P-61 Black

This famous night fighter makes a very flyable RC model. Twin engines are attention-getters, and a twin using .10 engines is easy on the budget. If you want something to cause some excitement at the field, take a good look at this one.

Frank B. Baker

THE NORTHROP P-61 was the only American aircraft designed specifically as a night fighter in World War II. The Black Widow reached combat status in 1944, and was used in both the European and Pacific theaters. In the latter area, it enjoyed a great deal of success.

Despite being a new design, the Black Widow was not kept in the USAF inventory after the war. However, a few Air National Guard squadrons were equipped with them for a short period. None were used in the Korean War, where the night fighter role was fulfilled by Marine F4Us and F7Fs.

An unusual incident is associated with the P-61. During the war there was an aviation-oriented comic strip called "Smilin' Jack," and its creator lived in the Los Angeles area. He noticed a rather unusual black twin-boomed aircraft that often flew over his home. He included sketches of this aircraft in the comic strip. After about a week, someone in the Army Air Corps realized that their top-secret night fighter was appearing in several hundred newspapers across the country. Needless to say, the black aircraft disappeared from the comic strip.

Actual examples of the P-61 are extremely rare. During the 1960's I heard rumors of a flyable Black Widow located in southern California. The USAF Air Museum at Dayton, OH has a P-61 in mint condition. I recently visited the

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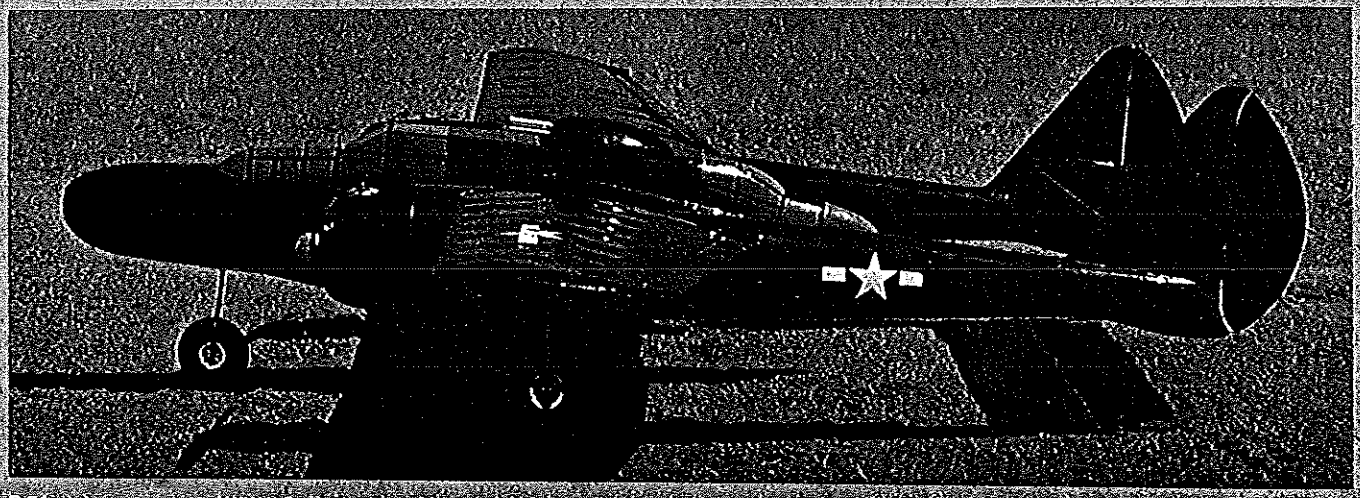
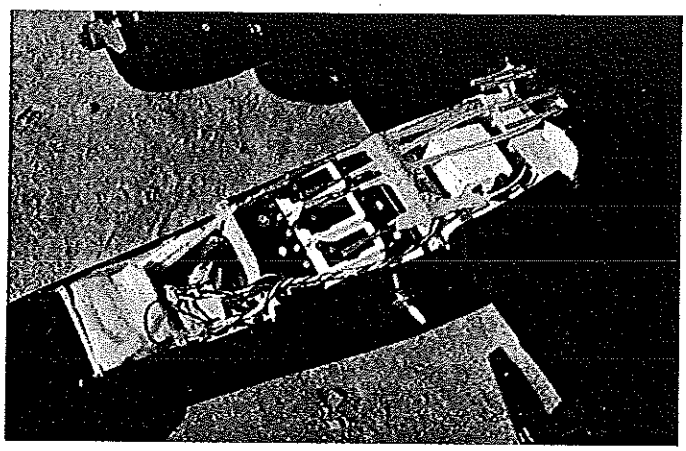
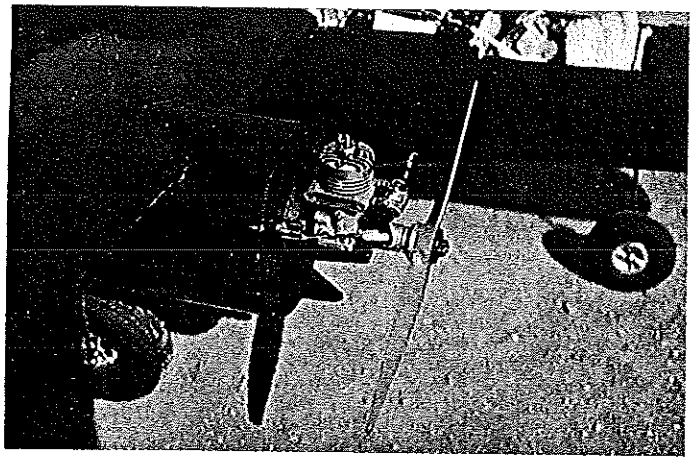


P-61 makes an unusual WW II Scale subject. Pilot sat in front cockpit, radar operator in the second raised cockpit, and a gunner in the rear. Bulbous nose housed radar equipment.

