

AVIA-INVEST 2014



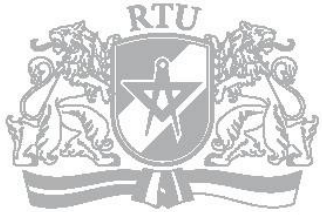
ESTOLAS PROJECT

Experimental research of aerodynamic characteristics of the ESTOLAS hybrid aircraft

Authors: *A. Urbahs, D. Titovs, A. Barovs, A. Aleksandrovs, S. Lučkinskis, K. Eglītis*

Speaker:
Sergejs Lučkinskis
Institute of Aeronautics

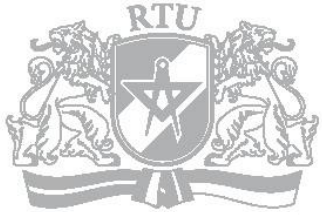
April 10-11, 2014. Riga, Latvia



Key ideas



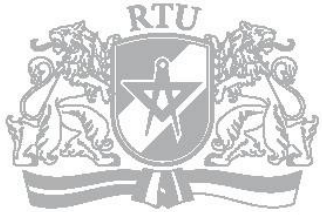
- Manufacture ESTOLAS model for researches in the wind tunnel
- Develop a measurement complex for ESTOLAS aerodynamic experiments
- Get aerodynamic characteristics
- Process the data received
- Draw a conclusion from the findings
- Give recommendations



