Labor Windkanal/Strömungsmesstechnik

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Optimization of a Test Rig for Aerodynamic Drag Measurement with Further Explorations of a Fuselage Rump

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https://hps.hs-regensburg.de/las39261/

1. Goals

Concerning dead water aerodynamics relevant to trailing structures such as the fuselage rump of a gliding model this bachelor thesis (LWS-BA-17/133) pursues the issue of reducing aerodynamic drag forces. Furthermore and as a premise for profound analyses upon the test model *Cyclone CY* the improvement of constructional and aeroelastic indulgences constitutes a consequent additional task.

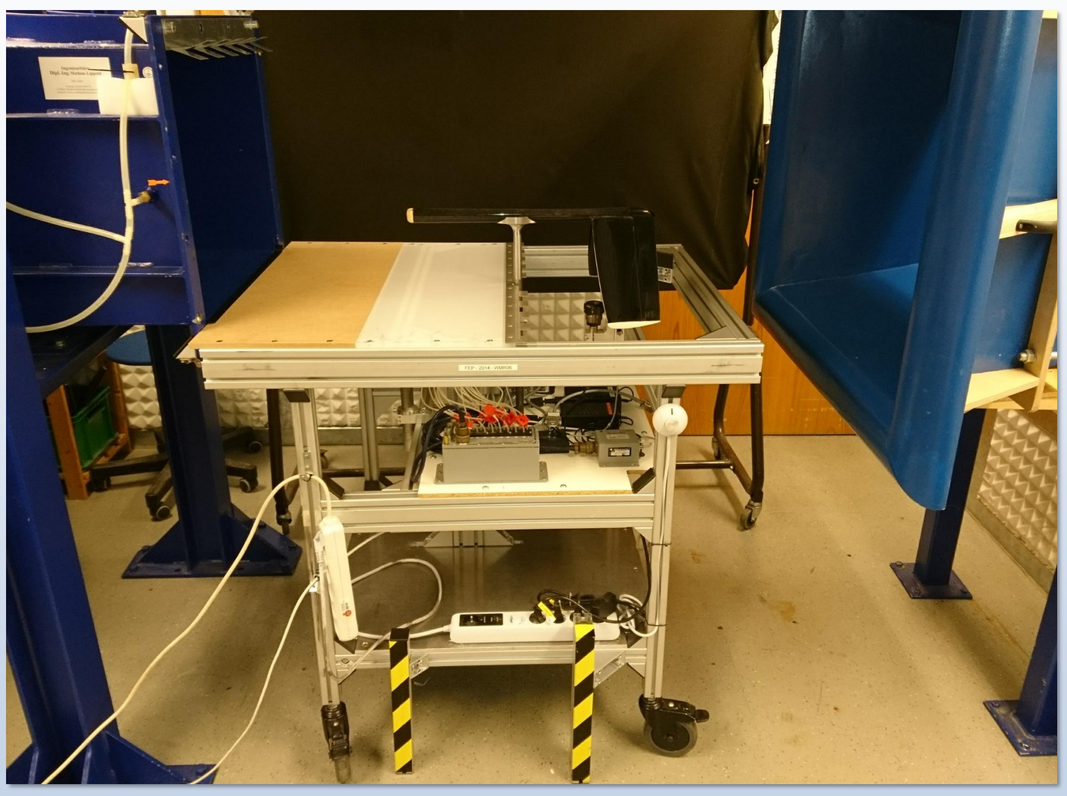

Fig. 1: Final test rig FEP-WMR06 with open, chevron-trailed surface and solid supports.

2. Improvement of the Test Set Up

Substituting several components of the former test set-up the inherent stiffness could be increased by a factor of 163, empirically proven by investigating bending deformations under defined stress previous and subsequent to the enhancement.

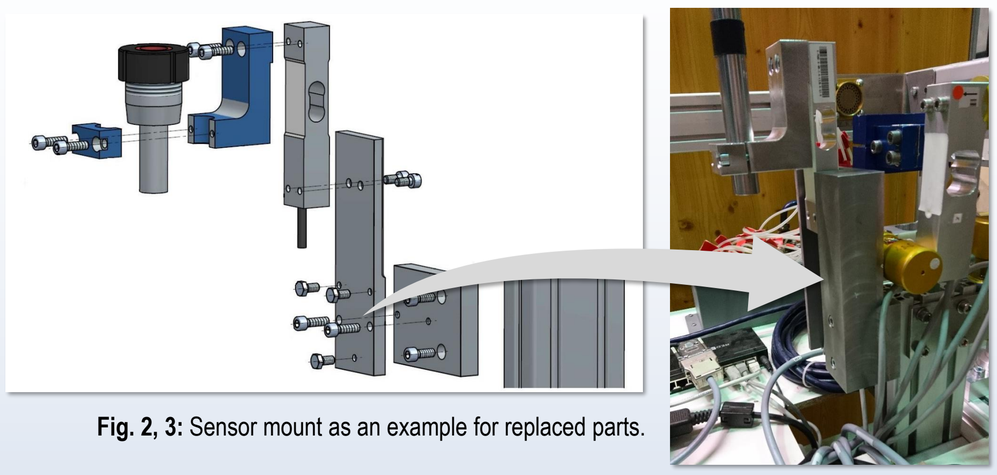

Fig. 2, 3: Sensor mount as an example for replaced parts.

