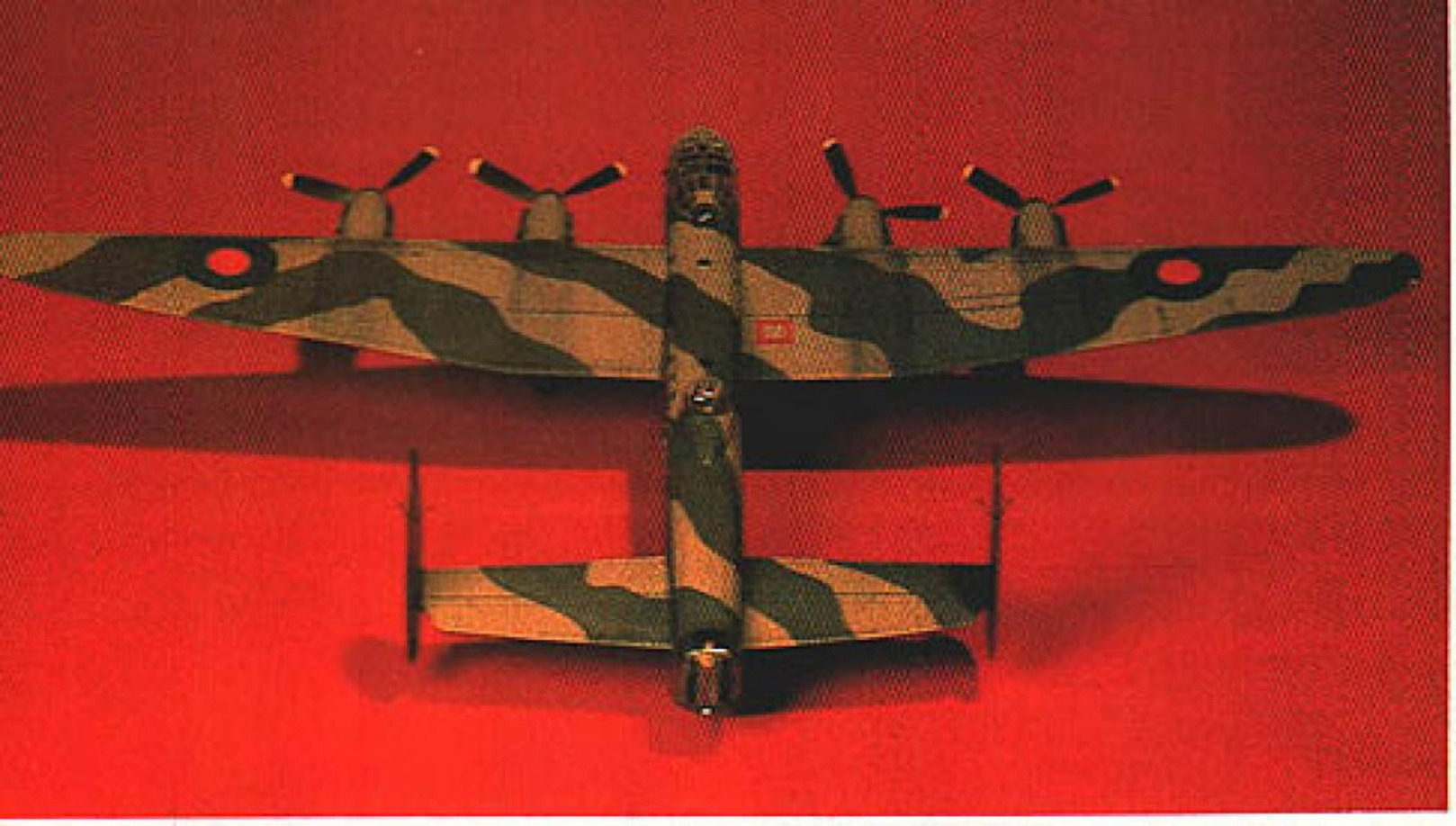
Pactra flat spray paints provide a solid appearance to the standard camouflage "war paint" but add just ½ oz. to the model's all-up weight.

