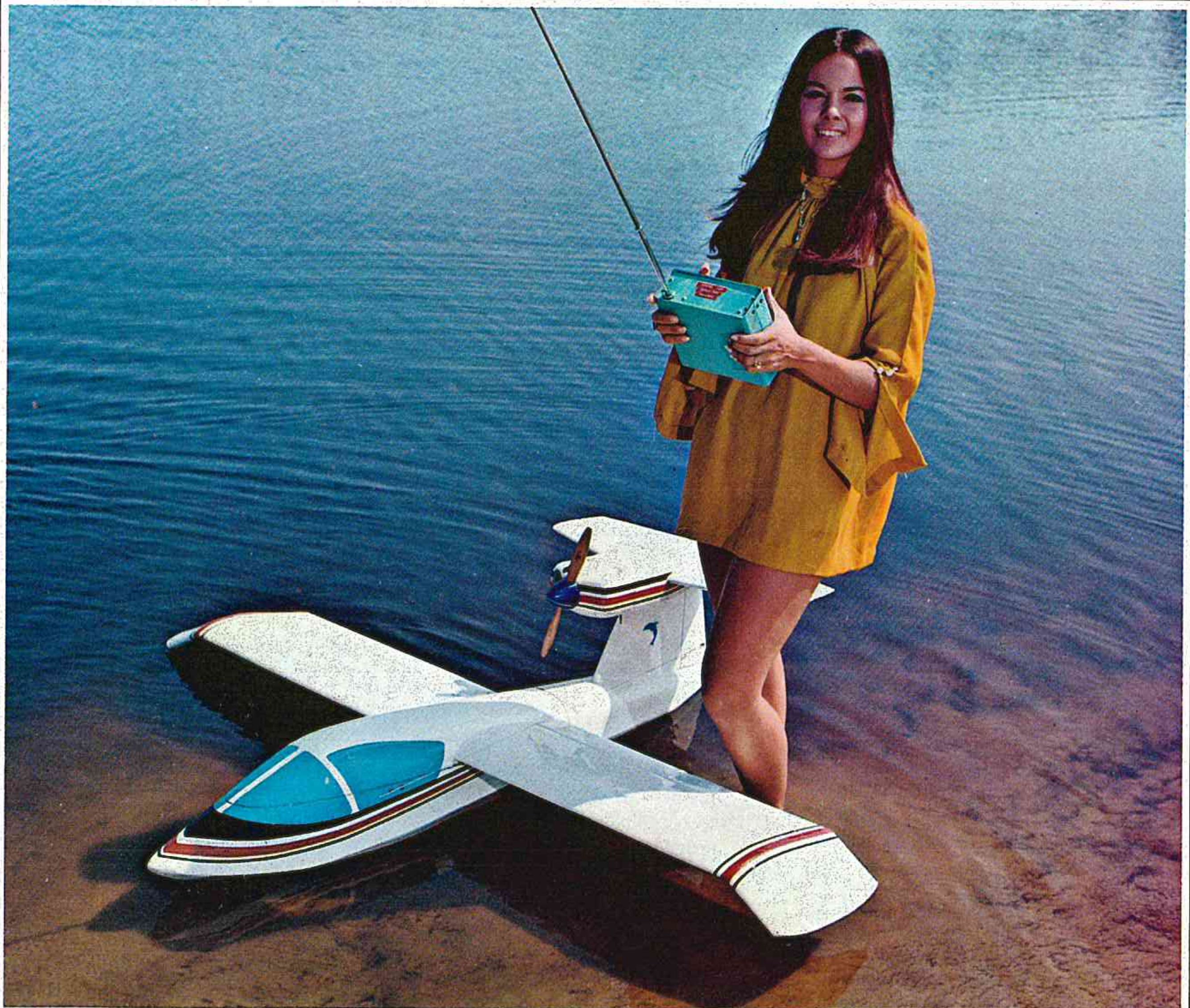
THE SPECTRA



By Don Haines & Paul Rhen

R/C MODELER MAGAZINE PRESENTS A FULL SCALE MODEL OF ISLAND AIRCRAFT'S SPECTRA AMPHIBIAN. THIS BEAUTIFUL AIRCRAFT IS THE RCM EDITOR'S CHOICE AS 'MODEL OF THE YEAR.'

R/C Modeler Magazine is proud to present the Spectra, the most beautiful and unique R/C amphibian design ever published by the model press.

As presented on the following pages, the Spectra is a 1/6th scale radio controlled engineering test model built by Island Aircraft Corporation, 10 Granada Avenue, Merritt Island, Florida 32952, as their engineering test model for the full scale prototype. The fully proportional ailerons, rudder, elevator, throttle and flap controls closely correspond to the full scale vehicle.

The full size Spectra is a bold design approach that yields exceptional performance coupled with startling good looks in a completely new amphibian aircraft concept. The secret to the Spectra's performance is in it's unique configuration that eliminates most of the drag penalties paid by amphibians in the past. This new configuration is in the patent pending stage now by Island Aircraft Corporation and will usher in a new dimension in airplane versatility, performance, and safety.

RCM readers will note the full scale Spectra shown in one of the photographs. This is Island Aircraft Corporation's research test vehicle and, except for some nacelle reshaping and relocation of the pitot boom, it represents Spectra's final configuration. Thus the model as presented here is virtually fully scale.