Model Manufacture ¹

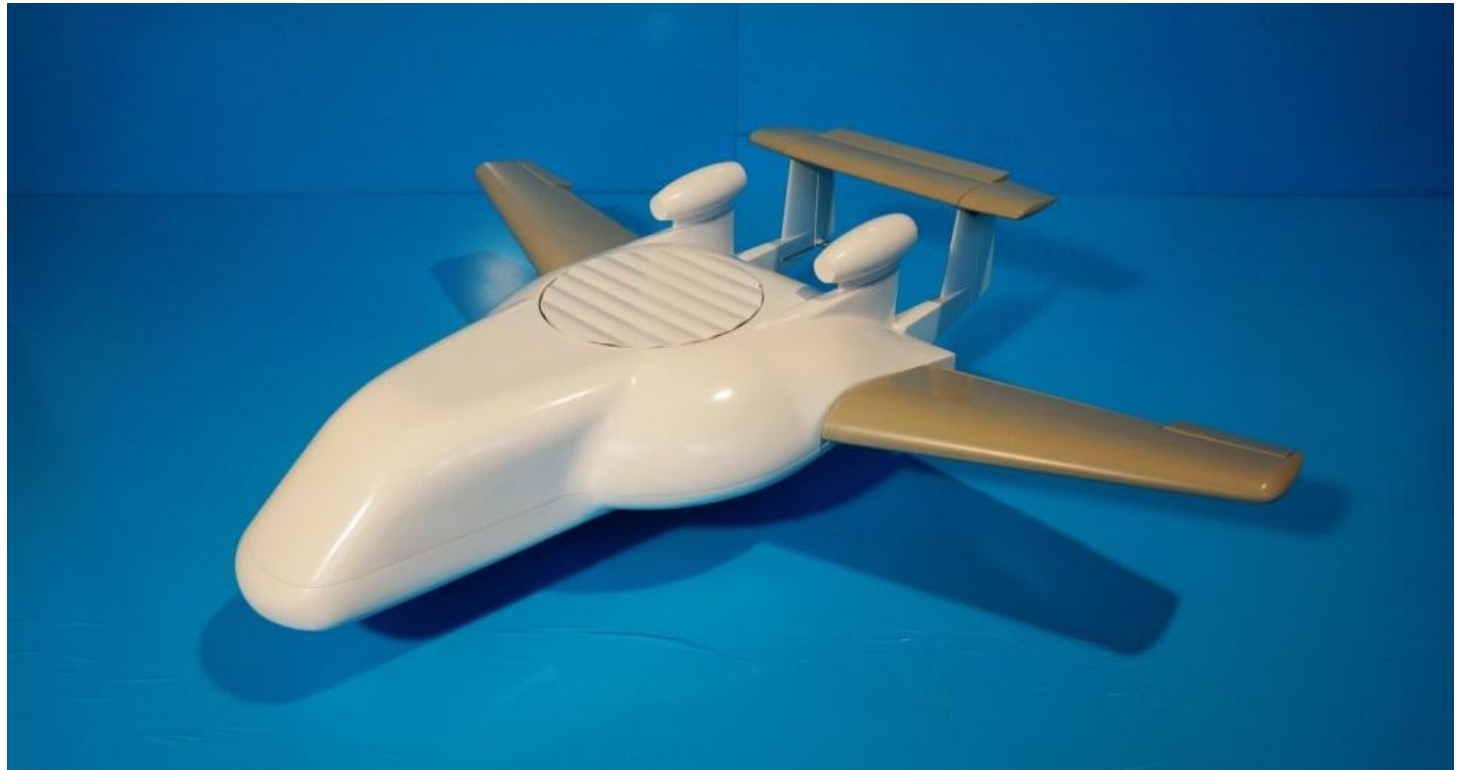
- “ESTOLAS” CAD model

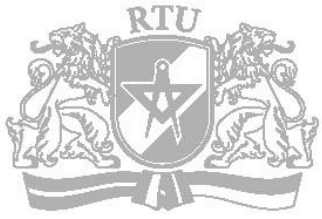




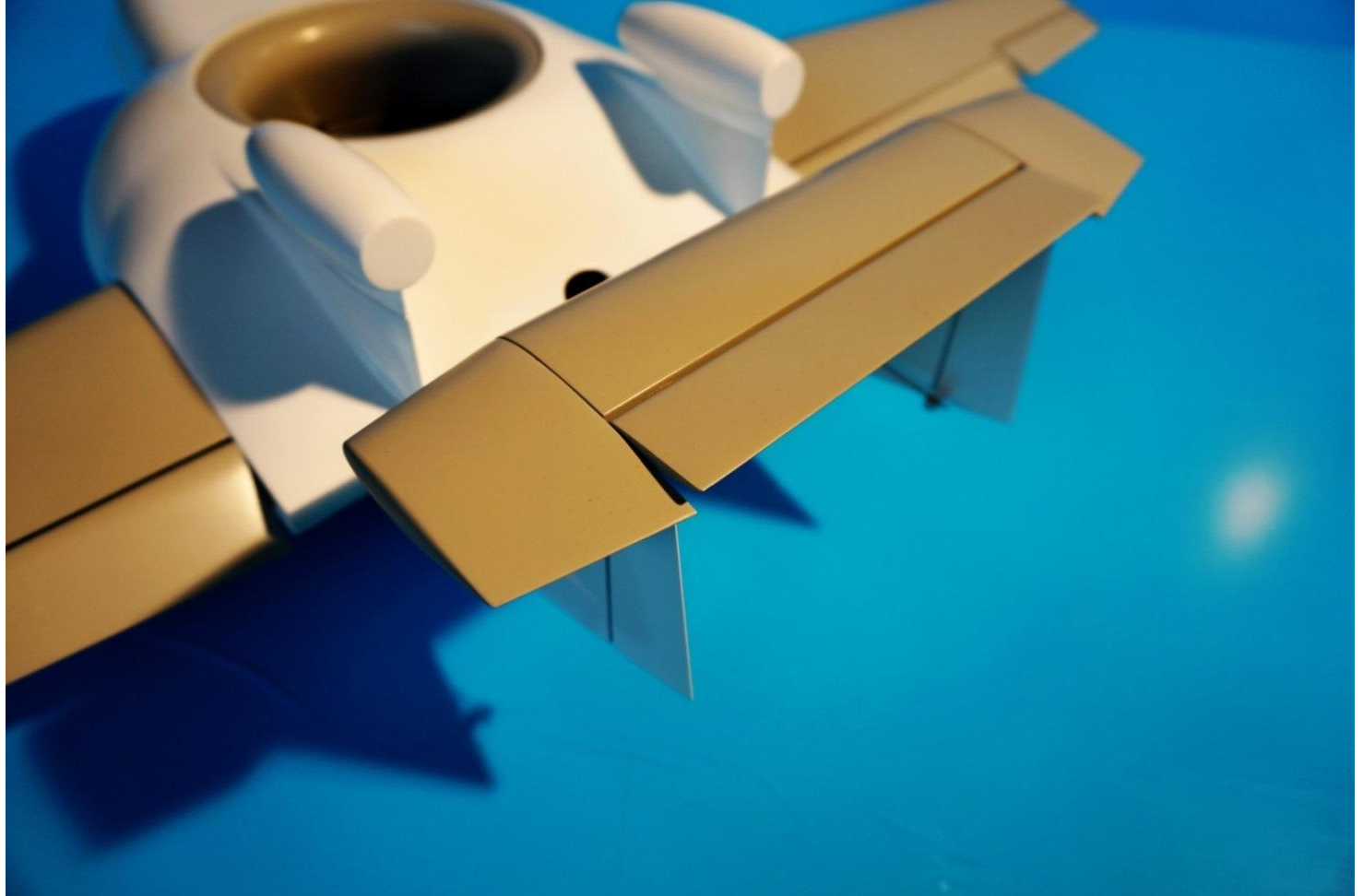
Model Manufacture ²

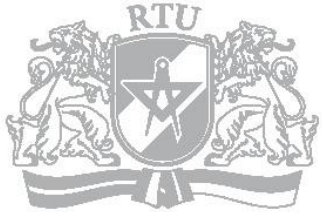
- ESTOLAS Finished model





Model Manufacture ³

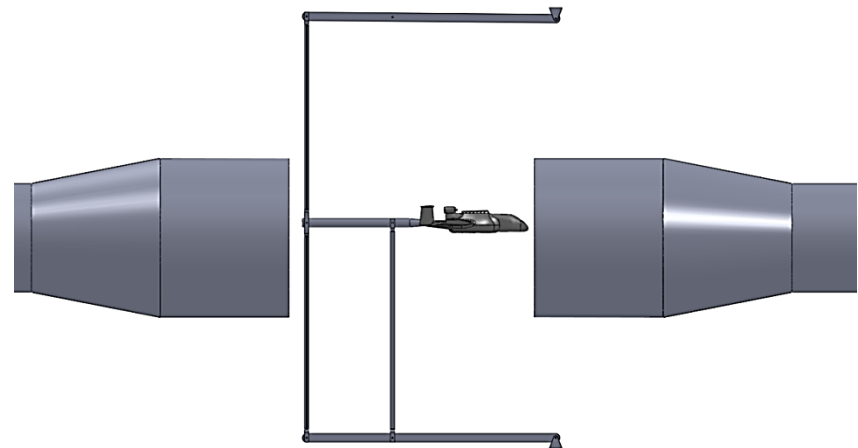


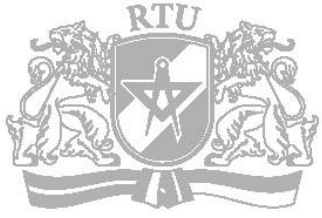


Aerodynamic complex

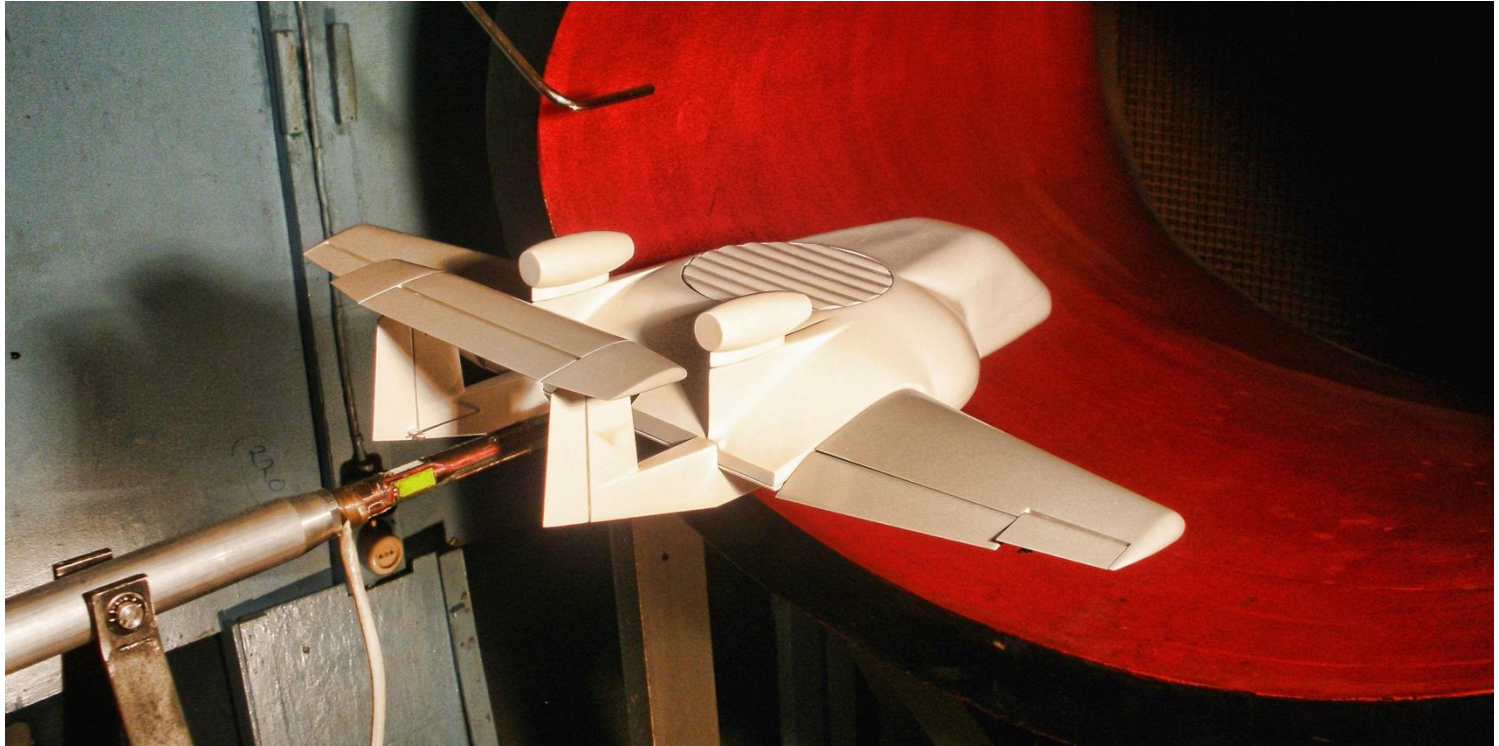


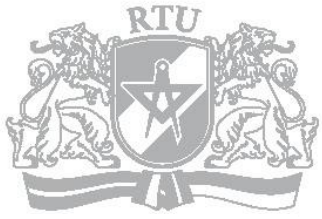
- Wind tunnel ($V_{max} = 45 \text{ m/s}$)
- Model positioning mechanism (α, β)
- Six component strain gage balance
- MCA, Digital manometer
- DAQ – Catman AP





