cylinder, liquid cooled engine equipped with a multistage supercharger, the MIG-7 was designed to operate at over 40,000 feet and demonstrated an impressive top speed of 429 mph. Armament consisted of one 20-mm cannon and two machine guns. The prototype was first flown in late 1944 and its performance was found to be excellent. In spite of the MIG-7's great performance, it was never put into production, as the threat of continuing German high altitude reconnaissance flights had all but ceased to exist at that time, with Germany's armed forces in steady retreat.



*Wing mounted to fuselage, ready for attachment of tail surfaces and canopy.*



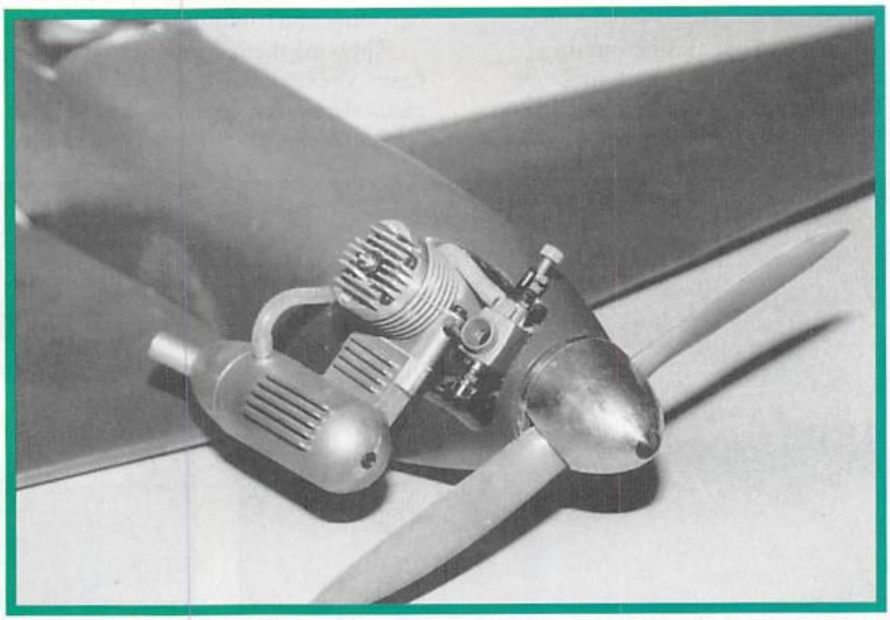
*Nose section prior to installation of plywood nose ring and cowl blocks.*

## CONSTRUCTION

As with past scratch-built aircraft projects, I prefer to cut out all of the basic parts prior to starting the assembly process. These parts include the fuselage sides and doublers, bulkheads and formers, sheet tail surfaces, wing leading edges and sub trailing edges, ailerons, and wingtip pieces.

While fabricating all of the shaped parts first does not actually speed up the assembly process, it does create a "kit" effect whereby the construction phases progress in a less interrupted fashion.

Selecting your balsa wood stock carefully, and using only the medium/soft grades (4 to 6 lb. cu./ft. density), can save several ounces of unnecessary aircraft weight. The only exception to this is the wing leading edge pieces, where fairly hard balsa should be used.



*View of the nose section with Thunder Tiger .25 engine installation.*

A product that works very well for creating formers, bulkheads, fuselage sides and doublers, etc., is See Temp instant template material, which is available from See Temp, P.O. Box 105, Sussex, WI 53089. See Temp is a frosted translucent surface plastic material onto which you simply trace the outline of the parts needed. Then score the outline with a sharp blade, bend on the scored lines, and you have a perfect template that is also reusable, should you wish to build another identical aircraft. "This is particularly appealing for a 1/12 Scale Combat model which, due to the competitive nature of the event, can often have a rather short life span!"