With regard to some interesting notes on the design features of the full scale Spectra, the engine location finally chosen is a result of an exhaustive preliminary design study to find a propeller location that avoided problems most previous single engine propeller driven amphibians have had – e.g., distorted air flow into the propeller caused by flow around wings, nacelles, pylons, or fuselages, and direct spray impingement on the propeller blades.

The configuration chosen for Spectra solves both these problems. The wing provides an effective spray shield under all conditions except when taxiing at low speeds under choppy conditions. Spectra's aft tractor engine arrangement provides all the advantages of a tractor installation and most of the advantages of a pusher; the propeller always "sees" undisturbed air, and the high velocity flow aft of the propeller does not impinge on the bulk of the fuselage causing extra drag as it does in most single engine landplanes. Instead, the high velocity air impinges only on the tail which means less drag and excellent tail control under all flight conditions. The tail mounted engine nacelle permits very efficient cooling air flow, resulting in less cooling drag. The exhaust runs straight aft producing a little thrust in the right direction.

Another interesting feature are the unique wing tips on the Spectra which serve several functions. At rest, and at low taxi speeds, they provide lateral stability. They provide this function at essentially no aerodynamic drag penalty. Their airfoil shape acts like a wing extension causing no more drag than a section of wing of equal length. In fact, some aerodynamic advantages caused by the end plate effect of these tips are expected. High speed taxi tests have demonstrated that the broad flat planing undersurface of the tips are very effective. Attempts to bury a tip on high speed runs have been made with hard over aileron control but the tip refuses to submerge.

The full scale Spectra cockpit is built around the pilot. The throttle lever is mounted at the forward end of the center arm rest providing a degree of comfort seldom found in a light plane. The pitch trim wheel is immediately under the pilot's thumb; the flap switch is mounted on the throttle arm near the pilot's forefinger. The pilot can raise and lower flaps, retrim, and change power levels without moving his hand from the throttle or his arm from the comfortable arm rest. Trim changes can be made simultaneously with power changes – a feature that is particularly convenient on a full-flap go-around.

A boom mike mounted on the canopy frame and a mike switch on the control wheel help reduce to a minimum the amount of time the pilot's hands must be removed from the controls.

No other reciprocating engine airplane, single or twin, has a cockpit as quiet as Spectra, simply because no other airplane has a cockpit as far from the propeller and exhaust system.

A great deal of attention has been paid to enhancing pilot visibility in the full scale prototype. The result is a combination of pleasing aerodynamics and excellent optics; the windshield is made with a single degree of curvature that virtually eliminates any distortion. The pointed nose and generous plexiglass area provides a level of visibility that far exceeds that available in any other single engine airplanes (or most any other kind, for that matter).

The pilot sits ahead of the wing, allowing unrestricted vision both up and down. Structural members in the canopy are made as narrow as practicable in order to keep "blind areas" to a minimum.

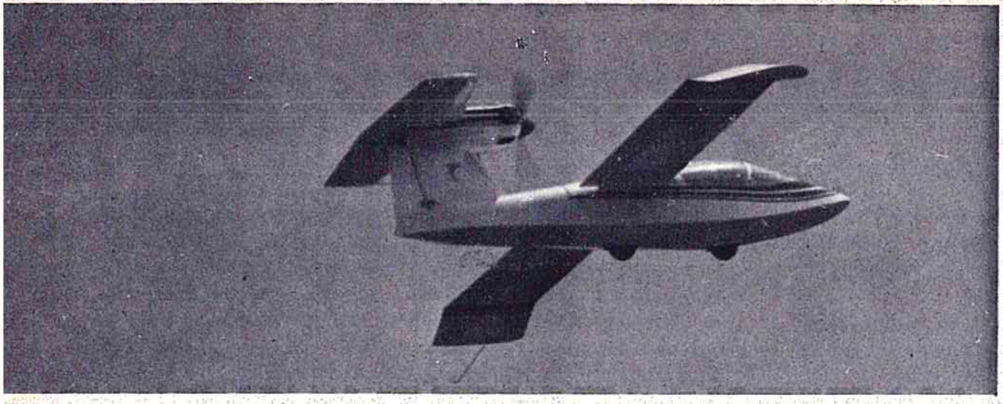
Another factor that contributes to the full scale Spectra's exceptional performance is it's retractable step. The relatively simple but effective retractable step continues to operate very well on Island Aircraft Corp's test vehicle. When retracted the step produces almost no aerodynamic drag.

The main gear will be stowed in the wings and will have a relatively wide tread providing very stable ground handling. When extended, the nose gear rotates up and forward out of the nose through a 270 degree arc into the down and locked position. This arrangement avoids putting a hole through the hull which keeps high water pressures off the well doors and outside the hull. The nose wheel can also be placed in the "bumper" or straightforward position where it acts as a fender for docking operations.

The full size Spectra is presently conducting water taxi tests. Speeds up to 40 mph have been attained and several step locations have been examined and the best arrangement has been selected. The spray rail configuration has received a great deal of attention; the simplest design proved to be the best.

The calculated performance and particulars of the full scale Spectra include a maximum speed in excess of 200 mph; a cruising speed of 190 mph at 75% power; a range of 1200 statute miles with auxiliary tanks; a gross weight of 3300 pounds; a horsepower rating of 310; a payload of 4 passengers and 120 lbs. of baggage; wing span of 37' and a wing area of 200 sq. ft.; and a fuselage length of 27'.

