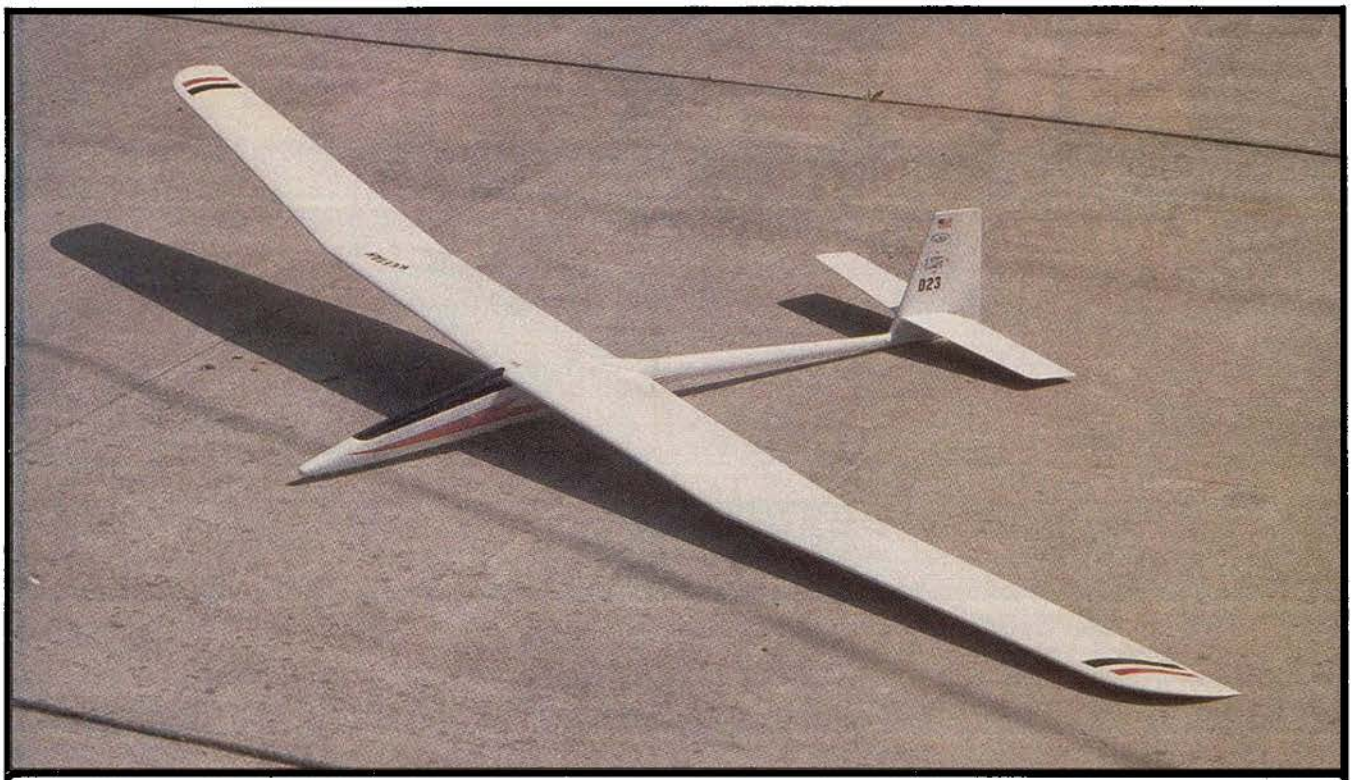


KEETAH

Harley (LSF #023), recently retired, is now busy with his sailplanes. This one is the result of his latest efforts, and it looks like a winner to us.

By Harley Michaelis

The designing of the 120" Keetah was triggered by Al Doig's column in the Feb. 1988 issue of RCM in which a wing planform that might improve performance was suggested. A similar planform, the Selig 4061 airfoil, and other innovations, have been combined to make an unusually efficient, unique, highly practical airframe. It meets the most stringent requirements for traditional competition.

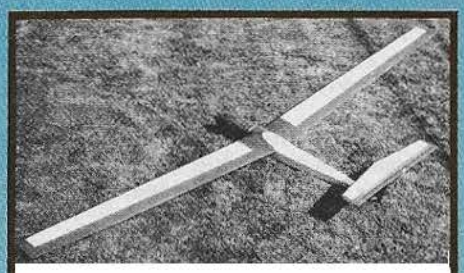
Properly built and trimmed, you can expect a steep, stable tow, spirited zoom release, all-around superb handling, rock-steady tracking, and outstanding response to thermals. It can be flown on simple radios, but with transmitters with mixing functions, the control options available for launch, thermaling, descent, and precision landings are almost mind-boggling.

Let's look at some of the many special features.

