Abstract Submitted
for the GEC11 Meeting of
The American Physical Society

Experimental study and numerical simulation of flow separation control with pulsed nanosecond discharge actuator GUISEPPE CORREALE, ILYA POPOV, ANDREY NIKIPELOV, SERGEY PANCHESHNYI, SEO HULSHOFF, LEO VELDHUIS, ANDREY STARIKOVSKIY, NEQLAB TEAM, TUDELFT TEAM — Active flow separation control with a nanosecond pulse plasma actuator, which is essentially a simple electrode system on the surface of an airfoil, introducing low-energy gas discharge into the boundary layer, with little extra weight and no mechanical parts, was performed in wind-tunnel experiments on various airfoil models. In stall conditions the significant lift increase up to 30% accompanied by drag reduction (up to 3 times) was observed. The critical angle of attack shifted up to 5{7 degrees. Schlieren imaging shown the shock wave propagation and formation of large-scale vortex structure in the separation zone, which led to separation elimination. The experimental work is supported by numerical simulations of the phenomena. The formation of vortex similar to that observed in experiments was simulated in the case of laminar leading edge separation. Model simulations of free shear layer shown intensification of shear layer instabilities due to shock wave to shear layer interaction.

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Date submitted: 22 Jul 2011 Electronic form version 1.4