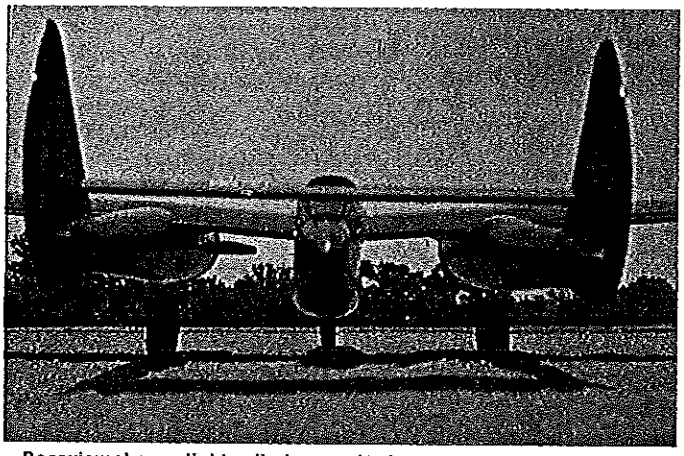
kwikdow



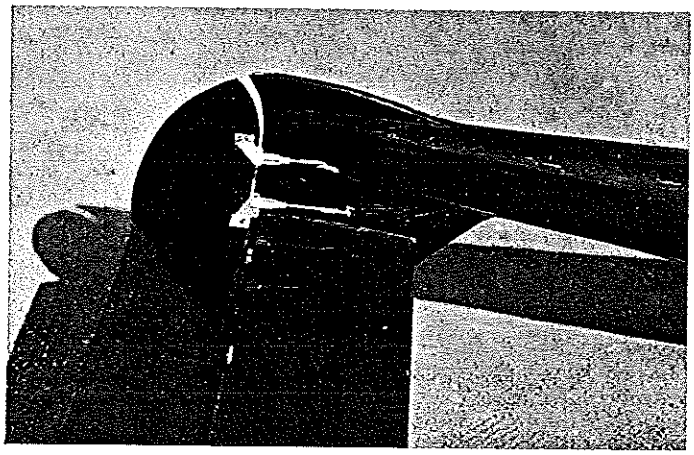
Servo installation is tight but accessible. Nylon guides are held to ply former with silicone sealer. Former lifts up for aileron servo.



O.S. Max .10 rests on its mount. Triangles are cowl supports.



Rear view shows slight gull wing used to improve prop clearance. A lot of the propeller extends beyond the cowling on each side.

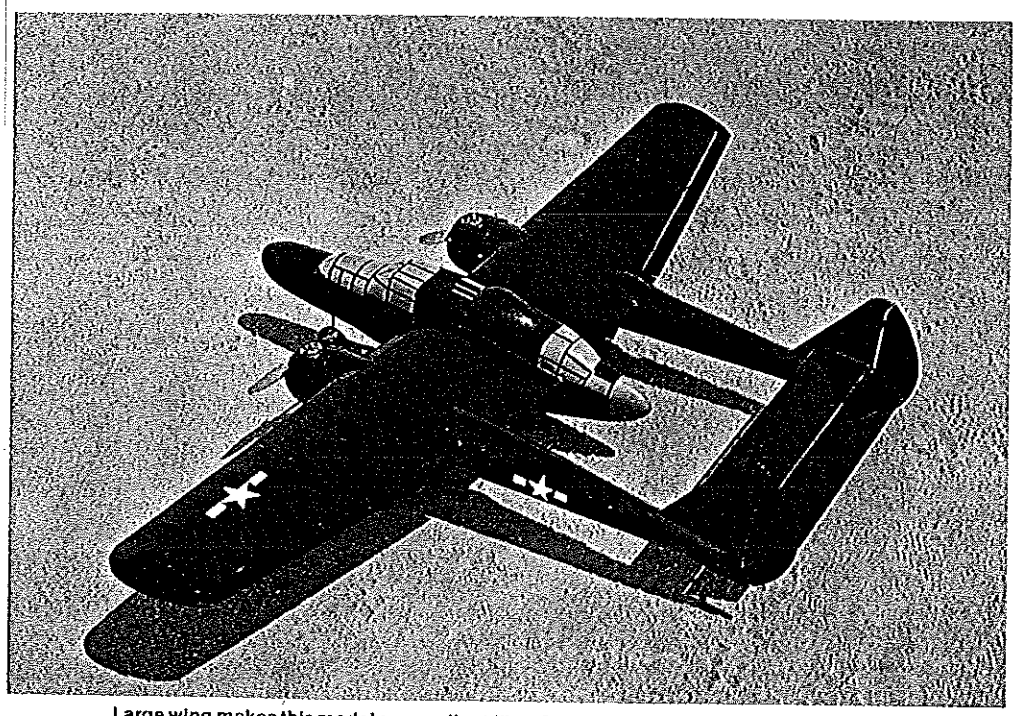


Elevator cable is brought up inside the fin to be in position for the control horn. Rudder cable passes through foam rear boom block.

museum, and was surprised at how small the P-61 seemed. It was parked next to a Douglas B-26, which seemed to be a much larger airplane. The P-61 fuselage is only slightly wider than the pilot's shoulders. The tail booms and rudders were also much smaller than I had anticipated. My perception of the aircraft's size had been based entirely on photographs.