■Dennis O. Norman

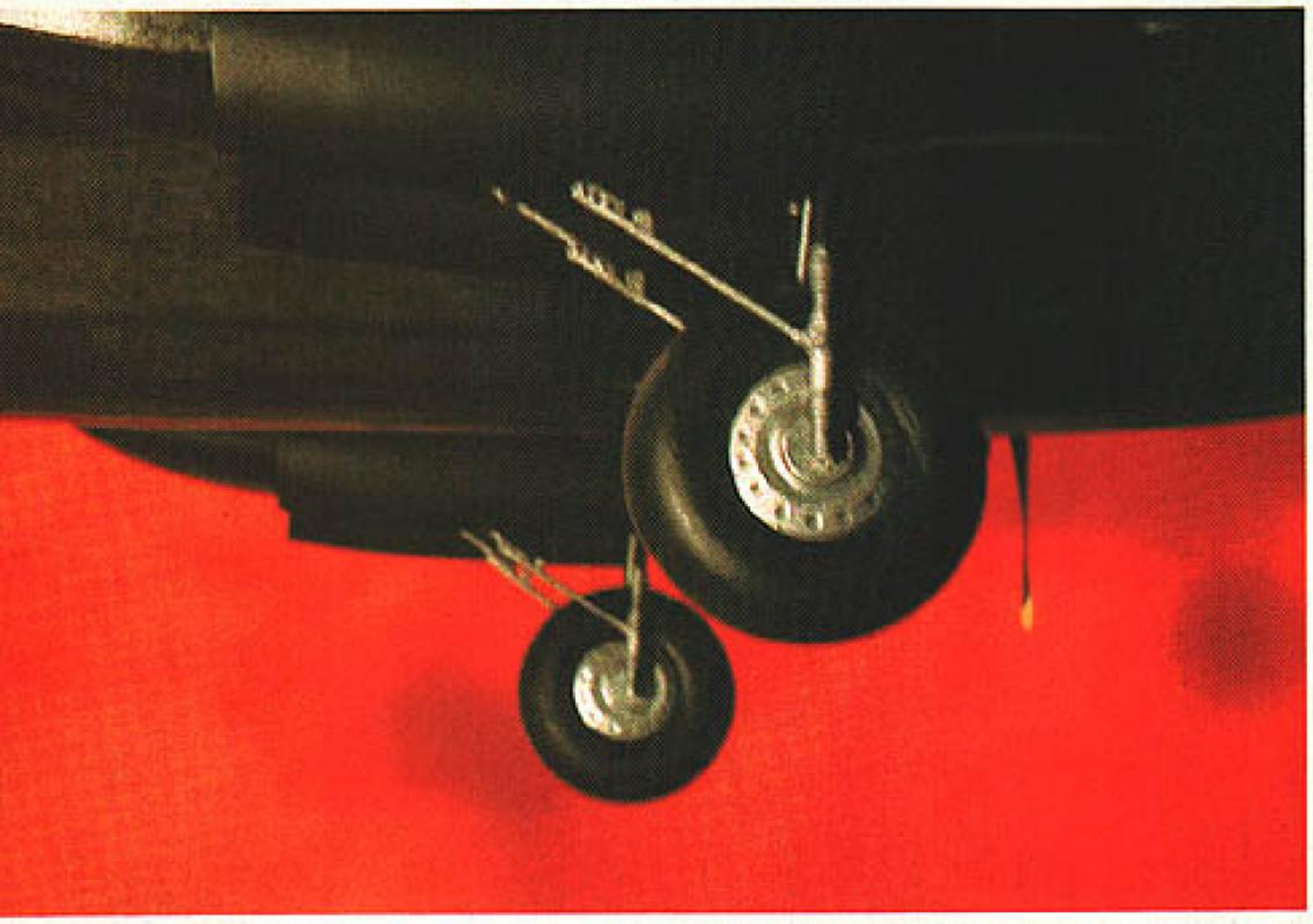
Avro Lancaster Mk.I

Nothing points out the level of a builder's skills more than a properly-trimmed, beautifully-detailed Rubber Scale model. This landmark recreated multi-engined bomber gives everyone, no matter what kind of modeling they do, something to strive for.

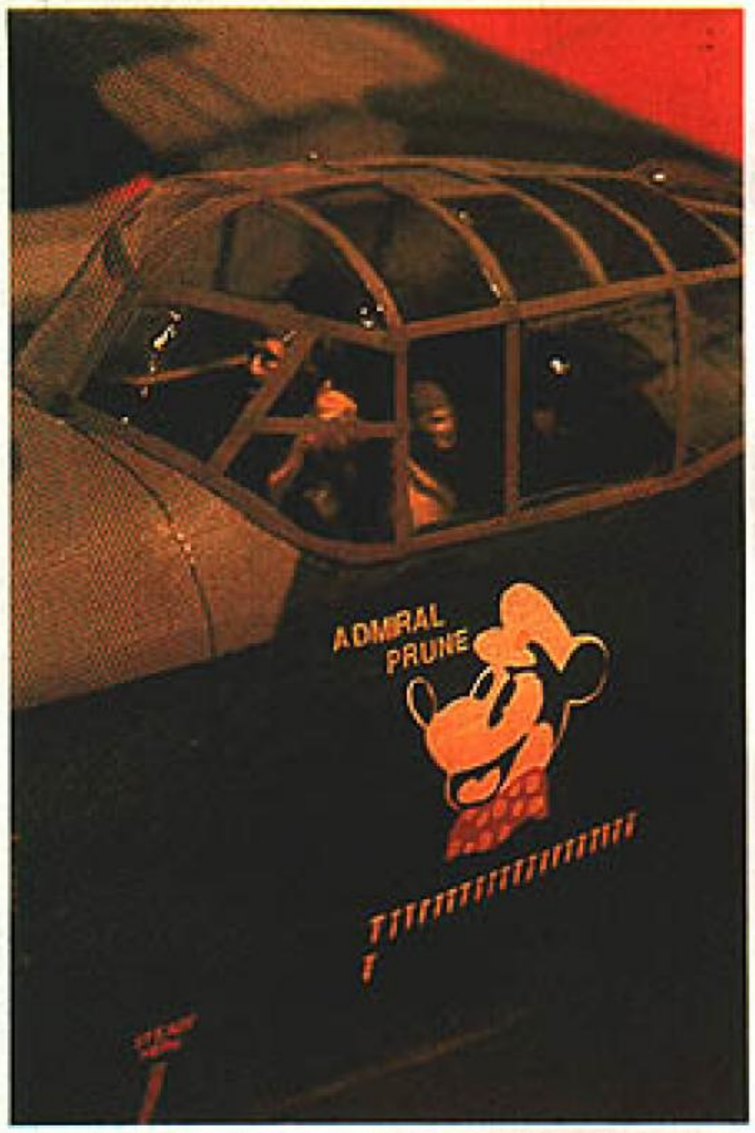
Running up the engines before take-off, the model sits proudly on its main gear which is taken off for hand-launch flight. Lightweight airframe does make ROG possible, though.



