MiG-29 Catapult Glider

Based on the single-seat MiG-29 demonstrator flown at Cleveland, Ohio in 1991, this slightly simplified design includes such details as a clear, vacuum-formed canopy, white foam-plastic pilot head, antenna, and laser range finder. The gull gray, pastel gray, and gray-green camouflage color scheme was matched as closely as possible, and the Soviet insignia appears in six places just as it does on the original.

This 1¾-oz., 12¾-in.-wingspan replica of the latest combat aircraft from the MiG design bureau looks as radical as the changes taking place in its homeland.

■Dennis O. Norman

HERE'S a chance to build and fly a model of one of the world's leading military aircraft and also to apply a new printing technique for sheet balsa parts.

From its sharp beak to its pointy tail feathers, the MiG-29 is every inch a bird of prey. Yet somehow this aircraft doesn't seem Russian. Gone is the stovepipe look of its predecessors from the Mikoyan and Gurevich (MiG) design bureau. In its place are sleek lines that reflect thinking wholly compatible with the political upheavals that have radically changed the character of the former Soviet Union during the past several years.

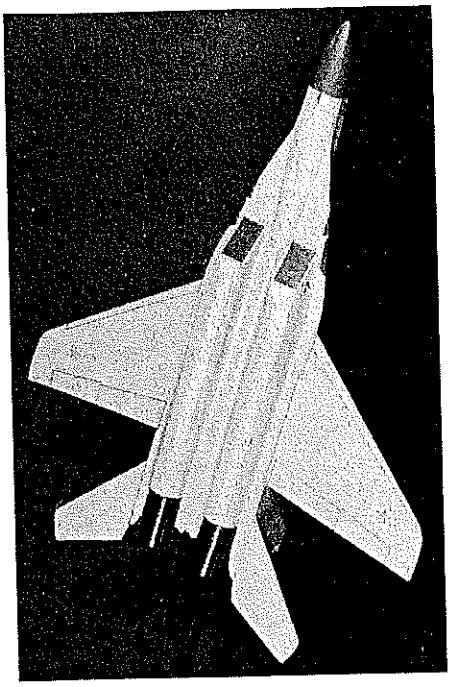
Five years ago, it was almost unthinkable that an advanced Soviet combat aircraft such as the MiG-29 would be flown peacefully over the United States, giving millions of Americans the chance to see it up close. Upon learning that a MiG-29 would be demonstrated at the National Air Show in Cleveland, Ohio over Labor Day Weekend 1991, I saw an irresistible modeling opportunity.

Of my seven children, seven-year-old Patrick has shown the most interest in aviation and modeling. He has watched "Top Gun" at least 30 times, has his own flight suit, and can identify many contemporary military aircraft including the MiG-29. Patrick shared my enthusiasm at the prospect of the Russian airplane's visit to Cleveland and was delighted when I suggested designing and building a flying model of a MiG-29.

The finished product, though of course beyond Patrick's present modeling skills, is durable, quite stable, and—being essentially a slingshot glider—well within his flying skills. It has given my son dozens of flights averaging 15 to 20 seconds—long enough to be exciting, but short enough to fit his attention span.

Making your print wood

Before beginning construction, make at least two full-size photocopies of the parts sheets shown on the left side of the plan. To simplify things, make the copies on



A view of the underside showing the gull gray background with contrasting tones on the nose and on the engine air intakes.

A junior Russian "Top Gun"? Nope, it's an all-American seven-year-old having fun. Patrick Norman shares his dad's passion for aviation, likes to wear flight gear.

Patrick prepares for a high-speed launch. Essentially a slingshot glider, the model flies for about 15-20 seconds.

11 x 17-in. paper in order to reproduce all the parts at once. Also, if you plan to print the sheet balsa using a new technique I've discovered (described below), I recommend duplicating the parts sheets with a copier made by either Canon or Minolta.

If you decide to use the well-known heat technique to make your print wood, proceed as follows:

Make a pattern using a modern copy machine (Xerox or the equivalent), place it face down against the sheet balsa, then "press" the back of the photocopy with a standard clothes iron heated to the Cotton/Linen setting. Be sure to move the iron firmly but continuously over the back of the photocopy to avoid scorching the paper. Also, be careful not to burn your fingers in the process.