The model presented in this issue of RCM is a duplicate of the full sized Spectra, actually used by the manufacturer for engineering tests for the full scale prototype. R/C Modeler extends it's congratulations to the Island Aircraft Corp. for one of the most outstanding light aircraft designs of our era. - - - - The Editors



One of Spectra prototypes flies with S.T. .60, Heath radio on rudder, elevator, ailerons, flaps and throttle.

The challenge of R/C Scale! More and more scale models are being built every year. Why is it happening? It's because of the tremendous advances made in the design of the radio control equipment. Gone is the requirement for an airplane which is stable as a rock, light as a feather, and streamlined as an arrow. A pilot who is proficient at flying today's stunt-pattern aircraft is fully capable of controlling a neutrally stable or somewhat unstable scale model. Scale models also tend to be heavy, but thanks to today's big (and dependable) engines, the weight problem has almost been eliminated.

The project I embarked on presented this challenge and more; build and fly a scale model to test a new concept in airplane design. The design, an amphibian with the engine nacelle mounted on the vertical fin, presented intriguing structural and aerodynamic questions.

The aircraft presented here is the second of two 1/6th scale engineering test models built and incorporates the latest changes in the design of the full scale prototype. During the flight test program various combinations of the engine thrust line, horizontal stabilizer and wing incidence, wing dihedral and control surface area were investigated using the model. The knowledge gained from this testing has made a significant contribution to the final design of the prototype. In many areas, characteristics of the model were found to be directly applicable to the full size prototype – the water spray pattern during takeoff was identical to the prototype (over the wing) – and the addition of short spray rails solved the problem. The model's airfoil was changed from a Clark Y to the NACA 2415. Two degrees of dihedral and a 7" increase in span were added to the wings on the second model. The nacelle and aft fuselage were slenderized, and the area of the vertical stabilizer and rudder were increased. A weight reduction effort during construction of the second model resulted in a savings of about one pound with no sacrifice in strength. It is still a heavy model, weighing 11½ lbs. dry. Power for both models has been a ST .60. The newer, more powerful Veco's, Enya's or Webra's are recommended.

Construction is fairly straightforward, however, here are a few notes before the details. We used good old Titebond on the original model, but changed to epoxy for all gluing on the second ship because of problems encountered with water softening the Titebond (it's water soluble) after a day of flying at our favorite lake. Use extra care to seal all exposed surfaces and joints where water may enter. Remember, happiness is a dry airplane. By the way, if you don't have a good sanding board in your set of model building tools spend a few minutes making one. It will save you hours over the long run, and you will have straight and true surfaces for gluing. Here's how: Find a piece of perfectly flat and smooth 1 x 4 inch pine about 9 inches long. Cut a piece of #80 open coat aluminum oxide paper approximately 1/8" smaller than the outside dimensions of the 1" x 4". Be sure to use a heavy duty aluminum oxide paper; regular sandpaper or garnet paper will last only a few hours. Glue the paper to the block, place another block and weights on top and let the glue dry thoroughly. I've used the same block for over a year now without wearing it out. Just be sure that the board is flat.

FUSELAGE: Keel construction was chosen as the simplest method of obtaining a structure strong enough to withstand the anticipated loads generated during the flight test program. The main keel is 1/8" balsa sheet with a 3/32" plywood sheet backbone over the wings and the main supporting member for the horizontal stabilizer and nacelle. All formers are 3/32" balsa with 3/32" stiffner strips, except formers 25A, 90A and 230C which are 3/32" plywood. Formers 100, 120, 140, and 160 are cut partially through at the fuselage parting line prior to assembly. Later, when the fuselage sheeting is completed and the top planking shaped, a few quick slices with your razor saw should allow the top to slip off nicely. Care should be taken to keep the formers perpendicular to the keel while the epoxy is curing, and don't forget to allow the 1/8" for the fuselage bottom to butt join to the keel. After the formers are set, the 3/32" balsa longerons are added and the side is ready for sheeting.

The bottom sheeting is done in two sections – the side is one piece. The aft section is easy; however, the front section has compound curves and must be pinned securely until the epoxy has set. I found that if I used one hour epoxy with a spot of the 5-Minute type here and there on the curves the tedious job of pinning and clamping

Equally at home on land or water, two Spectra prototypes illustrate amphibian profiles.

could be greatly reduced. Be sure that the sheet remains in contact with each former along its full length. The center of the sheet tends to pull away from the formers when it is pulled down at the front. While waiting for the epoxy to cure, rough cut and fit the canopy planking. Now lift the keel from the board, add the formers and longerons to the other side, and then the sheeting. Do not sheet the top of the forward section of the fuselage from station 25 to station 90 at this time. You have some weight and balance checks to make and about two pounds of lead and resin to add prior to closing up this area.

