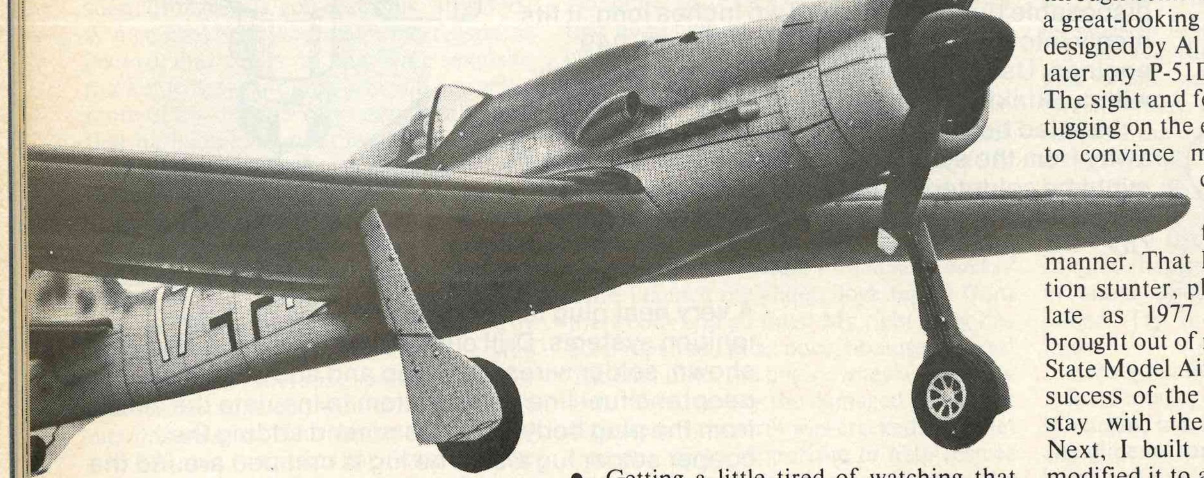
# FW-190D-9

## by David McClellan

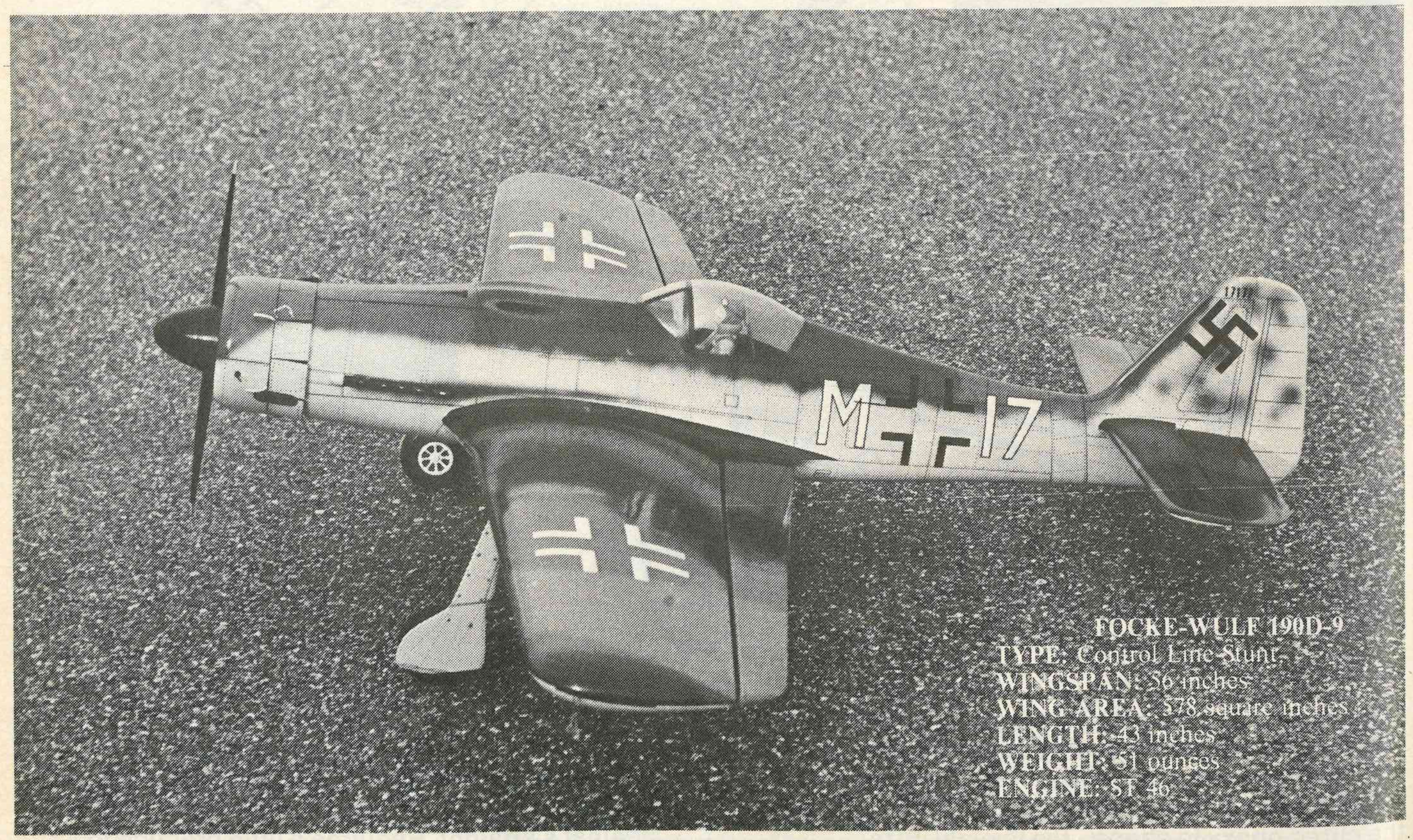


**Bored with all those sterile straight-line stunters? Here's a semi-scale ship that will fly with the best.**

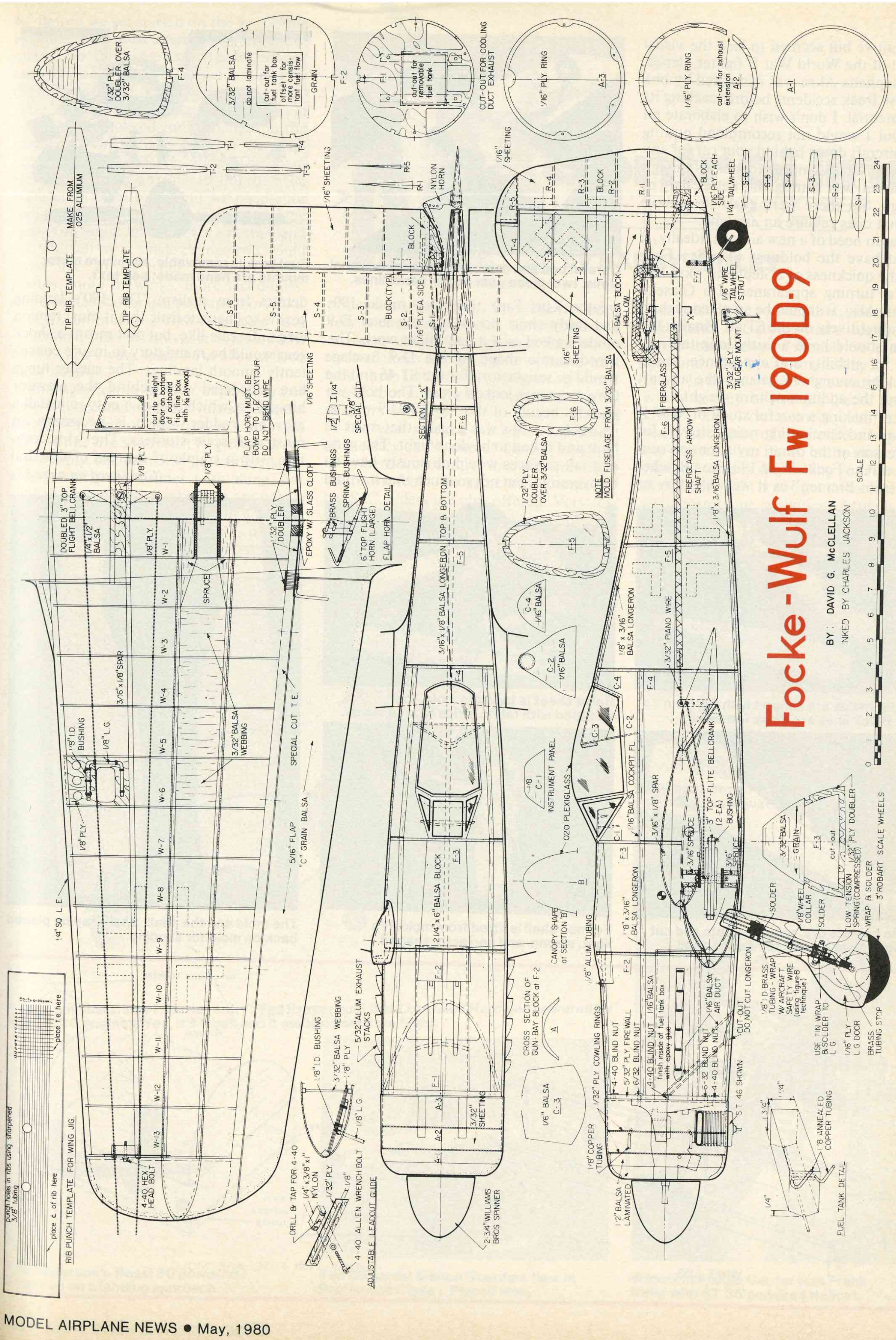
• Getting a little tired of watching that old yardstick going through the maneuvers? How about taking a little extra effort to build a real—well, almost real—World War II fighter plane? Then grab hold of the handle, rid your conscience of mercy, and get ready for combat. Scan the skies in search of "meat" for your "Butcher Bird." Maybe you'll find an unsuspecting Mustang—or a Stiletto? Maybe??

But why the FW 190D-9 or why semi-scale stunters at all? The easiest way to answer this question is to try it and see for yourself. I first tried the near-scale stunters around nine years ago and was so intrigued that conventional stunt ships no longer seemed to offer the necessary challenge.

This near-scale-stunt thing became a reality for me in 1970 when I was looking through some magazines and came across a great-looking near-scale P-51D Mustang, designed by Al Rabe. About seven months later my P-51D was finished and flying. The sight and feel of that big graceful brute tugging on the end of the lines was enough to convince me that scale-like stunters could be designed, constructed and trimmed to fly in a very competitive manner. That Mustang, my first competition stunter, placed in many contests. As late as 1977 the same Mustang was brought out of retirement to win the Texas State Model Airplane Championships. The success of the Mustang convinced me to stay with the near-scale type stunters. Next, I built a Mark Freeman Spitfire, modified