On the 'Wing... #116

CO8 Part 2 - The Airframe

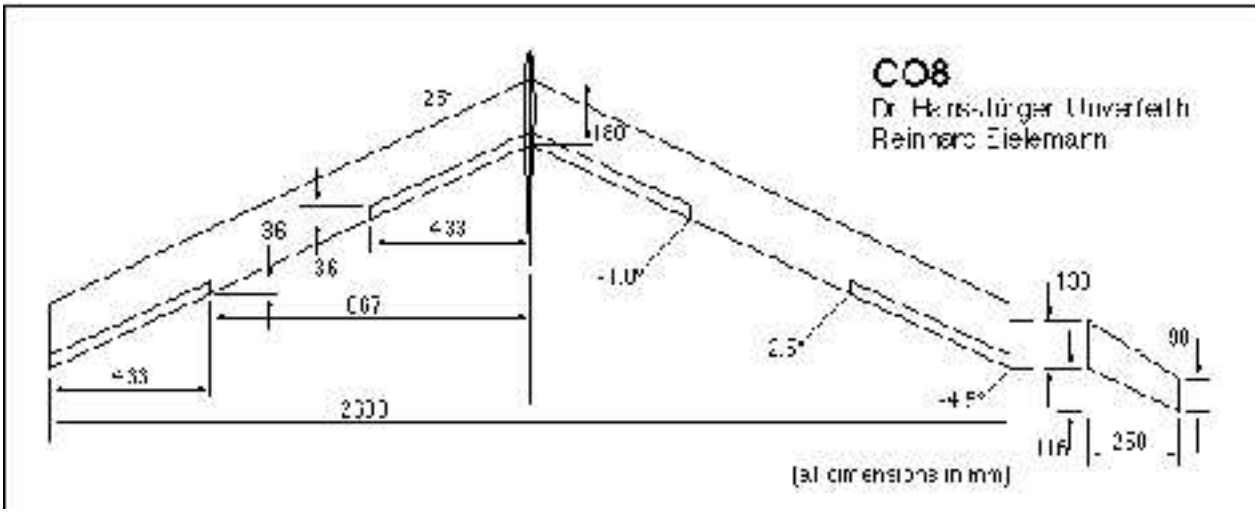
Last month we described the airfoil used on Hans-Jürgen Unverferth's CO8, the RS004A. This month we will make some comparisons between CO8 and other models in the CO series, particularly CO7, its direct predecessor.

Sweep

The first and most obvious difference between CO8 and most of the other models in the CO series is more sweep back. The early CO models used 18 degrees of sweep. The EH 1.0/9.0 section, with its near zero pitching moment, allowed use of just one degree of twist on these earlier designs, despite the shallow sweep angle. Changing the airfoil to the RS004A, with its significant negative pitching moment, would have ordinarily dictated a very large increase in twist. To keep wing twist from being too severe, the CO team increased wing sweep to 25 degrees. This is the same wing sweep as on CO7, which uses the RS001 airfoil, another section with a moderate negative pitching moment.

Dihedral

Many of us have designed aircraft using visual cues rather than mathematical formulae. Unfortunately, this method seldom works well when designing tailless aircraft. While designing CO8, much care was taken to determine effective dihedral within certain flight regimes. This is because effective dihedral is directly related to sweep angle and lift coefficient. Effective dihedral increases with increasing sweep and increasing lift coefficient. (We are currently writing a comprehensive article on effective dihedral which will appear in a future issue of *RCSD*.) CO8 uses one degree of anhedral to counteract the adverse effects of excess effective dihedral.



	CO8	CO7
Span	2600 mm, 102.36"	3300 mm, 129.92"
Chord, root to sta. intermediate tip	180 mm, 7.1", to sta. 1300	220 mm, 8.7", to sta. 1290 180 mm, 7.1", at sta. 1550 100 mm, 3.9", at sta. 1650
Wing area	46.8 dm^2, 725.4 in^2	70.0 dm^2, 1085 in^2
Aspect ratio	14.4	16.5
Airfoil	RS004A	RS001 series
Wing twist, root first sta. second sta. third sta.	0.0 degrees, sta. 0 -1.0 degrees, sta. 433 -2.5 degrees, sta. 867 -4.5 degrees, sta. 1300	0.0 degrees, sta. 0 -2.1 degrees, sta. 1290 -2.6 degrees, sta. 1550 -3.1 degrees, sta. 1650
Sweep angle	25 degrees	25 degrees
Dihedral	-1.0 degrees	0.0 degrees
Construction	moulded composite of fiberglass and carbon fiber, with carbon fiber spar	moulded composite of fiberglass and carbon fiber, with carbon fiber spar

Winglets

Hans-Jürgen, in his book “Faszination Nurflügel,” devoted several pages to the results of research on winglet shape, size and location. CO8 benefits from that research. Rather than covering the entire wing tip, the leading edge of the winglet root is 50mm behind the wing leading edge. As in previous CO versions, the trailing edge of the winglet is simply an extension of the trailing edge of the wing, and both are swept 25 degrees.

Aspect Ratio

CO8 is smaller overall than CO7, both in span and average chord. CO8 forgoes the multi-taper wing of CO7 and uses a constant chord planform, as CO2. There is also a small decrease in aspect ratio, from 16.5 for CO7 to 14.42 for CO8. This makes it easier to construct the stiff structure required.

Trim and Performance

As is usual with tailless sailplane design, wing twist is based on $C_{Lcruise}$ and the static margin. For CO8, wing twist was based on a $C_{Lcruise}$ of 0.35 and a static margin of 7.5%. Flying at a gross weight of 1400 g, the wing loading is 30 g/dm2 (9.8 oz/ft^2). The best glide ratio (L/D_{max}) is 22.5, a very respectable

value. What is surprising, however, is the minimum rate of sink, V_{ymin}, which is reported to be just 0.356 m/sec (14”/sec)!

Hans-Jürgen’s promise of CO8 being an excellent performer has certainly been fulfilled.