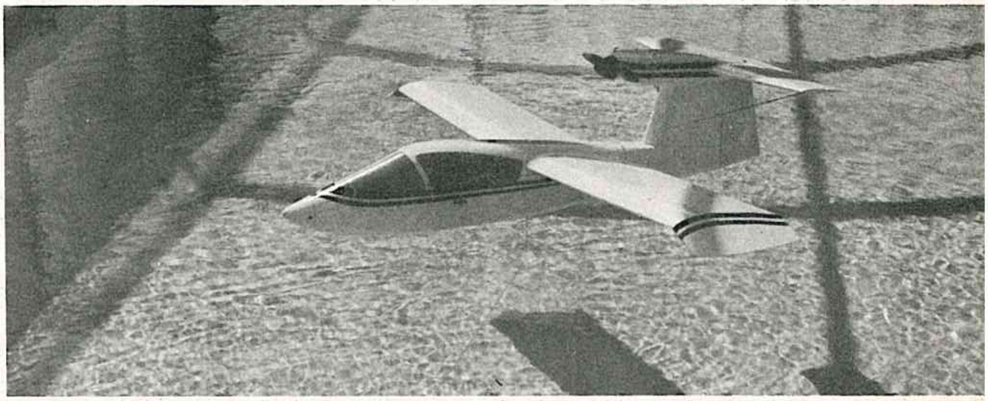
The leading edge and left and right halves of the vertical stabilizer ribs can be added at this time and the bellcranks and control rods installed. Check the installation carefully for free movement because there will be no access to these linkages after the skin is installed. You can use NyRod, Golden-Rod, or flexible cable, etc., however, I found that this increased the slop in the controls and reduced the throw where multiple bends existed in the control line run. I tried NyRods on the first model, but switched back to bellcranks on the second one. Motor control is the only control still using cable or NyRod.

If you are installing landing gear, you will have to fabricate a plywood bulkhead (25A) and a removable nose section. If you intend to fly it only as a seaplane, forget the plywood, glue on a chunk of balsa and carve it to shape. The plans show the landing gear version. In converting the ship from landplane to seaplane, make sure you put some silicone glue on the nose wheel pushrod hole to make it water tight after you remove the nose gear.

WINGS: Wing construction is also quite conventional. The rear spar and aileron spar are made from ½" balsa sheet. The leading edge is one of the standard blunt shapes available in hobby shops. Place the forward spar on the blueprint and glue the ribs in place using the notched leading edge and rear spar to hold the ribs in alignment. As soon as the epoxy sets, pull the leading edge, fill the notches with epoxy and pin it in place. An hour later you can pull the rear spar, fill the notches in it with epoxy, and pin it in place. Now glue the 3/32" sheet inboard trailing edge to the rear spar, install the rib sections and then the bottom trailing edge sheeting. Use soft balsa for this sheeting. I glued the back edge together without trying to taper it. Use clothespins to clamp it. You can sand it later after you pull it off the board. This method also ensures straight and strong trailing edges.

Now glue in the bottom forward spar and let it set.

While it is curing, start the ailerons. Put some Saran Wrap over the rib jig and rear wing spar to keep the aileron and wing separated. Pin the 3/32" top sheet in place; glue the aileron spar and the ribs to it. Glue in a piece of ½" behind the aileron spar where the control horn goes. Install the 3/32" bottom sheet using the same method for clamping the trailing edge. Glue the bottom forward 3/32" x 3" sheeting in place. When the epoxy is cured, turn the wing over, trim the tabs off and add the top leading edge sheeting.



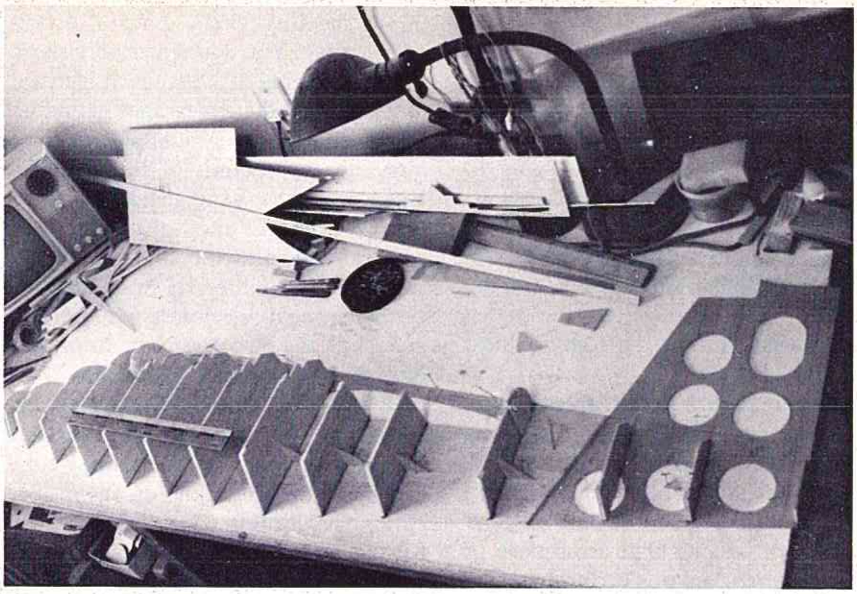
In its seaplane version, the Spectra is a remarkably beautiful aircraft.

Cut the ends off the wing section as shown between the 2nd and 3rd ribs. Carefully cut the ends to achieve the desired 25 degree droop angle for the tip and glue it back on. Install the rough cut block balsa wing tip and carve it to shape. Remember, the tips are also the floats, so don't change the shape of the bottom surface. The amount of dihedral shown is required to provide tip clearance during water takeoffs. The original model was built with the dihedral shown, then modified to zero dihedral angle at the request of the designer. Subsequent water taxi tests showed that the clearance was insufficient, and many of the high speed runs ended in water loops caused by a wing tip dragging along the surface.