A droop snoot. Why? (1) There is no belly to rotate on to lose landing points. (2) It puts the wing higher, reducing the chance of a tip or flap dragging. (3) The Center of Gravity is lowered, contributing to hands-off stability.

A flat wing center. Why? (1) It can more easily be built true. (2) There are no panels to misalign on the fuselage. (3) It can be made to withstand tow stress without heavy tubes, rods, plywood braces, etc. (4) Flap mechanics are simplest with no dihedral. 90° down comes easy and up flap acts as spoilers, eliminating the pesky things.

All hinging is done with flat surgical rubber (see July, 1988 Model Aviation). Briefly, flaps, ailerons, and rudder butt fit without gap, rounding, or beveling. Hinges stretch to permit edge pivoting. Tensioning keeps surfaces in contact, helps return to neutral, and provides flutter control. Hinge lines can be hairlines. Look for the pigmented rubber that is packaged by Ace R/C as "Harley's Hinges." The opaque, white urinary leg bag strapping weathers well. The translucent amber strapping will last a couple of seasons if shaded between flights.



ABOUT THE AUTHOR

Harley Michaelis has scratch built originals for over 50 years, exclusively R/C sailplanes since 1967. His first offered for publication, the Duoflex (see inset), appeared in the Oct. '69 RCM, when kits were almost non-existent. Numerous others were later published and his Mod-Pod, Hi-Pro, and the beautiful 150" Miskeet were kitted early 1970's. His Atrix was featured in the Dec. '86 Model Aviation.

Harley is a past president of the NWSS and devised the Percentage of Perfect scoring system. Now retired, he is busy with sailplanes, working to generate useful ideas and designs to pass along, including the unique concept of hinging with rubber as used on the Keetah.

Flap and aileron servos recess centrally in the wing and can't shift. Rigid, wholly internal linkups are used. The usual hardware array and attendant slop are gone. Electronic mixing eliminates mechanical mixers with potential for slop, and need for their space.

The wing is secured by a tow hook that doubles as a hold-down bolt. It goes through a slot and threads into a sturdy bracket to secure the wing. Tow position is adjustable. A small nylon bolt seats and keys the wing at the rear.

A rigid, free-moving pushrod goes direct from servo to stab. The low stab reduces stress on the slim fuselage on a hard dork. The 1/16" slab sides have ply doublers in that area and with the fuselage glassed it exceeds the strength of one made of fiberglass.

Tips are rigidly supported by clockspring steel blades that lock on. They easily attach and detach.

Sheet lead is built in a laminated nose. The space needed behind for the battery, Rx, and two servos in line is small. Wood added to the slim ply box enables carving a sculpture.

The fin is solidly laminated to the slab sides. A unitized appearance comes with filleting, glassing, and painting.

The stab halves have internal grippers to keep snug to the fin. The rudder is cable operated, looping through a neat "T" actuator.

Everything is solid. Nothing hangs out. The whisper heard in a high speed low pass is testimony to the unusually clean airflow.

Now let's look at the elaborate, sophisticated, and versatile controls possible with transmitters that mix functions. With the Airtronics 7SP, for example, these things can be done: In Mode 2, you have coupled rudder and ailerons on the right stick for wrenching turns. Unswitch rudder and fly ailerons, or fly rudder on the left stick for gentle, flat thermal turns. Use rudder trim and elevator preset trim (P.S.T.) or trim tab for coordinated, relaxed, hands-off thermaling.

Plugged into the throttle channel, you have normal rotation on the flap servo, with tunable elevator mixing to control pitch. Use a little down to steepen the launch. Use the trim tab to run flaps up a bit to increase speed, or more to act as spoilers. Drop 90° for safe vertical descent after "skying out." With the Aux. Lever put the ailerons up as spoilers, with tunable elevator mixing, and still turn with them. Reflex flaps and ailerons to maximize airspeed. You can have flaps go down and ailerons go up simultaneously on the throttle stick, with tuned elevator mixing.

Use elevator P.S.T. for a little up for launch and a little down to keep it boring in. You can rig ailerons so they are neutral with the Aux. Lever a couple of notches up, and then put both the ailerons and flaps down a bit to launch or slow the glide. All these choices will challenge quickest minds and nimblest fingers.

For a two page set of instructions to set up the 7SP to do the above, send a SASE and $.50 in stamps to Harley Michaelis, 26 South Roosevelt, Walla Walla, Washington 99362.

The wing can be all built up, all foam, or a built up center with foam tips. A custom cut, "Keetah Core Set" is available for $25.50, "Keetah Tips" for $17.50. Shipping is included. Order direct from Robert Sealy, 521 96th Lane NE, Blaine, Minnesota 55434. Matched, proper tip washout is critical to fine performance. The tips are cut with it and the beds can be used in skinning to retain it. The foam center section comes in two tapered lengths with cuts for the main spar and the flap hinge line facings. Builders do tip cuts.