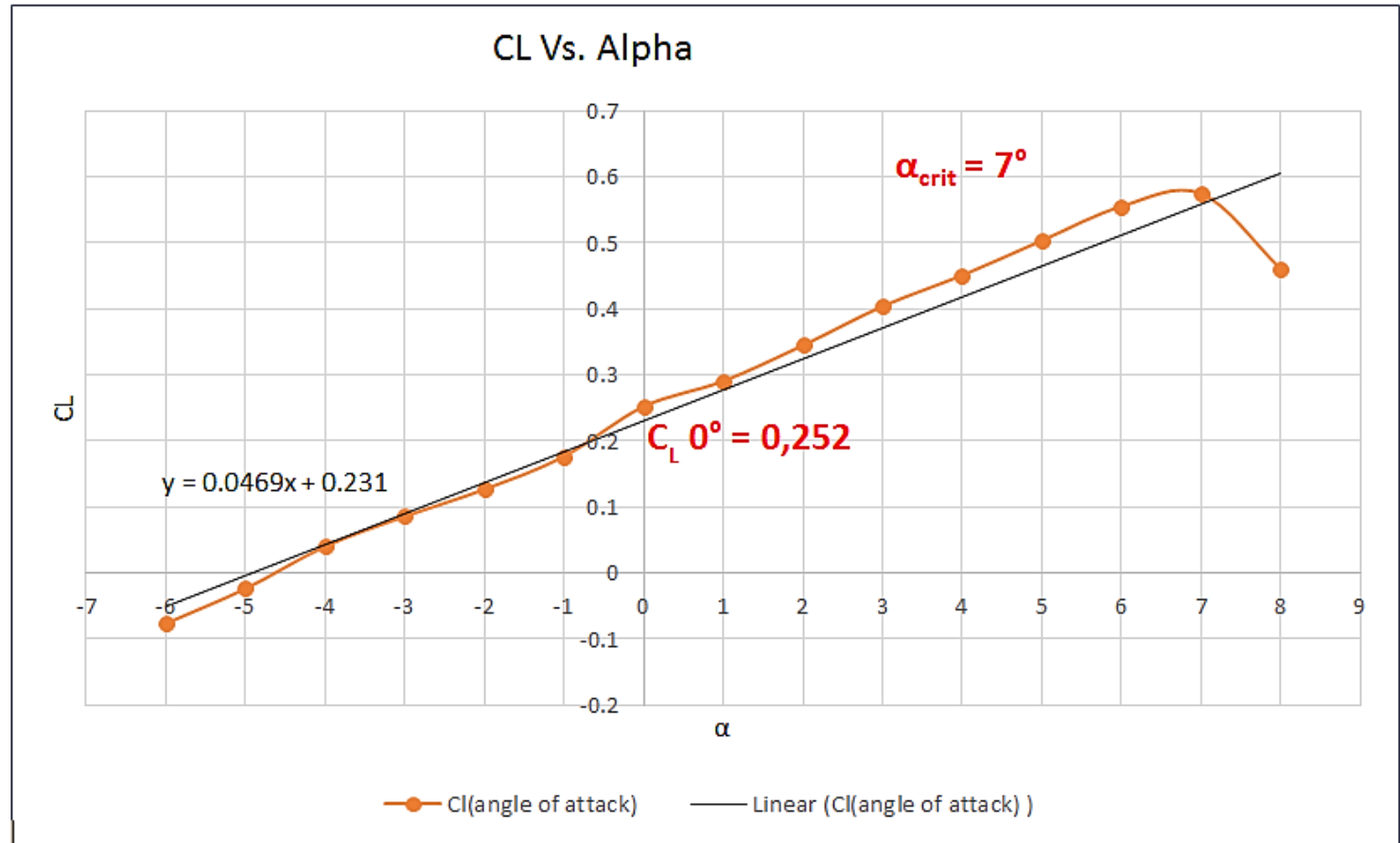
Aerodynamic Experiment

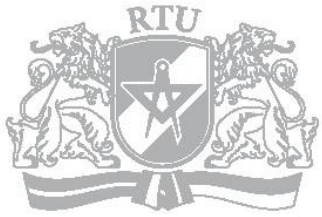




Experimental Results ¹

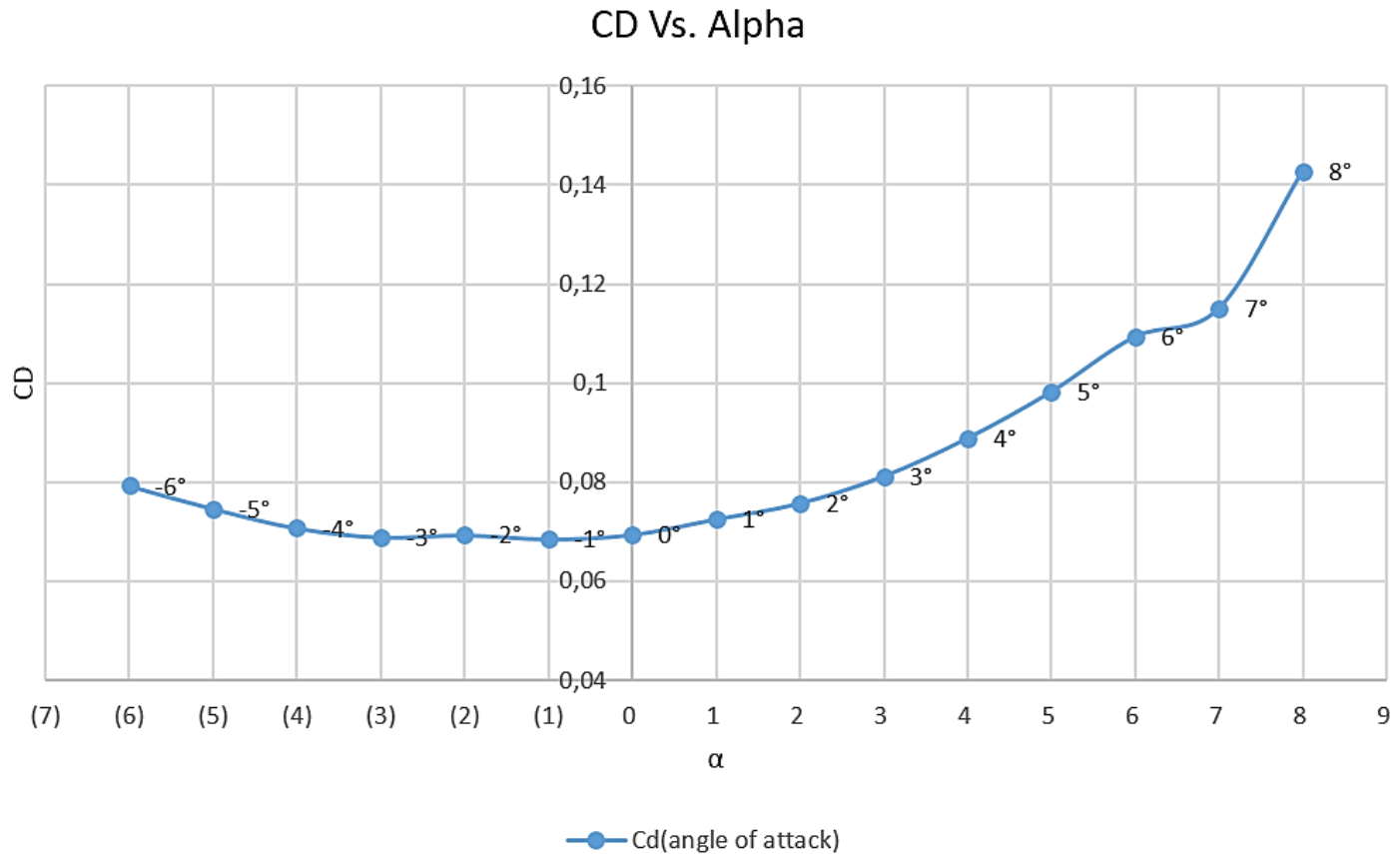
Diagram 1

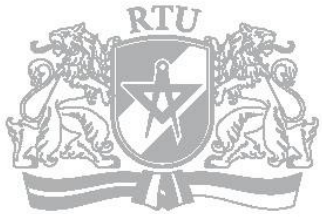




Experimental Results ²

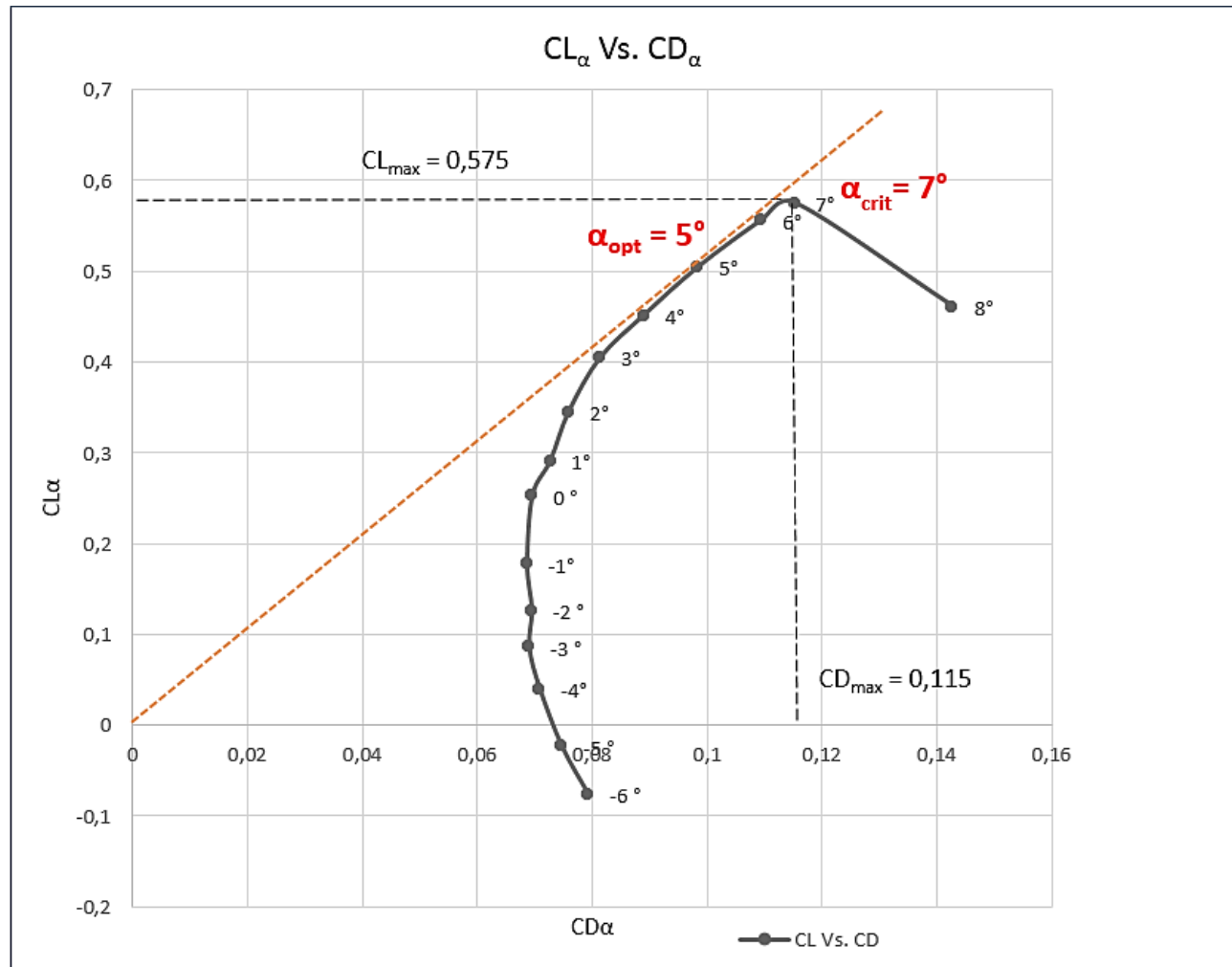
Diagram 2

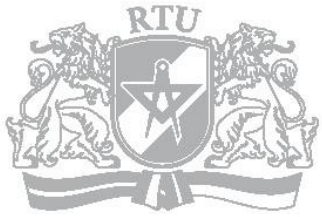




Experimental Results ³