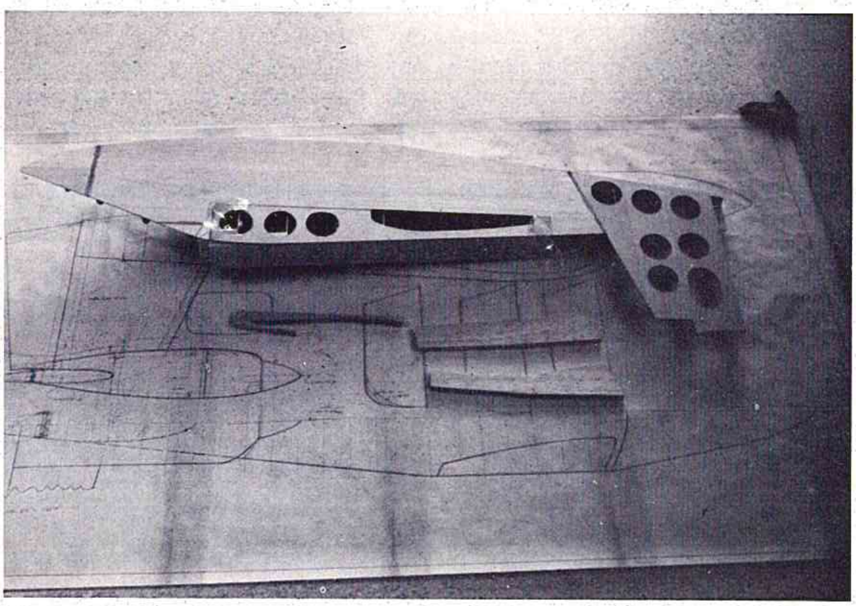
After the wing halves are joined, add the servo mounting board and the controls for the ailerons. Add the rest of the sheeting on the inboard section of the wing. You could probably sheet the whole wing without much increase in weight and the appearance would be improved. Slip the completed wing into the top section of the fuselage. Make sure the wing incidence angle (zero degrees) and alignment are correct and draw a line along the fuselage/wing intersection. Remove the wing, coat the joints with epoxy, and glue the two together, using the lines to ensure proper alignment.

HORIZONTAL STABILIZER: Cut and shape the rear stabilizer spar and the elevator spar. Cut the leading edge and mark the centerline on the inside. Notch the leading edge and rear spar for the ribs, and block the leading edge so that the centerline is parallel to your workbench. Cut the ribs from 3/32" sheet and mark the centerline on each at the leading edge. Drop the ribs into place making sure that the centerlines line up. Now cover the ribs with 1/16" balsa sheet for the stabilizer and 3/32" balsa sheet for the elevator. Remove the stabilizer, cut off the tabs, and glue on the other skin. After the sheeting is dry, taper the leading edge to match the sheet. Shape and sand the elevator hinge area for a smooth operation prior to final assembly.

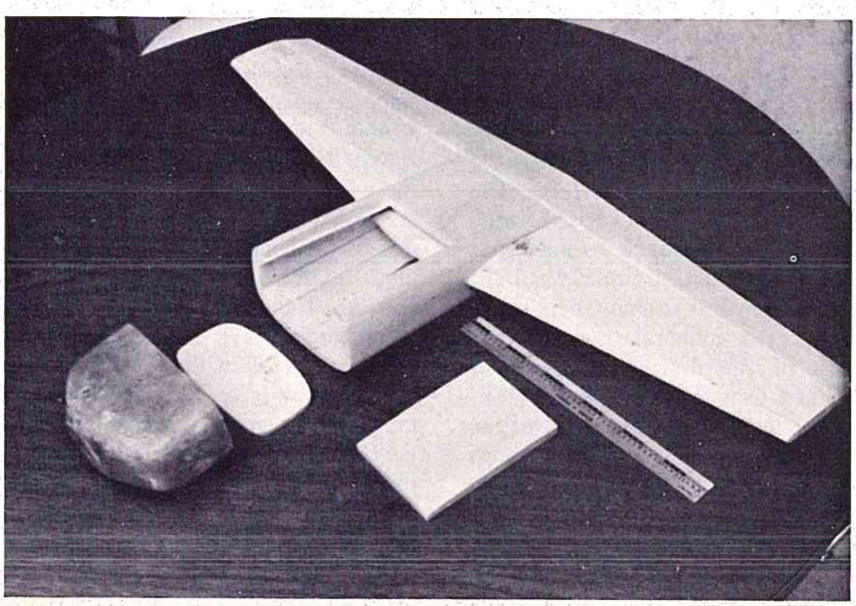
NACELLE: The forward section of the nacelle is molded fiberglass. If you are going to use a molded cowling, now is the time to make it. Make a ¼" plywood firewall that fits inside the cowling. The nacelle aft of the firewall is built up from ½" sheet and ¾" x ¾" triangular stock with a hatch in the top to allow access to a 10 oz. fuel tank and the engine control linkage. I tack-glued the top piece of ½" sheet in place originally and shaped the nacelle completely before cutting the hatch. Glue the firewall in place on the nacelle. (Don't put any glue on the top piece.) Put the cowling in place and



Basic fuselage built on center keel. Note lightening holes in vertical stabilizer.



ABOVE: Fuselage planked on one side. BELOW: Engine nacelle and horizontal stabilizer assembly.



draw a line around the intersection with the nacelle. Carve and sand the nacelle to shape using this line as the reference. After it is carved to shape and the stabilizer fitted, the top is cut loose and the hatch cut out. This ensures that the hatch has the correct shape and fit.

