The Carbon Dragon Foot Launch Sailplane

By Jim Maupin

Jim Maupin of Harbor City, California is well known for his "Woodstock" and "Windrose" sailplanes. The "Carbon Dragon" foot-launch sailplane is another challenge that Jim has been working on the last few years. Jim was kind enough to open his design notebook giving Technical Soaring readers a preview of the project. By summer of 1986 fabrication of the Dragon was well along with first flights scheduled for later in the same year.—Ed.

THE CARBON DRAGON

The goal in designing and building the Carbon Dragon was to try and bring foot-launch glider performance up into the lower range of sailplane performance.

It is basically a conventional wood structure with judicious use of carbon fiber/epoxy composite in certain areas to a.) save considerable weight, most specifically in the spar caps, and b.) to achieve the necessary stiffness not possible with wood as necessary for the flaperons.

WING

The Carbon Dragon airfoils were developed by Irv Culver and the wing specifics are as follows:

Span 44 ft.	Area 150 ft^2
Root Chord 50 in.	Tip Chord 22 in.
Taper Ratio 2.72 to 1	Aspect Ratio 12.9

Thickness Ratios:

Root T/C=22%

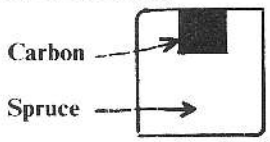
19% of semispan T/C=19.3%

Tip T/C=13.6%

The wing utilized full span, 30% chord flaperons. As flaps, they operate from 12° down to 4° up. As ailerons they operate from 4° down to 24° up.

The flaperons are driven at the inboard end only, by push rods inside the fuselage. To be stiff enough for this arrangement they had to be made of carbon fiber.

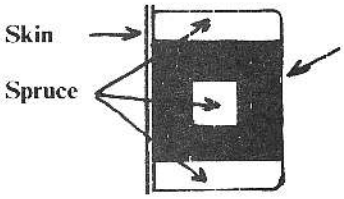
The flaperon spar caps and ribs are made of 5/16" square spruce notched on a table saw with .01 sq. in. of carbon/epoxy laid in the notch.