**Wing:**

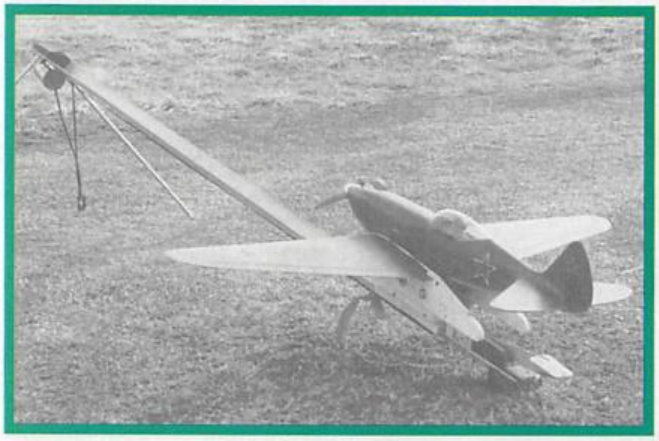
Start by first cutting out the necessary foam cutting templates. These templates can be made from 3/32" plastic laminate, plywood, or aluminum. I made mine out of plastic laminate. Cut the foam wing core blanks out of 1 lb. density expanded polystyrene (EPS) foam board. If you do not have a foam cutter or an aeromodeling friend who does, MIG-7 wing foam cores are available from Wallace R/C, 91 Sylvan Street, Avon, CT 06001. The cost is $16.00 plus $4.00 for packaging and first-class shipping.

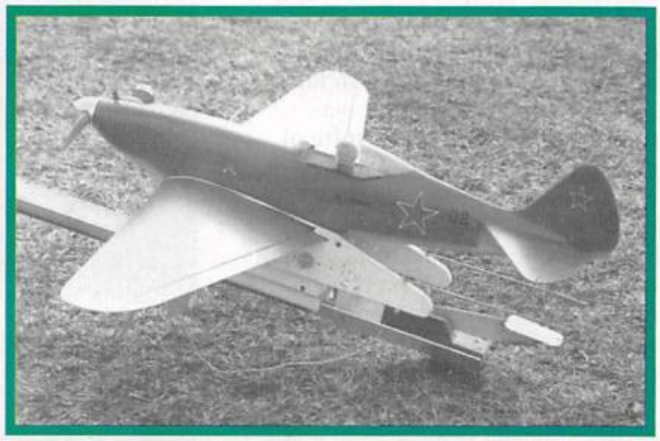
After the wing panel foam cores have been cut, carefully block-sand and vacuum them clean and set them aside. Prepare the 1/16" sheet wing skins and also block-sand and vacuum them. Be sure that the wing skins are slightly oversize to allow for the airfoil curvature and trimming.

Applying the wing skins to the foam cores can be via several adhesive methods. Epoxy, contact adhesive, and aliphatic resin all produce good results. Most modelers seem to have their own preferred method of sheeting foam wing panels and my preference is to use slow cure epoxy, thinned with isopropyl alcohol, for this step. I believe that this method produces in a stiffer, stronger wing with no weight gain, if done properly. I will outline the steps for this process, using the simple "weighting of the sheeted cores" method while the epoxy cures. Experienced modelers may prefer to use a press or vacuum bagging for this phase of construction.

Mix about 1-1/4 ounces of slow cure epoxy such as Hobby Poxy's Formula 2 or Great Planes' 45-minute cure epoxy and thin it with 90 percent isopropyl alcohol to allow for easier spreading. Apply the epoxy to the balsa wing skins and squeegee off all of the excess epoxy. If you don't have a plastic squeegee, an old plastic playing or credit card works equally well for this step. The coated balsa wing skins should appear to be dull and not have a "wet" glossy appearance as this indicates that too much epoxy has been applied. Squeegee or brush a small amount of epoxy along the leading and trailing edges of the foam cores. Apply the epoxy coated wing skins to the foam cores and place them back into the excess foam cradle pieces. Carefully align both sheeted wing cores and the scrap foam cradle pieces on a flap building surface and place a flat piece of plywood, plate glass, etc., on top, and then place heavy weights on the entire stacked assembly. Allow the epoxied wing panels to fully cure overnight.