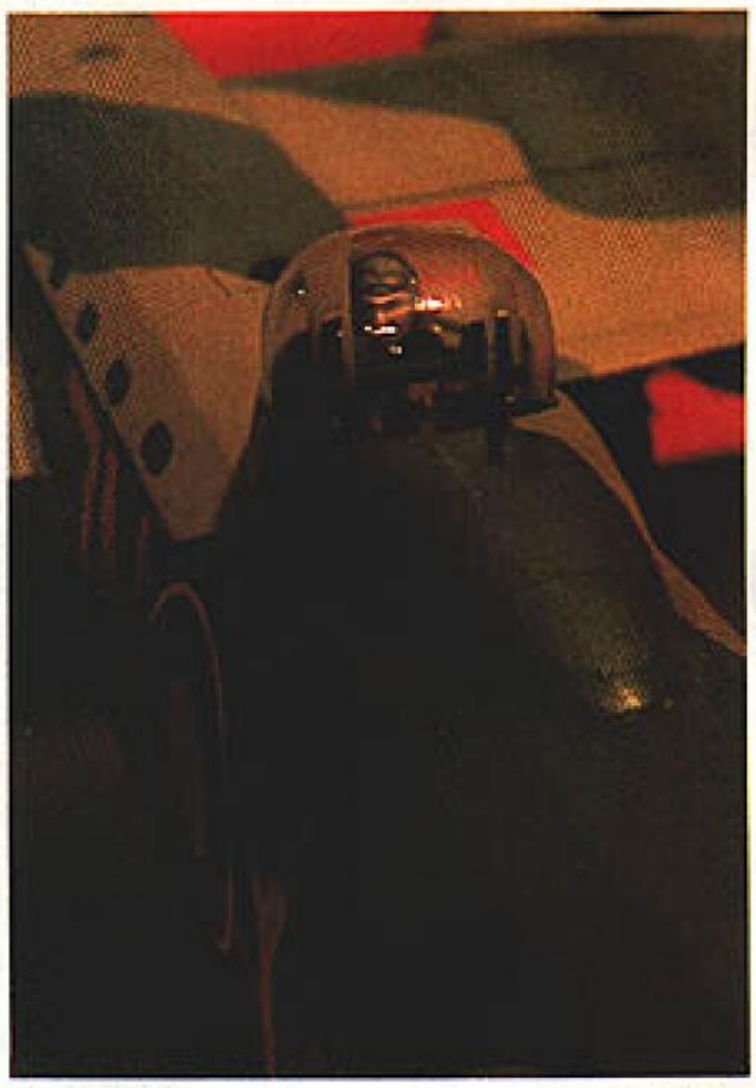
England's greatest heavy bomber of WW II, even as a model, is a study of purposeful grace and beauty. Model has the same structural support scheme as used for the full-size plane.



The combination of light structure and heavy detailing gives the outer port nacelle both character and functional beauty. Test flights with the three-bladed props are on the agenda.



The front office of "Admiral Prune" with the pilot and flight engineer at their respective stations. All pilot and crew figures were carved from a very-fine-grain Styrofoam block using a single-edge razor blade. Details were carefully sculpted into the foam with the head and point of a straight pin.



An attack from above and behind would be unwise as Hobson, our keen-eyed dorsal gunner, and his twin .303 machine guns are ready and waiting. The full-size Admiral Prune was lost during a night raid in 1943.

THE CREATION of a nice-flying four-engine rubber-powered model has intrigued me for several years. Once I tried it, the unusual and even unique problems I encountered along the way required some pretty unconventional solutions.

In 1980 I built a 60-in.-span version of the Tupulov Tu 20 Bear. It enjoyed only minimal success before being smashed to pieces at the 1982 Flying Aces Nationals. The lessons learned from the Bear were applied to the Lancaster with vastly better results. The Lanc has completed numerous successful flights with a best-flight time of 45 seconds. Its potential is still being developed, and I believe that flights of one minute or more are attainable.

This model is unique. Frankly once you understand what is involved, you may not want to build it. I do hope, though, that the design ideas incorporated in it will be of use to those who wish to build lighter, better-performing rubber-powered Scale models. The model Lancaster as I have built it has no conventional ribs or formers. Instead, it is built almost entirely of strip wood using what is known as the cracked-rib technique for the flying surfaces and what I have coined as a "strip-former" technique for the fuselage and nacelles.

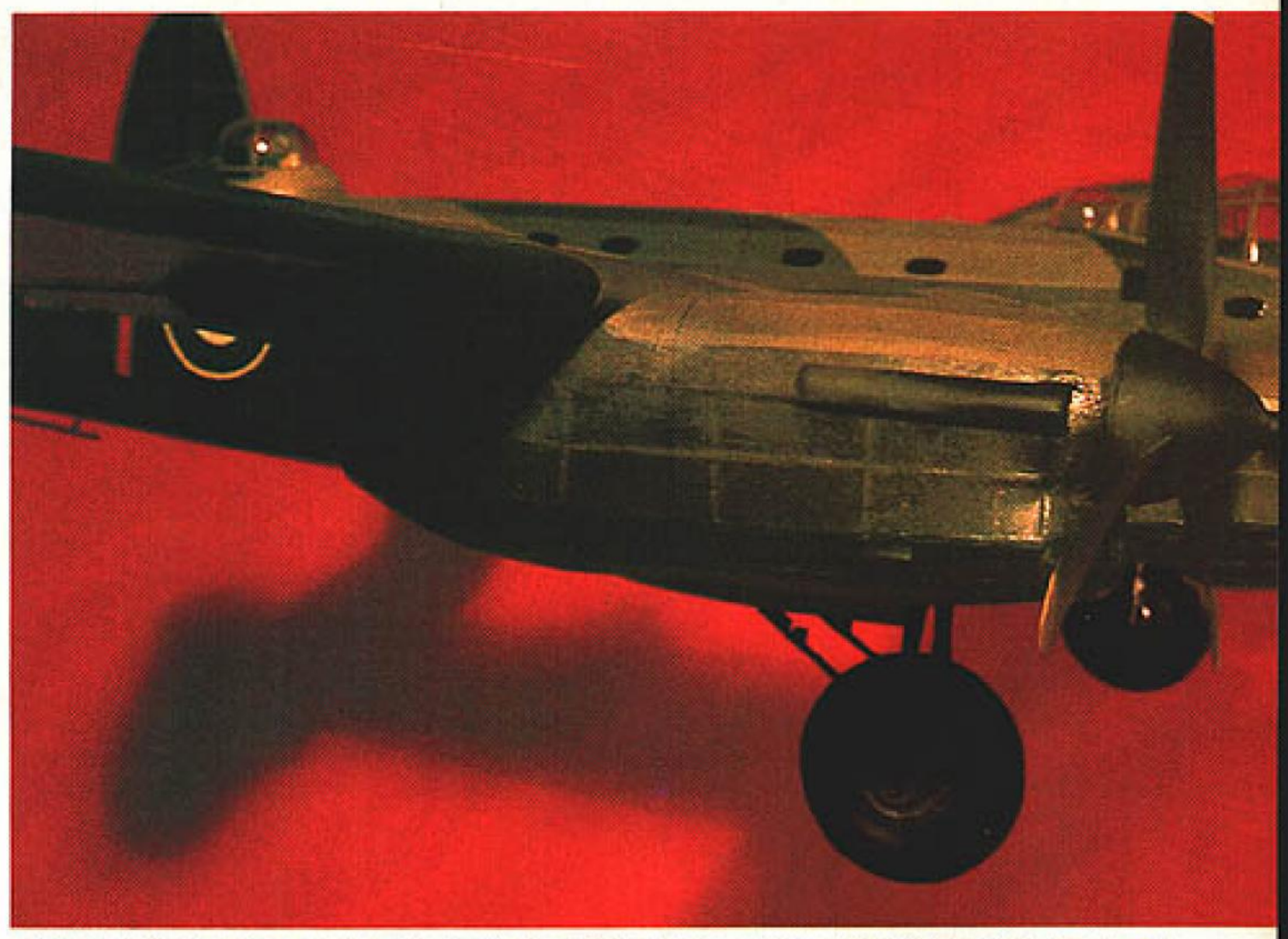
The full-scale Lancasters were very successful and were famous for their strength and load-carrying capacity. The key to their strength was a combination of a strong full-depth main spar in the wing together with a sturdy fuselage backbone. The model incorporates a similar philosophy in that it is built around a strong hollow triangular spar in the wing which is mated to a torsion box that runs the length of the fuselage.