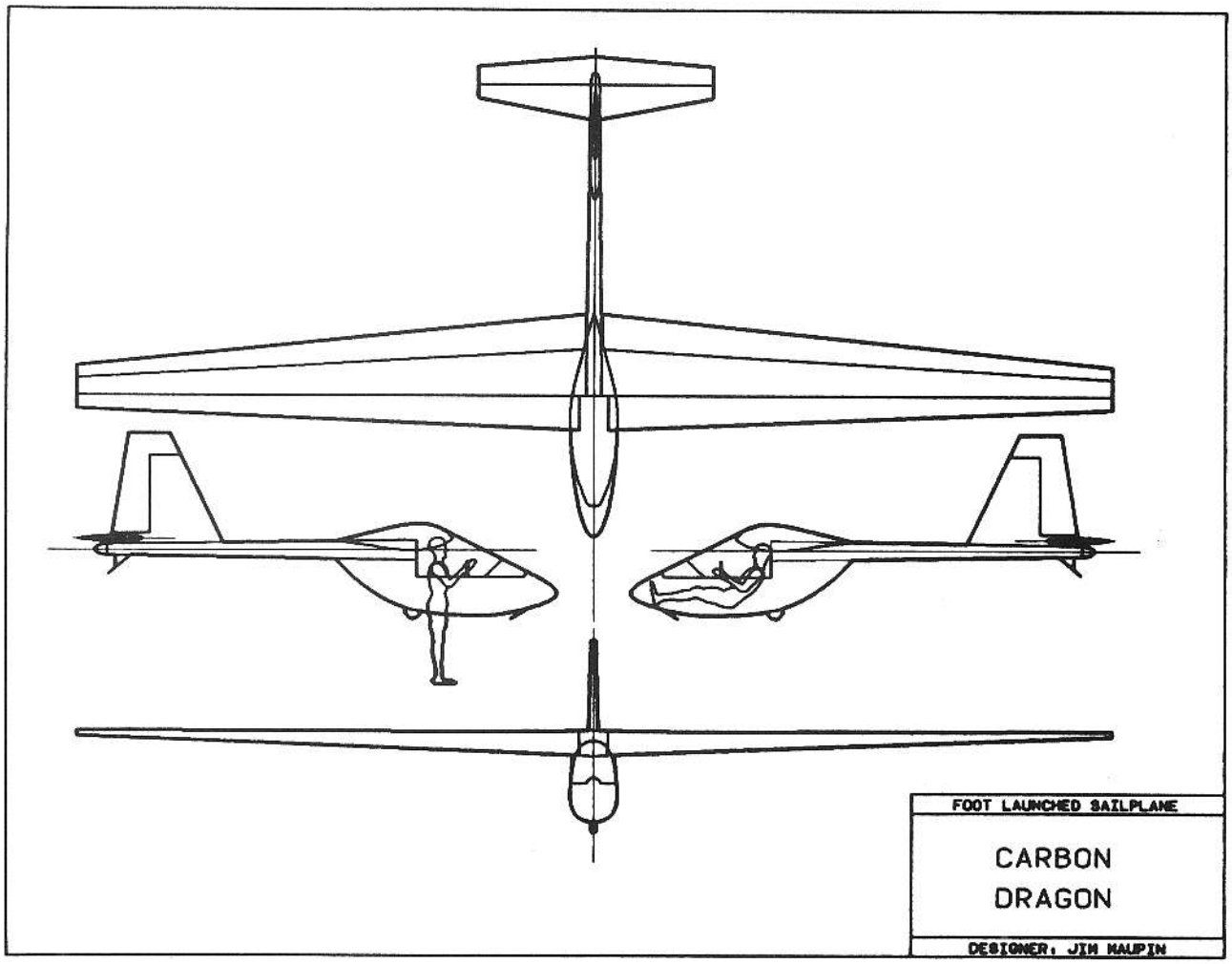
Section View
Flaperon Spar Cap

The ribs are mounted 45° to the flaperon spar to achieve torsional stiffness. The structure will be covered with lightweight Dacron at 45°.

The wing spar caps are carbon/epoxy in a box shape to prevent buckling. They have s spruce core.



Section View
Wing Spar Cap



Ribs forward of the wing spar are sawn from 1/4" 5-ply mahogany. Ribs between the spars are 5/16" spruce, notched for lightness.

Rib Sections

All forward of the flaperons are located on 21.3" centers. The wing spar shear web and "D" tube closure are 1/32" birch ply. The "D" tube will probably be supported additionally with 1/2" foam ribs spaced between the wood ones.

TAIL BOOM

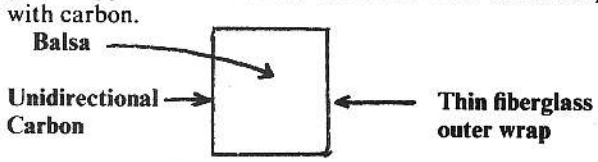
The tail boom is made of four carbon/epoxy longerons, 1/4" ply wood rings on 17" centers, and a carbon fabric shell. It is elliptical in cross-section, 10" by 7.75" at the forward end, and 5.5" by 4.5" at the tail. The outer shell was laminated in two halves within a female mold, the structure installed in one half, and the second shell half joined.

TAIL SURFACES

The tail spar caps are 5/16" square wood with carbon added in the high stress areas. Forward of the hinges, ribs are 1/4" ply sawn. Aft ribs are 1/4" square spruce, notched for lightness again. Control hinges are molded of carbon/epoxy.

PILOT POD

The forward fuselage will be built up by the stick and gusset approach. The sticks are to be balsa cores wrapped with carbon.



Section View

The pilot pod will be skinned with Dacron covering.

FOOT LAUNCHING

The plan is to have doors that open for foot launch. When closed, a small wheel in one door becomes the landing gear. The idea is to allow as versatile a launch range as possible. Foot, auto tow, bungee, horse, motorbike, ultralight aerotow, six Boy Scouts, etc.

WEIGHTS

The following are educated target weights:

Horizontal tail	7.0 lbs.
Vertical tail	5.0 lbs.
Fuselage	38.0 lbs.
Wings at 30 lbs. ea.	60.0 lbs.
Empty	110.0 lbs.
Payload (pilot)	190.0 lbs.
Gross	300 lbs.

Using these weights, the aircraft is stressed for 7.5 g's ultimate and 5.0 limit load.

PERFORMANCE

The following performance figures assume the wing is kept quite clean and smooth and the undercarriage doors and canopy fit well, at a wing loading of 2 lbs./sq.ft, gross/span^2=.155 lbs./sq.ft.

Takeoff speed in 0 wind 19.7 mph (obviously there is no intention of launching into "0" wind). Minimum sink is 1.76 ft./sec. at 30 mph with max L/D about 25:1 at 34.6 mph. The Vne is 80 mph.

The thermalling circle at 45° bank is 35 mph and R=82 ft. Circling with 45° bank at 30o mph give a R=60 ft. A complete circle is expected to take 8.6 seconds.

FUTURE

As this is written (early 1986) the Carbon Dragon was expected to fly in the summer of 1986. One of the possible experiments with the Carbon Dragon will be the installation of vortex generators (full span) just forward of the flaperons. Calculations and wind tunnel data indicate they could considerably improve the low end of the envelope, with minimum or no penalty at the upper end.