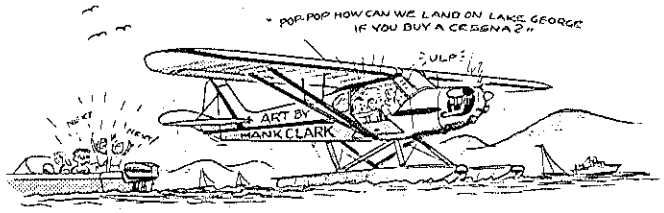
The Black Widow is one of those aircraft that naturally lends itself to being modeled. It has a large wing, a long nose, and a relatively long tail moment arm. In addition, it has an imposing look about it.

I have taken a few liberties with certain features. The actual P-61 had sharply tapered outer wing panels with very small ailerons, as the main roll control was by means of spoilers. I widened the wing tips by an inch or so and used full-span strip ailerons. The full-size aircraft has a large number of air scoops, oil coolers, etc., hanging all over the engine cowls. Since I'm too lazy to carve all that, I simply left them off. Finally, the P-61 had rather large wing leading edge air intakes which were also left off. Other than these discrepancies, the aircraft is true scale. Since I think that the O.S. Max .10 FSR is a jewel of an engine, the Black Widow model was designed



Large wing makes this model an excellent flier. Covering is black EconoKote, painted gray windows.

This is a big model for two small engines, so it must be built light! Author shows off the P-61 at a local park.



FOAM BLOCK CANOPIES AND TAIL TURRET (NOT REMOVABLE)

TOOTH PICK PEGS IF NEEDED

1/4" BALSA ELEVATOR AND STABILIZER

1/4" BALSA FIN AND RUDDERS

HOLLOW BLOCK TURRET

1/4" BALSA SHEET TOP

CABIN CANOPY IS ONLY HATCH REMOVABLE

BALSA BLOCK FAIRING

1/4" DOWELS

1/4" SHEET TOP

F11

ALL GOLDBERG SM NYLON CLEVISES

1/4" HARDWOOD SKID

F 13 1/4" BALSA

FOAM FAIRINGS BOTH SIDES

BALSA BLOCK

1/4" SQ. BALSA STRINGERS IN BOOMS AND FUSELAGE

3/32" SHEET

FIBERGLASS COWLINGS

3/32" BALSA BOOM SHEETING

1/16" SHEET BALSA TOP-BOTTOM WING CENTER SECTION ONLY

1/8" X 1/4" SPRUCE RAIL

1/4" X 1" BALSA AILERON (T.E. STOCK)

1/4" X 3/8" BALSA REAR SPAR (EXTEND INTO CENTER SEC.)

O.S. MAX .10 FSR ENGINES ON KH-15 MOUNT

3/32" BALSA GUSSETS STIFFEN T.E.

BALSA BLOCK SHEILD

SOLID BALSA TIPS

NOSE GEAR BELLCRANK SERVO STEERED ON 1/8" PLY F3

F8 1/4" BALSA

N1 1/4" PLY.

1/8" PLYWOOD L.E. REINF. AT C.S. THRU 4 BAYS

3/32" BALSA ALL RIBS

1/32" PLYWOOD FUSE. DOUBLER F1 TO F8

COWL MOUNTS

1/8" PLYWOOD MAIN SPAR REINFORCING (THRU 5 RIB BAYS OPTIONAL)