The wing's leading edge was molded over a waxed form. The "ribs" are from light but strong 1/16-sq. balsa strip. The wing tips are laminated strip balsa formed around waxed patterns cut to the size of the inside curve.

My original multi-engined Bear was destroyed in a low-altitude roll, which vividly demonstrated the leverage force of a wing-tip impact on the wing root and fuselage. To avoid this sort of massive destruction in the Lancaster, the wing tips were designed to detach at a point just outboard of the outer nacelles using a "tongue-and-box" arrangement. Sheet balsa was used only in those areas requiring additional strength, such as the spars and major attachment points.

Weight reduction has long been known to be one of the key ingredients of successful

Corp. MacGregor, a redheaded Scott with a handlebar mustache and four .303s, cheerfully waves as he awaits the next mission.



Massive yet simple, model's main gear plugs in for static display and is removed for flight. To see this model lumber up from an ROG would be a stunning sight worth lower flight times.

Just as clothes make the man, details make the Scale model. The Lanc's port navigation and formation lights nestle in vacu-formed housings for a very good touch of realism.

Black Japanese tissue with one coat of Sig Lite Coat dope covers all the lower surfaces. The full-size Lancaster's tail wheel did not retract, and the model's remains as shown for flying.

rubber-powered designs, and that's where the unconventional solutions came to play such an important part in the Lancaster model. I originally got the idea for the construction of the Lancaster's fuselage and nacelles from a ship modeling magazine article on making wooden boats by assembling them over waxed "male" molds which are carved undersized (by whatever the thickness of the finished shell). The "shells" of the Lancaster's fuselage and nacelles are ⅛-in. thick. This consists of a 1/16-sq. "strip former" made by laminating either two pieces of 1/32 x 1/16 strip balsa with white glue, or by laminating four pieces of 1/64 x 1/16 strip balsa over a waxed balsa mold.

To these formers, 1/16-sq. stringers were added to complete the shell. The fuselage was built in two halves, separated from its mold, and then joined together at the center. Each nacelle was built in this same manner.

The Lancaster required the carving of 22 molds for 58 vacuu-formed plastic parts and seven molds for laminated wooden parts. For many, the carving of a mold seems a forbidding chore. It need not be. A look at the Lancaster plan shows that it is drawn differently from any model airplane plan which you may have seen before. The scale lines of the fuselage and nacelles are represented only by dotted lines. The crucial shape of the molds is represented by solid lines.

If you approach the carving of the fuselage and nacelle molds as though you were making a traditional "solid" model, then you would carve the blocks to shape using a series of cross-sectional "female" patterns cut from lightweight cardboard or plastic to check the shape of the piece being carved at designated points. The final shape, of course, would be reached when all of the cross-sectional patterns fit snugly at their respective stations. Such a technique could be used to carve the molds for this model, but it would be tedious and unnecessarily time-consuming. Instead, I suggest that you carve the molds using what I call a "sliced-bread" system.

Begin the carving of a mold for one-half of the fuselage or one-half of a nacelle by tracing the solid lines of the part to be carved onto a piece of hard, flat ¼-in. balsa sheeting. Cut out the traced shape using a band saw or similar tool that will ensure a 90° cut. Draw lines on the ¼-in.-sheet profile at the stations representing the vertical formers shown on the plan's side view for the piece selected. Set the sheet profile aside for now. It will not be a part of the mold itself but will be used as the base upon which you will glue the balsa blocks for the final mold.

Trace the cross-sectional formers for the piece being made from the plan onto tracing paper. Transfer the tracings to brightly colored heavy-stock paper. The purpose of this will be explained later. I prefer blue, but any brightly colored paper will do.

The next step in carving the mold is to select a piece of straight-grained balsa block that is at least as wide as the side view of the piece being carved and as thick as one-half of the top view of the piece being

Fully wound with flagged retaining pins and pull bar in place, the Lanc is ready for another mission. Pins are inserted individually into each motor, then connected to the pull bar.

Launch of the four-engined Lancaster is an unforgettable Free Flight Rubber Scale experience. Flight times have yet to top 1 min., but it is a boundary within the grasp of this model.

carved. If large blocks are not available, you may assemble smaller blocks with cyanoacrylate (CyA) glue, making sure that the grain for each piece being assembled runs in the same direction to facilitate carving.

Draw the side and top profiles onto the balsa block, again referring to the solid lines shown on the plan. Saw the side and top profiles to shape. At this point, you have a piece of balsa which is flat on the side that represents the center of the piece being built and which is curved to the outer surfaces of the top and side views of the mold in question.