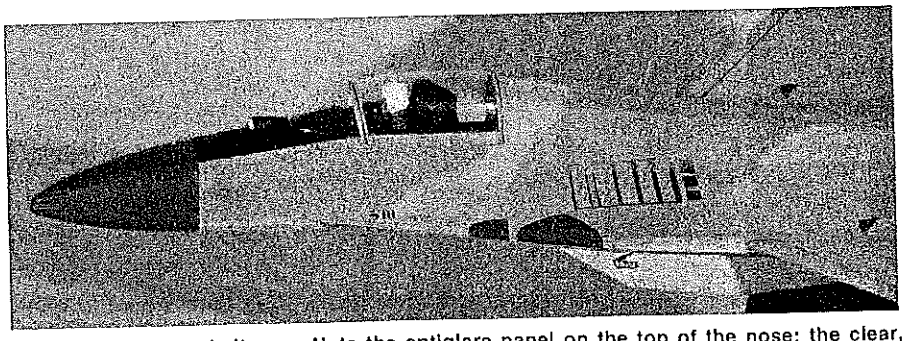
While this method will give you a clear copy, the heat from the iron will probably warp the sheet balsa. This is easily remedied. Press the rear of the balsa with the iron, then weight the sheets under a stack of books, or something comparably heavy, to keep them flat until they cool.

If you want to try my new, cold technique for printing the parts onto a balsa sheet, first purchase a Blender™ (clear) marker, made by Chartpak and available at art supply stores. As noted, use only parts sheet photocopies made with a Canon or Minolta copier.

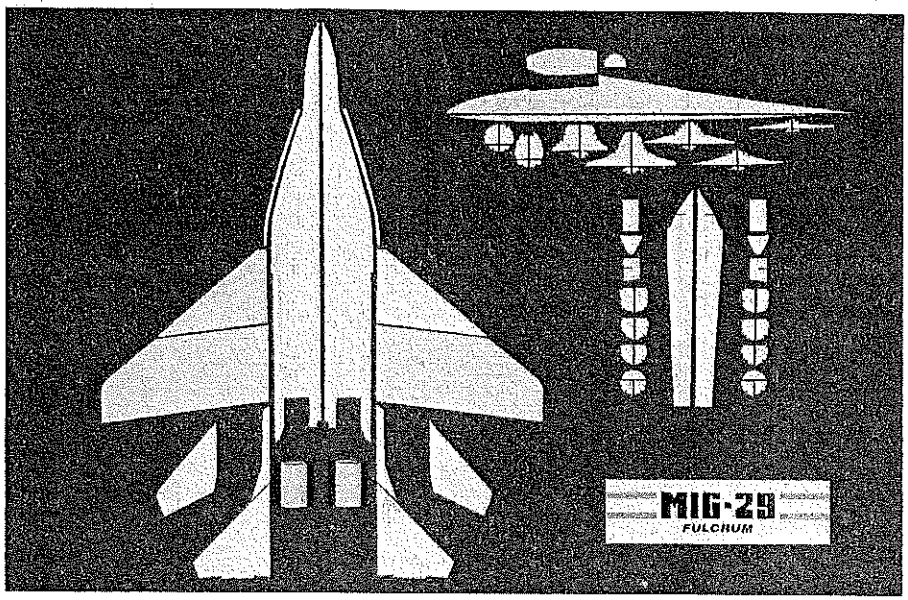
Place one of the photocopies, print side down, against a sheet of balsa. Apply the Blender to the back of the photocopy. The clear solution from the marker will saturate the photocopy and activate the printer's toner so that it prints (transfers) onto the balsa sheet.

As the Blender saturates the back of the copy, the paper will become temporarily translucent. To assure a good "take,"

Tail surface details. Note the light purplish gray on the tips of the vertical stabilizers. The aircraft call number is light royal blue outlined in white; the Soviet insignia is a red star outlined in white with a thin finishing outline of red.



Close-up of the cockpit area. Note the antiglare panel on the top of the nose; the clear, molded plastic canopy; and the white foam-plastic pilot head.



The MiG-29 parts are printed on 1/16 balsa sheet, then cut out. The tail pipes are made from one-inch-diameter cardboard rocket tube.

burnish the back of each Blender-treated part by rubbing the saturated paper firmly with your finger.

Allow 30 to 45 seconds for the paper to lose some of its moisture before gently peeling it away from the balsa. As you peel the paper back, hold it firmly in place to check the transfer. If any of the parts appear light or incomplete, lay the paper back against the balsa and reapply the Blender over the poorly printed portion(s). This should result in a sharp, crisp transfer.