The Swingees used are the newer, opposing set model, available from Ace R/C, etc. The spring steel used for tip support is .030 to .042 x 3/8" found at a steel supply, usually called "blue clockspring steel." If not stocked, ask them or your local hardware store to order some for you. Other materials used are stock hobby supply items.

KEETAH

Designed By:
Harley Michaelis
TYPE AIRCRAFT
Thermal Competition Sailplane
WINGSPAN
120 Inches
WING CHORD
8.667 Inches (Mean)
TOTAL WING AREA
1064 Sq. In.
WING LOCATION
Shoulder Wing
AIRFOIL
Selig 4061
WING PLANFORM
Modified Triple
L.E. Taper
BIHEDRAL EACH TIP
4½ Inches
O.A. FUSELAGE LENGTH
56¼ Inches
RADIO COMPARTMENT SIZE
(L) 13" x (W) 1¼" x (H) 2¼"
STABILIZER SPAN
25½ Inches
STABILIZER CHORD
4¾ Inches (Avg.)
STABILIZER AREA
118 Sq. In.
STAB AIRFOIL SECTION
Symmetrical
STABILIZER LOCATION
Midway of Fin
VERTICAL FIN HEIGHT
9¼ Inches
VERTICAL FIN WIDTH (incl. rud.)
6½ Inches (Avg.)
REC. ENGINE SIZE
NA
FUEL TANK SIZE
NA
LANDING GEAR
NA
REC. NO. OF CHANNELS
5 (4 Min.)
CONTROL FUNCTIONS
Rud., Flying Stab, Ail., Flaps
w/mixing functions via Tx
BASIC MATERIALS USED IN CONSTRUCTION
Fuselage ..... Balsa, Ply & Pine
Wing ..... Balsa or Balsa/Foam, Ply
Empennage ..... Balsa
Wt. Ready To Fly ..... 68-70 Oz.
Wing Loading ..... 9.2-9.4 Oz./Sq. Ft.

Construction text will be supplied with the plans. Retain this issue to review during construction.

Text assumes builders are experienced and details less common steps. The canopy involves work with fiberglass cloth and resin, such as the K & B. The fuselage is covered with glass cloth, filled and smoothed with the resin. It should preferably be spray painted with a durable paint such as K & B Super Poxy.

Some photos referred to are of different ships, but with similar details.

Photo #1: Nose has a 1/16" ply core in which a metal skid can go. 1/16" aluminum is shown here. 1/16" sheet lead (builder's or plumbing supply) is laminated between the core and cheeks, adding 5 oz. needed. Blocks to the right of the core match the slab side and are slightly beveled. They join the core and the slab sides. Not shown, a 1/32" ply bottom goes from the nose to the rear former. 1/4" triangular stock is used to join corners.

Photo #2: The front former has blocks on it for servo ears. Elevator servo, as shown, is put off to one side, so pushrod clears the former. Crosspieces attach to rails on sides. Servos are at right angles to former (black line) in different planes so the pushrod passes under the rudder arm. See Photo #4. The internal switch is operated with the assembly shown.

Photo #3: The brass plate is soldered to brass wrapped around a female Deans plug. Charging and battery monitoring are done via this.

Photo #4: Hatch is secured with rubber bands from screw eyes on it and former.

Photo #5: A maple block, with 4-40 blind nuts, sets in notches in center ribs in a built up wing, or between spars in foam wing.

Underneath is an aluminum "L" made from part of a "T" bar. Bolted on is 1/16" x 3/8" brass with 4-40 blind nut soldered on. Tow hook is made from a Du-Bro 4-40 threaded rod. Solder a small brass plate and bit of 3/32" i.d. brass tube under it and bend. Use rubber between it and fuselage. Screw through a hole in the brass plate to avoid it rotating.

Photo #6: Maple block is under the 1/32" ply subsheeting. Balsa plates between ribs position servos vertically.

Photo #7: Rails are glued to plates and ribs. Servos are bracket mounted. Aileron servos shown are Airtronics 94401, with black arms from the 98301 set. Find which position gives best 45° offset with radio on. Cut other three arms off.

Flap servo is the 94831 or 94461. The long Futaba FSH-6E arm fits. At rear, a Goldberg 332 AHB is on a 4-40 tempered stud in the setscrew hole of a 3/32" wheel collar. See the "U" in Photo #12. Use silver solder here.