Remove the sheeted wing cores from the foam cradle pieces and trim and block sand off the excess balsa sheeting, flush with the foam core edges. Glue the 1/4" x 1/2" leading and 1/4" x 3/8" sub trailing edge pieces in place. (While not structurally necessary, strips of .007" carbon fiber





*The MIG-7 "ready to start-up and take off," via catapult launch.*

laminate may be glued in place between the balsa leading edge strips and the sheeted wing panels as an additional "impact" strengthening measure. Block-sand these edges flush with the wing sheeting and trim the ends. The wingtips, which are made from either two pieces of 1/4" balsa sheet that have been laminated (cross grain) or 1/2" sheet, are now glued in place. Hinge and install the ailerons (without gluing the hinges in place) and glue the outer trailing edge pieces in place, between the ailerons and the wingtips. Block-sand both wing panels and radius the leading edges and tips to the indicated contours. Block-sand the root ends of both wing panels to produce the proper dihedral angle, and epoxy the two panels together, making sure that the dihedral angle is correct and that there is no built-in twist in the joined-together wing. Remove the ailerons and install the strip aileron horn assemblies so that they are recessed flush with the outer edge of the sub trailing edge. Apply the 3-ounce fiberglass cloth reinforcing to the top and bottom of the wing center section with slow cure epoxy that has been thinned with isopropyl alcohol. Carefully blot off all excess epoxy from the glassed center section joint. When the epoxy has fully cured, lightly block-sand the center section glass cloth and feather-in the edges to the wing skins with lightweight spackling. Finish-sand the entire wing assembly and set it aside.

**Tail Surfaces:**

All of the tail surfaces are cut from 3/16" balsa sheet. The elevators are coupled with a short piece of 3/16" hardwood dowel.

**Fuselage:**

Assuming that you have already cut out the various component pieces, the first step is to glue the 1/8" doublers to the fuselage sides. Be certain that you are making a "left" and a "right" hand side! Using the plan sheet as a guide, mark the positions of the various bulkheads and formers onto the fuselage sides. Glue the 1/8" sheet wing saddle doublers and 1/4" triangle stock in place on the fuselage sides. Glue formers F1, F2, and F4 in place, making sure that both fuselage sides and the formers are properly aligned. Position the engine mount, that is to be used, on the firewall (F1) and drill the holes for the 4-40 mounting bolts. Install the engine mount blind nuts into the rear face of the firewall (F1). Also install the 1/4" triangle stock firewall reinforcing pieces. Drill the holes for the throttle control cable and fuel line

in the firewall (F1). (I installed the engine in my MIG-7, a Thunder Tiger .25, 40° from vertical. This was done primarily to lower the carburetor closer to the centerline of the fuel tank and to improve the overall visual appearance of the aircraft.) Make the vertical "kerf" cuts in the nose section of the fuselage sides, taking care not to cut into the fuselage doublers. These cuts will ease the bending of the fuselage sides in order to install the nose ring. Install the engine to be used on to the mount. If you elect to install your engine at a 40° angle from vertical, or even in a side-mounted position, a portion of the right fuselage side will have to be cut away at this time. Install the spinner onto the engine and then install the 1/16" plywood nose ring behind the spinner, by drawing the fuselage sides in to fit flush behind it.

Trim the fuselage sides as necessary to produce a gap of about 1/16" between the spinner and the nose ring. Glue the nose ring in place. Cut, fit, and glue in place the top and bottom fuselage nose blocks. Remove the engine and the engine mount. Bevel the inside surfaces of the aft ends of the fuselage sides and draw them together. The width of the vertical aft end of the fuselage should be 3/16" so that the vertical fin/rudder will blend into it smoothly. When satisfied, draw the aft ends of the fuselage sides together and glue. Install formers F3, F5, and F6 and then install the 3/16" and 1/16" upper fuselage side sheeting pieces. Block-sand the top of these sheeting pieces flush with the top of the formers and install the top 1/8" front sheeting piece and the 3/16" rear "turtledeck" top sheeting. Install the 1/16" sheet cockpit floor and 1/16" sheet angled back "turtledeck" face piece. Also install the 1/8" square cockpit side trim pieces. The top surfaces of the fuselage can now be trimmed and sanded to the proper contour.