Draw a series of lines on the block at the stations where the formers are located. Next, placing the rough mold on its flat side, pass it through a thin band saw or carefully saw the block through at each of the former stations. The result will be a series of segments or slices, or what I like to call your "loaf" of sliced bread.

Take the ¼-in.-sheet profile that was cut out earlier and glue the first section or slice from your balsa loaf. I recommend CyA glue for this, as it bonds the slice almost instantly to the flat profile.

From the sheet of heavy colored paper cut the half profiles of the former cross sections which go with the half of the particular balsa mold you're working on. These paper patterns are to be placed between the slices of balsa in a multi-layer, sandwich style. Attach the first paper pattern to the slice already on the balsa sheet with rubber cement. Attach the next slice of balsa to the paper, remembering to also CyA it to the base. Make sure everything is pressed together firmly. Continue alternating balsa slices and paper patterns until the balsa "loaf" is reassembled.

Carve the mold to shape using an X-Acto whittling blade or similar carving tool. The brightly colored paper cross sections will begin to reappear as the blocks are carved to their correct shapes, and you can virtually complete the mold with the carving knife alone. About all that is usually needed is a light sanding with medium sandpaper to reach the desired final smooth contour.

Once a half-mold is completed, mark the former stations onto it again, using a Pilot-brand razor pen. Blank the edges of the ¼-in.-sheet base using Scotch-brand bookbinding tape or similar high-tack tape. In doing this, be sure that the edge of the tape covers only the ¼-in. edge of the base. Do not let the tape get onto the mold itself, as it will interfere with removing the finished product.

The mold is next coated with hot wax, which acts as a release agent. Melt some paraffin, such as is used for home canning or candle making, in a double boiler. Avoid heating the wax directly; high heat may cause fire. Apply the molten wax to the mold with a foam paintbrush. One quick coat should be brushed directly onto the raw wood. Carelessness or repeated coatings will only distort the shape of the mold.

When the wax cools, take a whittling blade or similar tool and, working perpendicular to the mold surface, draw it over the wax to smooth it and remove any unwanted lumps or distortions. The wax coating should be as thin as possible, but avoid removing it entirely.

Having smoothed the wax, carefully remove the tape from the edges of the ¼-in.-sheet base, thus exposing the raw balsa edges. It is most important that no wax be allowed on the edges of the base, since it will interfere with the gluing of the strip formers to the base's edge.

The formers for the fuselage and nacelles are 1/16-in. sq., and are made either by laminating two strips of 1/32 straight-grained balsa or by using four strips of 1/64 balsa. Before assembly soak the strips in ammonia water for 15 to 20 minutes.

Typically, a strip former begins by attaching one end of a balsa strip to the edge of the base, using CyA. The strip is then drawn around the mold at the station for the former being created, and the other end of the strip is attached to the opposite side of the base (also with CyA). Any excess from the strip protruding beyond the base is removed.

A second strip is then tacked to the first, beginning at the base as with the first strip. A slightly thinned coat of Titebond wood glue is then applied to the surfaces between

Continued on page 96

the two balsa strips. My preference is to coat the inside of the second strip for a distance of half or more of the length of the former to be created. I then coat the outside surface of the first strip from the edge of the base, draw the second strip down tight over the first, and hold it in place by Cy Aing it to the other side of the base.

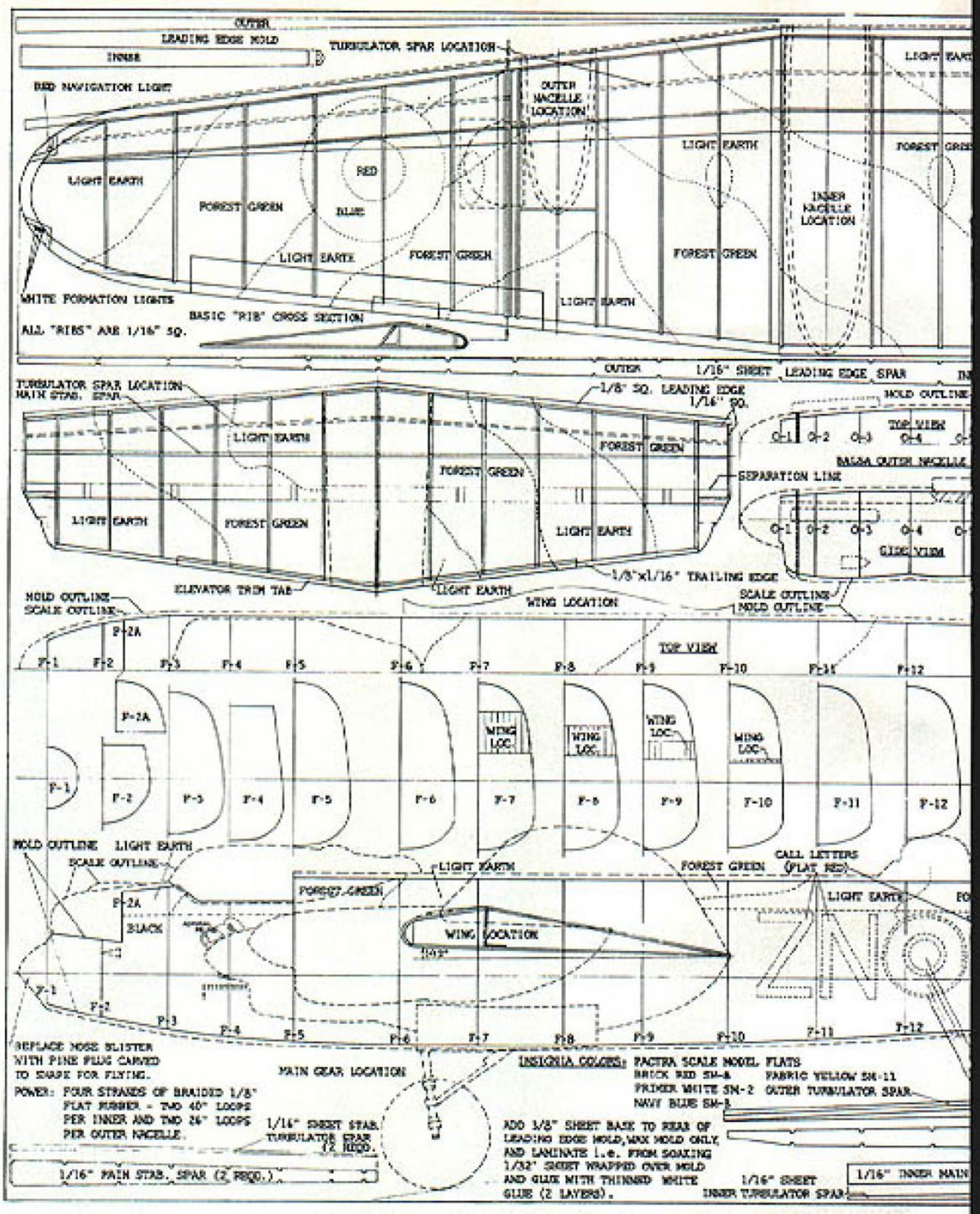
This process is repeated until all the formers are in place. If the piece being created has a concave area, the former strips should be held in place by pinning them against the mold where necessary. I had considered making the molds from material other than balsa but ruled it out since few materials hold onto a straight pen as well as balsa.

