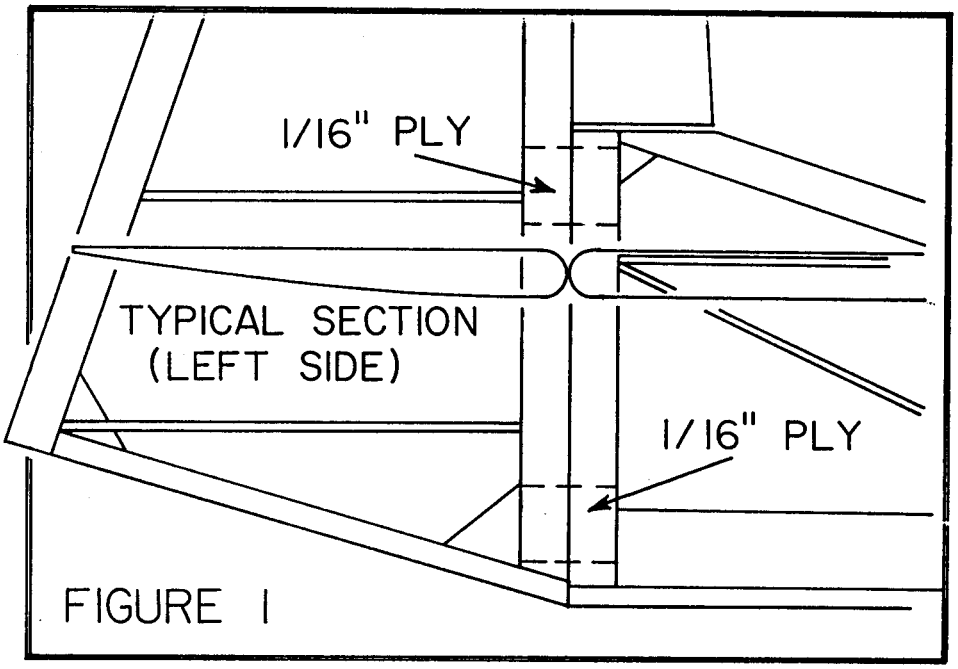
SOME NOTES ON THE CONSTRUCTION OF A STORCH IV

Gregory Vasgerdsian of California's Bay Area is planning to have a Storch IV ready for this year's Richland Scale Fun Fly in May. Gregory has full sized plans for his model, but some questions regarding certain aspects of the design and its construction remain. As some of his questions are relevant to other designs, scale and otherwise, we thought we'd share Gregory's questions and our responses with RCSD readers.

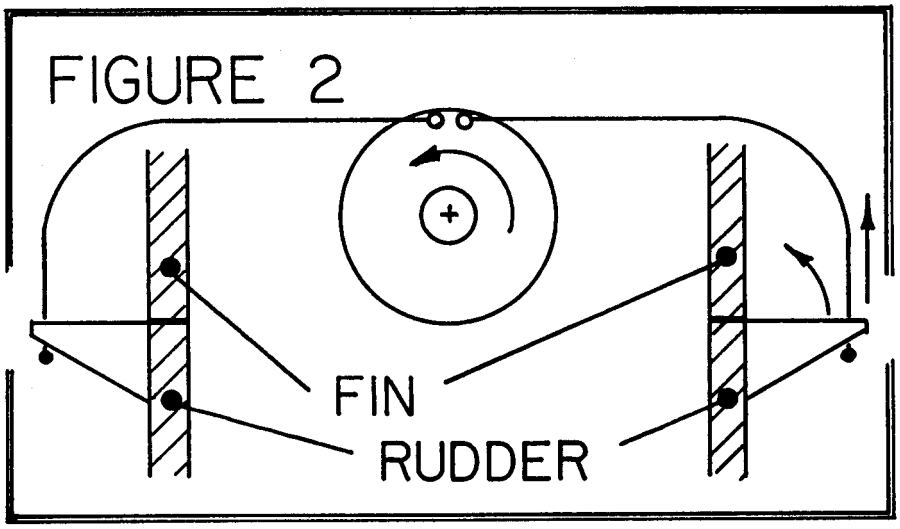
MOVABLE RUDDERS?

Gregory: "The plans show the fin and rudder construction (see Figure 1), which to me looks like the rudders should move, though the plans do not show a linkage to the rudders. Are the rudders supposed to move? How?"



B^2: Yes, the rudders are supposed to move. Swept flying wings with fins and rudders at the wing tips are usually set up so the rudders swing outward only, providing a method of yaw control. This should be the

case with the Storch IV model, as evidenced by the fin/rudder cross-section shown on the plans. Note the flat side of the rudder is outboard. (The cross-section for the right side is opposite to what is shown here.)



