CEAS/KATnet Conference on Key Aerodynamic Technologies, 20-22 June 2005, Bremen, Germany

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Title of Paper

Experiments to Plasma Assisted Flow Control on Flying Wing Models

For Presentation as

⊗ Oral Paper □ Poster

Topic Category

Advanced Flow Control Technologies / Aerodynamics of Novel Configurations

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Requirements for Oral Presentation

□ Overhead Projector ⊗ Video Beamer □ Slide Projector □ Any Others (Please Specify)

16 November 2004 B. Göksel

Date Signature

ABSTRACT FORM

Title: Experiments to Plasma Assisted Flow Control on Flying Wing Models

Author(s): B. Goeksel, I. Rechenberg

Organisation: Institute of Bionics and Evolutiontechnique, TU Berlin

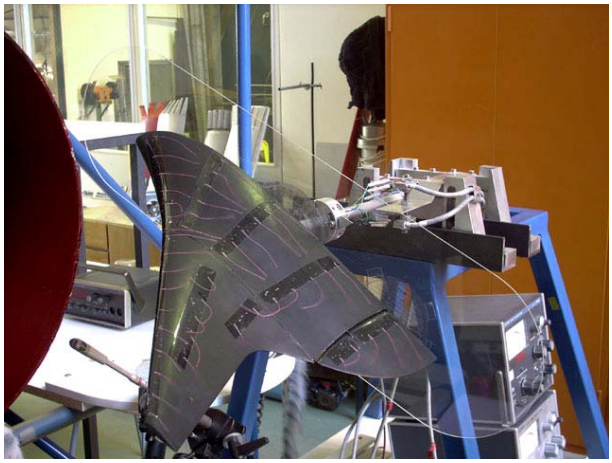
Text (between 400 and 500 words including key figure(s)):

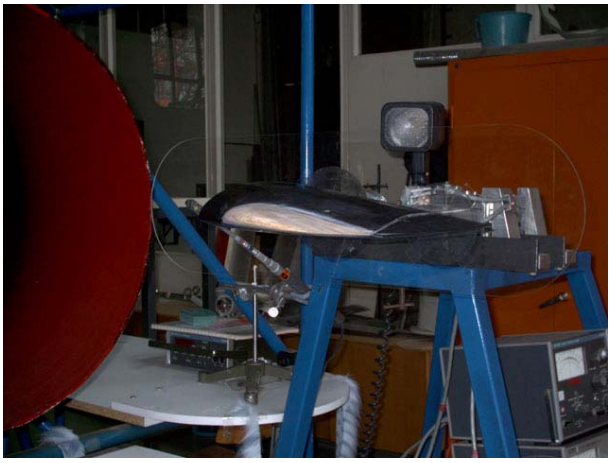
The paper shall present results of on-going experiments to plasma assisted flow control on bionic flying wing models with Eppler E338 airfoil, currently under development at the Institute of Bionics and Evolutiontechnique, TU Berlin.

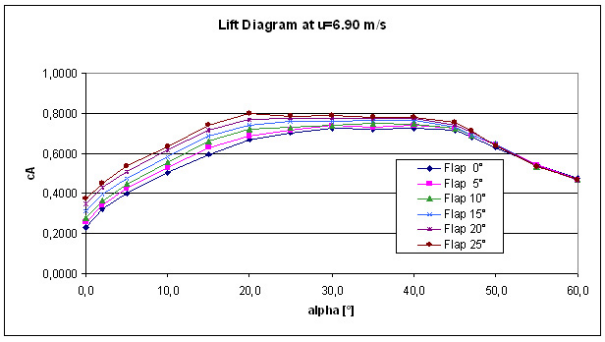
First results with a 2D-wing using the E338 airfoil will be presented at the 14th International symposium of the German working group in fluid mechanics STAB in November 2004 in Bremen. Experiments with the 2D-wing demonstrated the effectiveness of the plasma actuator at low Reynolds numbers occurring on the outer wing of the mini flying wing model.

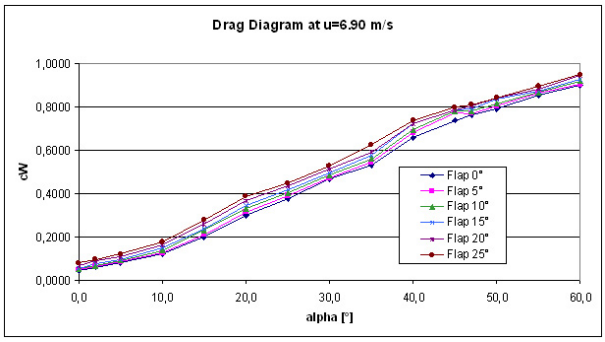
The plasma actuator can produce a quasi-steady or unsteady 2-D wall jet in the flow direction along the surface of the airfoil and thus add momentum to the boundary layer. This can be used to delay laminar flow separation on the leading edge at low Reynolds numbers. Each actuator consists of two metal electrodes separated by a dielectric layer as part of the airfoil surface. Sufficiently high voltages (at low radio frequencies in the kHz-range) supplied to the actuator causes the air to weakly ionize at the edges of the upper electrodes exposed to air. Several actuators can also be combined to generate travelling electrostatic waves by phase shifting to transport the weakly ionized air downstream or upstream. The first experiments have proven that plasma actuators in travelling wave mode can be used for steering without using any moving part like flaps. These actuators effectively acts like a “plasma field flap” but are missing the complexity of mechanical flaps. In this mode, the air flow can be actively separated and reattached locally, e.g. on the outer wing.

Figures and diagrams of 3-D wing (to be presented at CEAS/KATnet Conference):









Figures from STAB-Paper with 2D-wing – November 2004: Wing with plasma actuator.