1/8" X 1/4" SPRUCE SPARS UPPER AND LOWER

1/16" BALSA WEBS BEHIND SPARS

F 1 1/4" BALSA

3/32" SHEET BALSA FUSELAGE COVERING

1/8" PLYWOOD MAIN SPAR JOINER AT C/L THRU 4 BAYS

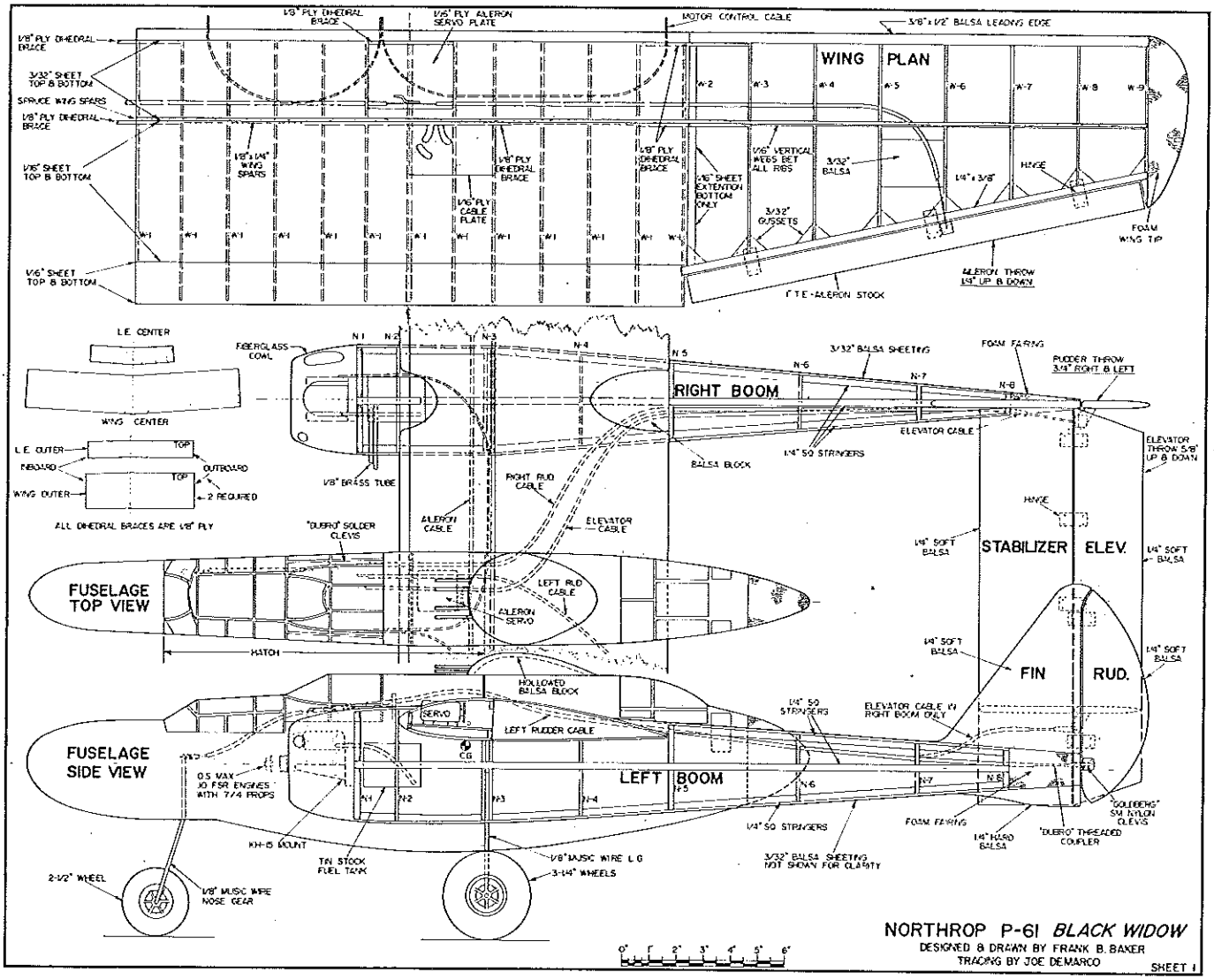
1/8" M. WIRE GEAR SANDWICHED IN TRIPLED 1/8" PLYWOOD N3

3 1/4" MAIN WHEELS

1/8" PLYWOOD L. EDGE REINFORCING THRU 5 RIB BAYS AT WING BUTT)

3/8" X 1/2" BALSA L. EDGE STOCK

2 1/2" NOSE WHEEL ON 1/8" M. WIRE

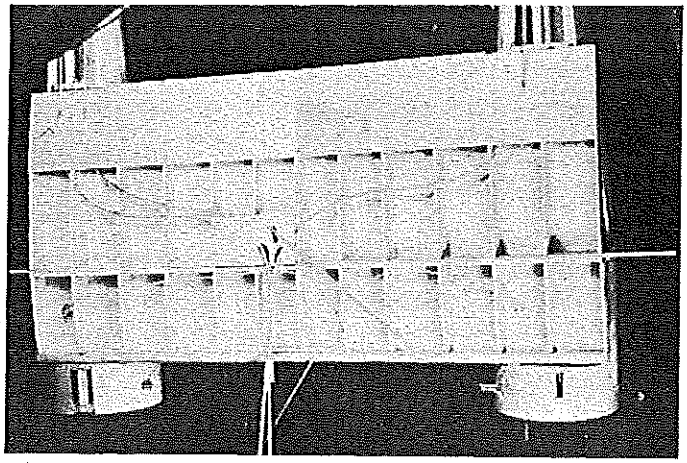


around them. The result was a rather large model for the engine size, but it flies perfectly. Due to its size, your biggest enemy is weight, so choose wood carefully, and sand all wood as much as you dare.

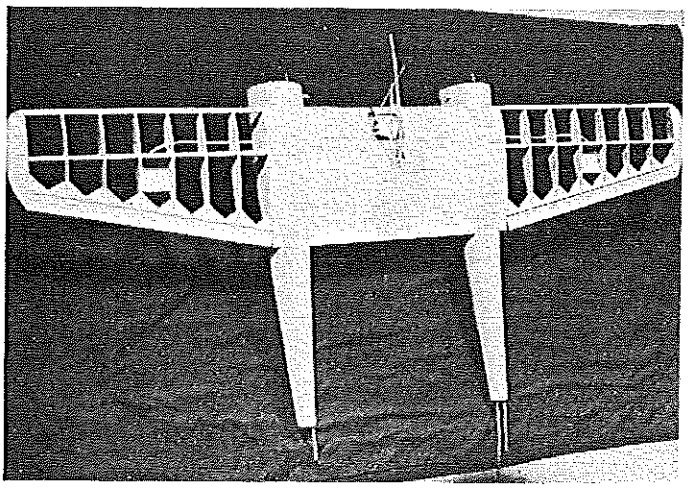
Construction. While the airframe construction is straightforward, the control system is a "plumber's nightmare." Once I had decided to put all the servos in the fuselage, the die was cast for a unique solution for actuating the rudders and elevators. I employed nylon tubing with flexible metal cable inside, the stuff usually used for motor control and sold in bulk by Hobby Lobby (HLH 805). This allowed me to bend the tubing in various ways to reach the desired locations. It also meant that once it was installed it would never be seen again. The end result was a control system that is smooth, functions perfectly, and yet can be easily adjusted for trim purposes. A side effect was the need to partially build the wing and booms in order to route the control tubing. This may seem rather formidable, but it actually goes together logically and easily. I have partitioned the construction into a series of stages that should help in doing the right thing at the right time.