it to accept a .60-size engine, and included some of Rabe's newer ideas. A great deal was learned from constructing and trimming the Spitfire. Unfortunately, before the Spitfire had seen any competition, a leadout broke and my dreams lay scattered on the asphalt. In search of a smaller, simpler aircraft, I elected to modify a Tom Dixon Stephens Akro, incorporating a thicker but smaller wing and the more powerful Super Tigre 46 for power. This aircraft proved to be very




Perhaps the greatest challenge in modeling is to build a competitive control line stunter that looks like a real airplane. Here's an outstanding example of the art, a "long nose" Focke Wulf that retains its scale appearance and wins contests too.



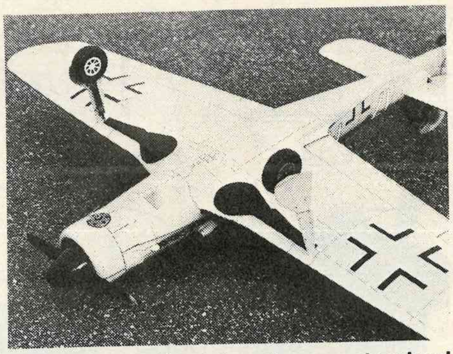

FULL-SIZE PLANS AVAILABLE . . . PAGE 121.

competitive but seemed to lack the visual impact of the World War II fighter planes. The Stephens Akro was destroyed by one of those freak accidents before reaching its full potential. I don't wish to elaborate on this, but I would not recommend putting your aircraft down behind your car for any reason. It was beginning to look as though frustration was getting the better part of my ego, but there were goals to achieve and that does require an airplane.

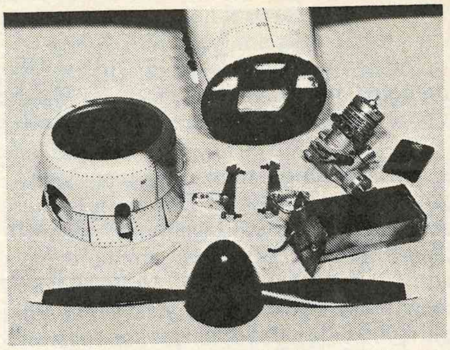
I was in need of a new aircraft. Ideally, it should have the boldness of a Sea Fury with the quickness of a Stephens Akro and the flat turning appearance of a Gieseke Nobler. Also, it should be small enough to fly competitively on the ST 46. Finally, the design should have a fairly long tail moment for stability and appearance, and a nose long enough to balance the aircraft without the addition of trim weight.