A simple method of achieving outward movement only is shown in schematic form in Figure 2. The cable, consisting of light stranded wire enclosed in a small diameter plastic sheath, needs to be free to slide through the control horn when pushed. A small diameter brass tube inserted in the plywood control horn is one way of achieving this. The small stop at the end of the cable then pulls the rudder outward as tension is applied to the cable by the servo.

A second method is to use cord, as one would to operate spoilers.

In either case, the rudder should be held against a stop by a light spring or rubber band so it remains in neutral when not being deflected by the servo.

The intent of the 1/16" plywood inserts shown on the plans is to provide a firm surface through which to install "figure 8" hinges of carpet thread, as depicted in Figure 3. The idea here is to make the hinges, then insert them in the trailing edge of the fin and leading edge of the rudder. This is an older method of hinging.

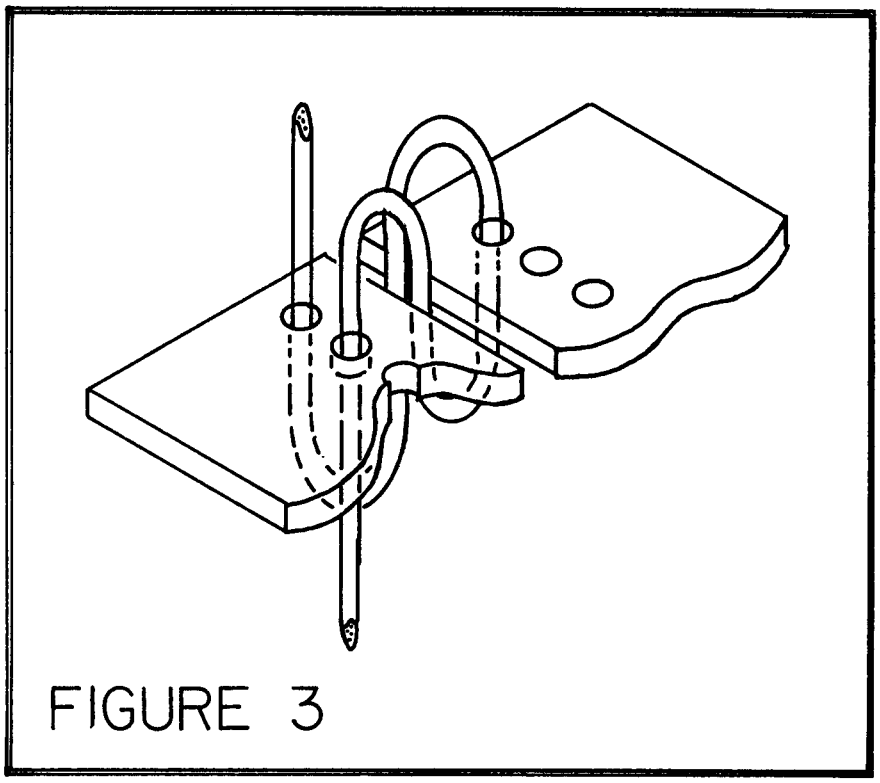


FIGURE 3

Small light conventional metal pinned nylon hinges marked for 1/2A size models can also be used, or, if using one of the heat shrink plastic films, the hinges may be made from the covering material itself. Both of these methods are far less labor intensive than the "figure 8" hinge.

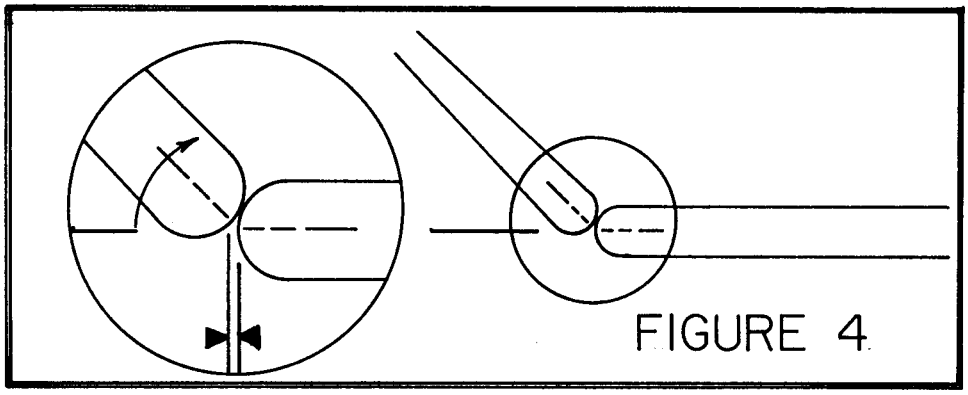
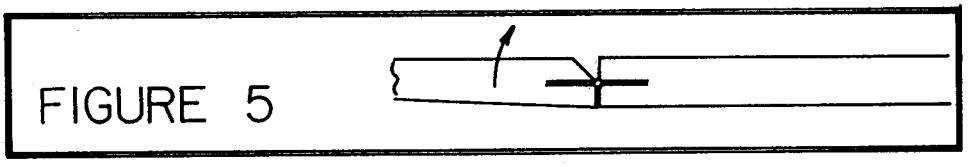
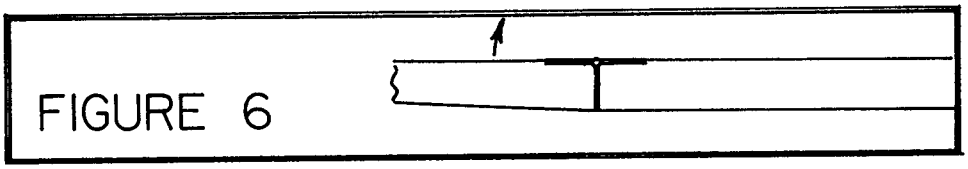