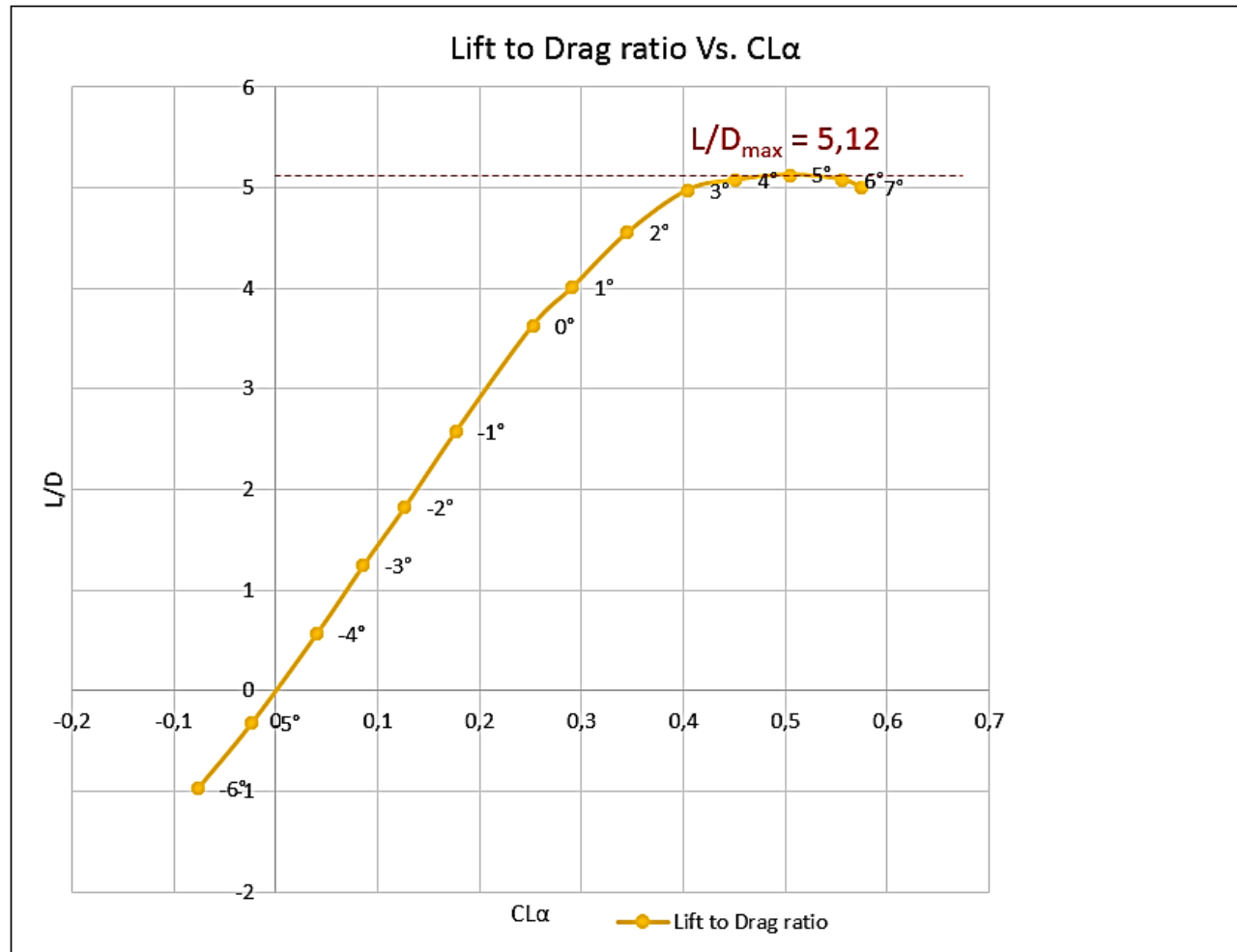
Diagram 3

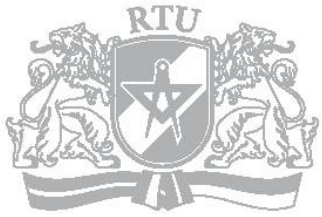




Experimental Results ⁴

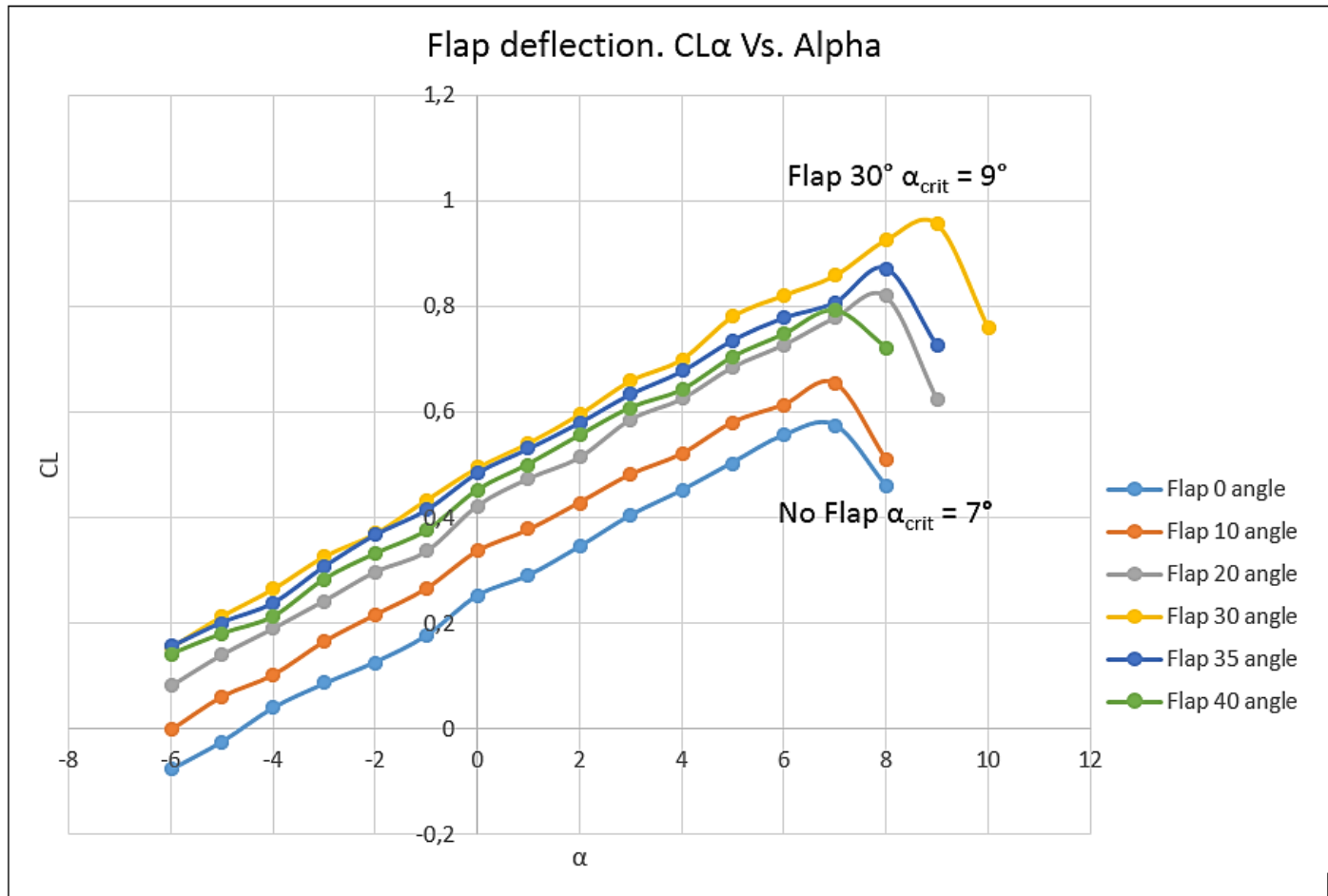
Diagram 4

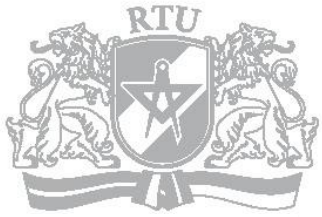




Experimental Results ⁵

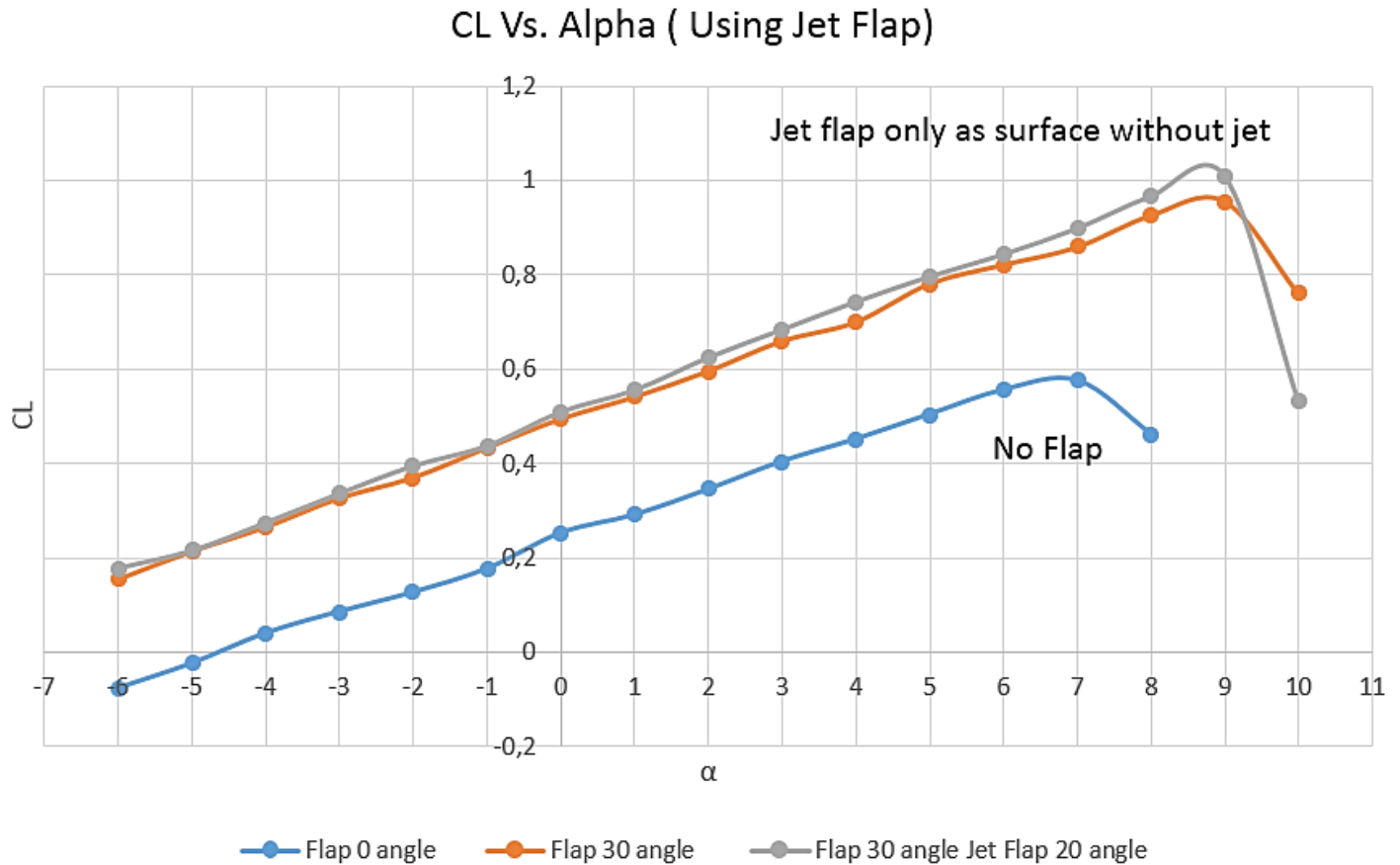
Diagram 5

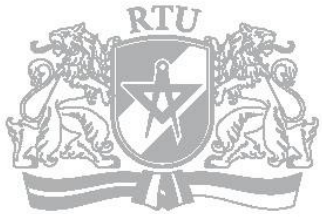




Experimental results ⁶

