A Research into and the Designing of the 'Ideal' Hydrofoils for a Laser

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Introduction Hydrofoiling is the concept of lifting a vessel out of the water, reducing its resistance and therefore reducing the thrust needed to maintain a constant velocity. For the Laser, a small sailing boat, one set of foils was already available, focusing on ease of use. In our research and design, the goal was to achieve optimal performance, which means our foils would perform better, but require more experience to use. Experimental Setup Our research was conducted with the CFD-software XFLR5. The Reynolds number, Mach number and NCrit were altered in order to simulate in the right circumstances. The effects of different parameters of the wing profile on the performance of a foil were investigated extensively and by reviewing these results and inflicting our design choices onto them, the ‘ideal’ wing profiles in 2D and subsequently the ‘ideal’ 3D-shape was formed. ‘Ideal’ in this case means best meeting the design choices formed at the start of our research. Results Table 1 – Properties of the foils Lifting foil Stabilising foil Wing profile NACA 7311 NACA 0011 Span (m) 1.2 0.50 Chord length in the middle (m) 0.24 0.10 Chord length at the tips (m) 0.06 0.025 Angle Variable angle between 0 (during flight) and 5.5 degrees (at take-off) Permanent angle of 6.725 degrees The simulations show that a Laser with these foils will start to take off at 2.1 m/s, which is a 30% improvement from the existing foils for the Laser. Conclusion According to our simulations, the design presented above will perform better than the existing foils for the Laser when they are handled by someone who is able to operate within relatively small margins. To verify the results of our simulations, a prototype is being build by us with help of several sponsors.

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