After making a careful study of WW II designs and eliminating many aircraft for one reason or the other, my attention centered on the Focke-Wulf 190, the "Butcher Bird from Bremen" as it was called by its creator, Kurt Tank. The early model 190s had fairly short noses, but the later D-9 model looked as if it just might work. The aerodynamic shape of the D-9 fuselage would be satisfactory for the ST 46 and the long moments looked great. The bold yet graceful beauty of the FW 190D-9 was irresistible . . . this was a plane that must be built and it had to be done right. The wing and tail surfaces would obviously have to be oversized, but not so much that it would detract from realism. The 190's landing gear is so characteristic that it must remain long and scale-like, but that meant a shock gear would be mandatory to insure consistently smooth landings. The rudder hinge line is located well behind the elevator hinge line, which makes it easy to install a movable rudder, which is necessary on most near-scale stunters. The wing location with a couple of degrees of dihedral

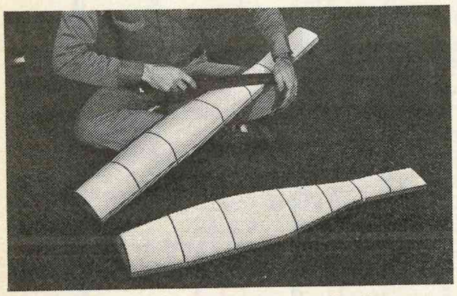
*(Continued on page 83)*



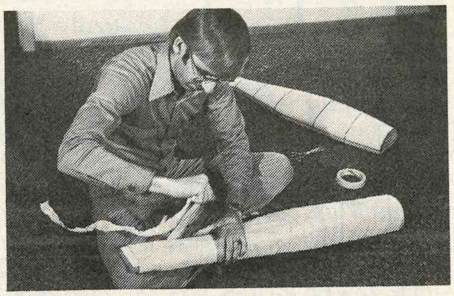
**Careful pen and paint work suggests wheel wells, two-piece gear doors, panel lines.**



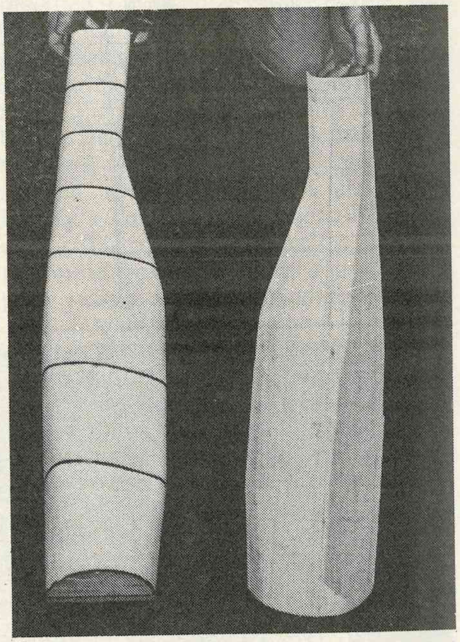
**Fuel tank is removable, aluminum motor mounts are hand made; see text.**



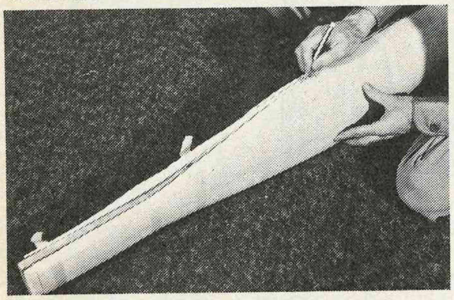
**Plaster molds are shaped with Surform tool. Black lines are balsa formers.**



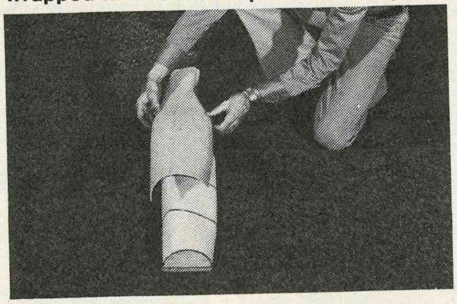
**Balsa sheet is taped to mold, then wrapped with fabric strips to hold shape.**



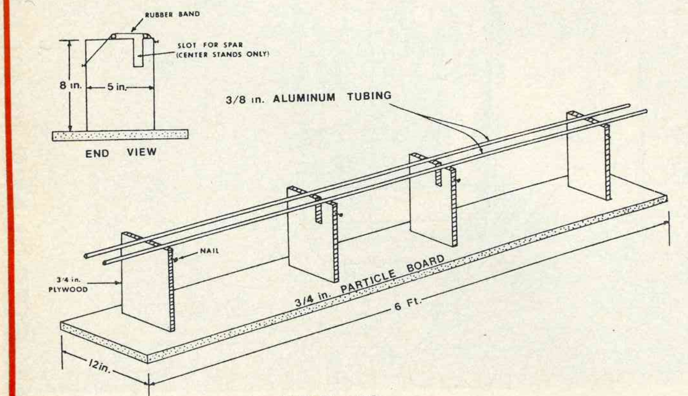
**The mold and the shell. Shell may be placed back on mold for sanding.**



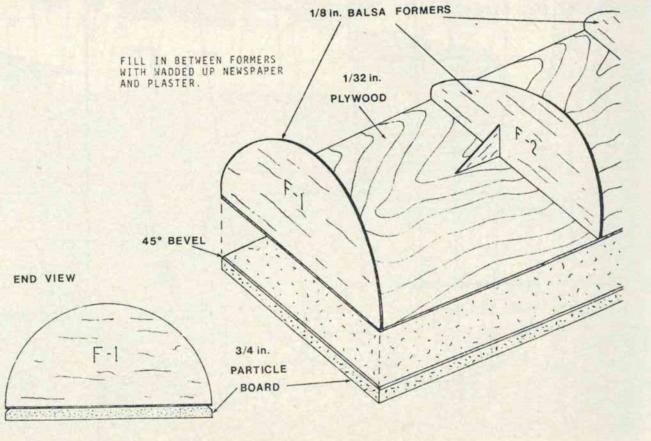
**When balsa is dry, remove fabric and cut along groove in mold to release shell.**