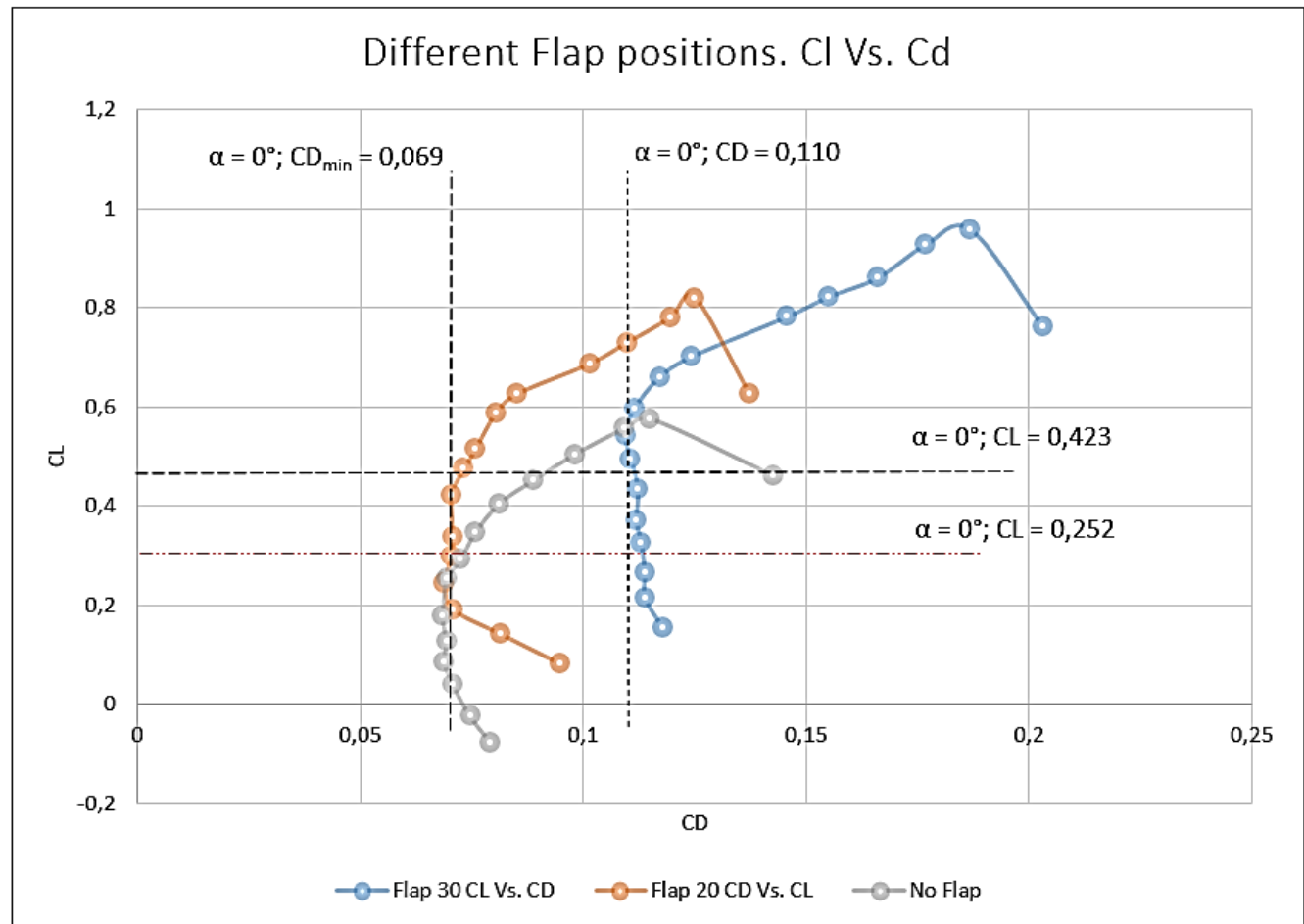
Diagram 6

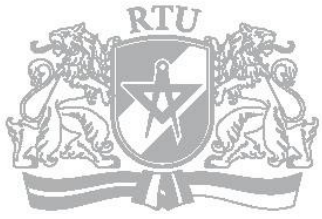




Experimental Results ⁷

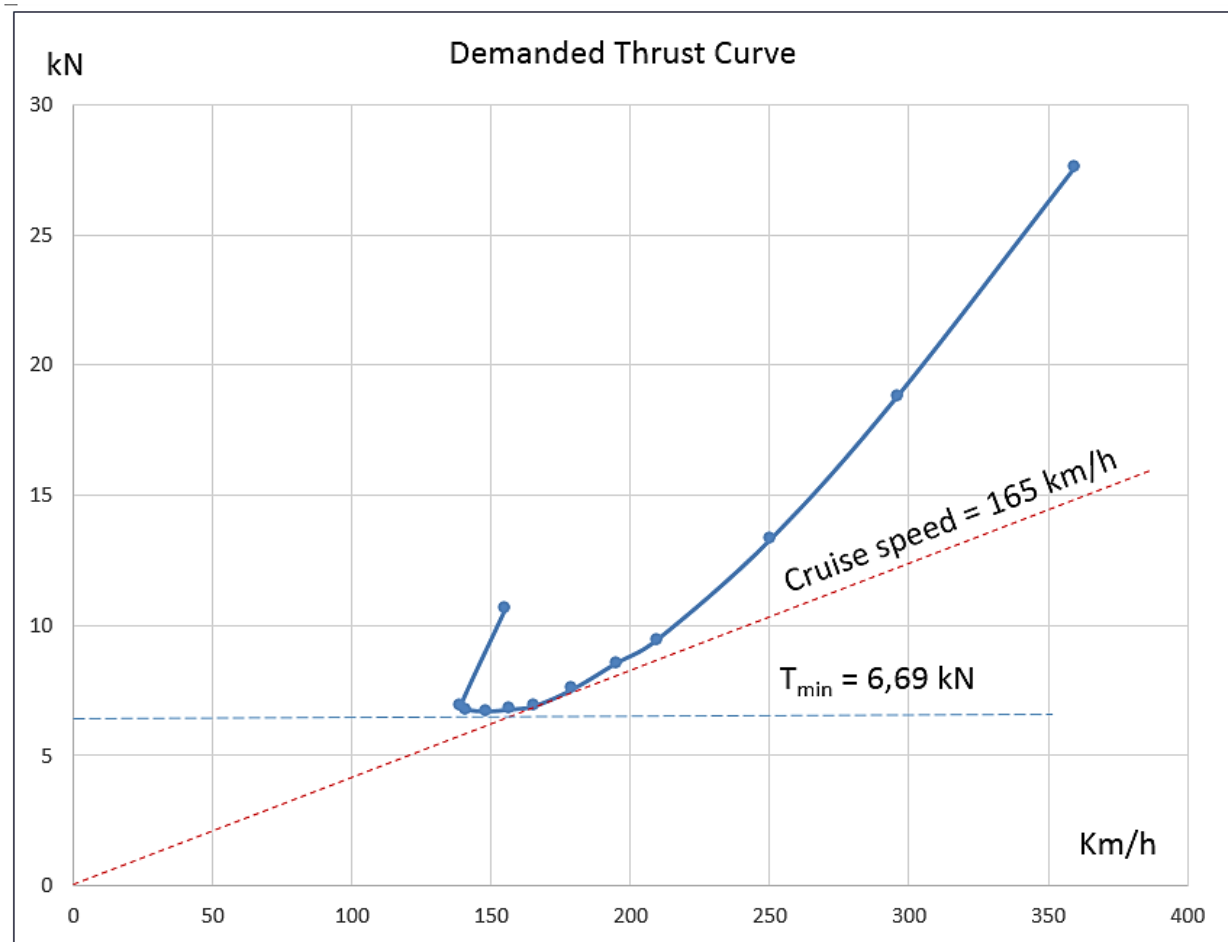
Diagram 7

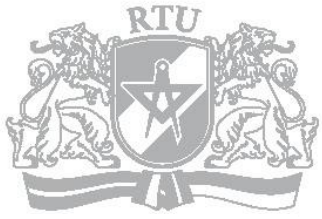




Experimental Results ⁸

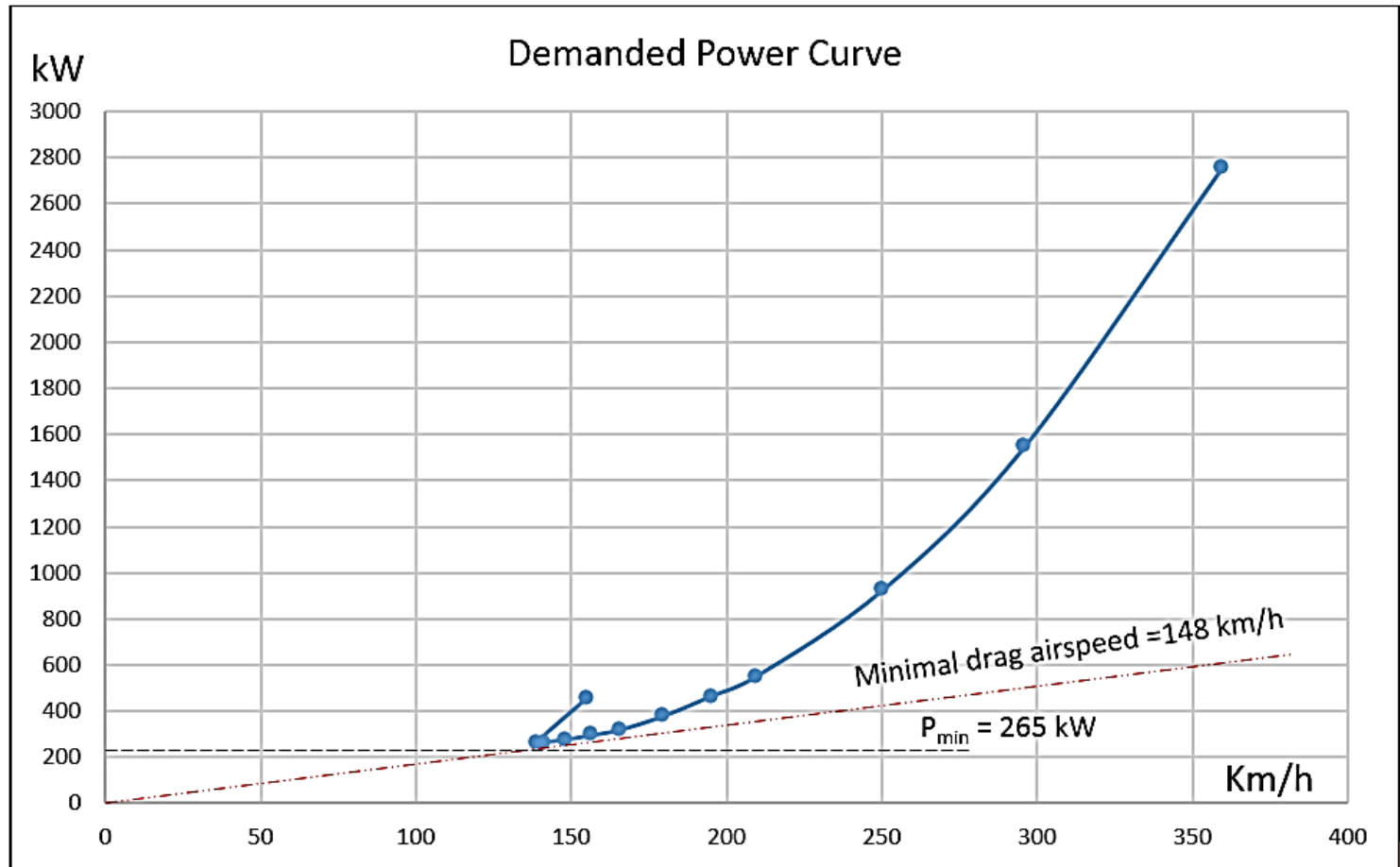
Diagram 8

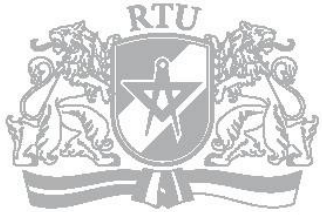




Experimental Results ⁹

