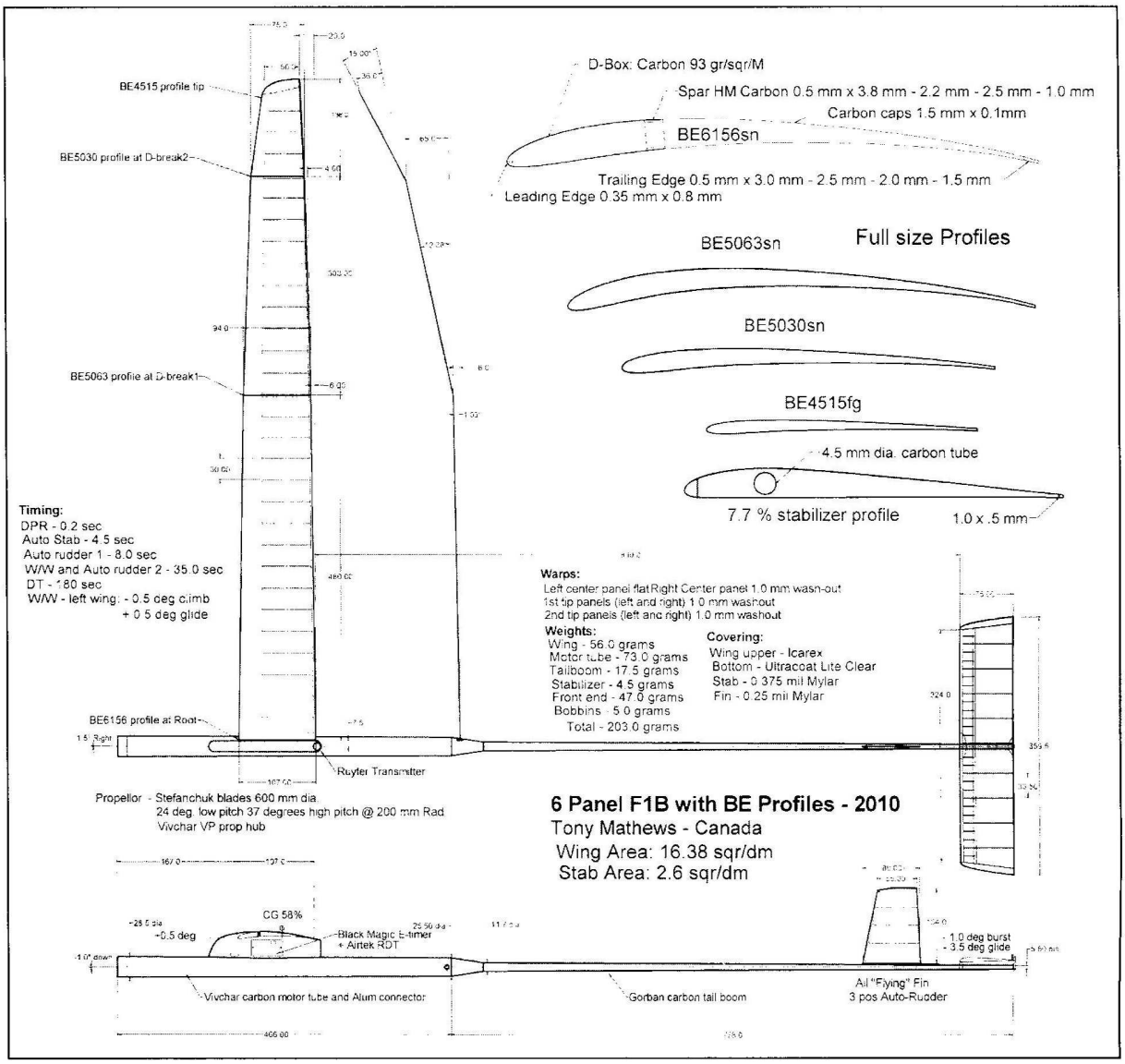
Tony Mathews

Mathews' Low-Drag F1B

This model began with a series of email communications with noted Canadian aerodynamicist Brian Eggleston in early 2008. I was looking to design a new model for the upcoming World Championships in Croatia and was originally curious about the possibilities of a flapper for F1B. To begin with Brian requested coordinates for the "gold standard" of F1B profiles, the Andriukov AA-29 section, which Alex kindly provided. This was analyzed using the X-foil program and naturally was found to be a very good section. Brian created a basic simulation that analyzed the burst and the cruise height gain, and then added the estimated sink rate for a generic wing to create a total performance estimate. The result of the flap investigation showed that the potential gains were very small (2 meters in height for example) which didn't seem to be worth the extra complexity of the flap mechanisms.



I then asked Brian to look at modifying his new low-drag F1A profiles for use as an F1B profile. The first investigation showed that while the low-drag BE airfoil produced a useful height gain during the burst, the cruise suffered as the low camber limited the lift available for the climb at slower speeds. The glide also was inferior to the AA-29 profile. Brian then began to modify his F1A airfoil to create a profile that had superior sink rates to the AA profile. The result was the BE6156 and then the slightly improved BE5063. Both profiles look far more conventional than the original BE F1A profile, but according to X-foil, should have some useful characteristics. The sink rate should be slightly better than the AA-29 profile, and the best glide is obtained when the profile is operating well below the stall angle, giving a useful amount of inherent stability. This should allow us to fly the model close to the best glide angle at all times even in windy or turbulent conditions. With conventional F1B profiles, the best glide angle occurs very close to the stall. As a result, you must either reduce the decalage or move the C.G. forward to fly safely in wind or turbulence. Thus the performance is reduced in those conditions.

Brian detailed his work on these profiles in his 2010 NFFS Symposium article "A Look at Airfoils for F1B Category Models".

The wing layout was designed t be similar to Alex's new 6-panel wing design, bu the chords were significantly increased towards the tips as it was determine that it might be possible to use a smaller than typical stabilizer (2.6 sq./dm versus 3.0 sq./dm).

The wing is very high aspect ratio, with a span of over 1.8 meters. Th dihedral angles were also increased to create more stability for goo thermal behavior.

The BE6156 was chosen for the root profile as we essentially "chickened out" from using the very thin BE5063 at the center of the wing! We decided to transition to the thinner BE5063 at the first dihedral break (note: both airfoils share the same upper surface shape). After estimating the Reynolds number at the remaining wing breaks, Brian developed two new profiles, the BE5030 and the BE4515 for the second dihedral break and the tip respectively. These had reduced camber and a significant lower leading edge "chin" to reduce undersurface separation at the low Reynolds numbers of the high aspect ratio wing.