**Formed shell is lifted from mold. It's light, strong, and perfectly shaped.**




WING JIG

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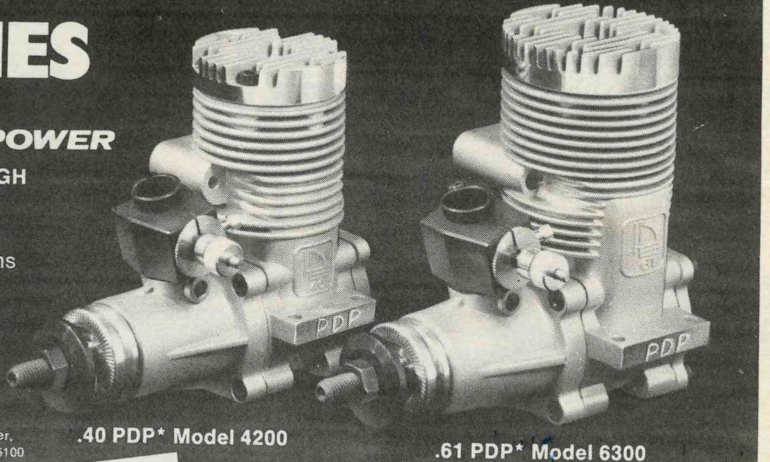

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## CONTROL LINE NEWS

*(Continued from page 80)*

racing events. John Ballard was in Houston on business the Thursday before the contest and joined Bill Lee and Larry Miller, also from the city, at Buckeye. John won Rat Race, Bill took Goodyear and Larry had the honors in AMA Slow Rat. Entries were down a bit in these events from previous years. These standard racing categories are quite old and the winning formulas are standard, though Larry Miller's low aspect ratio Slow Rat was a little unconventional. In Goodyear, Vic Garner had an AD-15 engine. I don't know much about it, but it seems to hold its own against the Rossi. Slow Rat almost requires the very nice custom Tune/Hill 36, which is a much modified OS 40.

Two very popular races are the ACLA Slow Rat and SWCLA Big Goodyear. Model requirements are similar; these rules are another attempt to offer an easier racing event. You must use a kit such as the Goldberg Buster and a 35. Denver's Mike Gale has a ship that clocks at 105 mph in traffic. Last year there were nearly 30 Big Goodyear contestants. I didn't count them this time, but there were definitely fewer.

The very difficult FAI Team Race had six teams present, which is a lot. Since the Nelson engine has become available, FAI has enjoyed a slow but steady growth. This year there will be a team trial in Albuquerque for the first time, and Phil Shew and Les Pardue are pushing hard to popularize the event there. Phil and Les had a new model with a clever ducting system to cool the engine. The venturi sticks up into a hollow pilot's head. These models are very light; wings and tails are solid balsa with a spruce leading and trailing edge to provide a little rigidity.

Leonard Ascher had the most unusual racing entry. His AMA Slow Rat was built with an ultra high aspect ratio wing. I don't know how well it did.

A couple of fliers I'd not met before came from Redwood City (near San Francisco) to compete with their sport scale models. Don Chandler's Top Flite P-51 was a converted R/C kit, done in a nice green color. Bob Anderson used four Super Tigre 23s for his colorful DC-6. Bob's was the first model I've seen painted with Pactra Formula U polyurethane paint. The orange and white combination made for an unusual scheme. The other scale models were Navy Carrier ships.

The future of this contest is somewhat uncertain. In the past, fliers from Phoenix swelled the contestant list and helped with the manpower. They are no longer around, but this probably isn't too serious. The Aero Challenge for Muscular Dystrophy imports all its officials and is doing quite well. I suspect the Buckeye affair will follow a similar course. ■

## FOCKE-WULF 190D-9

*(Continued from page 46)*

would put the vertical leadout location just about right.

A proven reliable *engine*, a proven *airfoil* (Rabe's specialty), and proven *moments*, used on many recent successful stunt models, all added up to success, but the big question had to remain unanswered until the craft was finished. It was uncertain if

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the correct combination had been properly calculated, but I was willing to gamble a year of building time to find out.

The FW 190D-9 did prove to be a quality performer. It sits atop its widespread main gear with chin held high, poised and ready to strike. Point the spinner into the wind, fire up the engine, pull a little down elevator so it won't leap into the air, and you are ready for some real serious fun! When released, the 190's tail immediately comes up and it will ride its realistic shock gear until you nudge in a bit of up elevator. The aircraft is exceptionally groovy with no tendency to "hunt" or "roam" in the maneuvers. The outstanding stability must be attributed to the long tail design. At first the 190 would not turn good square corners, but was outstanding in all other maneuvers. Adjusting the pushrod for maximum elevator travel helped, but the corners still fell far short of my expectations.

It was apparent that an error in design had been made. The elevators simply were not big enough to move the long tail fast enough to satisfy the demands of the AMA Stunt Pattern. A 1/4" strip of balsa was added to the trailing edge of the elevators. This really made a difference. The 190 could now turn a good corner, but I felt the wing was capable of carrying an even sharper turn without stalling. Another 1/8" strip was added to the elevators. Now it could fly exceptional squares and this was accomplished without any sacrifice to its stable characteristics (the larger elevators are incorporated in the plans). The drag from the large flaps gives a desirable braking effect in the corners and this, combined with a relatively strong engine, creates a "stop-turn-go" illusion in the square maneuvers. The 190 not only turns good squares, it also has the *appearance* of turning good squares. This is a very important characteristic.

After trimming, the 190 flew better patterns than any other airplane I had ever flown. It takes a little practice to consistently "grease" the plane on in the landing. If you let the plane land a little fast, pulling a little down elevator immediately after the main wheels touch, the 190 will stick to the pavement and roll out tail high, gently lowering its tail just before coming to a stop. The shock gear is very forgiving and will smooth out many would-be errors. Trimming and practicing with the plane had been interesting and fun, but the time had come to match the plane against the Noblers, Stilettos, Genesis, and whatever else shows up piloted by those experienced Texas fliers.