Diagram 9

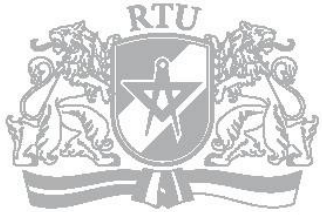




Experimental Results ¹⁰



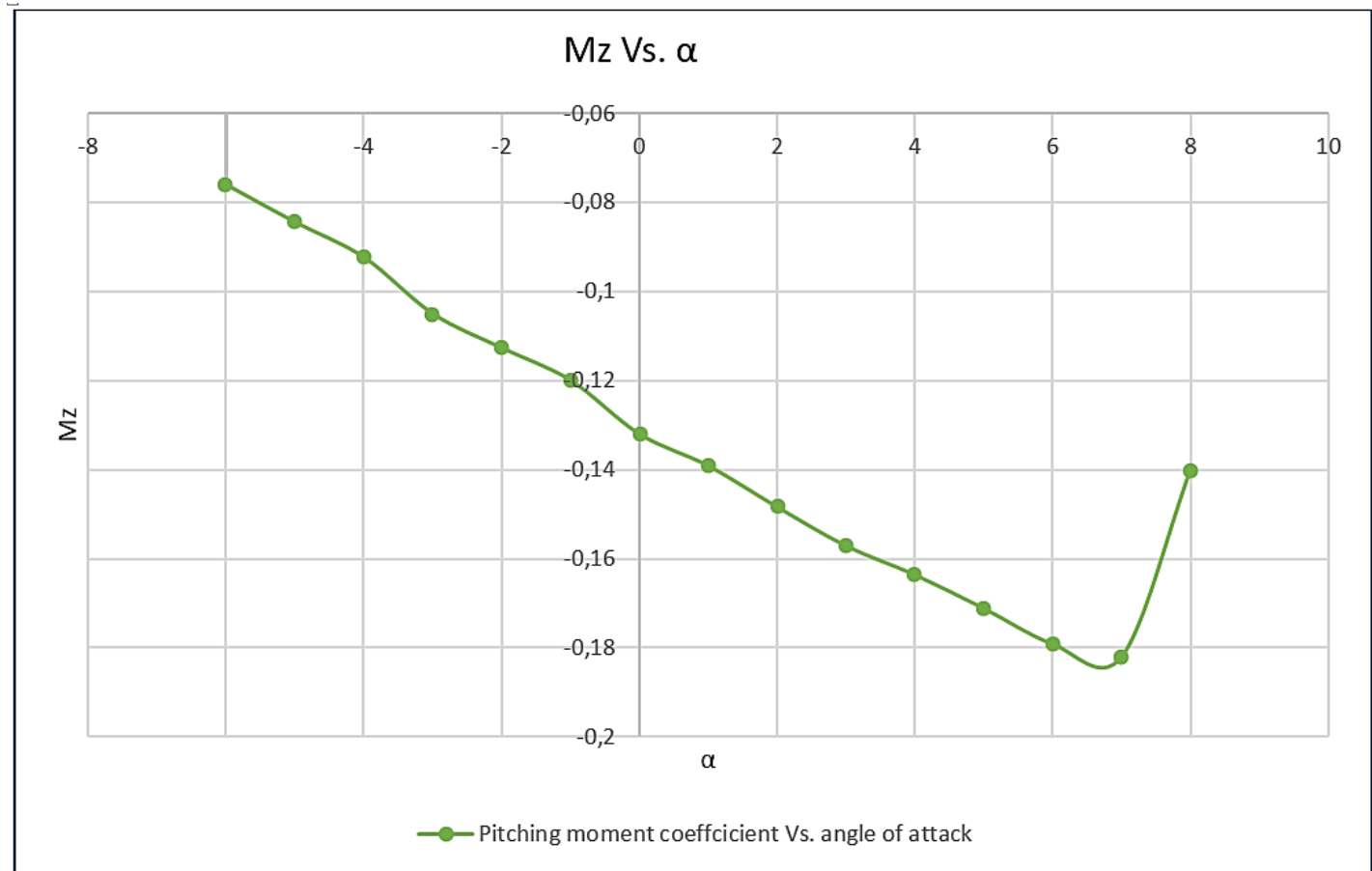
- $V_{TO} = 162 \text{ km/h}$ (Central PU OFF)
- $V_{TO} = 148 \text{ km/h}$ (Central PU ON)
- $V_L = 150 \text{ km/h}$ (Central PU OFF)
- $V_L = 138 \text{ km/h}$ (Central PU ON)
- $V_{cruise} = 165 \text{ km/h}$
- $V_{md} = 148 \text{ km/h}$