The ply plate extension behind the hinge line is spaced to allow "float" of the flap "U" axis as flaps deflect. An

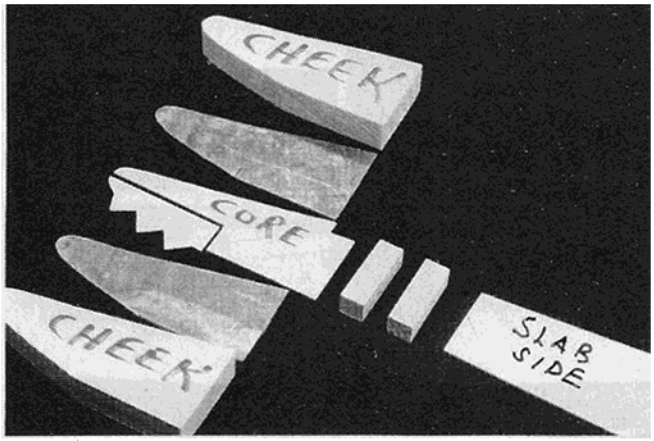
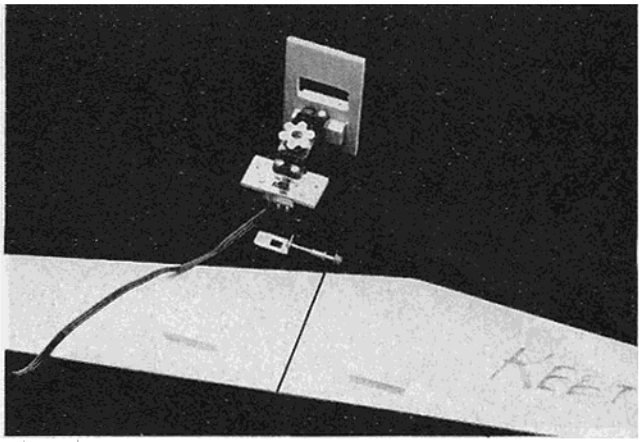


Photo #1



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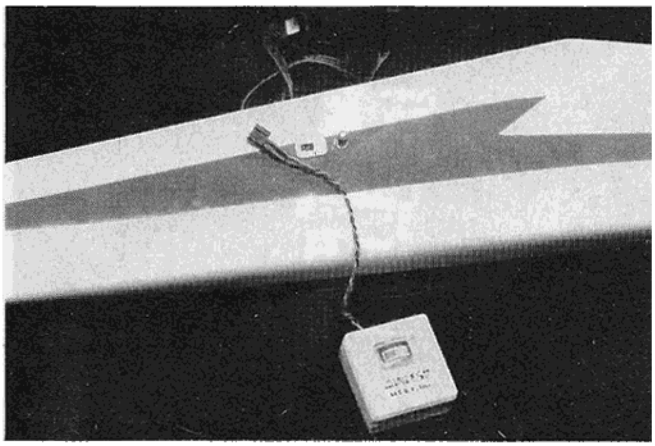
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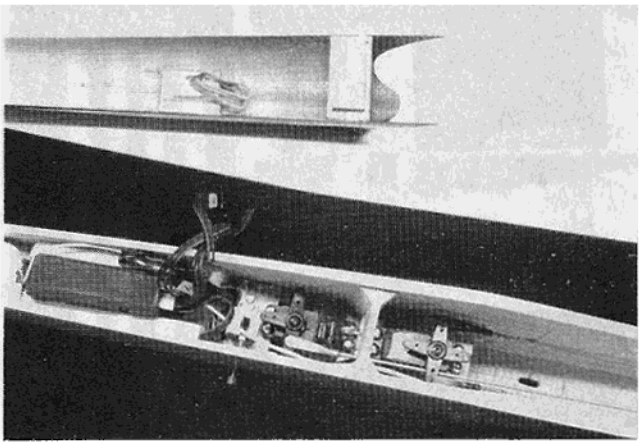
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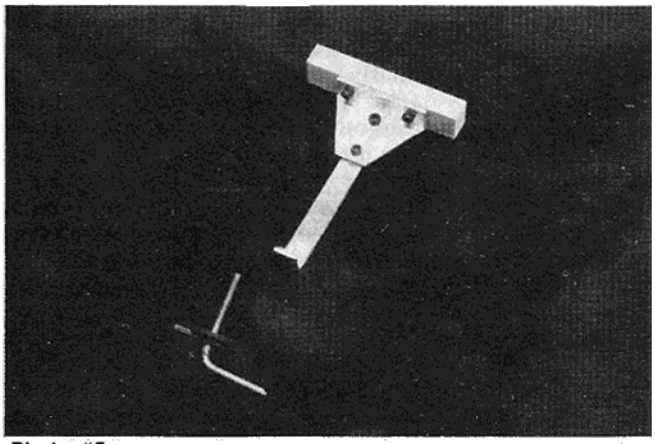
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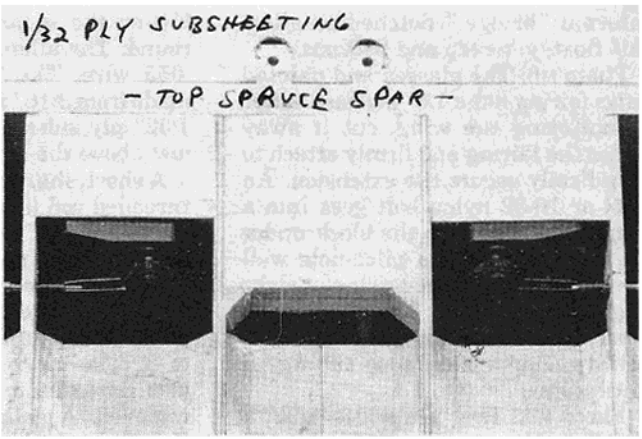