A rather cause orientated approach led to the manipulation of miscellaneous aspects pertaining to the air stream pattern affecting the trailing section and the V-tail respectively. Thus,—to give two examples—on one side the mounting position of the model has been altered ensuring a more laminar air flow to reach the rump, on the other hand margin turbulences of the measurement section have been alleviated deploying vortex generators, so called Seiferth wings.

Fig. 4: Flow behind the Seiferth Wing harnessed at the open test section.

3. Fog Visualization

In view of measurements conducted later on, a fog visualization had been supposed to reveal the existence of dead water regions trailing the fuselage's very end.

As one can easily observe, upstream springing fog unveils an area of surface bound vortices, known as dead water region, when approaching the tail with the probe.

Fig. 5: Exploration of flow patterns applying a fog probe, with outlet held at some distance…

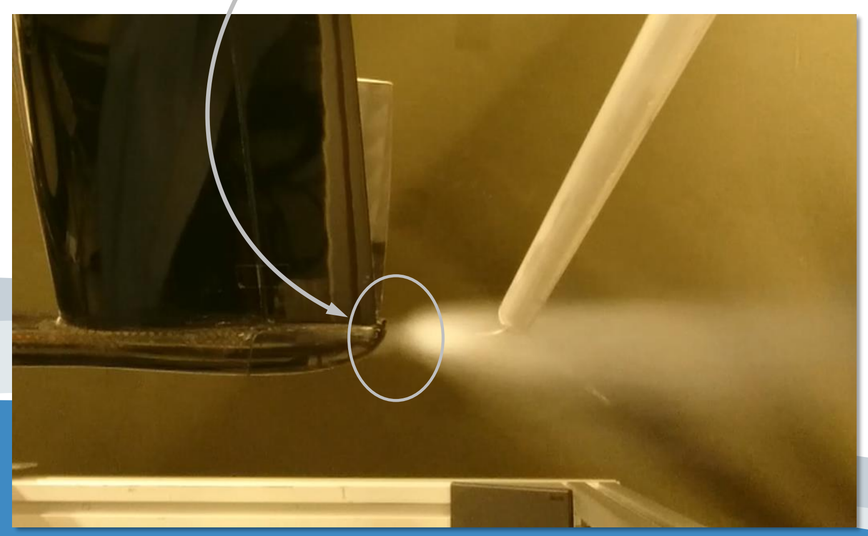

Fig. 6: …and closer to the tail.

4. Measured Results

While on the one hand results issued in the preceding thesis could be widely verified on the other hand several novel modifications have been scrutinized. Among them completely new designed rumps were attempted, regrettably omitting positive effects.

Albeit, it has been able to realize a scientific and methodical procedure of conducting measurements upon the rump eventually evidencing the effect of a moderate sized splitter plate that has already been deemed as useful before. Hence this modification lowered the C_D value by 2.9 drag counts, referred to the original *CY* tail.

Fig. 7: One of the new tail geometries.

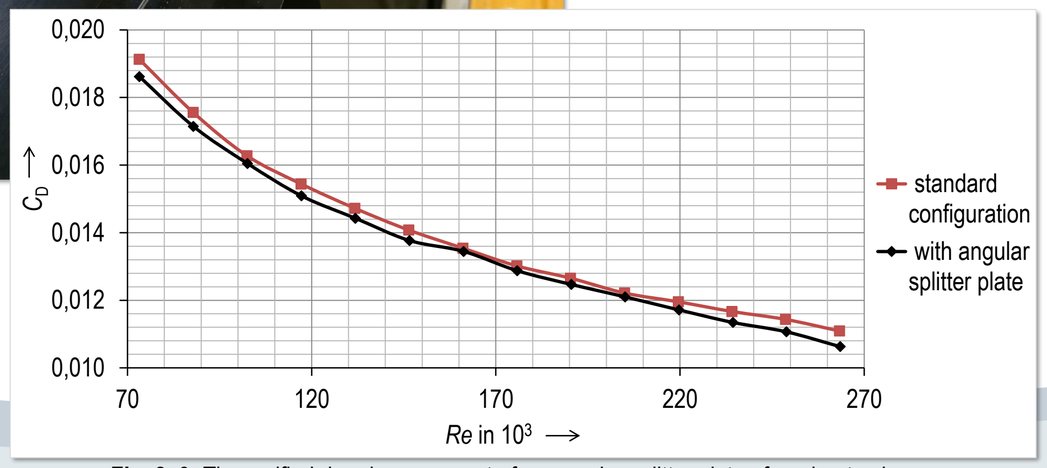

Fig. 8, 9: The verified drag improvement of an angular splitter plate of moderate size.

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