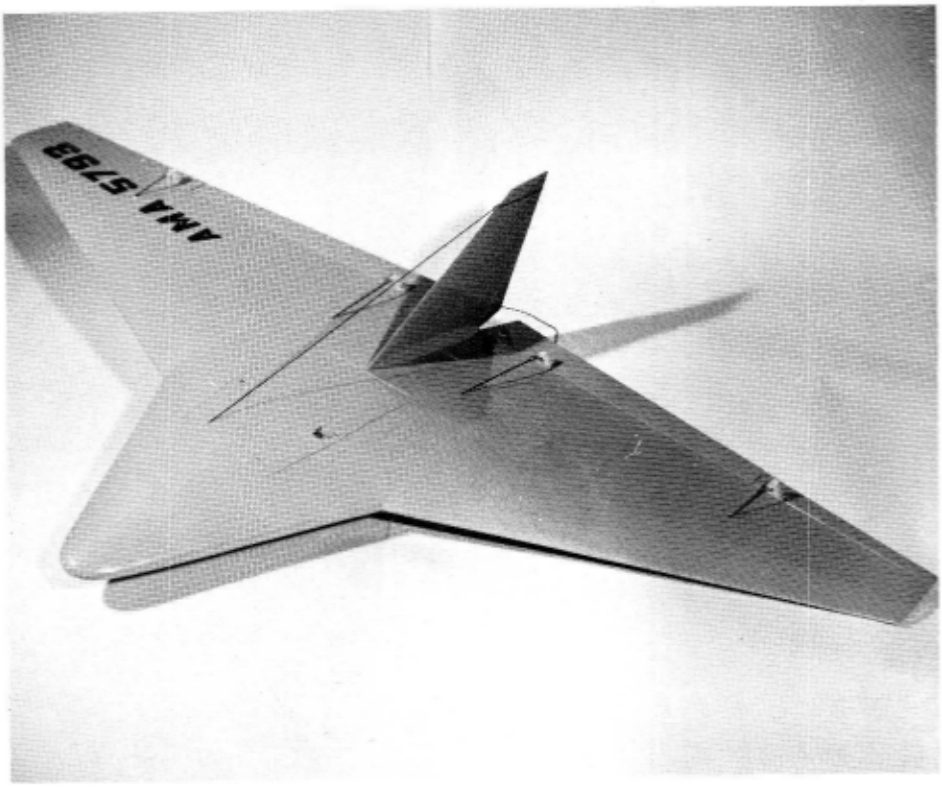
DELTA DIAMOND



Above: A handsome two-channel plane. Might even perform well over flat land with a small engine in nose. Right: Author poses with his highly original design. It is actually among his first RC model planes.

The Delta Diamond was started in November 1970 as a towline glider—Delta No. 1, of the Dyke Delta "JD-2," in platform only. It is a very stable glider, even when carrying extra weights. Delta No. 1 was flown many months to find the balance point, in calm and in winds up to about ten mph. Every time the model came off the 50-ft. towline it would turn and fly with the wind for a short distance then turn back into the wind. On a calm day it would fly in a circle about 150 feet. As this model isn't an A1 or A2 glider, the flights lasted no longer than 15 sec. at the most. I still fly Delta No. 1 but without the extra weights.

Delta No. 2 was an enlarged Delta No. 1 with a 36-in. span. It started out as a towline glider but with additional construction needed for the future installation of the radio gear and controls. It was first flown as a towline glider to recheck the balance point and to see if we could tow it up. It went up at about a 60-degree angle for 15 feet before nosing over into a dive. The tow hook was moved forward one inch and this time it went straight up on a perfect tow. The glide was fast, but not short as with most flying wings.

We towed the Delta up on a 150-ft. line. If the wind was up, the Delta would release with a slight pop-up. As the weight was increased, we had to run faster or wait for the wind to blow. We never did get to the total weight of the RC. Flights were mostly like the flights of the Delta No. 1. The radio was installed after about ten flights. The control setup was coupled aileron and elevator only. Total flying weight came to 28½ oz. which was greater than anticipated.