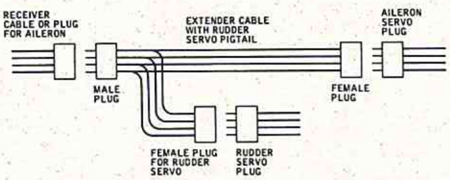
Now is a good time to pin the stabilizer and nacelle together and check the fit and alignment on top of the vertical fin. Draw a line on the plywood keel for the vertical fin along the bottom of the nacelle. This will ensure that you have the proper angle of incidence (zero degrees) when you epoxy it in place. Also, with the nacelle temporarily in place, work out the control pushrod runs for the rudder, elevator and engine. Now you can remove the nacelle, glue the horizontal stabilizer and nacelle together, glue on the top of the nacelle, and then glue the nacelle to the vertical fin. After the nacelle is glued in place, and all control linkages are operating satisfactorily, the vertical stabilizer can be sheeted with 1/32" ply which adds all of the strength required for many hours of flying. The rudder sheeting is 1/16" balsa.

WEIGHT AND BALANCE: Install the engine and cowling on the nacelle. Temporarily install all of the radio equipment. Then, assemble the complete model including landing gear, if used. At this point the model should be complete except for the 1/8" sheeting on the top front section of the fuselage and the MonoKote covering. Put 10 ounces of weight in the nacelle fuel tank area to simulate a full fuel load. Add weight to the front two bays of the fuselage until the CG comes to the location shown on the plan. Now, remove approximately 6 oz. of the weight from the nose section. Mix up 6 oz. of resin and pour it over the weights to seal them in position. This also greatly strengthens the forward hull section. I coated the bottom surface of the third bay with resin also, since you can't seal this bay when the top front sheeting is installed. When the resin sets up you can install the 1/8" balsa sheeting on the top of the front section and you're ready to cover the airplane.

COVERING: The model was covered with Top Flite's Super MonoKote. This keeps the weight down and the wife happy. You also keep the Hobby Store owner happy when you buy more than 15 feet of the stuff. Make sure your seams are all overlapping and well sealed.

RADIO INSTALLATION: Installation of the radio equipment is conventional and there is plenty of room. You get some added vibration insulation effect with the engine located on the top of the tail far from the equipment. This doesn't mean that you can forget the foam around the batteries and receiver, since they need all the cushioning you can provide.

The only thing different is the extender cable needed to run from the receiver back to the aileron servo. If you are going to use coupled aileron and rudder, this is the convenient place to make the "pigtail" to tie rudder into the ailerons. The sketch shows how I did it on my Heathkit. Kraft has a similar cable commercially available for their system this year.

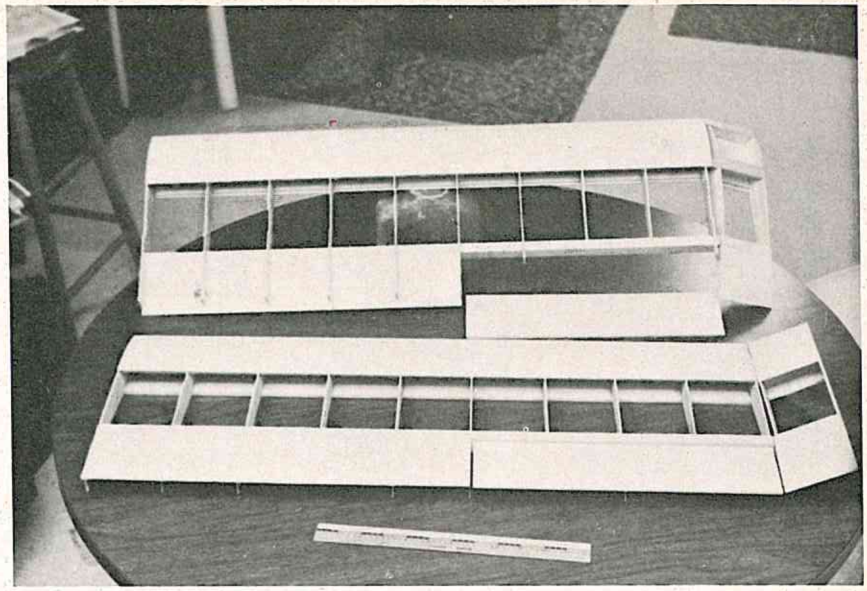


Make sure that you can do this with your system prior to trying it. I know it will work on both the Heathkit and Kraft systems. Make sure you have the rudder servo output hooked up such that the rudder moves right when you move the aileron stick control to the right. If your servos are properly set up with the transmitter, you should be able to shift from separate aileron and rudder to coupled controls without adjusting the rudder control linkage. However, if you aren't familiar with your equipment or don't know someone who is, don't try this adjustment; just remember to adjust the mechanical linkage for the rudder when shifting from one method to the other.