Once all the strip formers are in place for the piece being built, fill in the spaces between them with either laminated strips or pieces of 1/16-sq. balsa. Next, take long strips of 1/16-sq. balsa and glue them over top of the fillers. This results in the creation of a 1/16 x 1/8-in. longeron parallel to and immediately above the edges of the 1/4-in. balsa base. Using CyA, glue individual stringers over the strip formers at the stations shown on the plan. As a backup measure for added strength, I put a very light coat of Titebond glue on all joints.

Finally, add lightweight 1/16 sheeting to areas needing it (such as the fuselage nose). Sand the sheeting to shape while the entire assembly is still on the mold.

When everything is right, cut the molded piece from the mold. Use a sharp hobby knife to cut through the area where the 1/4-in. base and the laminated strips join. This, of course, is at the inside edge of the laminated 1/16 x 1/8-in. spine present at the juncture.

Once all the strip formers have been cut, the piece should separate from the wax mold without difficulty. If there are problems, however, carefully slip a piece of surgical silk or other high-strength thread between the wax mold and the piece. The



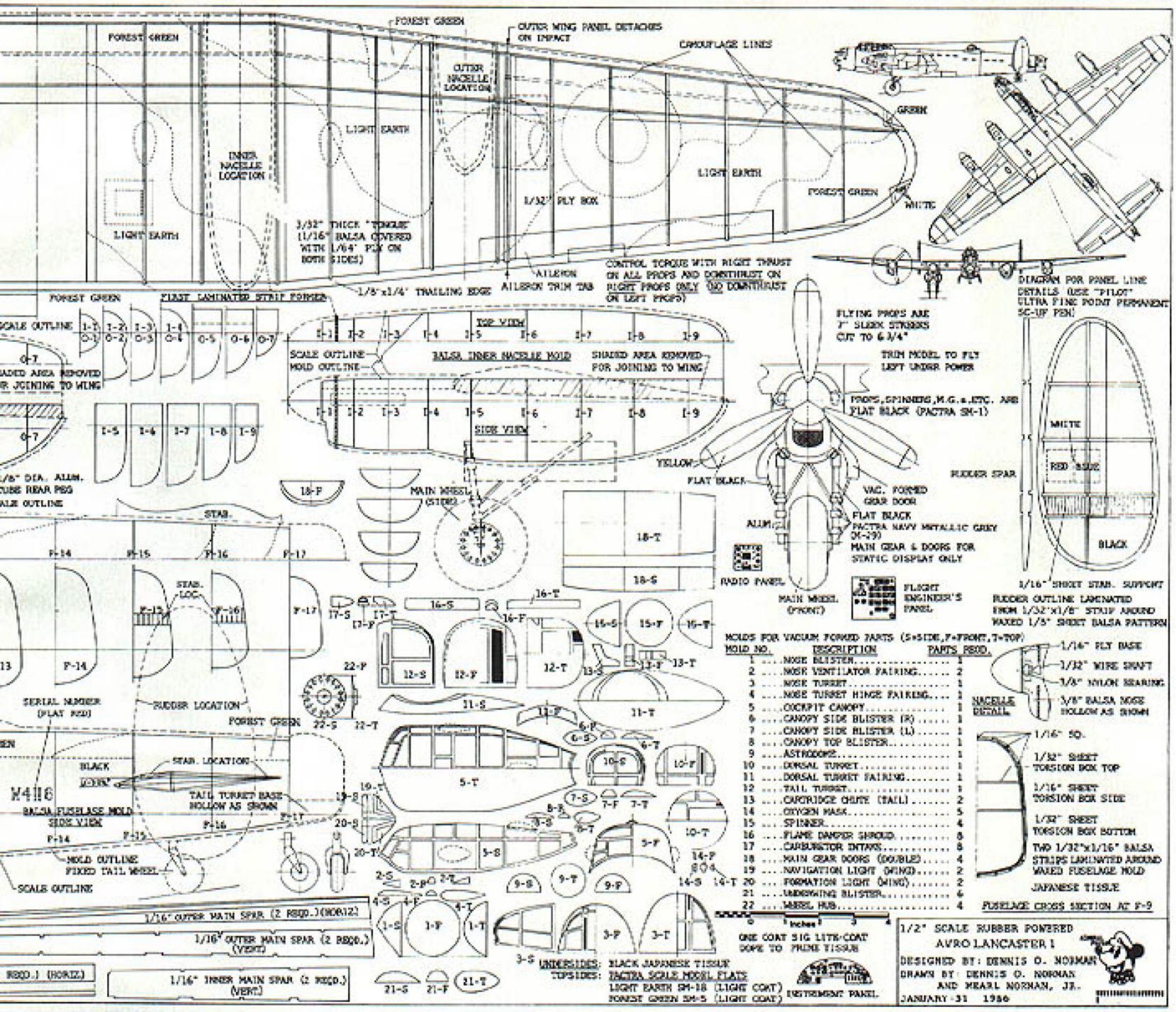
The Normans' 1984 FAC Nats Lancaster flight team. Chris, wife Linda (expecting Patrick), and Dennis. Helpers spanned three generations, as the author's father drew the plans.

thread should then be drawn down the length of the piece, with the pressure against the mold, until it is completely separated. Be careful that the pressure exerted on the string is toward the mold to avoid breaking the piece.