Those who prefer simplicity may opt to mount the wing to the fuselage via the rubber band and dowel method. While it is a bit more work, I elected to use the front dowel/rear mounting bolt method and this is what will be explained. Install the hardwood wing bolt blocks. Fit the wing into the fuselage wing saddle and mark the position on the wing leading edge for the retainer dowel, using the 3/16" hole in former F2 as a guide. A good way to do this is with a short piece of 3/16" brass tubing that has been bevel-edged and sharpened on one end. Simply pass

the sharpened end of the tubing through the dowel retainer hole in former F2 and rotate it against the leading edge of the wing to mark the exact location for the dowel. Drill the 3/16" hole into the leading edge of the wing and epoxy the hardwood dowel in place, allowing the epoxy to cure with the wing in place in the fuselage wing saddle. Drill the holes through the wing and into the hardwood mounting blocks, for the wing mounting bolts, using a #25 drill. Tap the holes in the hardwood blocks with a 10-24 tap and enlarge the holes in the wing to accept the 10-24 mounting bolts.

Install the fuselage bottom sheeting. Trial-fit the tail surfaces and, when properly aligned, glue them in place. Sand and fit the fuselage/vertical fin fairing blocks and then glue them in place. Trim the clear plastic canopy to fit and install any cockpit detailing or pilot bust desired, then glue the canopy in place.

The various radio components, fuel tank, and control linkages are now installed. While I elected to use smaller radio components in my prototype, there is sufficient room within the MIG-7 to accept standard-size radio gear. A 4-ounce Hayes fuel tank was installed. Should a larger fuel tank be desired, there is adequate space to install a 6-ounce tank.

**Finishing:**

How to best finish my MIG-7 was a bit perplexing, as the number of heat-shrinkable type covering films that are available in a flat finish are very limited. The Perfect brand of flat military paints that are manufactured by Cheveron were not stocked in any local hobby shops and even the mail order outlets that I called, either did not stock them or did not have the colors that I was seeking. The use of high gloss, film-type covering materials was considered; however, I preferred a more scale-like flat or satin finish. One method of finishing favored by many within the 1/12 Scale Combat fraternity is to use inexpensive acrylic latex house paints. While I had always been a bit skeptical of this method, I decided to give it a try.

After finish-sanding my MIG-7, a thinned coat of finishing epoxy was brushed on to seal the wood grain. After light sanding, a coat of lightweight primer was sprayed on. When dry, most of this primer coat was sanded off, leaving only that primer that filled the wood grain and minor imperfections. A very light coat of thinned out primer was then sprayed on to produce a uniform base color. A trip to the local Home Depot resulted in the purchase of two quarts of acrylic latex house paint and a pint of satin finish clear polyurethane, all for just a bit over twenty dollars. I was able to obtain what appeared to be exact (or at least very close) matches for the military green and bluish gray finishes that the Soviet Air Force used during World War II.

The bottom surfaces of my MIG-7 were painted first, using the bluish gray color, which was thinned with water before spraying. The thinned latex covered surprisingly well and dried rapidly. The darker green top surface color was then sprayed on and covered as well as the lighter bottom surface color. An added bonus associated with using latex house paint is that being a one-part paint, you can dump what was not used back in the can, rather than throwing it away, as is the case with two-part epoxy paints. Judging by the small amount of latex paint that was required to paint my MIG-7, I now have what amounts to a lifetime supply of World War II Soviet Air Force colors, and all for under twenty dollars! Prior to deciding to give latex house paint a try, I had experimented, using several types of latex paint that were left over from various home painting projects. None of these paints were very resistant to glow fuel. A rag soaked with fuel would easily soften and remove them.

I had been told that if you allow any raw fuel spilled onto a latex finish to sit until the alcohol and nitromethane evaporate, the oily residue can be removed without affecting the latex paint. I tried this and found it to be only partially true. I had also been told that the use of a thin finishing coat of ordinary polyurethane over the latex would produce a far more fuel resistant finish. Major Decals produces a variety of 1/12 scale insignias, in both the pressure sensitive and water transfer types.

My MIG-7 was finished with the water transfer type decals and then a final light coat of thinned satin finish Miniwax brand polyurethane was applied. I was genuinely surprised and pleased with the overall finish result. It was much better than I had expected and certainly equal to that which might have been obtained using epoxy type paints. Time would tell regarding its fuel resistance.