Build the framework of the two inner wing panels, joining them at the center using the ⅛ plywood dihedral braces, paying particular attention to locating the top and inboard. Sheet the whole bottom of the wing and only one inch of the top at the trailing edge. Roughly shape the leading edge of the wing, and set this assembly aside.

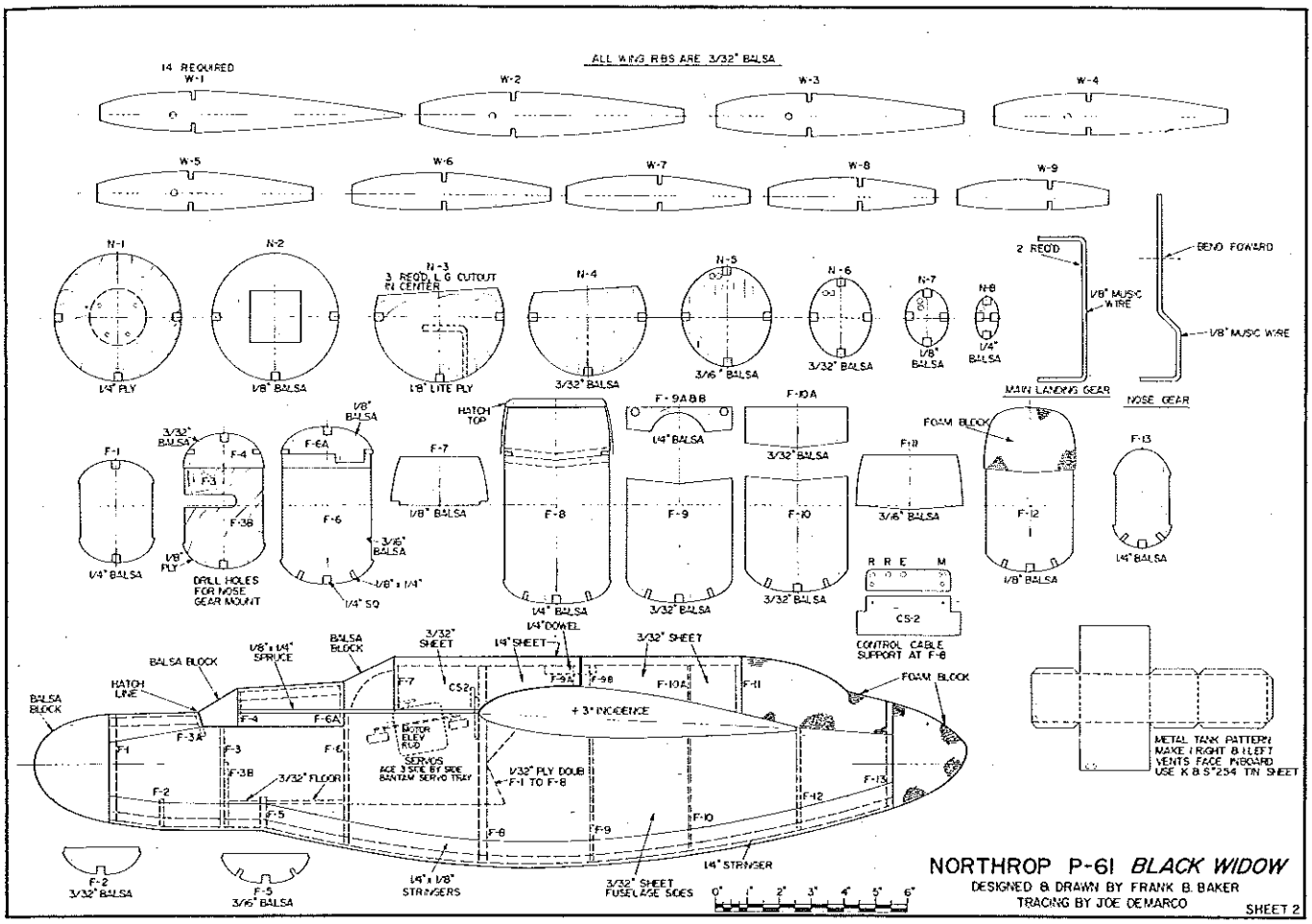
Cut out the ¼ plywood firewalls, drill them for the Kraft KM-15 engine mounts and install blind nuts. Use the pattern provided and construct two fuel tanks. The K-S 254 Easy-Solder tin is a dream to work with. Before closing up the tanks,



Ply plate provides an exit point for the control cables routed through wing. Cable guides must be routed carefully to avoid slop.



Wing boom assembly shows aileron cable routing. Note gas tank pipes.



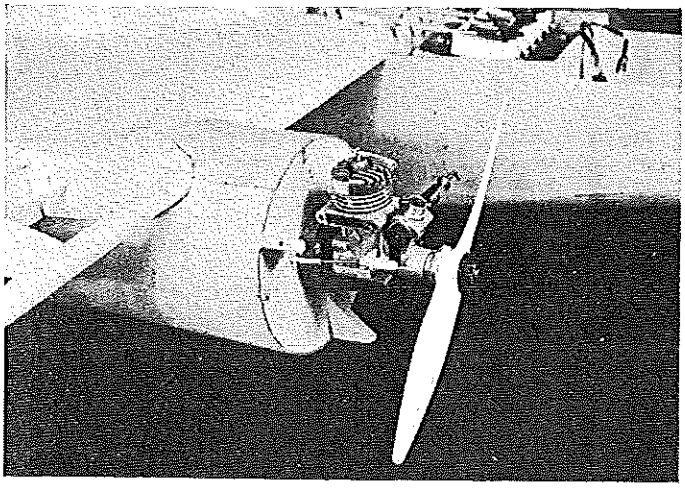
install the filler vents and the fuel pickup tube. Be sure to make one right and one left tank. The filler vents always face inboard, but the fuel pickup location varies depending upon whether it is the right or left tank. Drill the ⅛-in. hole for the fuel tube and the 1/16-in. hole for the motor control cable in the firewall. Push the fuel tube of the gas tank through the hole in the firewall, and roughly align the tank at the back of the firewall.