Join the two pieces of each assembly at their centers using Titebond glue. Slip paper clips over the spines to hold the halves together while the glue is drying. All this work may sound tedious; but once you master the technique, you will find not only that it is fun to do but, more important, it produces an extremely lightweight yet strong fuselage or nacelle.

Wing. Aside from the hollow triangular main spar and the molded leading edge, the wing structure is a conventional "crack rib" design which, I trust, requires little explanation. The tail surfaces are similarly simple. The wing is constructed in two sections, which are joined to the fuselage. Lightweight sheet balsa should be used sparingly for gussets and structural reinforcement of the joints involved. The Lancaster was built entirely from extremely

Full-Size Plans Available . . . See Page 188



light, contest-grade balsa from Micro-X Products, P.O. Box 1063, Lorain, OH 44055 (216/282-8354). Great care must be used to select the strongest and lightest balsa available, and Micro-X has always met this vital criterion for me.

Flying. The prototype Lancaster was flown on two loops of ⅛ flat FAI rubber cut to a length of three and one-half times the distance between the peg and hook of each of the respective nacelles. The motors were then lubricated and braided by back winding so as to slightly shorten and stiffen them

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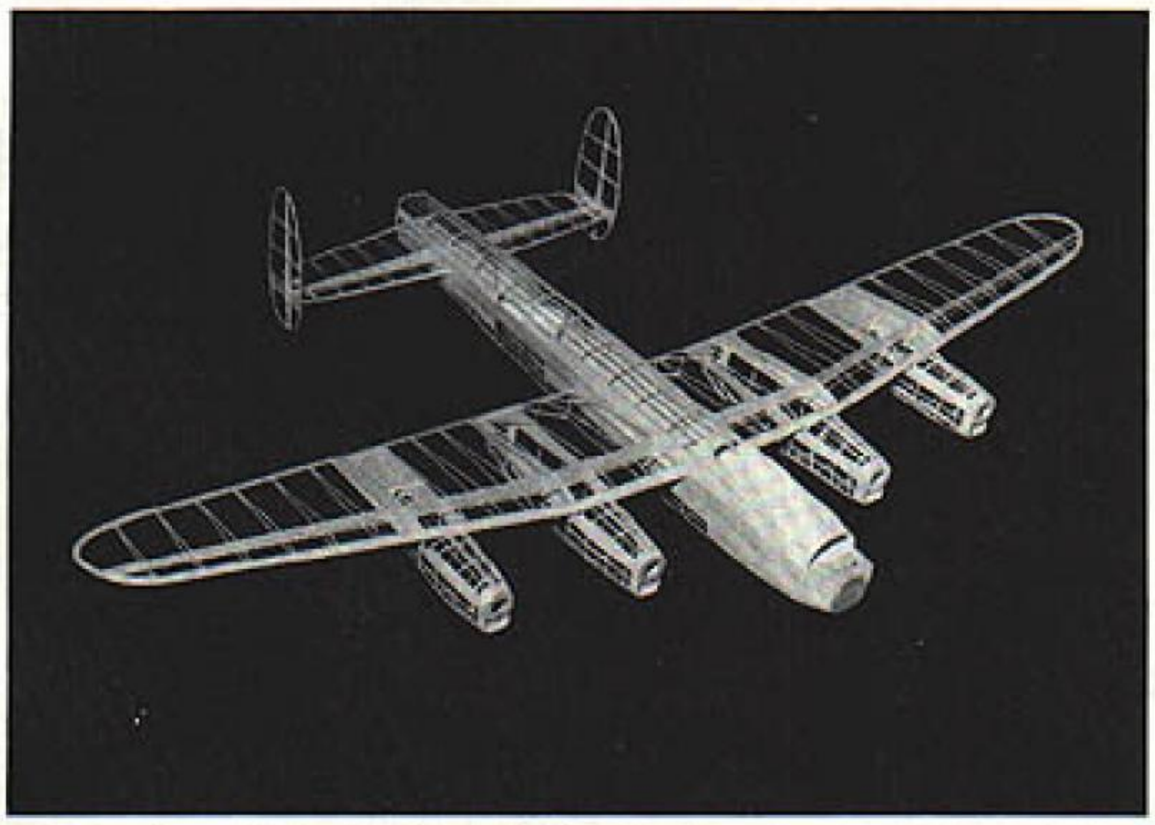