The FW 190's first public appearance was on May 14, 1978 at Dallas, Texas, where the plane garnered over 500 points to score second behind Al Rabe. Two weeks later the plane was loaded in the car and it was off to Houston for the Texas State Model Airplane Championships. Again the aircraft racked up over 500 points to take first place, edging out several Nats qualifiers. Then it was time to make preparations for the Nats to see how it would rank against the highest echelon of competition. Due to a late draw on the first day of qualifications, the winds came up before my turn to fly. My engine was not running well and the winds were too much. I missed qualifying by a large margin. It would take a near perfect flight the second day for any chance to make the finals. The next day my engine seemed to be putting out the power I needed and the winds remained calm. This set of judges, however, was scoring considerably lower than the first. Even though the FW 190 placed in the top five the second day, when the scores were added together, it just was not enough and the FW 190 had missed qualifying. I left the Nats a little frustrated, but when I look back, I realize that on that second day of qualifications the FW 190 outflew some very good airplanes. The 190 had proven its potential.

After the Nats a great deal of time was spent practicing and refining the 190's trim. On September 3, 1978, I returned to Dallas for the traditional Southwestern Championships. There was a large turnout of contestants and the FW 190 again posted high scores to place second, again behind Al Rabe. To close out the season Dallas decided, on rather short notice, to hold a PAMPA classed contest. The winds were terrible and the turnout was small. The FW 190 handled the winds very well and took home its final victory for the year.

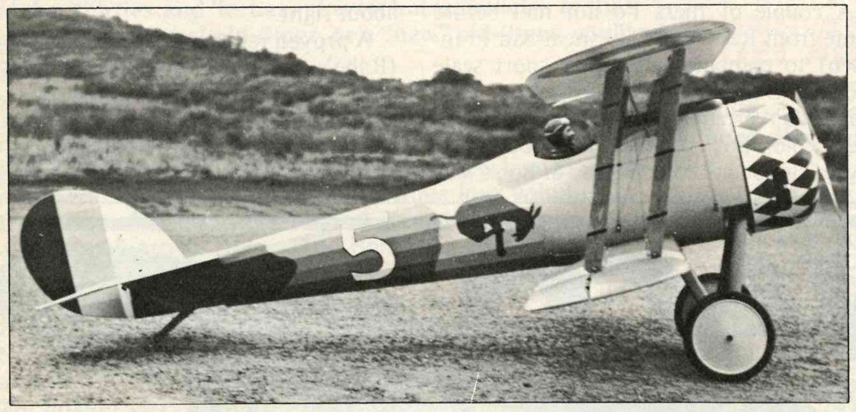
In 1979 the 190 won the Texas State Model Airplane Championships for the second time and also won the Southwestern Championships in Dallas, but again it was hard going at the Nats in Lincoln, Nebraska. Flying against the toughest field of competitors ever, the 190 fell short of qualifying. However, the 190 has not placed below second place in Texas competition, and there was no longer any doubt that it was a competitive aircraft and able to fly well in the wind. The aircraft seemed to possess the qualities I had worked so hard to achieve.

Before you make up your mind to build the FW 190D-9, or any near-scale stunter, you should consider a few things. First, you are going to spend more time constructing than you have on any previous conventional type stunt ship. This project is no seven-day wonder. Seven months would be a closer guess, so take your time and shave off those extra ounces. Remember, an ounce saved in construction will be equivalent to a pound in a 16-G corner. Second, you will probably spend a little more money. Third, you will undoubtedly spend more time and effort trimming and correcting the problems characteristic of this type of aircraft. And fourth, you must build a set of molds to construct the fuselage. Any alternative will undoubtedly be too heavy. When your project is complete, I am sure that you will agree that the extra time, effort and money was well spent when measured against the satisfaction you will receive. But remember, this aircraft represents a highly complex and sophisticated design, and a great deal of experience in building contol line stunt planes is a necessary prerequisite to building it.

The statistics on the FW 190D-9 are as follows: Final weight was 51 ounces, plus tip weight, and is carried by a 56 inch span, 578 square inch wing with an airfoil of 24% thickness increasing to 26% at the tip. The flaps are full span, totaling 113 square inches, and move 33° in both directions. The horizontal stabilizer spans 21 inches with an area of 61 square inches. The elevators total 48 square inches and move 31° up and 41° down. The fuselage has a length of 41 inches, plus spinner, and the tail moment is 17 1/4 inches hinge line to hinge line. The engine is an ST 46 turning a 12 1/2x5 1/2 prop with a 2 3/4 inch Williams Brothers spinner. The fuel tank is a standard square wedge type that is removable and adjustable with a capacity of 5 3/4 ounces. It is made from tin can stock. That's about enough on the numbers, so let's start building.

FUSELAGE. The most important design element that makes a near-scale stunter stand apart from the average stunt ship is the fuselage. As stated before, in order to keep this aircraft light enough to be competitive, a molded-skin construction is absolutely essential. Many fliers avoid scale-like stunters because of the extra effort required to make a set of molds. Once tried, I am sure you will agree it is really not that difficult, and besides, you won't have all those blocks to hollow. There are a number of ways to make a mold. I chose to use plaster of paris because it is easy to use, readily available and less expensive than balsa wood. Recently, Ron Harding has used foam to construct his molds with great success. This sounds as if it would make a mold light and easy to handle. It should be cheap too, but so far, I haven't had a chance to try it.

The fuselage shell is molded in two halves, necessitating the construction of two separate molds. To make a fuselage mold template, trace the outline of the fuselage from the plans, reducing the outline to allow for the 3/32" thickness of the balsa fuselage shells. Cut out your template and trace the outline onto a sheet of 1/2" particle board. Saw this out and repeat the procedure on a sheet of 1/32" plywood. Bevel a shallow 45° edge around the particle board and glue the plywood onto the board letting the plywood overlap the bevel. This will form a notch around the base of the mold that will provide a guide for cutting the shell from the finished mold. This will complete the base for one mold. Turn the paper outline over and repeat the entire process for the other mold (see diagram). *(Continued on page 88)*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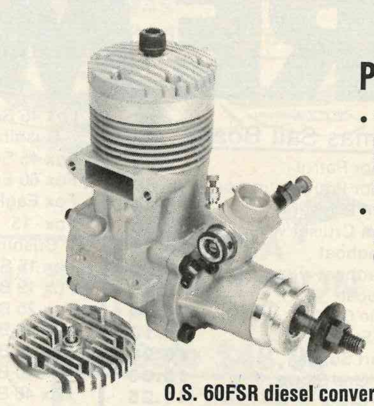