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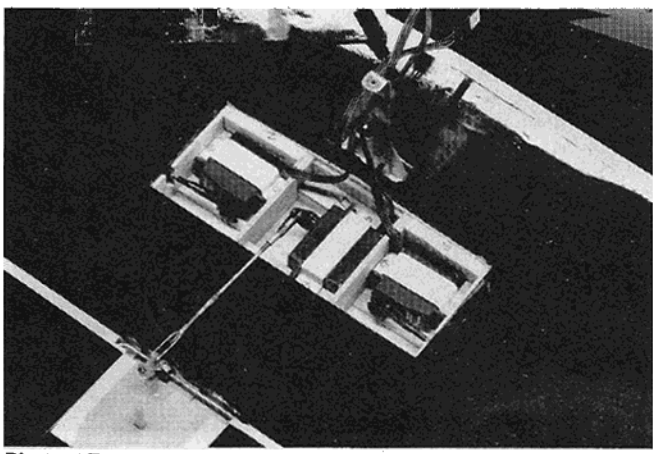
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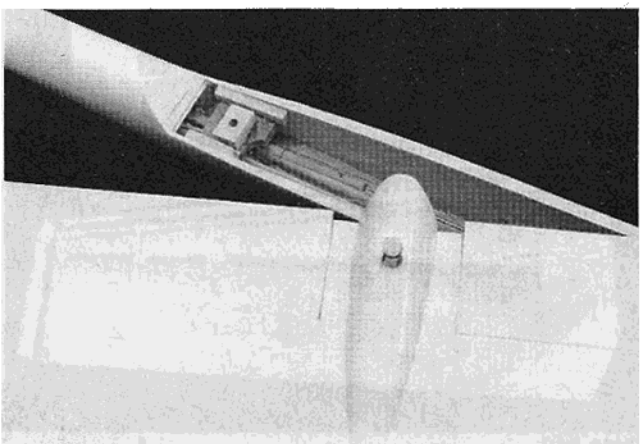


Photo #8

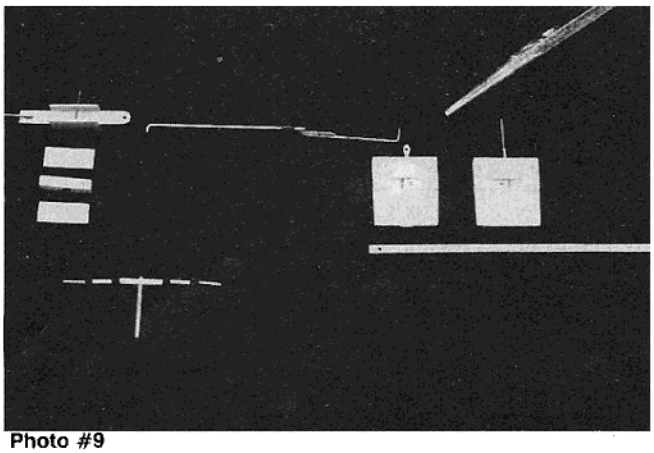
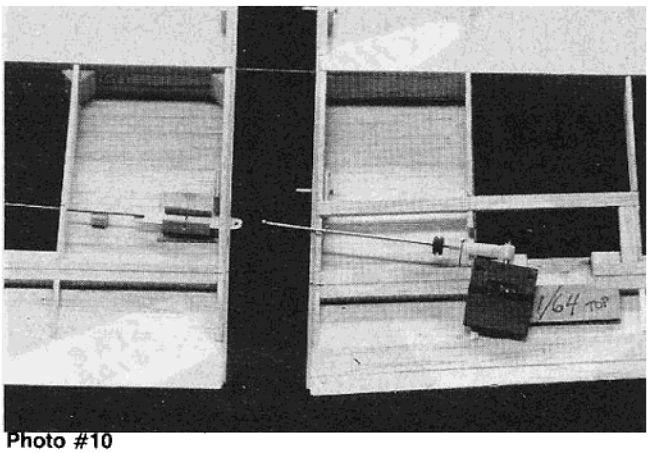