This new technique avoids the hazards of a hot iron and the hassle of warped balsa sheets.

Construction

Begin construction by joining the side longerons at their centerlines. In doing so you will note that the locations of the top fuselage formers appear on the top left side of the longerons (and also on the bottom right side) as a guide to placement.

Install the top longeron directly over the centerline of the joined side longerons, and you have the basic "keels" for the upper fuselage. Finish by adding formers F-1T through F-4T.

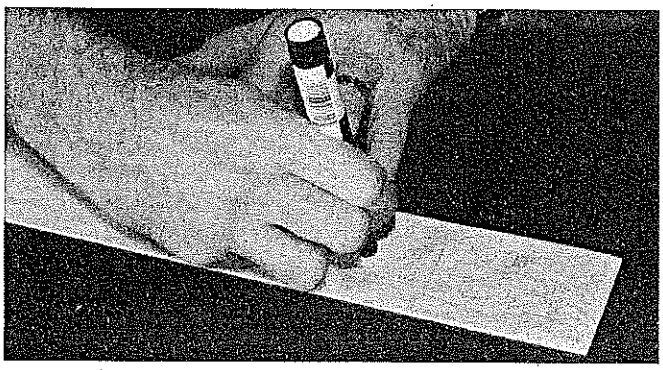
Assemble each half of the wing by joining parts W-1 and W-2 so that the flattened tip of W-1 is at the centerline facing forward.

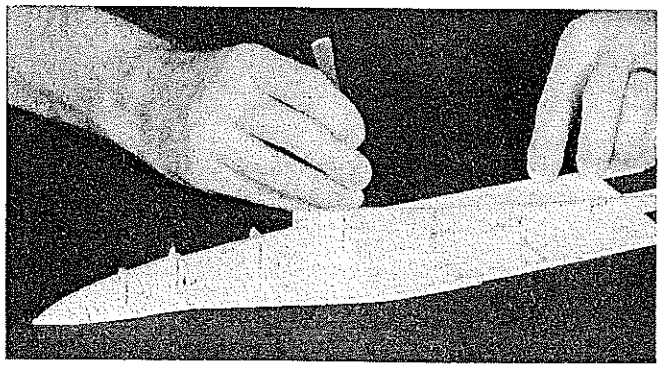
Although the MiG-29 wing has an anhedral, or droop, the model also has dihedral for greater stability. To set the dihedral, place a 1/16-sq. balsa strip beneath each wing half at its intersection with the side longeron. By pressing the centerline of each wing half flat into the joint of the top and side longeron and using the balsa strip as indicated, you will be elevating the tip of each wing half approximately 3/8 in. This contributes to the airplane's excellent flight characteristics without radically changing its appearance.

Once the wing halves have been joined to the fuselage, install F-5T through F-7T. Complete the basic contour of the fuselage top by adding 1/16 stringers as shown on the plan.

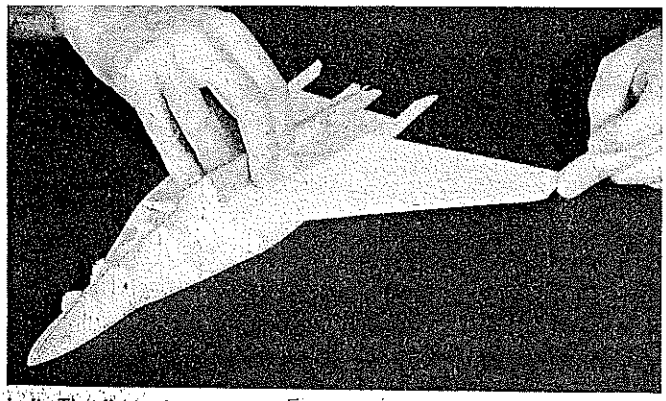
While every effort has been made to draw the parts accurately, some misalignment of the stringers may show up when the parts have been notched as indicated. If this occurs, simply widen or narrow the spacing between the stringers until the contours are smooth and flowing.