Airtronics radio equipment was used in my MIG-7. The airborne pack consisted of a 92745 FM receiver,

94501 mini servos, and a 270 mAh battery pack. The transmitter was an Airtronics 660 Infinity.

My MIG-7 ready-to-fly, less fuel, weighed 36 oz. (2 lbs., 4 oz.), which produced a wing loading of 16.7 oz./sq. ft.

**Flying:**

An unexpected break in the cold New England winter weather presented the opportunity to test-fly the MIG-7 sooner than expected. A January day with the temperature in the upper 40s, sunny skies, and almost no wind was too much to resist. After the usual radio range check, the engine was started and adjusted to produce a slightly rich setting and smooth idle. I own, and normally use, a catapult for my 1/12 Scale Combat aircraft and this was the method of launching that I used for my initial test flights of the MIG-7.

A final check was made of the control surface movements and, with the engine at full throttle, the catapult release was triggered. The MIG released perfectly and was climbing out on a straight heading, but at a rather steep angle. Several clicks of down elevator were required to produce a more acceptable climb rate. The next few minutes were spent trimming the elevator and ailerons for hands-off, straight and level flight at full throttle, and acquiring a feel for the MIG.

All the usual basic aerobatic maneuvers were performed, using both high and low rates, in order to determine the ideal control surface travel movements. The first landing with the MIG was both easy and uneventful. About 1/3 throttle was maintained until on final approach and making it to the grass landing area was a certainty. The throttle was then completely closed to shut down the engine (and also to keep any dirt or foreign matter from entering the carburetor venturi during the landing) and the MIG settled in for a nice belly landing. A few more flights were made, trying various amounts of elevator and aileron travel, and also moving the C.G. a bit rearward to fine trim the aircraft to my liking.

The recommended control surface travel limits for initial test flights are as follows:

Ailerons = 1/4" up, 3/16" down, Elevator = 3/16" up and down.

Regarding the C.G., it is suggested that the first flight be made with the C.G. at the location shown on the plan sheet. Once the aircraft has been trimmed, some modelers may elect to relocate the C.G. further aft, to suit their own preferences.

A couple of unassisted hand launches were then made to assess the MIG's take-off characteristics via that launch method. The first hand launch was made by taking a few steps forward and using a firm, overhand toss, which resulted in the MIG climbing out at a nice angle. The second hand launch was made by standing stationary and using a firm overhand toss, with the MIG at a slight nose up angle. Again, the MIG was away and climbing out nicely.

The Thunder Tiger .25 engine, which was completely stock and running on 10% fuel with a 9 x 4 APC prop, provided more than ample power for the MIG-7. On my next trip to the flying field a week later, I replaced the Thunder Tiger engine and mount with a Conquest .15 engine and mount. This was done for the purpose of comparison.

This also required positioning the battery pack as far forward as possible, as the Conquest engine and muffler are almost 2 oz. lighter than the Thunder Tiger. The switch to the smaller engine did not adversely affect the in-flight performance of the MIG. A minor loss of speed was offset by a gain in maneuverability and agility. While the MIG-7 hand-launches easily, and the use of a catapult is certainly not necessary, I still prefer to use a catapult because I am a Mode I flier and it is nice to be able to have both thumbs on the sticks during launch, especially during windy conditions.

The catapult that I built and use is not my design. It was designed by Rick Smith, who offers plans of his catapult design free to anyone who is interested. Just send a self-addressed stamped envelope to: Rick Smith, c/o Smith Engineering, 6507 Manchester Lane, Eden Prairie, MN 55346, and ask for a copy of his catapult plans. This catapult operates very well. It uses an 8-foot length of 2" aluminum angle, as a track (which can be purchased at any Home Depot), with a wood carriage that rides on two pieces of UHMW polyethylene plastic as bearings. Propulsion is derived via two short lengths on R/C sailplane "hi-start" surgical tubing.

Overall, I was most pleased with both the appearance and in-flight capabilities of my MIG-7 and hope that those who also decide to build one, will be equally satisfied.