Photo #9



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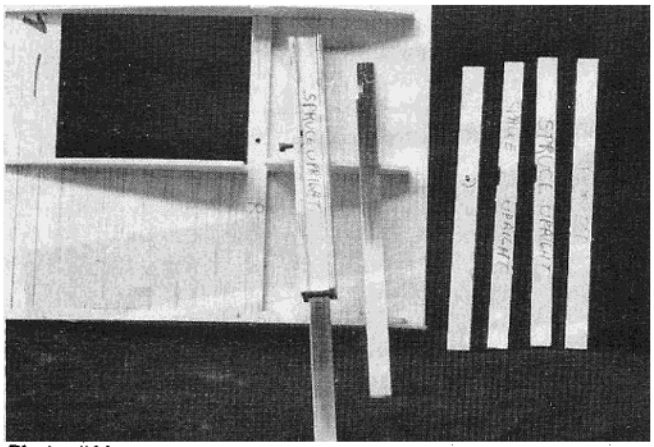

Photo #11

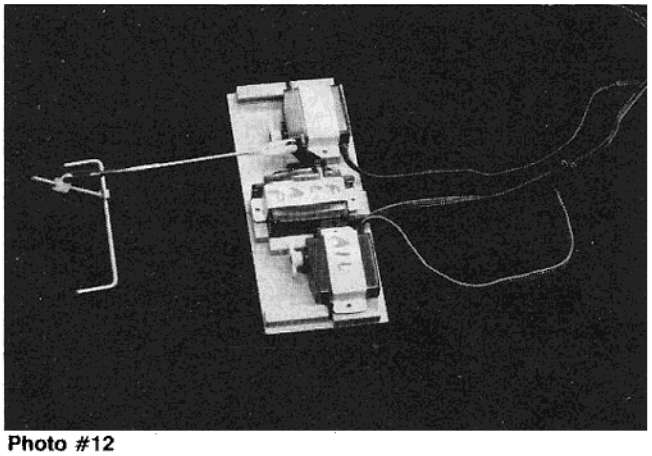

Photo #12

internal "bridge," notched to allow this float, joins top and bottoms.

Photo #8: The glassed and painted balsa fairing has a 1/8" ply base. After MonoKoting the wing, cut it away under the fairing and firmly attach to help firmly secure the extension. An 8-32 or 10-32 nylon bolt goes into a blind nut. Tack glue the block under the rails, and drill a pilot hole well rearward through the fairing at right angles to the block. Then knock the block out, set the nut in, and reglue solidly. Put a sleeve of tubing in fairing top.

Photo #9: The "slider" is 1/32" x 1/4" K & S brass with a .055 hole (#54 bit) on the square end, 1/16" on the round. The aileron pushrod is K & S .055 wire. The 7/8" slider track is made from 3/16" x 1/4" hard balsa and 1/32" ply sides. A common pin runs just above the slider.

A short, sharp bend is made in 1/16" threaded rod (original Nyrodapter or Goldberg 1/16" aileron pushrod) to go down into the slider hole. Lift it and push the slider down to engage. It adjusts in the clevis. Remove the pinned arm and silver solder .055 wire to it. The photo shows the Swingee arm flattened to 1/8" width, threads removed. A gauge made of 1/8" i.d. K & S square brass tube with a .055 hole centered 3/16" from the end is used to guide a #54 bit. Alternatively (and better), snip the threads and force a 1/4" piece of 3/32" i.d. square brass tube on the arm, 3/32" from the body. Zap it on, then slip the gauge against the body and drill the hole with a drill press, everything squared up. File off the raised letters, the slanted pin ends, and round off the vertical stops at the center of the Swingee. Treat with WD-40 to loosen.

Use the gauge also to make a pilot hole in the 3/32" i.d. crossbar of the rudder "T". Join the "T" and drop a piece of silver solder inside and heat. Zap in the telescoping tubes and drill