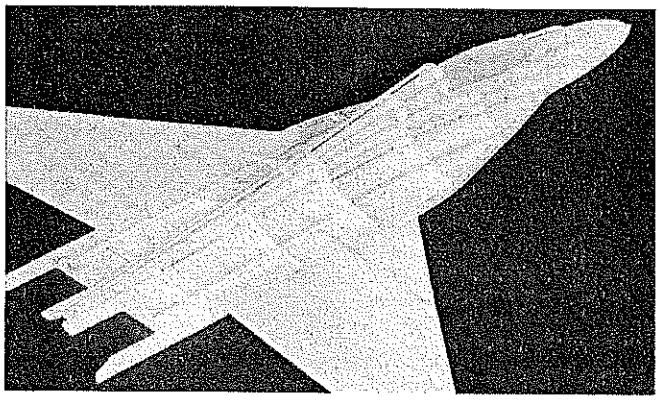
Add the long, curved F-Ws to either side of the forward portions of the side longerons to fair them into the wing contour. Install C-1 and C-2 to define the cockpit area.



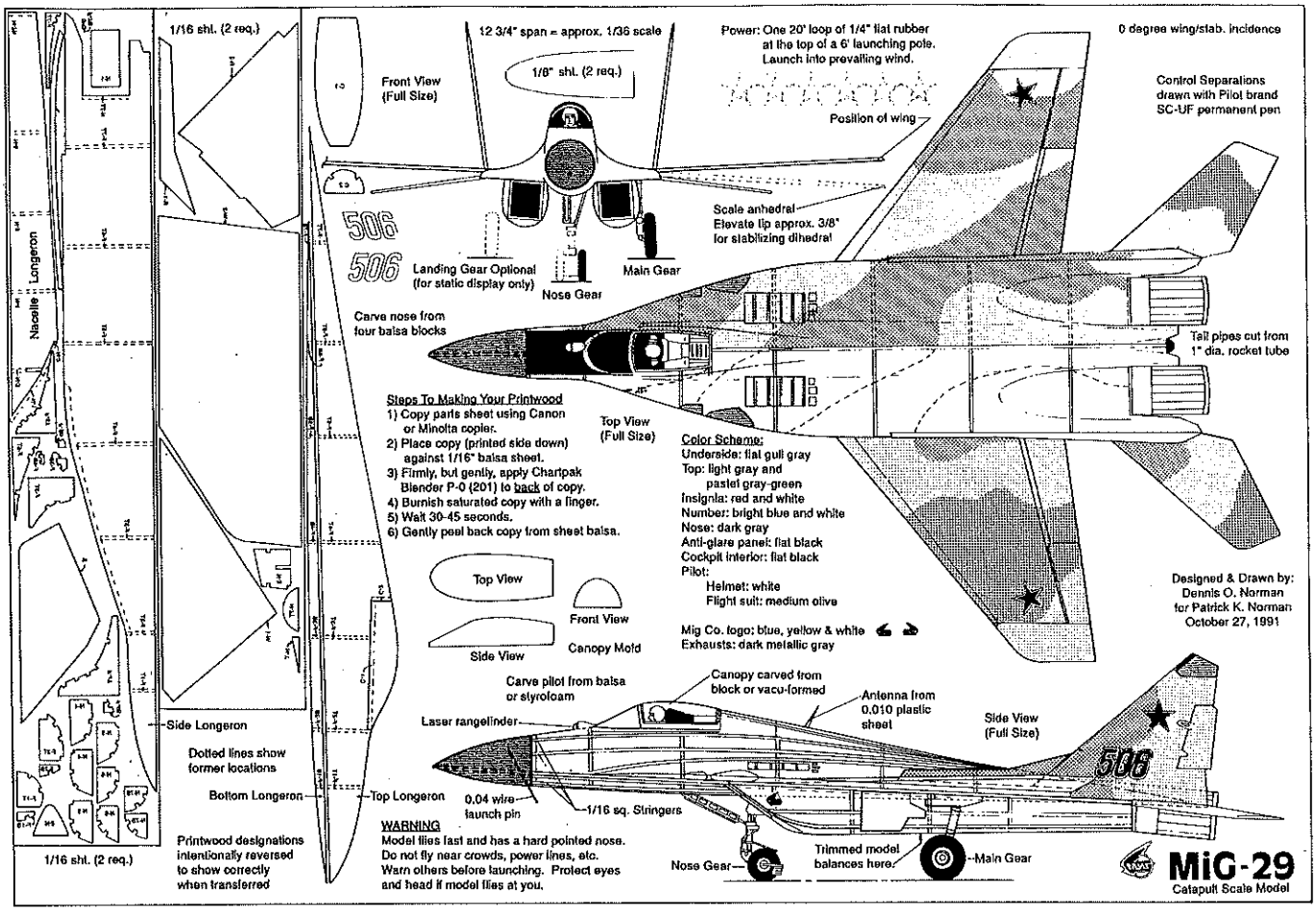


Left: Using a Chartpak Blender™ clear marker to print the aircraft parts onto sheet balsa, a technique discovered by the author that achieves sharp, crisp results without the need for heat. Right: Installation of formers F-1T through F-4T.