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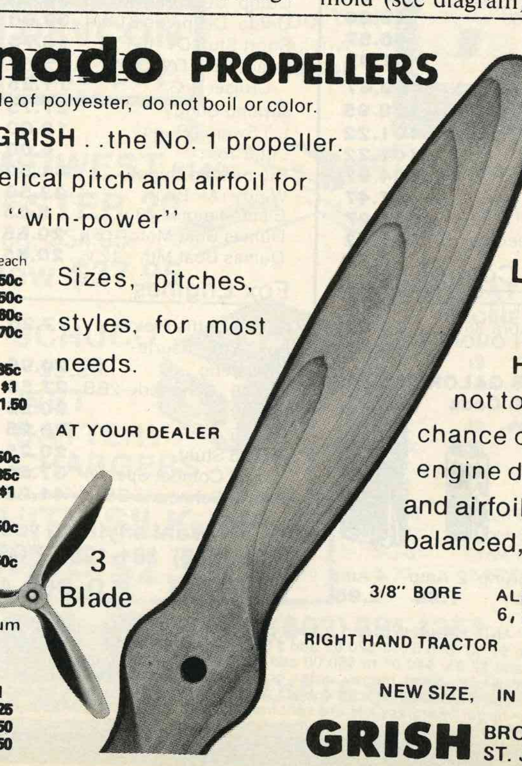


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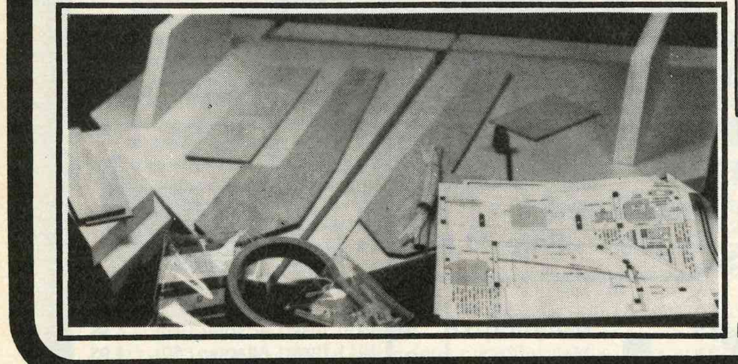

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## FOCKE-WULF 190D-9

*(Continued from page 85)*

To accurately form the shape of the mold, templates traced from the plans must be used. Bulkhead templates for the mold are traced from the fuselage bulkhead templates. The mold templates differ from fuselage templates in that they are each separated into left and right halves with 1/32" removed from the flat edge at the fuselage center. This will compensate for the 1/32" plywood doubler glued to the base of the molds. The *back* of the 1/32" plywood (where the notch is) is the fuselage centerline, and not the front of the 1/32" plywood. Now, using your templates, accurately draw the outlines of each bulkhead onto a sheet of 1/8" balsa. Cut these out and glue them to the base of each mold half in their respective locations as shown on the plans. Supports can be added to help steady the formers. Using a felt-tip marking pen, color the edge of each former to make it somewhat visible through a thin layer of wet plaster. The molds are now ready for filling.

You can stuff some wadded up newspaper between the formers to take up space and cut down on the plaster required. Purchase about 15 pounds of plaster of paris and mix up a portion in a bowl, but remember you will have to work rapidly to finish each mold before the plaster begins to set up. Work on one mold half at a time. Overfill the mold slightly, covering up the formers completely. After the plaster begins to harden, use an open rasp file (Stanley Surform, for instance) to shave the mold until the formers show. Now make the other half. The molds are now complete and you are ready to mold the fuselage shells.

Using waterproof cement (Ambroid), glue enough sheets of 3/32" balsa edge-to-edge to go around one mold. Cut this to the general shape required to cover the mold and soak for 10 minutes or so in water. (I use the bathtub.) Carefully work the sheeting around the mold and wrap with masking tape to hold it in place. I usually start at the thickest part of the mold and work toward the ends. The sheet balsa probably won't form to the mold without several bulges occurring at the top and bottom of the fuselage. Work these bulges to the cockpit and wing locations and then crush them flat. These areas will be cut out anyhow, so no repairs will be necessary. Finally, wrap the entire mold with long strips of gauze or fabric. Repeat the entire operation on the other half. Set the molds in a warm, dry place and allow to dry overnight. The next morning remove the fabric wrapping and tape. Then sand the shells while on the mold and use a sharp blade to carefully trim them around the grooves in the bases of the molds. You will now have two accurately formed fuselage halves.

Before putting the two shells together, assemble the framework to go inside. Cut out all formers from 3/32" balsa and laminate all formers from F-3 back with 1/32" plywood. Cut out the firewall from 3/16" plywood, and saw out the holes for the cooling duct and fuel tank. Drill the holes for the aluminum engine mounts and install the 6-32 blind nuts. Drill the holes for the cowling and install the 4-40 blind nuts. The aluminum engine mounts can be ordered from Bob Wilder, 2010 Boston St., Irving, TX 75061. Unless you indicate and diagram exactly where you want the holes drilled and tapped, Bob will send them blank. You can also make them yourself from 3/8" aluminum, but they must be accurate to avoid misalignment in the engine thrust line.

Make the fuel tank box and finish the inside with epoxy glue. Mount the box on the back side of the firewall with the rear of the box angled slightly toward the outboard side of the fuselage. A centerline must be drawn on each side of the fuselage shells for aligning the engine, fuel tank box, wing and horizontal stabilizer. Glue longerons in place on the formers and firewall, and install entire framework in one of the fuselage shells. Use epoxy glue to secure the firewall to the shells. Add cockpit floor and tail gear, and glue both shells together. Make cutouts for cockpit, wing, and gun bay block. Carve, hollow and install the gun bay block. Sand the fuselage smooth and fiberglass the entire fuselage using .6 ounce fiberglass cloth. Make the mold for the canopy from a balsa block, coat with polyester resin, and sand the canopy mold. Mold the canopy from .020" plexiglass. Mask off the clear portions of the canopy and epoxy it in position using masking tape to hold the canopy down until the epoxy hardens. Carve and hollow the turbocharger intake scoop, and epoxy onto the fuselage. The cowling was made by molding 3/32" balsa around a coffee can and carving the nose ring from laminated 1/2" balsa.

The fuselage is now nearly complete with the exception of painting and a few details. The fuselage gets its strength from its size—so much of the internal structure commonly used on most conventional stunt planes has been left out. Fortunately, due to a recent revision in the pull-test requirement, it is no longer necessary to reinforce the fuselage . . . the pull test may be done by holding one hand on the inboard wing tip. This virtually eliminates the possibility of crushing the light, but strong, fuselage.

WING. In order to have a competitive airplane the wing *must* be built straight and light. Since foam wings are too heavy for semi-scale airplanes, a jig will be required to build a built-up one. This jig should be used all the way through the building process, including most of the sheeting. A simple jig can be built using two 3/8" aluminum rods about 6' long and a sheet of 3/4" particle board 6' long by 1' wide. Make at least four stands 5" wide by 8" high. The stands must be exactly the same height, and you can check this by sighting down the top of the stands after they have been attached to the jig base (see diagram).