We tried to hand-tow the Delta up but could not run fast enough, even with the wind helping. I built a powered winch to see if this would help. On the first flight all the winch did was keep the Delta airborne. It seemed as if there wasn't enough power or speed on the winch. We changed the pulleys around and increased the speed of the take-up reel. This time it took off, climbed about 20 ft. and rolled over, doing a spin before releasing. The only damage was a broken rudder. The rudder was glued back on and the tow hook was moved forward another inch. I got in one more flight, only this time the Delta didn't gain any altitude—on release it turned into the ground. Off came the rudder again.

With the rudder reinforced and the tow hook moved back half a inch, we tried it again. Tow off by the power winch this time was good, and the Delta got about 150 ft. up before release. Now I found out I had too much control area in the elevons and landed on the nose this time, without damage. I reduced the elevons to a 3/4-in. wide strip, with a total movement of half an

If Jonathan Livingston Seagull had met one of these in flight, what a pair they would have made! Great flying slope soarer is capable of fancy aerobatics. / by Ed Erfurth

inch on elevator, less on aileron. On the first launch it went straight up again. Only after release and trying to turn did I find I had cut down the controls too much. On landing this time the wing tip hit a small bush causing the Delta to bank up sharply, flip over on its back making contact with the ground while flying sideways, breaking off the rudder. (Delta No. 1 did this same crazy maneuver whenever it hit something on landing.)

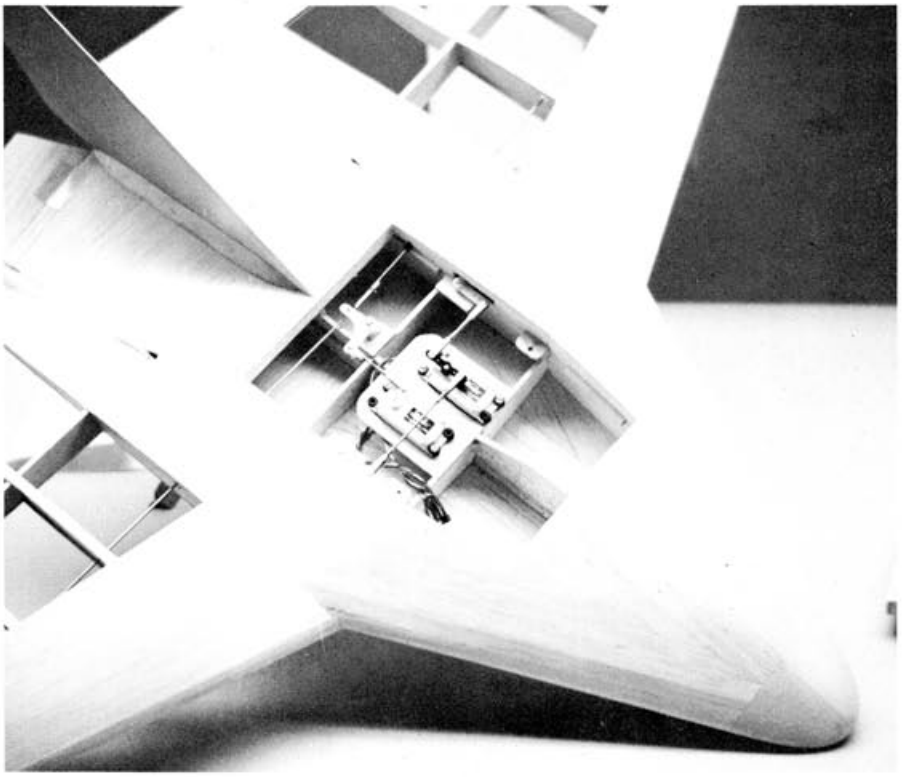
I increased the width of the elevons to 1¼" to see if this would give me more control. This time I took it to a small 20-ft. hill. Launching by myself I found that I could not get on the controls fast enough to keep the Delta up in the lift. It was halfway to the bottom of the hill before I could apply up elevator. This was the first flight with the Delta from a hill. It lasted less than ten sec. On the second flight, the Delta was launched for me so I could keep my hands on the controls. The Delta went out about 50 ft. losing about ten ft. in altitude. The right turn was slow, but it came around alright. I turned the Delta back around to the left to bring it back across in front of me. I kept trying to get more altitude but couldn't. I ran out of air very abruptly and hit a small boulder. The damage was a little more severe this time.