Left: The first wing half being installed. A 1/16-sq. balsa strip is used to set the 3/8-in. tip elevation for the dihedral. Right: The basic upper fuselage has been completed by the addition of the 1/16-sq. stringers to contour the top.



Install parts N-7T as shown; these will serve as the top portion of the base for the tail pipes, to be added later. This completes the upper fuselage (above the level of the side longerons).

Begin lower fuselage construction by placing the bottom longeron vertically over the centerline formed by joining the two side longerons. Install F-1B through F-7B at their respective stations.

Complete the basic shape by adding four 1/16-sq. stringers, two on each side of the bottom longeron. One pair will lie flat against the bottom of the side longerons to form the contour between the lower fuselage and the bottom of the side longeron pieces. The other pair will of course form the contour of the lower fuselage immediately to each side of the bottom longeron.

Build the engine nacelles by placing pairs of parts N-3 through N-7B vertically against either side of both nacelle longerons. When each nacelle subassembly is completed, align it on the bottom of the side longeron closest to it so that the longeron's outside edges are parallel to the outside edges of formers N-5 through N-7B. Formers N-4 and N-3 are progressively narrower, creating a curve that follows the outer contour of the side longerons in that area.

When each nacelle has been properly aligned, glue it to the bottom of the side longeron so that formers N-7B line up exactly on the slot at the rear of the side longeron directly under N-7T. Together, these formers (N-7T and the two N-7Bs) should form a circle that will serve as the base for the tail pipes, which will be added later.

Install the N-2 and N-1 formers to create the nacelle contours in the area of the engine air intake for each side. Note that N-1 is approximately 1/8 in. narrower than N-2. This allows you to add short pieces of 1/16-sq. balsa to the outer edges of the N-1 formers and projecting slightly forward of each N-1, thereby creating the edge of the air intake structure.

Also note that the intakes are tilted slightly outward. To achieve this, add the small, wedgelike NT pieces between the N-1s and the bottom of each side longeron, arranging them with the wide end toward the fuselage centerline and the pointed end facing outward. This helps to achieve the proper tilt for each intake while securing it to the bottom of its respective side longeron.

Complete the nacelle structures by adding three pairs of 1/16-sq. stringers to each nacelle.

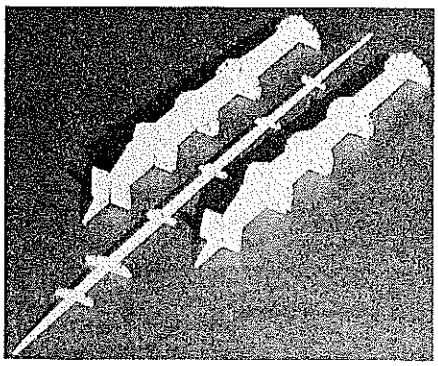
Install the first pair of stringers on the bottom of each side longeron so that it smoothly follows the longeron's contour while also creating the intersection between the nacelle and the underside of the longeron. This provides an anchor area for the Japanese tissue covering that will be added later.

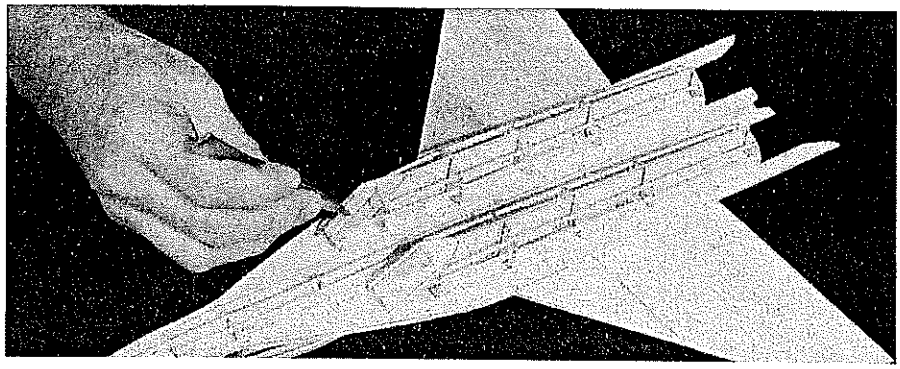
The structure of each nacelle is then completed by the addition of the remaining two pairs of 1/16-sq. stringers at the notches shown on the formers in the area between each nacelle longeron and the side longerons. The first pair is installed so that it meets N-3 at its intersection with N-2. The second pair is positioned above the first and then connects with the sides of the intake structures as previously described.