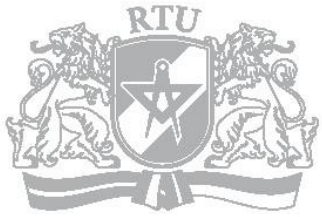


Experimental Results ¹¹

Stability and steer ability ¹

Diagram 10

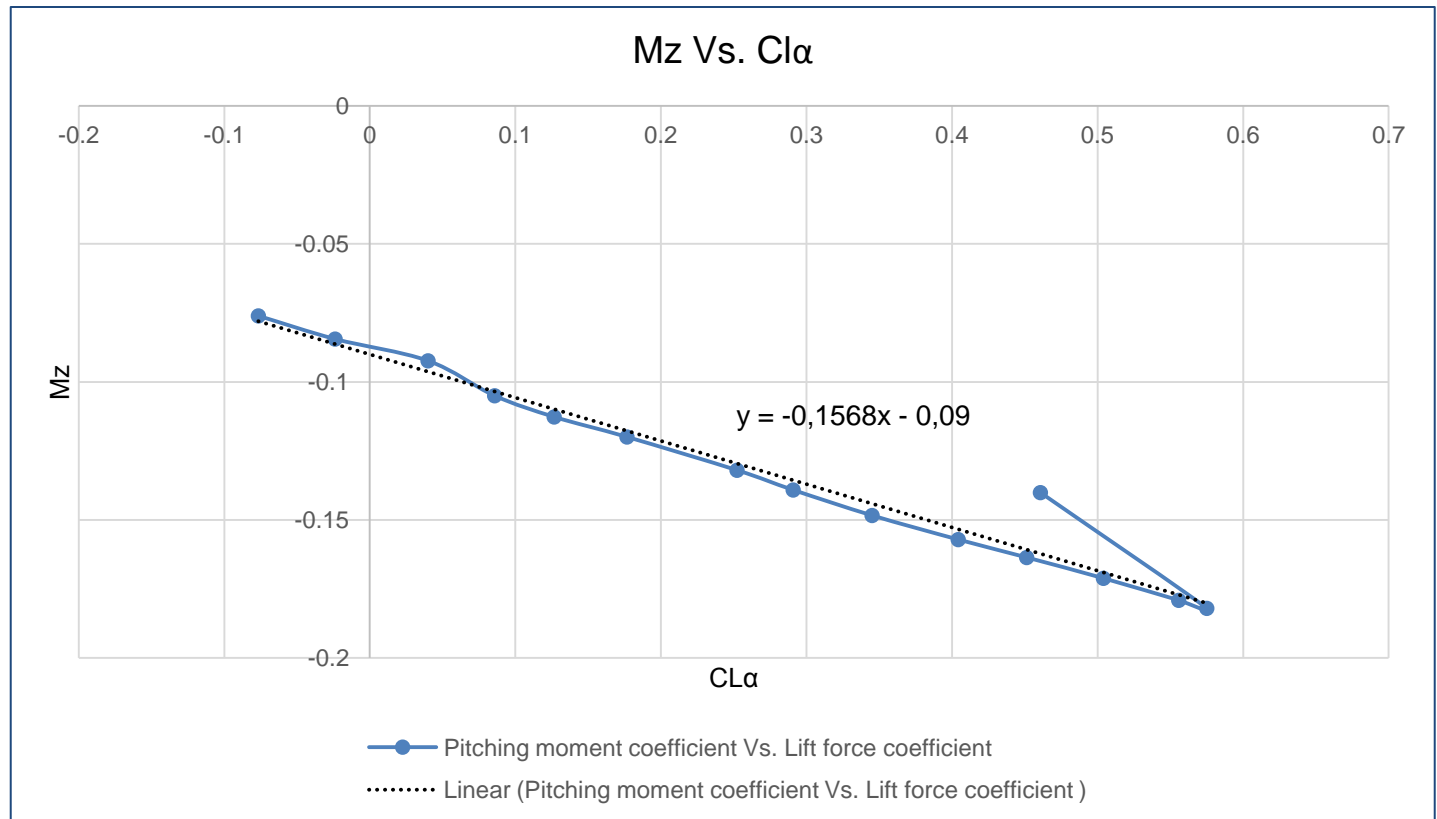


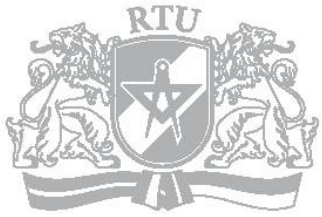


Experimental Results ¹¹

Stability and steer ability ²

Diagram 11

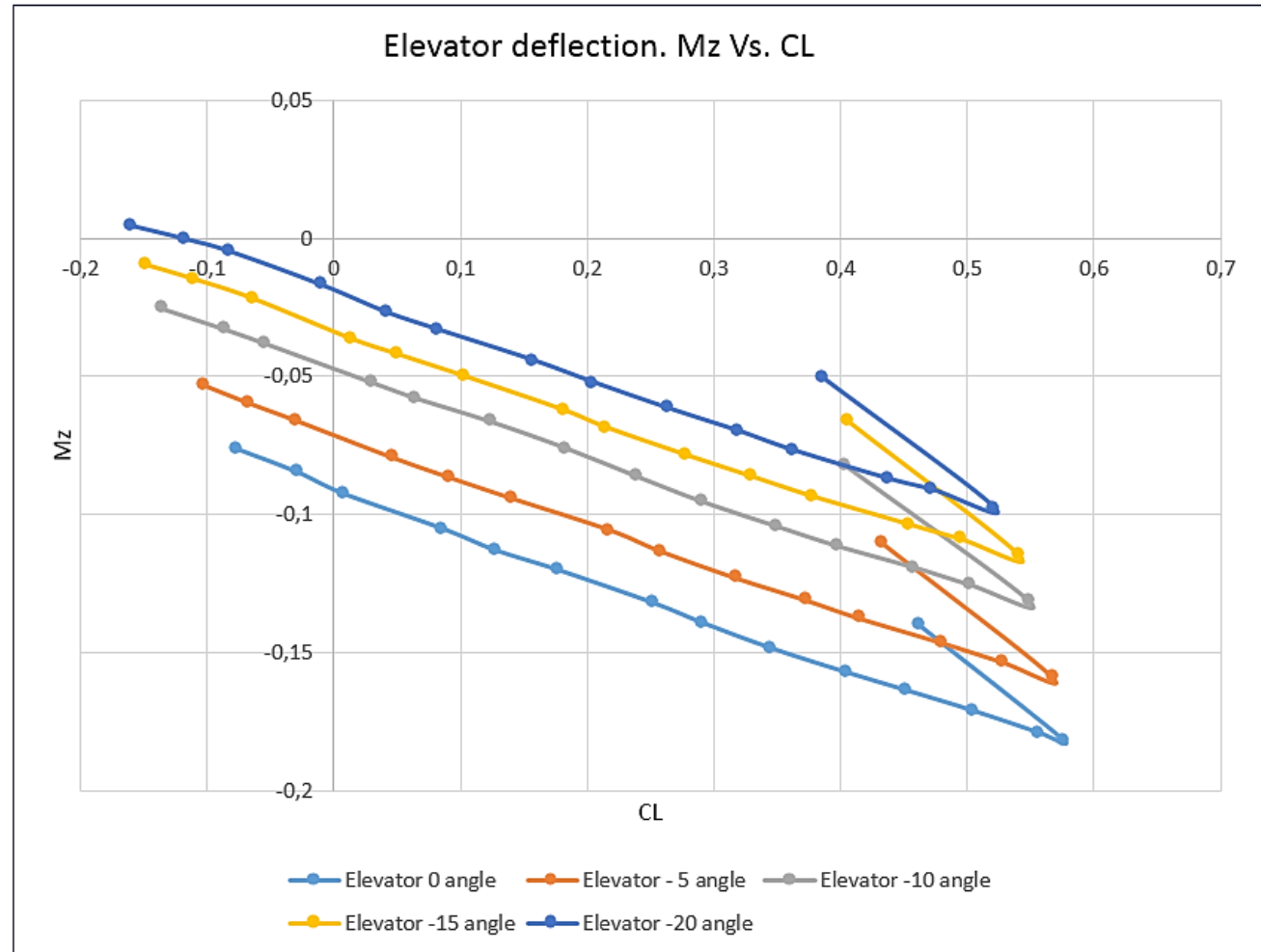


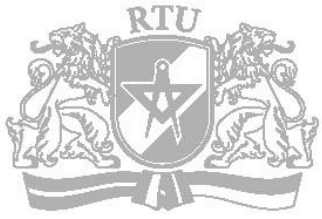


Experimental Results ¹²

Stability and steer ability ³

Diagram 12

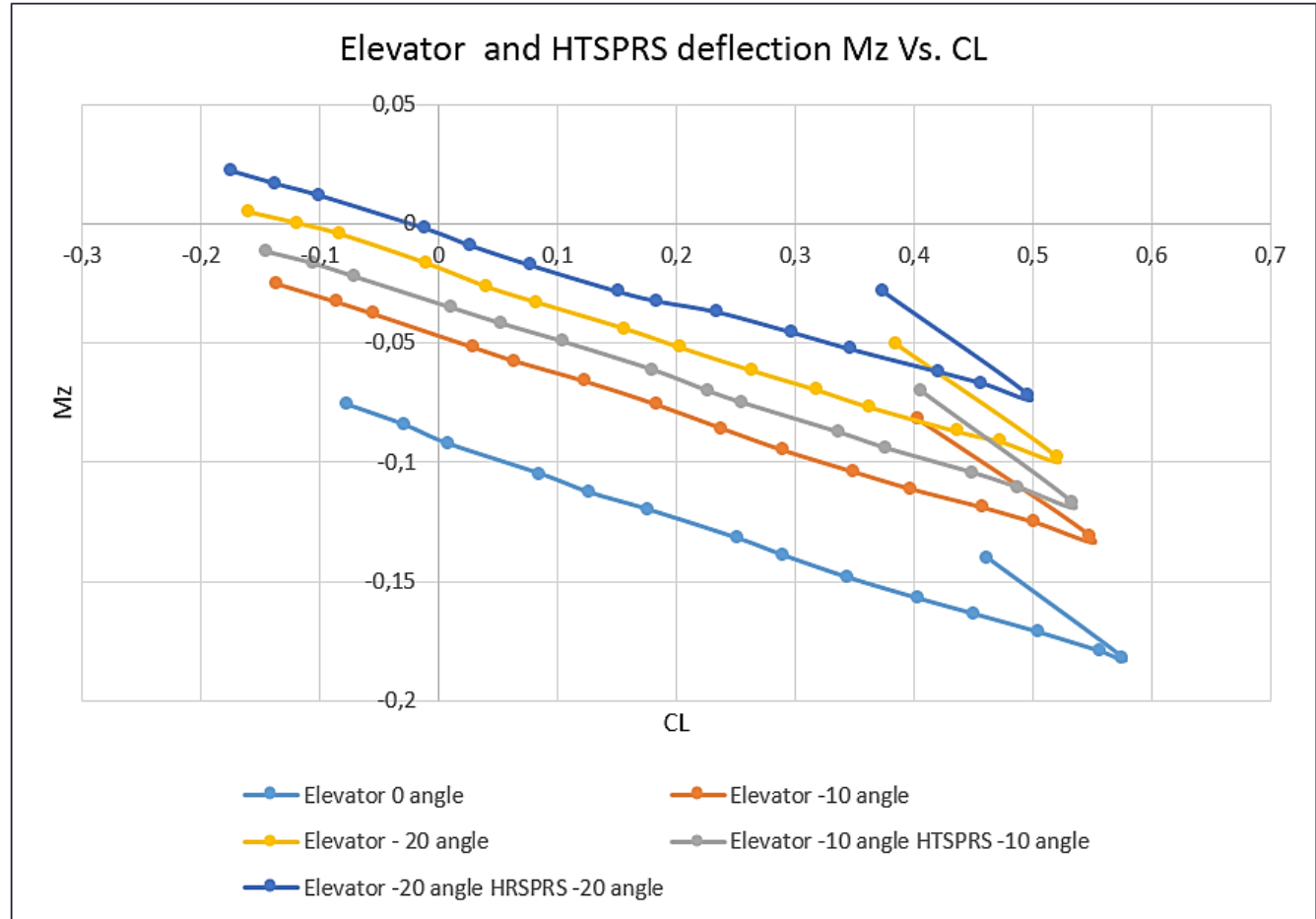