Cut the six landing gear mounting plates from ⅛ Sig Lite Ply. Bend the main landing gear from ⅛-in. music wire. Use epoxy to assemble one right and one left sandwich with the landing gear as the middle layer. Be sure that the wheel axle faces inboard in both assemblies.

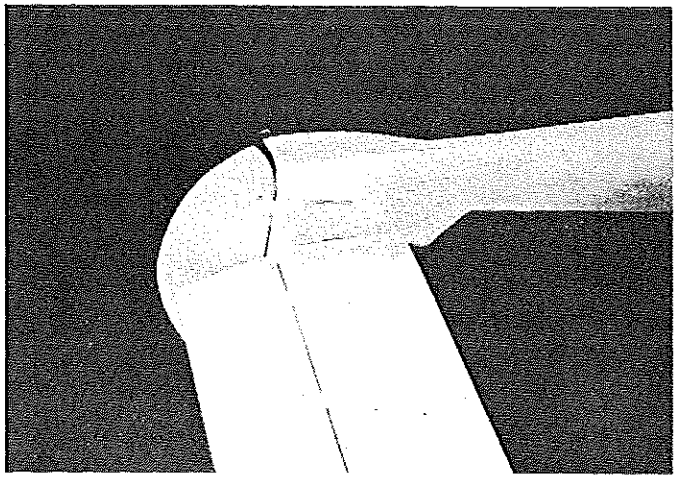
Decide which boom will be the left and which will be the right. Construct the booms by mounting the firewall (including the tank an the formers) on the ¼ square stringers. Make sure that the holes for the control cables are on the inside of the boom. Horizontal and vertical lines on the boom formers will help you make straight booms. Be particularly careful to make sure that the firewalls are at zero degrees (both vertically and horizontally) relative to the center line of the booms. Check again that the tank vents and the wheel axles face inboard.

Once the basic boom is constructed, sheet the lower two-thirds with 3/32 balsa. You will find that a single 3-in. sheet can be used over the full length of the boom. Soak the sheet balsa in water containing some household ammonia, and it will bend to any shape you need. Pica Gluit does a nice job of gluing the damp sheets to the framework. From N-5 to N-8, do not cover the top one-third of the tail boom. Cut three 36-in. lengths of the nylon control cable tubing, then string the control tubes through the holes in the formers. Leave about 3 in. extending beyond N-8 at the rear. Install the flexible cable tubing for motor control through the firewall and N-2. Put a small amount of silicone sealer around each tube to keep it from slipping.

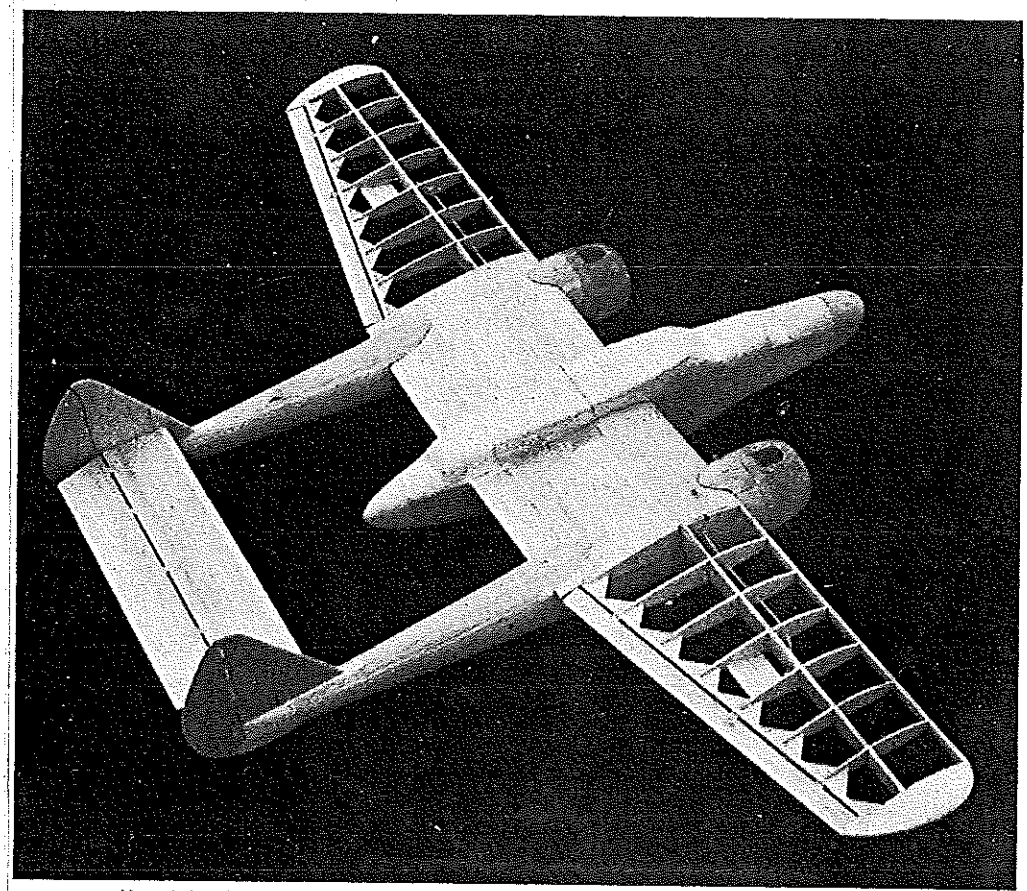
Now comes the important part. Place the booms under the wing, and mark where the rudder and elevator control tubes touch the top sheeting. Cut slots so that the cables can pass through. Mark where each motor control tube enters the bottom of the wing, and cut a hole for it to pass through. Now pin the booms to the wings after pulling all the control cables through their holes. Check to see that the booms are parallel both horizontally and vertically. This process may require some cutting and trimming on the booms to get a good fit and alignment. Finally, use a Robart incidence meter to measure that the wing is at +3 degrees incidence while the booms