FIGURE 4

The edge contours of the fin and rudder shown on the plans may make it difficult for a hinge of any type to work properly. The underlying problem is shown in Figure 4. The two edges try to rotate apart when the surface is deflected, and this puts a strain on the hinge. We recommend a change to one of the contours shown in Figure 5 and 6. The latter is easiest to build, particularly if using the covering material as a hinge, and has the best appearance; it is also the strongest.





ELEVON CONTROL SYSTEM

Gregory: "The plans show one servo (located in the wing root) to operate each elevon, as I've drawn in (see Figure 7). Since I'm not too familiar with flying wings, I'm not quite sure what will give this model the best control. Use elevons for up and down and the rudders for left and right... Elevons mixed elevator and aileron? (I don't have a radio that will mix this, and a mechanical mixer for this function would be a hassle since the wing will be a two piecer.)"

B^2: We would not rely on the rudders alone to bank and turn the 'ship, as the rudders will generate rotation on the yaw axis only, and any banking will come as a result of sideslip. There really needs to be some method of roll control.

The term "elevon" is a combination of the words "elevator" and "aileron." The two elevons thus control both pitch and roll, and these surfaces operate as both elevators and ailerons. With elevons and the rudders as described previously, control will be through

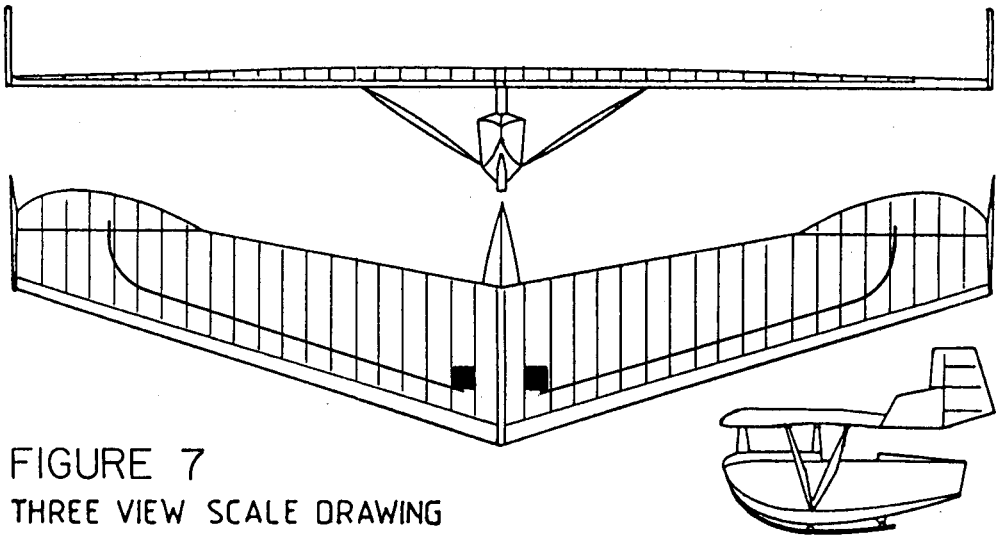


FIGURE 7
THREE VIEW SCALE DRAWING

all three axes. We would recommend this type control system for the Storch IV even if it were not so stated on the plans.

A mechanical linkage would be a complicated affair due to the two piece wing, but there are several solutions to the problem of getting two functions from one control surface:

(1) Use an electronic mixer, like the Christy Mixer (available from Ace R/C for about $35), which can mix any two functions. These mixers plug into the receiver, and the two servos then plug into the mixer. We have not used one of these, but from reports they do work well. Total servo throw as available from one channel is reduced to 50% of normal. The only way to get the left elevon to go to full deflection, then, is to give full "up" elevator and full "left" aileron. Make sure the linkage geometry provides sufficient throw.

With the Storch IV's large fuselage and generous wing thickness, placement of an electronic mixer within the airframe should not be a concern. Hook up the mixer to the aileron and elevator plug on the receiver, the rudder servo to rudder. This will give the controls a feel similar to that of a conventional tailed aircraft.