Sand the fuselage and nacelle structures to permit a smooth covering with Japanese tissue. Fill in each portion of the nose forward of formers F-1T and F-1B with medium-hard balsa block. Rough cut the block to the side and top profiles of the fuselage by following the shapes of the

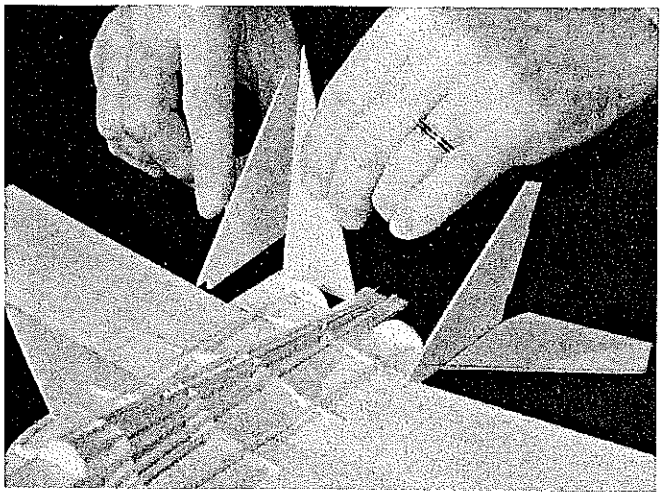
MiG-29 Catapult Glider

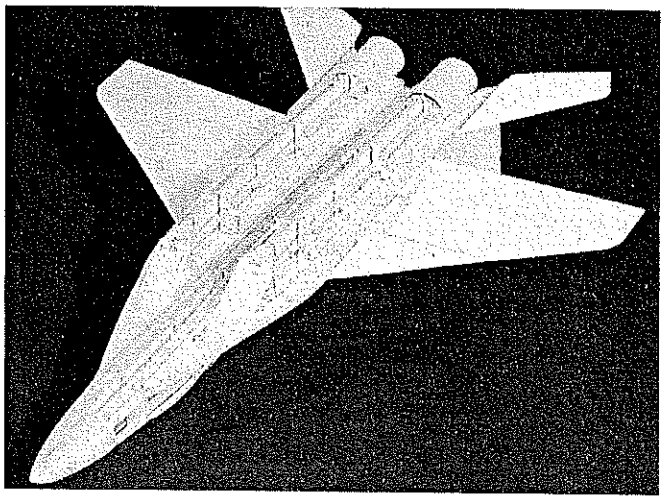
Type: Outdoor catapult glider
Wingspan: 12 3/4 in.
Wing Area: not available
Recommended size of catapult rubberband: Ten- to 20-ft. length of 1/4-in. flat rubber
Expected flying weight: 1 3/4 oz.
Type of construction: Built-up (print wood sheet balsa)
Type of covering/finish recommended: Japanese tissue; model airplane dope.





Left: Lower fuselage construction under way. The bottom longeron with formers installed and the two nacelle subassemblies are ready for installation. Right: After the N-2 and N-1 formers have been added to create the nacelle contours in the area of each engine air intake and the intakes have been secured with the wedgelike NT pieces, three pairs of 1/16-sq. stringers are installed to complete the structure of each nacelle.





Left: The stabilizers are installed at an outward tilt to provide a 0°-0° incidence between the horizontal flying surfaces. Right: Bottoms-up view of the airplane with the lower structures completed and ready for covering.

adjacent longerons. Glue the block firmly in place, then carve it to blend with the fuselage contours.

Join the pairs of vertical and horizontal stabilizers at right angles to each other. Don't attach them to the model until after covering.

Covering and finishing. At a minimum the fuselage and nacelles must be covered. Use lightweight Japanese tissue, and arrange the tissue grain to run lengthwise along each piece being covered.

If desired, the wings and tail surfaces may be finished with sanding sealer and several coats of dope. Instead, I applied Japanese tissue directly to the sheet balsa flying surfaces to quickly seal them and provide a smooth surface for painting.