Delta No. 3 is basically the Delta No. 2 with the wingspan increased to 48 in. I also changed the control system to elevator and coupled aileron-rudder. The nose section was also beefed up. I was thinking with the longer wing and the controls set up so I could change them in the field, I would be able to get in more flying time, and the flying speed of the Delta would be less.

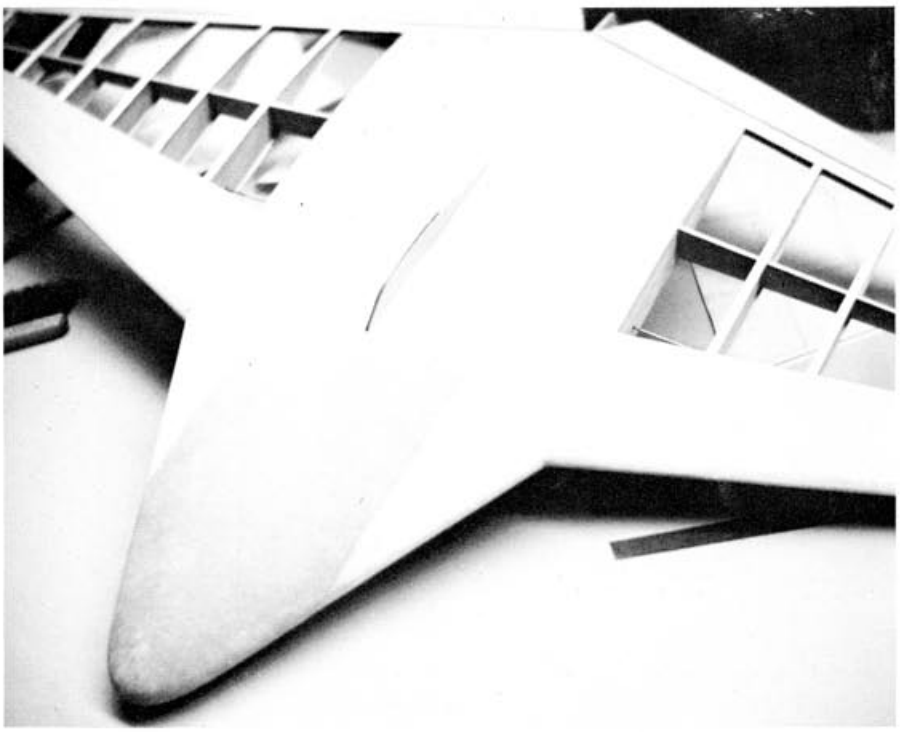
The first flights were at a baseball field on a calm morning. The hill, or slope, is about 15 ft. high. With the nose pointed at a spot about 75 ft. away and a good push, I was able to glide the Delta in a straight line 200 ft. before touchdown. Two oz. of lead weight was added in front of the battery pack before I was able to get a level flight without elevator trim.

Next, the Delta was launched at an angle to the hill to see how the turns would come out. I was able to make "S-turns" before touchdown after five flights. The longest flight that morning was over 300 ft.

We subsequently headed out to the dry lake bed. The launch with the power winch was straight up. On release the Delta was turned back around—or so I thought. It came around fast and dropped its nose at the same time. The only control used was elevator. It turned alright only with rudder trim. On landing I reduced the rudder throw to half an inch either way. Launched again and on release the Delta nosed up into a stall. It just nosed over into a glide. The turn this time was better, but the nose still



Area below nose is protected by skin of celastic—fiberglass could also be used. Note skid for landing and something to hold onto during launching.