O.S. Max .10 FSRs provide plenty of power. Kraft-Hayes 15 mounts used.



Note elevator control cable routing along inside edge of vertical fin.



Here it is with the heavy work done. Select light wood for center, tail booms, and other sheeted areas to save weight wherever you can.

are at zero degrees. When all is correct, glue the booms to the bottom of the wing.

Route the rudder, elevator and motor control tubes through the wing ribs as shown on the plans. A sharp piece of brass tubing or a small round file can be used to make the holes in the ribs. Make the 1/16 plywood cable plate, route the rudder and elevator tubes through it, and glue it in the wing. Run the flexible metal cables through the nylon tubing just to make sure that none of the turns are too tight. Remove the cables, and set the whole assembly aside.

Build both the outer wing panels, and install the strip ailerons. Install the nylon tubes for the aileron control lines, leaving enough to reach the center of the wing. Feed the control tubes through the holes in the inner panel wing ribs, and glue the outer panels to the dihedral braces protruding from the inboard panels. Trim the aileron tubes at the center as per the plans. Feed flexible cable in at the left aileron until about 3 in. comes out at the right aileron, and cut it off at the left aileron with about 3 in. showing. This is where the Hobby Lobby bulk pack pays off, as we need near to a full-span continuous length of cable here.

Install the 1/16 plywood servo mounting plate. Tack-mount a servo using mounting tape. Solder the Z-shaped 1/16-in. music wire coupler to the flexible cable. Check to see that the servo can travel its full range.

Finish sheeting the top of the booms and the top of the inner panels of the wings. Be sure to put in the 1/16 balsa that extends the lower wing sheeting into the outer panels. It provides a place to anchor the wing covering. The hard part is all behind us now.

The fuselage sides have 1/32 plywood doublers in the front half that are glued in place with contact cement. Construct the fuselage using normal procedures. Note that the servo rails are installed so that the servos are low at the front end. Install your favorite steerable nose wheel gear before you sheet the belly of the fuselage. Note that the part of the fuselage above the wing is built separately.

Pin the completed fuselage to the wing, and check for alignment. The horizontal center line of the fuselage should match that of the booms. You may have to trim a bit to get everything aligned. Glue the fuselage to the bottom of the wing.

The part of the fuselage that is above the wing is constructed next. Build the whole upper fuselage as a unit right on the wing and lower fuselage. Mark where the double former occurs at the rear hatch separation line, and tack glue all formers ahead of this line to either the wing or the fuselage. Glue on the foam block that is the rear cone of the fuselage. Carve and sand the whole fuselage to shape. Use a razorsaw to cut through at the rear hatch line and the forward hatch line, and pry the hatch off. I used Goldberg cowl clips to hold the forward hatch. I did not show them on the plans as they are hard to install. I'll leave the hatch hold-down to your usual method.

Cut the fins and rudders out of soft sheet, and install the hinges and the control arms. Note that both control arms face inboard. Glue the rudders to the booms, and use some foam blocks to fair the fins into the booms. Add the lower fins. Now measure the distance between the vertical fins. If all went well, the distance should match the plans. In any case, cut the stabilizer/elevator out of soft ¼ sheet balsa to the measured distance. Install the hinges and control horn, and glue in place. Be sure to check that the stabilizer is at zero degrees relative to the center line of the boom.

Final control hookup. Install the lower ⅛ plywood cable support plate in the fuselage. Mount the aileron servo (if you have taken it out). Feed the rudder, elevator, and motor control nylon tubes through the ⅛ plywood upper cable support plate, and use two screws to attach it to the lower plate. Use some silicone sealer to hold the tubes in place. When dry, trim the tubes about ½ in. ahead of the plate. Run the flexible metal cables through the rudder and elevator tubes, leaving about 2 in. at the surface end and enough to reach F-7 at the fuselage end. Solder threaded brass couplers (HLH809) to the cables. Install nylon Kwik-Links in the middle of the threaded part, and clip to the control horn. Trim away the nylon tube until full control movement is achieved.

Install the rudder, elevator and motor servos in a servo tray, and mount the unit on the servo rails. Pin the rudders in neutral, slip Du-Bro solder links on the flexible cable, and clip them onto the servo arms. Trim any excess cable, and solder the links in place.

Run both motor control cables through the 1/16-in. nylon tubes until F-7 is reached and about 2 in. protrudes beyond the firewall. Mount a solder link on the motor control servo, and feed both cables into it. Cut off the excess cable, and solder the link to the cables.