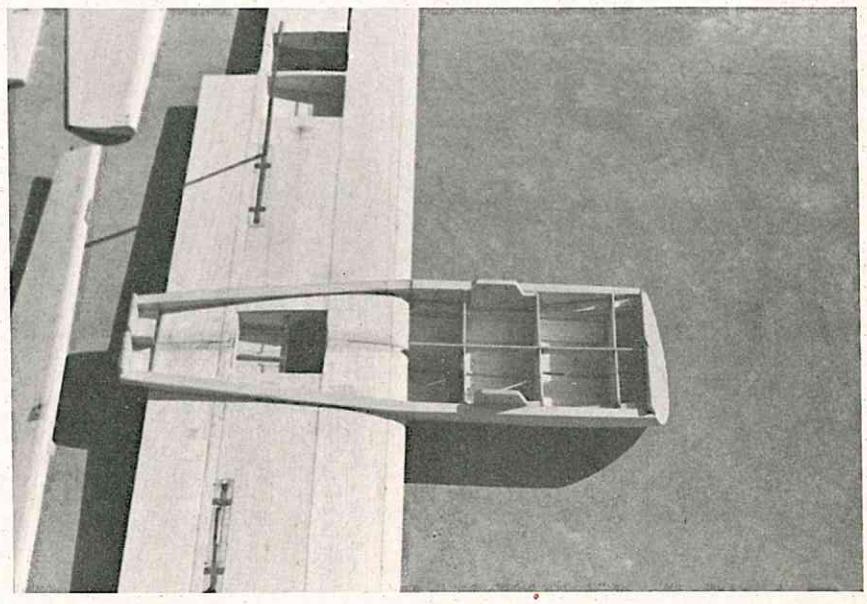
FLYING: First, be sure the main landing gear is installed as shown. If the CG is correct, the airplane should stay on the tail if it is tipped back even with the fuel tank empty. I strongly recommend that you make the first flights using coupled ailerons and rudder. You will find that the adverse yaw effect of the long nose and ailerons requires a large amount of rudder especially at low speeds.

Ensure that the elevator is at zero deflection angle at neutral trim. Then set the elevator trim on the transmitter to full up for takeoff. For the first takeoff, make sure you have plenty of smooth runway available. As the speed

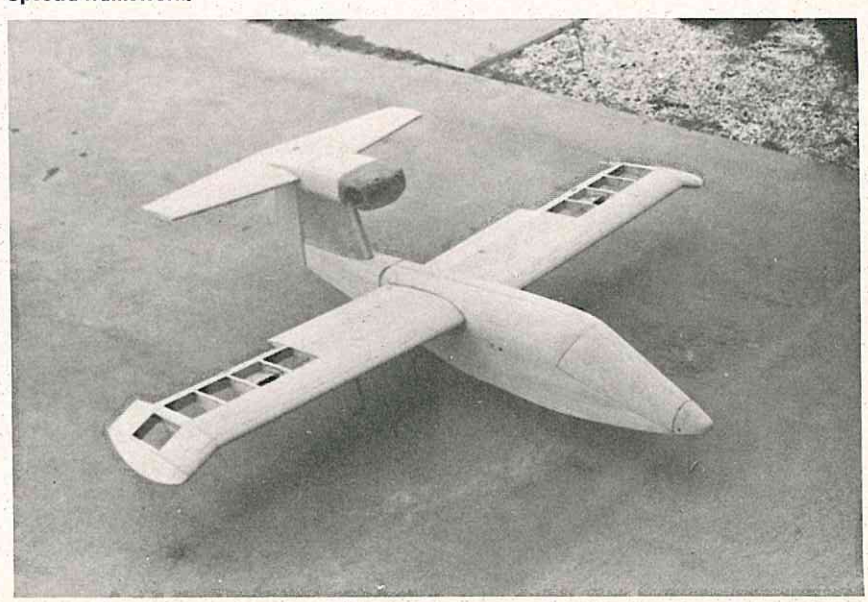
(continued on page 78)



Wing panels partially completed. Nose tip assembly.



ABOVE: Completed wing showing detachable fuselage top section. BELOW: Finished Spectra framework.



dark red, blue, midnight blue, yellow, orange, bright red, metallic gold, metallic red, and metallic green. Sole distributor in the United States is Technisales. Prices are highly competitive and the material has proved extremely economical to use considering the superb finish that can be achieved with it. Solarfilm should be available shortly at your local hobby store or it can be ordered direct from the distributor. As we mentioned, this material has been extensively tested and researched by R/C Modeler Magazine and carries our unqualified recommendation and approval. ☐

RUMPLESTADT C TYPE

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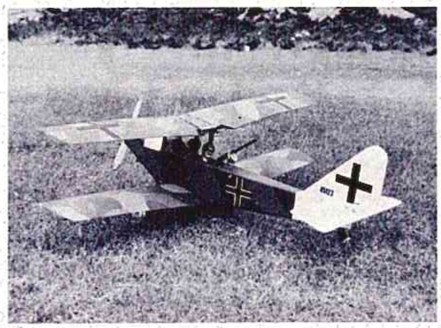


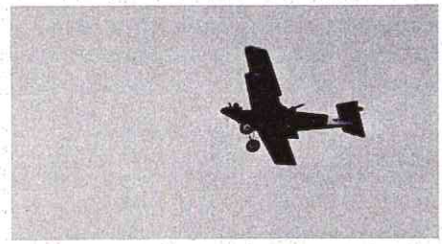
Just before capture by the British.

1/20" sheet over a 5/32" frame using a 1/4" square spar at the hinge line. Or, you can simply use 1/4" square soft balsa. Remember, as in most planes, to keep the weight down in the tail area. The landing gear is made from music wire pieces soldered to a music wire axle. Then the axle is cut in the middle and a piece of rubber tubing slipped over the cut. This allows the landing gear legs to spring apart on landings.

FINISHING: All balsa parts are covered with two coats of 50-50 clear dope and lightly sanded after each coat has dried. Then the entire plane was painted with Liquitex artist acrylic available wherever artist supplies are sold. It should be thinned with a slight amount of water, but left fairly thick as it smooths out nice. It dries to the touch in less than an hour but takes about twelve to eighteen hours to dry thoroughly and about forty-eight to cure completely. As always, it is best to try test samples first. You can detail it to suit your own taste. I used Williams Bros. wheels and pilots and mocked up the machine gun. Our Editor, Don Dewey, used Solarfilm on his versions including yellow Solarfilm directly over the foam wings.