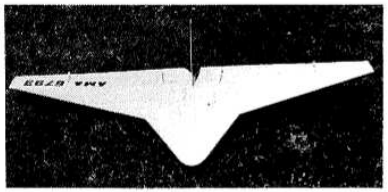


Two servos handle the flight work. A Vector Director from Airtronics could be used to mix servo controls to operate elevon system. (That means two long control surfaces which move collectively and differentially for full control.)

Plans on next page
Text Continued on page 87

DELTA DIAMOND

(Continued from page 31)



The double delta shape is particulary stable during a stall. Airfoil is slightly reflexed for good lift and control.

wanted to head down. Opposite rudder just made the tail come down with little roll action from the ailerons.

On nearing the ground this time I let the Delta land by itself. A wing tip hit a small bush and over it went just like Delta No. 2. The rudder broke off. No more flying that day for the Delta. The following flying session I got in three flights before I lost the rudder. I was still having trouble with rudder control, so I cut the rudder area in half and installed an extra-long control horn on the rudder giving me less throw, now down to 1/4 in. either way. I never touched the aileron controls—they had 1/8 in. up and down.

We later found a more suitable slope from which to fly—it is a 80-ft. high and half-mile-long bluff. The only landing area is the road along the top.

The first flight there with the Delta was very exciting. It was very stable and easy to fly. I could see what the model was doing because I was at the same height. I stayed way out from the bluff, over 75 ft., on this flight. On coming in closer to the bluff, I tried flying back and forth. The turns were mushy. I landed in one piece. I disconnected the rudder and pinned the rudder in neutral.

The next flight was just as good as the first except the turns were now sharp and quick.

After about ten min. total flying time on the Delta off the bluff, I flew at a Hang Glider meet at Torrance Beach, Los Angeles. I flew the Delta for three short flights as there just wasn't enough wind. On the last flight I had radio interference, lost control, and almost hit some people on the beach who were watching the contest. Yes, we did confirm that it was interference by turning on the receiver and transmitter and waiting for it to happen again—it did within one minute. The transmitter was about 25 ft. away—my transmitter that is. We never did find out who was causing the interference.

It was over one month before I could fly again. When I did get to fly, I tried it off the high start—50 ft. of 1/4-in. shock cord and 300 ft. of 30-lb. fishing line. The Delta would go up fast but would do a pop-up on release. I had to hold about half down elevator to prevent this. One time I held a touch of up elevator and it did a loop on release. Back to the power winch for more altitude to see if I could do it again. Yes it would. I tried a roll on the next flight. With full aileron control it dropped about 25 ft. doing the roll. This was the last stunt I ever tried.

The last flight for Delta No. 3 was in 15 mph wind. Damage was not too bad, left wing broke off, nose block was pushed up and back into the center section and the servo mount was broken loose.

Delta No. 4, christened the Delta Diamond by my wife and called the Delta Demon by me, is the same as Delta No. 3. The changes made were heavier bulkheads in the center section and a larger fin. No extra weight had to be added to balance the model this time. This is the model pictured in the photos.

Test flying the Delta showed up a little nose heaviness, but one turn on the elevator clevis corrected this. The flight characteristics were the same as on Delta No. 3. It had good aileron and elevator response.

The Delta has been shown to many modelers. They all liked the small size and one-piece construction. All asked the same question: Why all the dihedral with aileron control? Well, I wanted stability, and with a flat wing the CG would have been high, making the Delta hard to control. So I added five degrees of dihedral in each wing. I also wanted to experiment with different control setups, elevator and rudder, coupled aileron-elevator, coupled aileron-rudder and elevator. I have flown the Delta in all of these modes but have settled on aileron and elevator.

The one-piece construction has many advantages in itself. Most of these show up at the soaring site. No wings to assemble, no rubber bands to break and you can move around with it without hitting anyone with the wings or tail. Also, if the slope is far from the parking lot, just tuck the Delta under one arm and grab your transmitter in your other hand and take off. Nothing else is needed. The Delta's wing is strong so you don't have to worry about the wind breaking it. All you have to do is hang onto it.

Construction

The basic framework is of the egg crate type of construction. Everything interlocks into each other for a very strong structure that can take a lot of punishment.