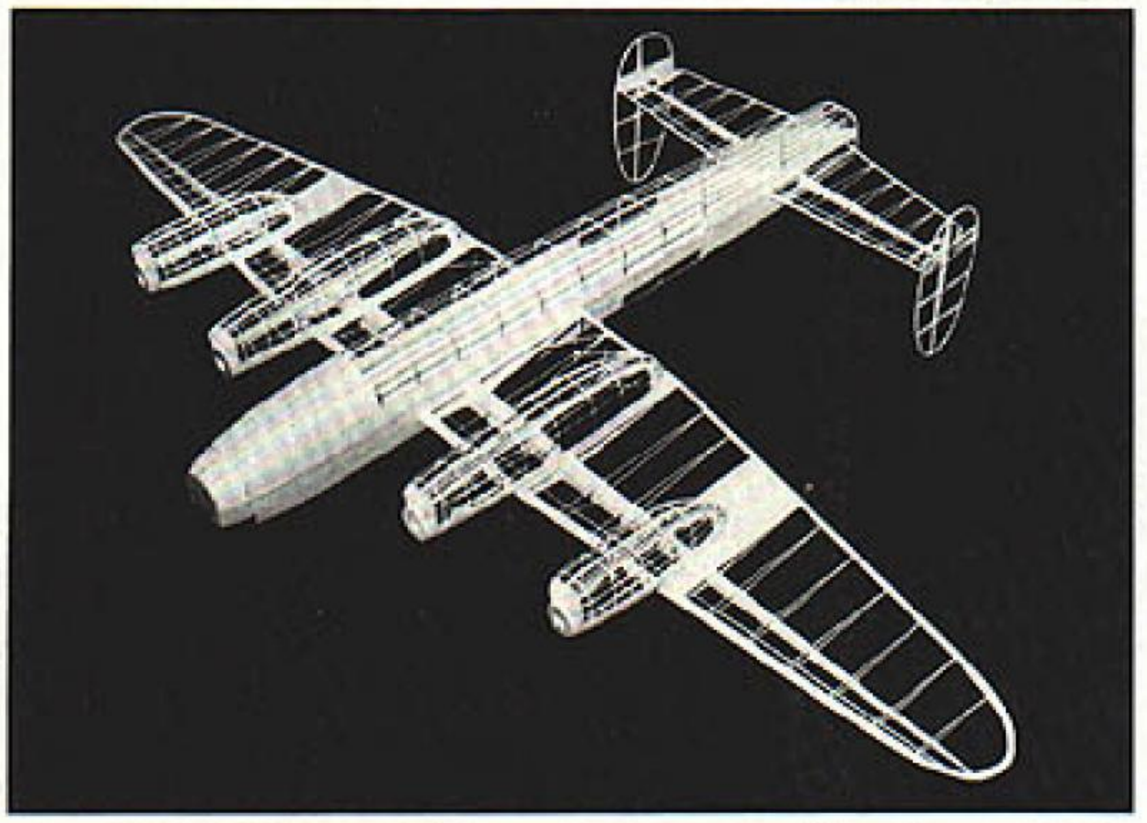

These two pictures lay to rest the old adage that beauty is only skin deep. Here, it definitely goes all the way to the bones. Using the cracked-rib method for wing construction and the male molds detailed in the text to form the nacelles and fuselage are just the basic requirements for making a four-engined rubber model flyable. These shots detail the magnitude of this effort even more than the finished product.

happening around town. Spreading the word through these vehicles visibly increases the number of spectators who come to watch a contest. Each event makes a few more people aware of our club and our hobby.

Special event flyers. The traditional contest information sheet distributed by the club sponsoring a contest is written in AMA rule book language for the benefit of the contestants. We also produce a separate announcement, written in layman's terms, to invite spectators to come watch a contest or participate in a seminar. We include the name and phone number of a club member to contact for additional information. These announcements are placed on bulletin boards in high-traffic areas such as shopping malls, public libraries, hobby shop windows, etc.

Display window exhibits. We obtained permission to put a Control Line model exhibit and information placards in a local shopping mall's unused display case. The display was in place for two weeks to promote an upcoming contest.

Our exhibit attracted so much attention—it was on display far longer than we could have sustained a manned mall show—that the mall merchants demanded to be allowed to use the previously unwanted display case. Doing the window exhibit gave us exposure to such numbers of people that we're eager to do another—but still waiting for the display case to become available again!

Entry-level Control Line events. The instant a modeler masters his first Control Line trainer, he joins the ranks of the sport flier. At this point, participating in a contest with the other club members seems far beyond his grasp. To bridge this gap, the Norfolk Aeromodelers include an entry-level event at each contest.

To be effective, the event must be one that anyone can fly using simple off-the-shelf items. Our most popular entry-level event is Profile Sport Scale (rules appeared in the April 1984 *Model Aviation*, page 73). Anyone who can fly a profile replica of a full-scale aircraft for 10 laps can compete.

Many profile Control Line kits are patterned after a full-scale prototype. Some, like the Sig Shoestring or Sterling's Beginner Series, make good Control Line trainers, permitting someone's first model to also be entered in his first contest. Featuring an entry-level event at each contest gives the new flier something to look forward to, maintaining his interest and enthusiasm. It bridges the gap between sport and contest flying and builds confidence.

To summarize, our efforts produced the results we aimed for. Club membership continues to grow. The number of active fliers has doubled. The father-and-son flying team that first flew the club trainer two years ago are now among our most aggressive Combat fliers. Some of the people who built their first model at the recreation center are now regulars who join us each Sunday. The local hobby shop has Control Line merchandise in the store, and the owner is quick to point out the new Control Line kits that just went onto the shelf.

This doesn't mean that our promotion efforts have stopped. We realize that everything we put into action got us to where we are now, and we want to keep it that way. Promoting the sport is an evolutionary process, and there is always a refinement that needs to be added—like a car pool to get Junior modelers to the club field. But that's a problem—no, a challenge—the Norfolk Aeromodelers will gladly deal with.

SAFE FLYING IS NO ACCIDENT

Lancaster/Norman

Continued from page 97

without losing the energy represented by their considerable length. Seven-inch Sleek-Streak propellers were cut down to a diameter of 6¾ in. for the prototype. Only two-bladed props have been used thus far to fly the model, but flying three-bladed props will add to the realism.

The fully-wound motors are temporarily held in place by placing an 8–10-in. length of 1/32 piano wire vertically through each nacelle so as to pass through the wire hook of each prop assembly. A hook is bent into the lower end of each pin so that the pins themselves can be attached through hook-eyes imbedded at the appropriate spacings in a piece of 1 x 2-in. pine strip.

When all the motors are wound the pine strip is pulled down vertically from the plane. By simultaneously removing the pins from the prop assemblies, this action permits all the motors to unwind. The model is launched—horizontally, but firmly—into the prevailing breeze.

At its best, model aviation captures the beauty and the excitement of manmade flight. Even with this fragile replica, the spark of one of history's great aircraft is rekindled.

Sugar Pup/Hux

Continued from page 105

Cutting board. To aid in cutting foam blocks and in special angle cuts, you will need a cutting board. The board is made with a 3-ft.-sq. sheet of ¾-in. plywood. The sheet must be flat and true. Using a triangle to ensure accuracy, attach 12-in. polished hardwood strips on each end at 90° to the board and 3 in. from one edge. Use 1-in. blocks under the board to gusset the strips. Also attach two wood strips at 30° for cutting the tip angles. Draw a line with a