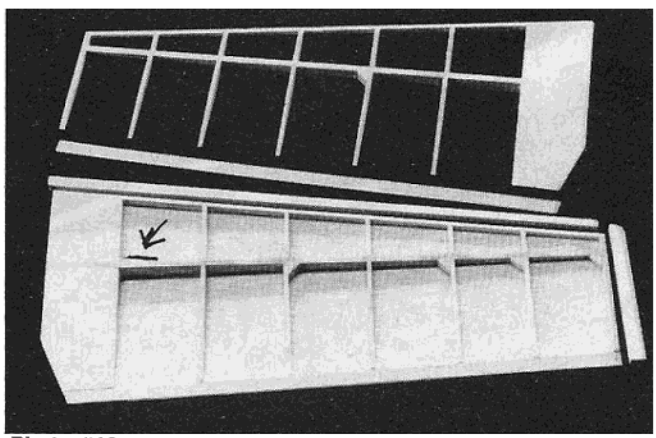

Photo #13

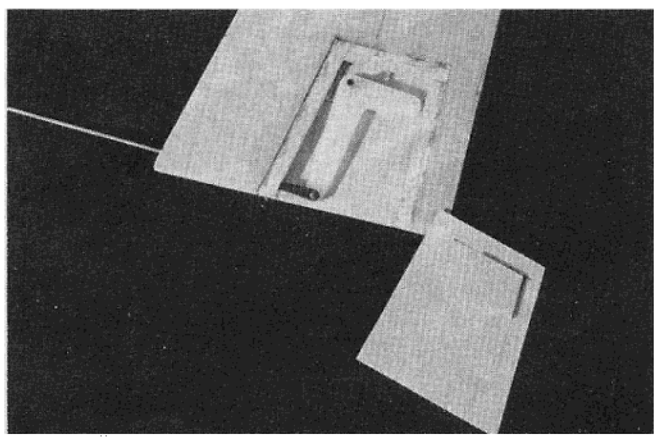

Photo #14

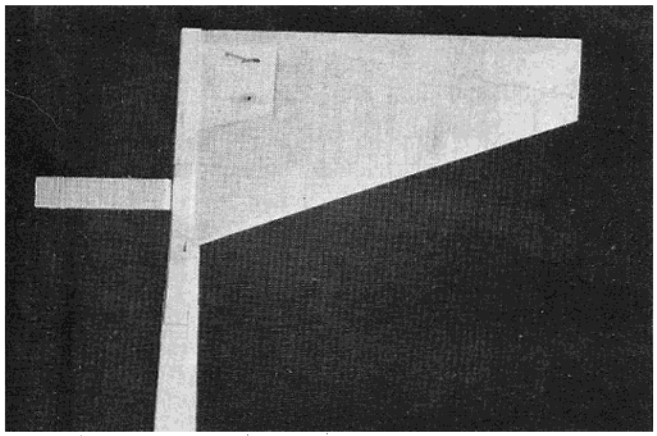

Photo #15

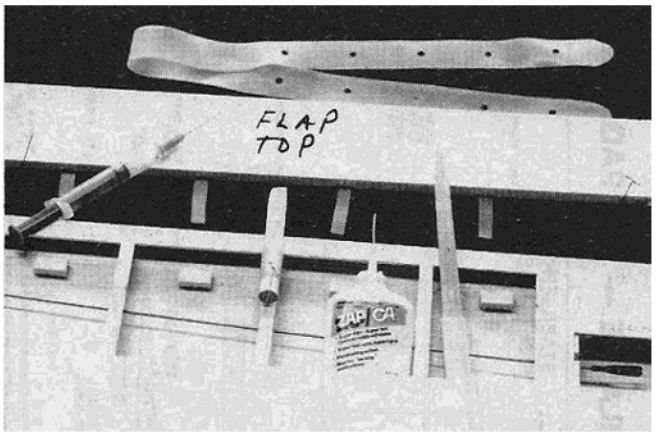

Photo #16

through.

Photo #10: Earlier ship showing guide pins, ply plates, and the position of slider and track on 1/64" ply base. The stop prevents the slider slipping out with pushrod off the output arm. Engage/disengage is easier if the guide pins are short.

Swingee front is Zapped to the structure. Rear slips in a receptacle consisting of ply plates top and bottom glued to wedge shaped ends that match the Swingee rear slope. This must be made without bind, or side or vertical play. Position this on the aileron and shim vertically as needed so the arm points forward in neutral aileron. Fit below and above the receptacle so it will be solidly glued in position between the skins. Swingee is not glued, but moves in and out during deflection.

The steel bar is glued in the tip and slides into a receptacle between the spars.

Photo #11: Joined receptacle and parts are shown. Note how the end of the steel is trimmed to slide over the non-recessed 4-40 blind nut. Blade must center over the nut to be engaged by the setbolt. Use setbolt of length to engage notch but not jam blade at top. Zap can be used to join receptacle parts by wicking. Use a blade plus a thin shim when adding the second upright, so slot is a hair wider than blade. Vertically, you want a no-slop, no-bind fit. Use 7" pieces of the clockspring steel. Position the blind nut so 3" protrudes out the center section.

Photo #12: With foam wing, servos are similarly mounted, but go on a plate of ply on top skin underside. Lay out so the flap linkage clears the fuselage.