Cut out all formers and ribs and prefit them together before gluing. Glue the 1/16 x 1/2" strip to the 1/8 x 1/4" TE spar on top only. Glue F5, F8, R1 and R3 together making sure they are aligned correctly and are not twisted. Add R10 and the TE checking that R10 is level. The TE should be straight and not bowed. Glue F1 in place and the 1/4 x 3/4" LE from F1 to R3 on both sides. Glue R3A to R3 checking the top side is the same level as R3. The 1/4 x 1/2" LE is now added to the outer wing panels.

The rest of the formers and ribs are now added to the center section. Add the wing ribs and spars. Finish the hatch frame and install the 1/2" sq. hardwood hold-down blocks and 1/4" triangular pieces to the hatch frame. The 1/8" plywood for the blind nut is glued to R2 and braced with 3/8" triangular pieces. Glue in the 1/16" plywood doublers F4A in front of F4 and the 3/8" triangular braces. The 1/8" plywood skid is glued in with the balsa doublers R1A and R1B. Glue the 1/4" sheet doublers on either side of R1 between F7 and the TE spar. Glue in the tow hook mount 1/4 x 3/8 x 5" hardwood. This completes the framework.

Carve the elevator and aileron from one piece of 1/4 x 2" balsa sheet—to give you the built-in twist. Make one left-hand and one right-hand. Attach them temporarily to the TE. I used small pieces of MonoKote which can be removed later for finishing the construction. Cut out the hatch framework and set aside. Install the 1/8" plywood servo mounting plate and brace with 1/4" sq. balsa along both sides of R1.

Install your servos so you will know how to mount the bellcranks. The bellcranks are mounted on 1/8" plywood pieces and braced with balsa blocks in the center section only. 1/16" music wire is used for the pushrod between the aileron bellcranks. I used Du-Bro Solder Kwik-Links at the end of the 1/16" wire. The pushrods from the bellcranks to the control surfaces are bent 90 degrees and are held in by the spars only. The control surfaces are set up as follows: 1/8" up and down on aileron; 1/4" up and down on elevator. More can be added later for faster response.

Remove the servos and control surfaces and replace the hatch frame. Place small strips of wax paper between the hatch and the center section so that no glue will get in between. Start planking the nose from F1 to F6 first. The top with 1/16 x 1/2" balsa strips and the bottom with 3/32 x 1/2" balsa strips. Note the pattern—this will help bending around the curves. Mark each strip where it crosses over the hatch so you will be able to cut it out later. Finish sheeting the top center tail section.

Before doing the bottom tail section, shape the bottom of the TE spar. The bottom 3/32" sheeting extends over the TE spar in the center section only. Add the 1/16 x 1/2" strip to the bottom TE spar. Glue on the 1/16" sheeting to the top and bottom of the wing LE and the 1/16 x 1/4" cap strips to the wing ribs. Glue on the 1/4" sq. wing tip blocks and the nose block. Sand everything to shape being careful not to sand through the top of the nose section. Cut out the hatch section. For added protection, cover the bottom from the nose to the skid with a six-in. wide strip of Celastic or fiberglass. Cut out the rudder from 3/16" sheet balsa and sand to shape. Glue in position and add the 3/8" triangular braces to either side.

Covering is up to the individual. I covered mine with MonoKote so I could attach the control surfaces to the plane without leaving a gap.

Install the servos, receiver and battery pack. Make sure you have wrapped the receiver and battery pack in foam for protection. Check to see if the balance is correct. Shift the battery pack if needed. Weights can be added to the nose block if you covered it with MonoKote. If not, you will have to add it in front of the battery or receiver. Don't add all the weight to one side. I had to add two oz. to the original model and still my total flying weight came to only 30 oz.

Flying the Delta Diamond on a slope takes an eight to ten mph breeze to stay up. Over this and you will have to start adding weight as the wing loading is very light—about 7-1/2 oz. per sq. ft. Also, when slope soaring, try to keep the nose into the wind. If it should turn around and come into the slope, all you will be able to do is hold full up elevator and hope for the best. Landings just about have to be hands off because you do not have rudder control—if anything, hold down elevator.