Once you have covered at least the fuselage and nacelle structures, you're ready to join the preassembled vertical and horizontal stabilizers to the rear of the fuselage.

The MiG-29 has been designed with a 0°- 0° incidence between the horizontal flying surfaces. This means that each stabilizer half is aligned with the same angle of attack as each wing half forward of it. To accomplish this, carefully align each subassembly so that the bottom of each rudder is exactly flush with the bottom of the side longeron against which it is glued.

The tail surfaces are also tilted outward. Care should be taken to align them as shown on the plan front view.

Carve and shape the engine fairings from soft 1/8-in. balsa sheet. The fairings look like giant fingernails—flat on the bottom and convex on the top. Install them on the top of the rear fuselage immediately forward of the tail pipe base created by formers N-7T.

Cover each fairing with Japanese tissue. Cut the tissue about 1/8 in. oversize, and fringe the lip with narrowly spaced cuts to blend with the contour of the tissue-covered upper fuselage surface.

Install two tail pipes cut from a piece of 1-in.-dia. cardboard rocket tube as shown on the plan.

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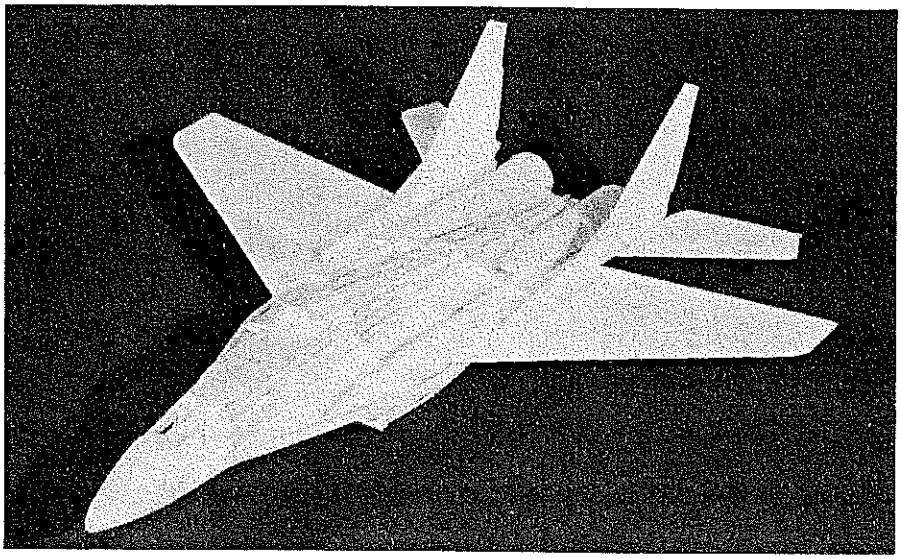

The completed upper structures await covering with Japanese tissue.

MiG 29/Norman

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Painting and detailing

Seal the tissue-covered portions of the model with at least one coat of clear dope. As noted above, any uncovered structures should be filled with sanding sealer and several coats of clear dope, with a light sanding between coats.

MiG-29s have been widely distributed in a variety of color schemes. The prototype is based on the single-seat demonstrator that Patrick and I saw in Cleveland during Labor Day weekend 1991. Its distinctive camouflage scheme features flat gull gray undersides with a combination of light pastel gray and gray-green on the upper surfaces.

I prepared several color chips of commercial paint and took them to Burke Lakefront Airport for visual matching with the colors on the demonstrator.

Model Master FS36440 Flat Gull Gray proved a close match for the color on the undersides, and was sprayed from a can on to the undersides of the model.

Since none of the paint chips duplicated the light gray and gray-green on the top surfaces of the full-scale plane, I resorted to mixing Tamiya acrylic paints. The light gray was made from approximately two parts XF-25 Light Sea Gray to one part Tamiya XF-2 Flat White. The pastel gray-green was approximately two parts Tamiya XF-2 Flat White to one part Tamiya XF-26 Deep Green. The mixed colors were thinned with water and applied with an airbrush.

Tamiya XF-63 German Gray closely approximated the light purplish gray used on the nose and on the tips of the vertical stabilizers of the full-scale aircraft.

The antiglare panel on top of the nose forward of the cockpit, the cockpit interior, and the interior of the exhausts were painted with Tamiya XF-1 Flat Black acrylic.

Tamiya X-10 Gun Metal was chosen for the exterior surfaces of the tail pipes.

