On the 'Wing... #120

Mike Carris' Swallow

Mike Carris has built a beautiful swept wing glider for thermal flying. Named Swallow, Mike's sailplane is a high aspect ratio 'wing with winglets.

Swallow, as shown in the included 2-view, has a 122 inch wing span of approximately 1020 in^2. Two inches of the span is due to the fuselage width. The wing has a double taper, with the main taper extending out to within 9.5 inches of the tip; the second taper extends all the way out to the tip. The root chord is ten inches, and the wing main taper gives a theoretical tip chord of 7.5 inches. The second taper removes 1.5 inches from leading edge of the wing tip, giving a true tip chord of five inches. There is no dihedral.

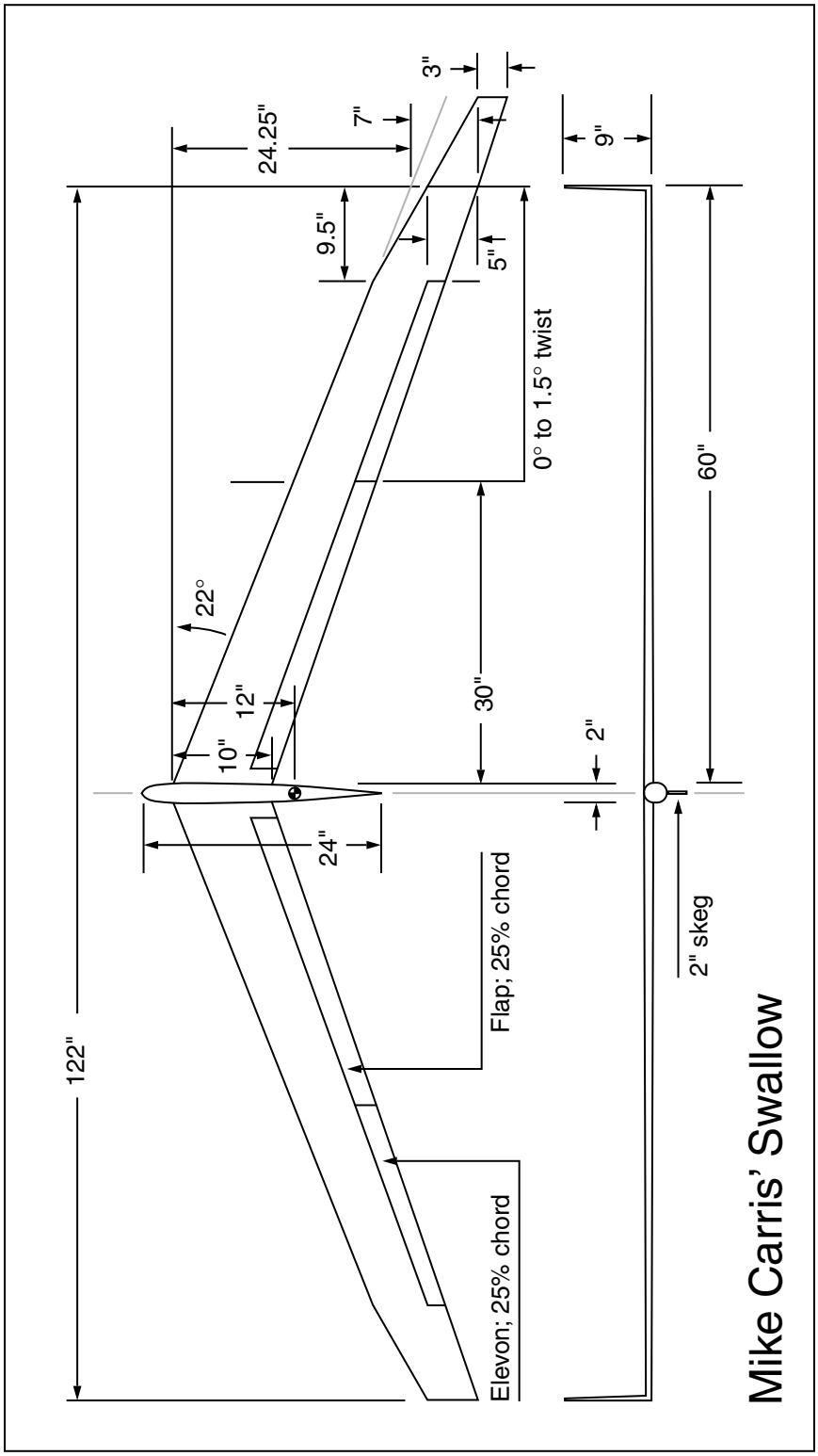
Mike used the EH 2.0/10.0 airfoil across the entire span. Wing twist was computed using a $C_{Lcruise}$ of 0.45 and a quarter chord sweep angle of 21 degrees. The outer half of each wing is twisted 1.5 degrees. The CG is 12.5 inches behind the leading edge of the wing root.

Mike and his Swallow

The center sections have 28 inch flaps of 25% chord. To keep the flaps off the ground, Mike added a two inch skeg to the bottom of the fuselage aft of the CG. The ailerons, also with 25% chord, cover the outer panel up to the beginning of the second taper, 9.5 inches from the wing tip. The winglets have a five inch root and use the same taper as the last 9.5 inches of the wing. They have a nine inch height and a tip chord of three inches.

The fuse is 24 inches long and about 1.5 inches deep. There is a single tow hook which is mounted one quarter inch in front of the CG.

Mike used Joe Wurts' spreadsheet for determining the carbon-glass ratios. Construction consists of one layer of 3.5 oz. unidirectional carbon and


Mike Carris' Swallow
122"
24"
10"
12"
22°
24.25"
7"
3"
9.5"
5"
0° to 1.5° twist
30"
2"
9"
60"
2" skeg
Flap; 25% chord
Elevon; 25% chord

Mike's Swallow and a Laser

3.2 oz. E-glass on a bias over all surfaces. There is also an extra layer of 3.5 oz. unidirectional carbon on the top of the wing root which extends out 12 inches. This fabric is cut to an oval shape. A half inch carbon rod passes through the spar about five inches from the root. The wing is very stiff, and resists bending and torsional loads very well.

Flight behavior borders on exceptional. Swallow is very easy to control once off the line, and performance potential is definitely there. Launching, however, has been quite problematic, as the 'wing consistently veers and tries to roll off to one side. The difficulty during launch is most likely due to two conditions:

• First, the tow hook is mounted to the bottom of the fuselage, a location well below the vertical CG. This creates a lever arm which tends to over-rotate the wing at the most critical time. Moving the tow hook forward can reduce this effect, but only with an accompanying loss of launch altitude. Common methods of solving this problem involve either recessing the single tow hook or mounting two tow hooks to the underside of the wing. The latter solution dictates use of a bridle, but has proven to be extremely effective.

• A lack of anhedral is a second factor in the poor launch dynamics. Yaw-roll coupling in swept wings becomes more intense as C_L gets higher, as during launch. Anhedral (negative dihedral) would both reduce yaw-roll coupling and lower the CG on the vertical axis.

Mike's Swallow is currently unflyable due to damage received during launch. While the damage is fixable, Mike has instead moved on to a swept wing tailless RC-HLG. He does, however, have plans for another, somewhat smaller, Swallow.