(2) Rather than purchasing a computer radio which can directly mix aileron and elevator functions, see if the transmitter has both V-tail and aileron/rudder mixing capability. If it does, hook up one elevon servo to the rudder socket on the receiver, the other elevon servo to elevator, then connect the rudder servo to the receiver's aileron socket.

With a Mode 2 transmitter and V-tail and aileron/rudder mix turned on, both elevator (pitch) and aileron (roll) functions will be on the right stick, and the rudders (yaw) will be coordinated with the ailerons. The left stick will control only the roll function of the elevons and there will be no rudder coordination.

If the transmitter has V-tail mixing only, control of the elevons will be through the rudder and elevator sticks, and control of the rudders will be through the aileron stick. This setup may take some getting used to, but is entirely feasible.

(3) A final option (and one which we've never tried in flight) is to use a basic transmitter operating in Mode 2, and hold it at a 45 degree angle to the body, oriented so the elevator and aileron axes are as shown in Figure 8. The elevon servos are connected to the receiver aileron and elevator outputs, the rudder servo is connected to rudder.

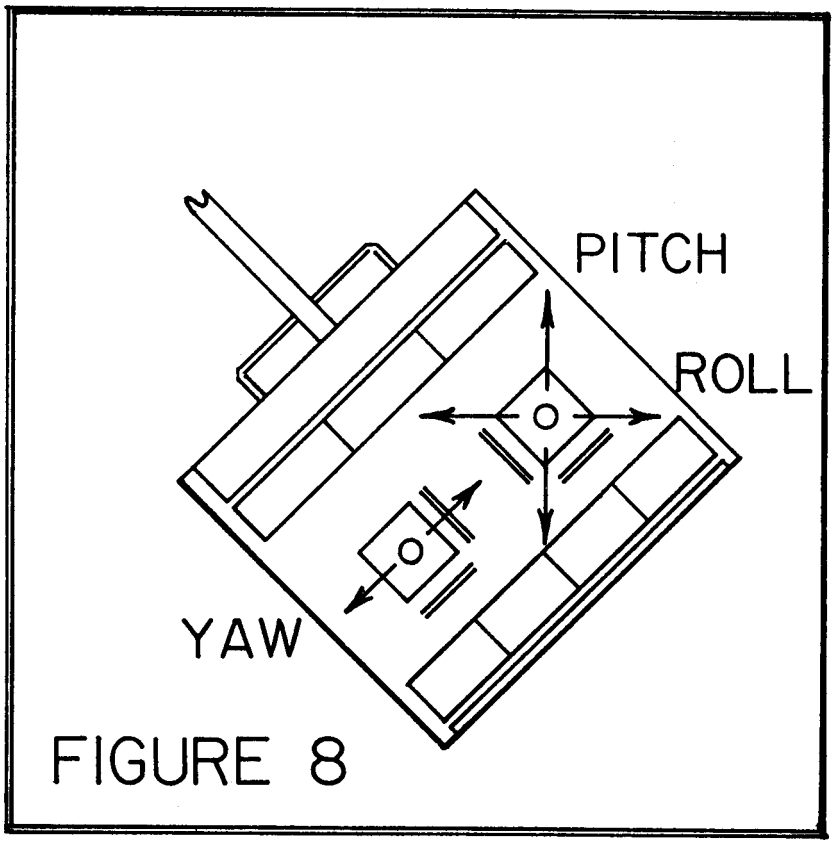


FIGURE 8

With this option, the elevons are controlled from the right stick with shifted axes, the rudders from the left stick with no axis shift. It may take some time to become accustomed to the offset pull of the centering springs on the two sticks, but this method should work well if practiced on the ground first.

ADDITIONAL COMMENTS

We would highly suggest mounting the elevon servos in the wings so the pushrods can connect directly to the elevon control horns. Curved cables give a lot of slop, something which is quite detrimental in a swept 'wing configuration. If there is insufficient room to mount the servos at the inner edge of the elevon, go ahead and mount them as shown in Figure 7, but use a bellcrank system rather than sheathed cables.

The Storch IV should make a good slope 'ship. However, winch or hi-start launches will be impossible as the two required towhooks will need to be mounted on the lower surface of the wing rather than on the fuselage. In this location the struts will get in the way of the bridle's lines.

Gregory plans to have his Storch IV completed in March so he has some flight time on it by the time the Fun Fly comes around in May. As the Storch IV has been a favorite of ours for some time, we are quite eager to see the completed model. This is an exciting project, and we wish Gregory the best of luck in his endeavor.

Photograph from Howard Siepen

EXPERIMENTING WITH A TAILLESS, MOTORLESS PLANE

The wings are arrow-shaped, with a rudder at the tip of each wing, instead of a tail rudder.