Using the root and tip rib outlines shown on the plans, make rib templates from aluminum. The ribs are made by sandwiching 12 pieces of 1/16" balsa between the templates and sanding to shape. This makes a double set of ribs for each wing panel. Making two sets of ribs at a time reduces the angle of the bevel on the edges of the ribs of highly tapered wings. Repeat this process for the other half of the wing or, alternately, use the smaller even-numbered ribs for the outboard wing panel. Making two sets of ribs at a time also provides an incentive for building a follow-up airplane. You will already have the ribs made.

A sheet of celluloid is used to make the jig template guide. Lay the celluloid over the illustrated guide provided on the plans, scribe all the lines, and drill the holes for the jig tubes. Draw a center line on each rib. Use a small piece of sharpened 3/8" brass tubing to cut the jig tube holes in each rib. Lay the celluloid guide over each rib, aligning the center line on the rib with the line of the corresponding number on the guide. Align the trailing edge of this rib to the vertical line of the same number on the guide. Now, using the piece of 3/8" brass tubing, cut a hole in the rib at the two locations provided by the guide. Align and cut the holes in each rib in the same manner. Now place the ribs on the jig tubes, spacing to the locations shown on the plans. Place the jig tubes with ribs onto the jig stands. Sight check the alignment, and frame the wing by adding the leading and trailing edges and also the top and bottom spars. This same procedure has been used with excellent results on my last four airplanes, and all of the wings have been true and accurate.

The control system should be assembled before installing in the wing. Most people do not double the bellcrank, but I feel safer using two, so they are shown on the plans. If a single bellcrank is used, just add another shim on the top and bottom, and install in the same manner. I also recommend replacement of the bolt with a stronger one. By using two bellcranks, the strength will be greatly increased and the bearing surface where the leadout wires attach will be doubled. Epoxy the bellcrank mounts to the spruce doublers in the wing.

The flap control horn is light and simple. Use a large Top Flite 6" horn with brass bushings. Purchase a set of two additional wire bushings and place on the horn. The pushrod bushings are made of 1/8" brass tubing and are soldered in place. Now, *bow,* do not bend, the horn wire around the trailing edge of the wing and lace to the trailing edge with thread. If the horn wire is bent, springy controls will result. Make and install the flap pushrod and put stops on the bellcrank to limit the flap travel to no more than 35°.

The shock gear is constructed basically

from three pieces of 1/8" music wire. Bend each wire as shown on the plans. Place the 1/8" i.d. brass tubing glides on the gear, wrap and solder in their proper locations. Check to make sure the gear slides easily up and down the glides. The springs are fairly weak and the weight of the airplane should almost collapse the coils. Do not forget to put the brass bushing on the gear where it mounts inside the wing. This will provide a bushing for the torsioning twist. The complete gear is then laced to the 3/32" plywood mount using aircraft safety wire. Now epoxy the mount, complete with gear, to the lower wing spar and leading edge in the wing. Cut out and install the webbing between the spars from gear to gear. Due to the design of the shock gear, it will not bend backward to absorb shock, so a torsion bar effect was designed into it. The wire will twist in the brass bushing on the mount inside the wing. Any alternate design must provide for this movement. Hundreds of landings and takeoffs without failure have proven the durability of the design of this gear.

Because of rudder offset and leadout location, all stunt models fly slightly nose-out. This is normal, especially when the aircraft slows for the landing. This outward yaw still exists after touchdown through roll-out, therefore the wheels should be aligned by turning each wheel slightly toward the inboard wing tip to eliminate sideward stress on the gear and to allow the wheels to track smoothly as the model rolls around the circle slightly nose-out. Care must also be exercised to align the gear doors to prevent unwanted drag or yaw in flight.

The wing is now ready for sheeting. Once the wing is sheeted, warps and twists are impossible to remove, so check the alignment very carefully before sheeting. Glue enough sheets of 1/16" contest balsa (4 to 6 lb. stock) edge to edge to cover one side of one wing panel. Sand the sheeting with No. 400 sandpaper using a block before gluing onto the wing structure and, with the exception of the leading and trailing edges, no additional sanding will be necessary prior to finishing. Glue and pin the sheeting in place.

Carve the wing tips from balsa blocks. Make the adjustable tip weight box in the outboard tip; cut the adjustable leadout guide from nylon and install, using a 4-40 allen head type mounting bolt. Cut out and shape the flaps and fiberglass with .6 ounce cloth. After drying, several additional coats of fiberglass will be necessary to increase rigidity. Each layer should be cured and sanded individually. Do not install the flaps before painting the model. Fiberglass the entire wing using .6 ounce cloth.

In order to conserve weight and increase strength, a fiberglass pushrod was used from flap to elevator. This can be found at archery dealers . . . ask for the lightest weight arrow shaft they sell. Fiberglass is recommended because it is lighter than wire and is not subject to metal fatigue as is aluminum. It is fairly simple to construct and no guides are needed. Although metal clevises have been used in the past without failure, I don't advise it.

TAIL. Again, as with the wing, the tail surfaces must be built accurately, with emphasis put on *lightness.* The stabilizer is built up and sheeted with 1/16" contest balsa. Cut the slots for the hinges and fiberglass the stabilizer with .6 ounce cloth. Epoxy and fiberglass the stab to the fuselage after careful alignment. Because of the thickness of the stab, solid balsa would add entirely too much weight. Make the elevator connecting wire, placing a brass bushing on the wire before bending to shape. With the wire in place, fiberglass the bushing onto the stab in the proper location.

Now build up and sheet the elevators. Although the elevators are thinner than the stab, they would still be too heavy if carved from balsa sheet. Again, using .6 ounce cloth, fiberglass the elevators, but do not install until the aircraft is finished. A large Goldberg nylon horn is used on the outboard elevator. Be sure to drill a hole in the horn at the location shown on the plans for the rudder control rod. A nylon clevis is used for the rudder control.

The rudder and fin are built up and sheeted in the same manner. The tail block should be hollowed so that light from a flashlight will show through. Very little rudder movement was necessary on this airplane. Remember, it is a long way from the tail to the balance point, so make every attempt to keep it light.