Photo #13: Similarly constructed stab. The root has three layers of 1/8" balsa cut 1½" wide. The bottom layers are glued to the spar. A 1½", 1/8" o.d. aluminum tube is glued where they meet at the front. By the arrow, a 3/4" piece of the rubber used in hinging is Zapped on the spar. The wire end is rounded and slides on and grips the rubber. It must not go over the rubber end or will curl it and lock the stab. The tube for the rear wire is 1/8" o.d. with 3/32" o.d. in it.

After the first layer is on, slip the assembly on the wires to locate rear tubes. Tack them on, slip off, then bury in the root laminations. Add 1/4" balsa root cap (not shown) with holes for wires, rib pieces, and sub LE. Shape to airfoil and wick 1/32" sheeting to it. Wick 1/64" ply at the TE and put 1/32" balsa on it to feather. Wick on the other side. Add LE, solid tip. True to the fin. LE should be rounded about like 1/8" dowel, not sharp.

Photo #14: Different ship, but shows bellcrank made of Sig nylon. Fin is preferably made of 5/16" C-grain contest balsa. 1/32" ply sides with 1/16" doublers inside support the 11/16" long, 1/8" o.d. brass bearing tube. Be sure the cutout for the bellcrank and pivot point used allow plenty of room for rotation. You will need all the stab motion you can get to point the nose down steeply with flaps down. Size the internal bearing strips to get everything flush. Set a 1/4" wide strip of 1/64" or 1/32" ply in the LE for ding protection. A cap of 1/16" ply can be set on top. Use numbered drill bits to avoid slop or bind. #52 is good for clevis pins, #30 at bearing tube, #53 to hold 1/16" stab wire.

Photo #15: Fin glues between slab sides. Note 4" doubler of 1/16" ply by fin front, edges beveled. This becomes an outside finished surface. Balsa goes rear of it. Fuselage ply box consists of 1/16" slab sides, 1/32" ply bottom (to rear former) and 1/64" ply, cut cross grain, to fin front, top and bottom.

Photo #16: 3/8" wide strips of hinging rubber are Zapped in flaps, ailerons, and fin, then into the adjacent structure under slight tension. July '88 issue of Model

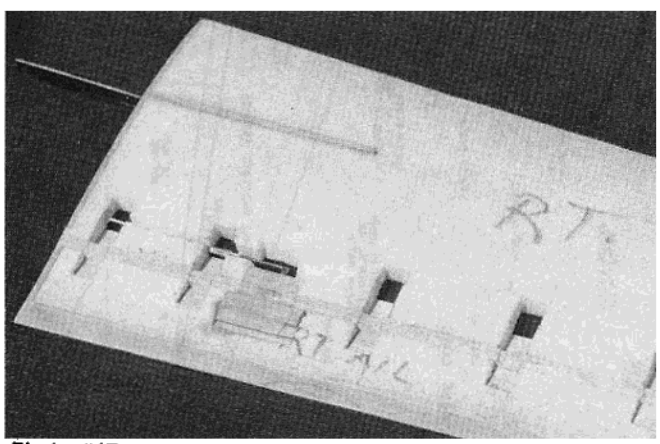

Photo #17

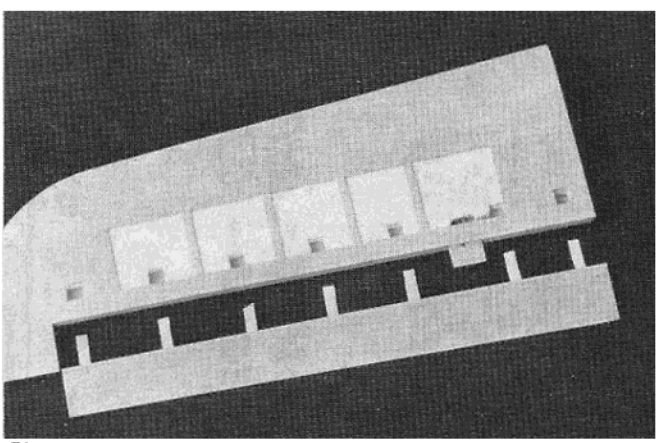

Photo #18

Aviation details "how to." In this photo, hinges have been anchored in a covered flap. Loose ends slip through adjacent slots in the wing, and then are Zapped to the blocks. MonoKote is then sealed. The left side of a center section is shown, but, oops, that's the right side flap. Hinges go low in flaps, high in ailerons.

Photo #17: Note the beveled and tapered hinge line strips are notched, and cuts made in the foam where rubber hinges go. Careful work in making a fine butt fit gives a hairline fit of surfaces.

Photo #18: Inverted view shows hinges Zapped to the aileron. Loose ends will be anchored, working through the openings with simple tools described in text. Cleats of balsa are attached to the top skin underside. Ends are attached under slight tension to the cleats. □

From RCModeler June 1989