FLYING: Gas it up. Start it. Check the controls on high and low engine. Take off. Fly! ☐

The Rumplestadt takes to the air.



SPECTRA

(continued from page 37)

increases, hold full back stick: Rotation and lift-off will occur at the speed where elevator effectiveness overcomes the nose-down pitching movement due to the engine thrust. **Do not** release all of the back pressure immediately upon takeoff or you will be right back on (or in) the ground at high speed. As the speed builds up, gradually reduce the amount of back pressure. The ship should level out or continue in a slight climb with the stick in neutral. Adjust the trim setting for level flight. It should be somewhere between full up and neutral. Now reduce the throttle setting to about 2/3rds without touching the elevator. There should only be a slight change in flight attitude and only a small trim adjustment should be required to maintain level flight.

You can roll the airplane if you want, just keep the speed up. One difference is apparent, and that is because of the engine location, you will need little if any down elevator while inverted. The ship will loop and it will spin if you work at it. However, if you do plan to spin it, make sure your CG is not farther aft than shown or you may get into a spin from which you won't recover. I made this mistake with the original ship and spent three weeks putting it back together. Later spins, made with the proper CG, were easy to recover from with the model spinning in a very steep nose-down attitude. Try not to pull too many G's on recovery. Remember this is a heavy airplane, so start your maneuvers high and recover early.

When you are ready to start your landing approach, put in a lot of down trim. On the Heathkit GD47 transmitter with the Bonner type sticks, I use full down trim. Other systems with the electrical type trim adjustment may not require full down. This trim adjustment should keep the nose down as power is reduced, and allow you to use back stick during the landing. If you still have to hold forward stick during the final approach, you either have the center of gravity too far aft or not enough down-trim. Keep the nose down and the speed up during the approach. If the nose gets too high and the speed too slow, it will tend to wallow when you make a turn. If your approach isn't in the groove and you feel you may have to go around, make your decision before you get below an altitude of 10 feet if you can. This will leave you sufficient height for the additional loss in altitude you will get when you give it full throttle. I would recommend making a simulated approach at about 50 to 100 feet altitude the first time just to get the feel of how much up-elevator is required to keep the airplane level when power is applied for a go-around.

I think the model's appearance in the seaplane configuration is prettiest. It also presents the airplane as the full-scale ship will appear with the landing gear retracted. Again, make sure it is water-tight before you put it in the water. See you at the lake! □

RCM'S 1970 SLOPE SOARING

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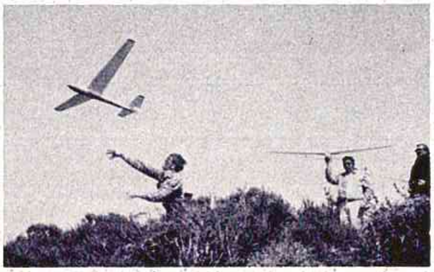

Typical launch at start.

18th. Only one round was flown on Saturday because there had been a storm on Friday night, and the winds following the storm were blowing at 30 mph with gusts occasionally above 40, and more than half of the planes which flew were pretty heavily damaged on landing as the wind tossed them around in the manzanita covering the hill. But Sunday was a different story. Calm in the morning, with the wind picking up around 10 A.M., and finally settling down for the final races in the afternoon at a firm 20-25 mph. Lift was fantastic; Bill Woodward, who had damaged his slope soarers in the wind, entered a standard, low wing multi ship, normally with a .60 up front, which he replaced with a pound of lead. He removed the main gear, but left the nose gear in place. Launching was tricky, to say the least. Since it's hard to hold a low wing job and hand launch it, he resorted to an unusual procedure; his assistant actually launched the plane inverted, then Bill flew it out over the beach, rolled it upright, and then went on up to his holding pattern for the start of the race!

The lift was so strong that following the races I saw Rick Walters soaring a quarter midget L'il Toni racer, complete with landing gear and Max.15 up front – but with the engine dead. He raced it up and down the course for ten or fifteen minutes just for pure sport. Any model which could glide would have stayed up. And that meant that the racing gliders could really load up with lead. I was racing my "Led Nalivag" (Del Gavilan spelled backwards) at 5½ pounds – nearly double its normal weight of 3 pounds. Bob Andris doubled the weight of his Peregrine Mk2, and still had excess lift. In my opinion, for the conditions which existed, he had the fastest plane aloft. Unfortunately, he had a midair crash with Jerry Arana, which put them both out of the final race.

Some fifty contestants were entered this year. When the qualifying rounds were over, twenty fliers competed in the semi-final heats. Out of these twenty, three fliers emerged with the same number of points – John Baxter, Sam Crawford, and Joe Corr.

Unfortunately, Sam and John were on the same frequency. They had the option of flying against the clock or, alternatively, one of them changing frequency. The decision was to fly against the clock. It was too bad, because it took away the challenge of head-to-head confrontation on the course. Even so, it was exciting, particularly if you had a watch and could see the comparative times emerge at the end of each lap.

John Baxter, flying a KA-6, won the RCM perpetual trophy for 1971 with a beautiful flight of two minutes and eight seconds. It is the first time that a full potential of the KA-6 has been realized in this annual event – and only because John spent many hours in serious practice with his KA-6.

Second place went to Sam Craw-