The Soviet insignia, a red star outlined in white with a thin final outline of red, appeared at six locations on the demonstrator (on the outside of each vertical stabilizer and above and below each wing half).

The aircraft call number 506 is light royal blue outlined in white. The MiG-29 company logo on the outside of each nacelle just aft of the intake is light royal blue, light yellow, and white.

The canopy may simply be carved from balsa block and painted gloss black, with the light green framing cut from painted bond paper. I recommend, however, carving a mold and vacuum forming the canopy from thin (approximately .010) butyrate sheet. This may be done either with a vacuum former or by using the following method:

Firmly attach a 4 x 6-in. piece of butyrate sheet to a sturdy frame, and heat it over a hot plate until it begins to droop. Plunge the canopy mold into the hot butyrate. As the plastic stretches over the mold, it takes only a moment to cool and harden into the shape of the canopy.

Make the headrests and other internal details from scrap balsa. I carved the pilot's head from a very fine grade of white foam plastic. Although it involves extra work, a clear canopy with a pilot figure and interior details greatly enhances the look of the finished model.

I drew the control separation lines with a Pilot brand SC-UF permanent pen.

No landing gear? Since this craft was designed for vigorous high-speed flights that typically end with a landing on grass or weeds, I did not include landing gear. If you want to fabricate landing gear for display purposes, any of several plastic kits of the MiG-29 would serve as a three-dimensional reference. The approximate size and location of the landing gear has been included on the plan.

Again for the sake of simplification, I omitted details such as the characteristic Pitot tube on the tip of the MiG-29 nose and various protuberances from the flying surfaces.

The characteristic laser range finder was carved from scrap balsa. The housing is flat black; the front portion is flat aluminum. The antenna, located on the top of the fuselage aft of the cockpit, was cut from .010 butyrate sheet.

Flying

The prototype weighed approximately 1¾ ounces ready to fly. While that may sound heavy for a model of this size, catapult gliders generally perform best when their mass permits good wind penetration. Provided it is heavy enough, a catapult model can deliver spectacular flights—even in turbulent gusts of 15 to 20 miles per hour.

The prototype literally flew off the drawing board and required no ballast. If your model fails to balance at the point shown on the plan, add clay to either the nose or tail as needed.

Since the glider is to be launched using a 10-to-20-ft.-long loop of ¼-in. flat rubber, install a heavy (approximately .04 in.) wire launch pin in the nose block at the point shown on the plan. The rubber loop is attached to the top of a launching pole.

Both for reasons of safety and to obtain a good launch angle, I suggest that the launch pole be approximately six feet long.

Before launching the model with the catapult, test glide it by hand in tall grass to check basic trim. If the craft appears nose-heavy or tail-heavy, add clay to the appropriate end to correct the glide. If it rolls or turns, check the flying surfaces for warps or misalignments. Correct them until the glide is smooth, flat, and stable.

Once the model appears stable on hand launches, begin low-power (minimal-stretch) catapult launches into the prevailing wind. If you decide on a mildly angled crosswind launch into the wind, tilt the glider so that the wind strikes its bottom surfaces (i.e., its undersurfaces). As testing progresses and you stretch the flat rubber toward its limits, climbout will become more and more spectacular.

Finally, a word of caution. Unlike some catapult gliders, this one is fast and powerful. While that's part of the fun, it's also a hazard. With its pointed nose, the model is potentially dangerous. Care must be taken to:

- Always fly downwind and away from spectators and others in the area.
- Always warn others before launching the model.
- Turn away from the model if it's flying toward you, and protect your eyes and head.

If you follow these simple rules, flying the MiG-29 should be a delightful—and safe—experience.

When responding to advertisers, mention that you read about them in *Model Aviation*.

References

1) Jay Miller, *MiG-29 Fulcrum* (Aerofax, Inc.). Extensive photographs, drawings, and minute details.

2) John Fricker, "MiG Fulcrum," *Air International,* Dec. 1988, pp. 281-289, 316. Cutaway drawing, color photographs.

3) Steve Zaloga, "The U.S.S.R.'s MiG-29 Fulcrum," *Finescale Modeler,* July 1989, pp. 42-49. Excellent scale drawings, color photographs, details.

4) Hans-Heiri Stapfer, Don Greer, and Joe Senell, *MiG-29 Fulcrum in Action* (Squadron/Signal Publications, Inc., 1991; Number 112, 49 pg.). Excellent history, photographs, color profiles, details. ✈