FINAL ASSEMBLY. The wing should be installed and aligned with 0° incidence. Measure straight down from the fuselage centerline to the leading edge of the wing and again from the fuselage centerline to the center of the trailing edge. These measurements must be the same. At the same time, align the wing parallel to the horizontal stabilizer. Use epoxy glue and two coats of fiberglass cloth to join the wing to the fuselage. Do not forget to solder the pushrod in place on the flap horn. The boot, or flared part of the wing where the leading edge joins the fuselage, is built using the rib outline on the plans. Mount and sand flush with the wing sheeting. Carve the fillets from balsa to save weight. Sand the entire model with No. 320 sandpaper, *wet.* If you try to dry-sand the model, you will probably have to buy your own sandpaper factory.

FINISH. Each part of the aircraft should have already been fiberglassed, so very little additional sealing remains. Using fiberglass for an undercoater has several advantages. Fiberglassing obviously adds a great deal of strength. Since the wing is sheeted entirely with 1/16" balsa, the additional strength is very desirable. I was afraid that fiberglassing an entire stunt ship would be too heavy, but I discovered that it really does not add any more weight than other sealers. This is the lightest and best finish I have ever achieved. I hope you will give fiberglassing a try, especially if you are going to use epoxy paints. Finally, brush on a couple of coats of epoxy undercoater and try to sand it all off before spraying the color. This will fill the remaining flaws that may show.

The epoxy paints will bond well to fiberglass, but it is best to stay with one type of epoxy and not switch from one to the other. I prefer Hobbypoxy because it has always given good results. The colors used on this plane covered well and no primer coat was necessary. (Colors with weak pigment such as red, yellow, and purple do not cover well and it is best to use a silver primer first.) Start by spraying the lighter colors first. The 190 was painted sky blue, light and dark olive drab, light and dark gray, in that order. Mask the crosses and swastikas using frisket paper and paint them black. Ink the panel lines last and spray on two coats of clear to deepen the colors and seal the ink lines.

Make the imitation exhaust ports from 9/32" aluminum tubing and paint before installing. Install the exhaust ports by cutting a slot in the fuselage and filling it in with black tinted Hobbypoxy glue. Before the glue dries, place the exhaust pipes one at a time in the proper location.

Install all movable surfaces (flaps, elevators and rudder) using epoxy and nylon hinges. Install the gear doors and wheels, take some pictures, and head for the flying field.

TRIMMING. Trimming an aircraft for maximum performance involves many different considerations including balance, aircraft weight, engine, prop, tip weight, leadout location, rudder offset, gear doors, fuel, engine cooling, and wind. All these things will greatly affect the performance of your aircraft. Make your first flights on a calm day. I think that an aircraft trimmed to fly well in calm weather will be all right in the wind. The large air intake on the 190 is excellent for providing cooling air into the engine compartment. To provide an adequate cooling flow inside the engine compartment, all the unnecessary space on the firewall was cut out and a duct was provided to exhaust the air out the bottom of the nose. While I left the cowl flaps slightly open on my airplane, the possibility exists that the cowl flaps disturb the airflow over the tail surfaces. This may have been part of the cause for having to enlarge the elevators. I recommend that the flaps be built closed as shown on the plans.

Experiment with different props. I tried everything from an 11x6 Zinger to a 13x5 Rev-Up. I narrowed a 14x6 Top Flite prop, set the pitch at 5 1/2" using a prop pitch gauge, and cut the diameter to 12 1/2".

(Continued on page 93)

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## FOCKE-WULF 190D-9

*(Continued from page 91)*

Constant work with props is necessary to obtain maximum performance.

Due to the size and bulk of the FW 190D-9, I found that the aircraft flies best when trimmed to fly as *cleanly* as possible with very little outward yaw. On my aircraft, I eventually found the plane flew best when the rudder was offset only 1/8" with the elevators set at neutral. I would recommend starting with about 1/4" outboard offset and working from there. The engine was also installed with no offset. Also make sure the gear doors are properly aligned. Misalignment of the doors can cause trim problems and unnecessary drag. The leadout location shown on the plans produced the most desirable performance on my aircraft.

The aircraft should be balanced as shown on the plans for proper elevator sensitivity. If the balance is correct, adjust the elevator travel so that the aircraft will turn as tight as possible both inside and outside before the wing stalls. Start with about two ounces of tip weight and reduce until all "hinging" ceases. I finally ended up with only an ounce.

If the plane flies through the square eight with no hinging, wiggling, or stalling, you are in pretty good shape. Don't be afraid to trim your aircraft. You may think that your plane is flying well only to discover that it can be made to fly better. Don't ever stop trimming and working with your aircraft. You might also experiment with different engines.

Always take off upwind. Otherwise, the wind will have a tendency to blow the tail up and the aircraft will nose over. If the wind is blowing out of the north, set the aircraft down in a northeasterly direction from the center of the circle. This will allow for the aircraft to pick up adequate speed before entering the downwind side of the circle. Also, this will produce a weathercock effect, turning the nose of the aircraft toward the outside of the circle as it passes upwind.

In closing, I would like to pay sincere tribute to an individuai who deserves a great deal of credit for the development of this aircraft. Al Rabe's untiring efforts to innovate and develop new ideas and make them known to the public have afforded many of us the opportunity to explore the new dimension of near-scale stunters in this exciting and challenging scientific sport.

I hope you receive as much enjoyment from your aircraft as I have from mine. Remember, you have to practice and constantly work with your new aircraft to make it do exactly as you want it to. Write to me if you need specific help in building your FW 190D-9. My address: David McClellan, 2504 Hilltop Dr., Apt. 202, Waco, Texas 76710. ■

## INTO THIN AIR

*(Continued from page 29)*

the Bolivian *Altiplano*. There are no telephone or power lines, no trees, and visibility is limitless. The only problem with this modeler's dream field is the extreme altitude and sudden gusts of wind which can change from 5 mph to 35-40 mph without warning. These challenges can make flying R/C extremely exciting as well as extremely difficult. However, Bolivians have learned to cope with these problems and are now probably flying R/C models regularly at higher altitudes than anyone else in the world.

This writer was surprised at the high state of the art achieved by the La Paz Model Aviation Club. On a regular Sunday flight line, there was a 9 ft. Piper J-3 Cub assembled by Rolando Meneses, an electronics technician, from a Nosen kit. It easily equals the highest U.S. modeler standards in both construction and electronics. In order to adapt the Cub for high altitude performance, Rolando uses an OS Max .60 Schnuerle engine with a Du-Bro prop drive unit and gives his commands with an E.K. Super-Pro radio. He also had to trim off 3 lb. of model weight and install a 22x10 propeller instead of the factory recommended 12x6.

Rolando is also the proud owner of a 63" wingspan standoff-scale Piper Cherokee