At the aileron end of the cables, install threaded brass couplers that have been trimmed to about ⅛ in. for both the threaded and non-threaded ends. Put the aileron servo in neutral, and trim the cables until the ailerons are in neutral. When everything fits with the control links snapped on the control horns, solder the couplers to the cables. Finally, run a short piece of tubing and cable from the rudder servo to the nose gear, and install a solder link at each end. Be sure to fasten the tubing securely to the fuselage.

Install a radio and a battery pack in the fuselage, and connect all the servos. Set the hatch down on the fuselage, and see where it hits things. Use a knife or a Dremel tool to start carving away on the inside of the hatch. The ⅛ x ¼ spruce stringer will need to be drastically cut away. Keep carving until the hatch fits. Turn on the radio, and cycle all the controls. Carve the hatch until all servos move full range without hitting the hatch.

The cowls were built using the familiar balloon method. Glue up some pine or redwood, and turn down the forms on a wood lathe. Make the forms about ½ in. longer than the cowls so that the rear of the cowl can be cut evenly. Once the cowls are fabricated, cut the holes for the engine, exhaust and needle valve (remembering that there is a right and a left). Glue the cowl supports to the firewall, mount the engines, and fit the cowls. Finish hooking up the motor control cables and linkages. Use ¼-in. pan-head screws to hold the cowls to the supports.

The whole model was covered with iron-on black Mylar film. I used EconoKote, but other brands also will do nicely. The front of the booms from the landing gear forward were sealed with polyester resin and painted with black Pactra Formula U. The P-61s were not highly decorated; except for some white stars, there is not much trim to add.

Flying. The P-61 is a relatively large model with small engines, and must be treated with respect during the takeoff and climb-out. To make this as easy as possible, the wing has a lot of incidence, and the nose gear adds to a nose-up stance. All of this is intended to get the model airborne easily. Typically, I taxi out into the wind, hit full throttle, and let it roll until it appears to be light on the gear. A slight amount of up elevator will cause lift-off.

Once in the air, keep a shallow angle of climb until the speed builds up. In the air the P-61 is relatively fast and quite aerobatic. It does a very nice loop and will roll easily. Don't roll it too

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Black Widow/Baker

Continued from page 30

slowly, as the fixed fuel pick-ups will starve an engine in a slow roll.

The Black Widow is a dream to do touch-and-goes. Use a wide pattern, and set up a long final approach. Even at lowest throttle it does not want to lose altitude. On final approach the model assumes a rather flat attitude that can be held right down to the ground. Application of full throttle results in an immediate return to the air.

With those large wheels, all the landings on our grass field have been no-bounce greasers. Single-engine performance is excellent and allows one plenty of time to set up a normal landing approach. The ailerons are sufficient to handle single-engine situations, and the rudders are very effective if you want to use them.

Despite its size and the small engines, the P-61 handles like a trainer. It is docile, has no hidden faults waiting to bite you, and goes where you point it. Best of all, it does all of this with a great deal of realism.

Frequency Scanner/Lange

Continued from page 39

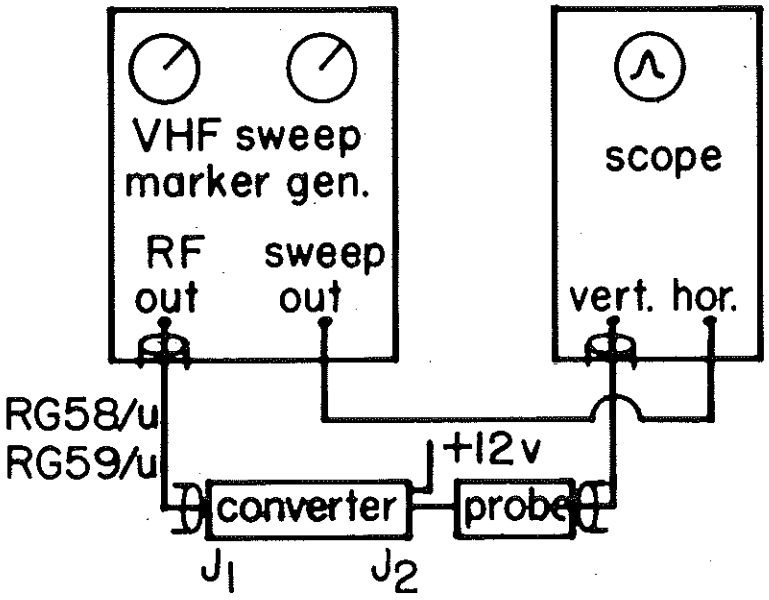
you wish, use an RC transmitter to check the accuracy of the signal generator. The coupling of L6 to L5 and the tuning of L5 should be checked for a peak of curve amplitude consistent with good oscillator starting.

I have made some sensitivity tests with several converters and a signal generator with a calibrated output. I could usually detect 0.1 microvolt signals. One to three microvolt signals boomed through loud and clear. Considering that many RC receivers are rated at two to three microvolts sensitivity, that's quite acceptable. The best results are obtained when using a 3- to 5-ft. extended whip antenna for 4 or 6 meters. I usually can hear an RC flier's transmitter two to four miles from the field when over flat terrain and with the car engine turned off.

Sources for Crystals

JAN Crystals, 2400 Crystal Dr., P.O. Box

BANDPASS ALIGNMENT WITH SWEEP GENERATOR AND SCOPE



ground generator, scope and converter to aluminum or copper sheet on bench