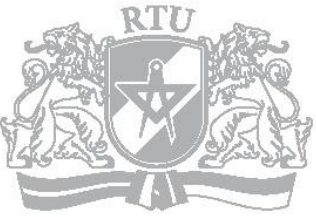


Experimental Results ¹³

Stability and steer ability ⁴

Diagram 13





Experimental Results ¹³

Stability and steer ability ⁵

Diagram 14

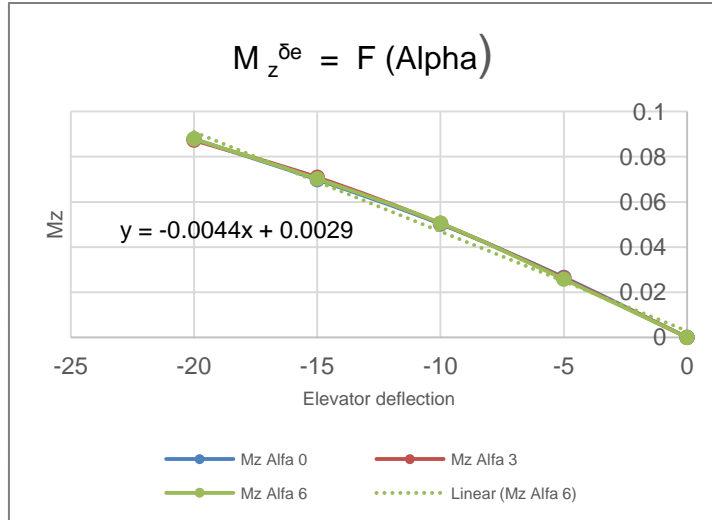
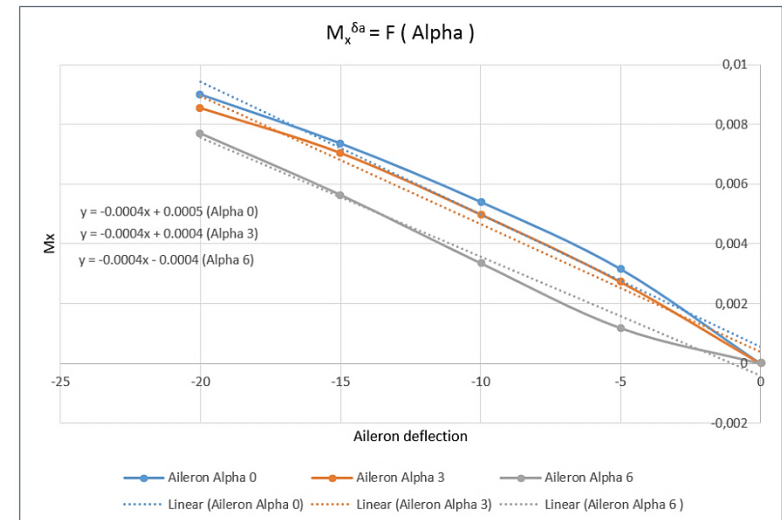


Diagram 15



$M_y^{\delta r} = F(\text{Alpha})$

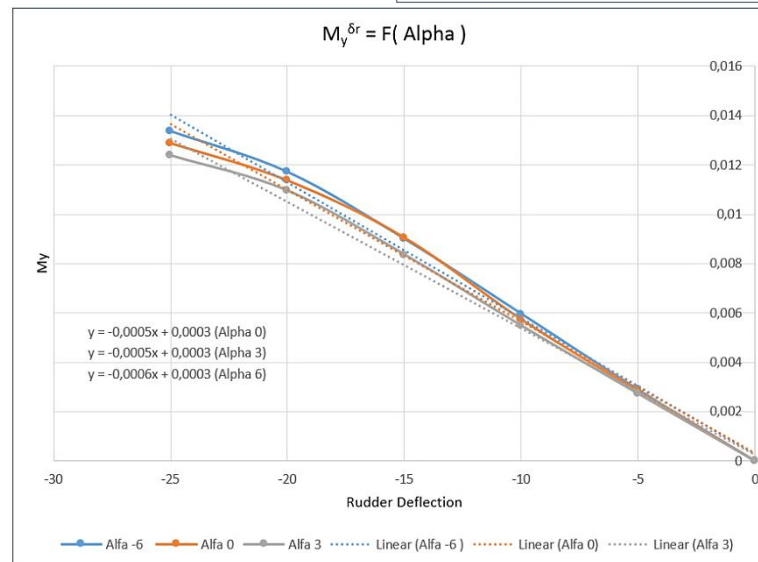
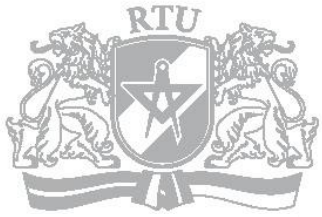


Diagram 16





Experimental Results ¹⁴

Stability and steer ability ⁶



Diagram 16

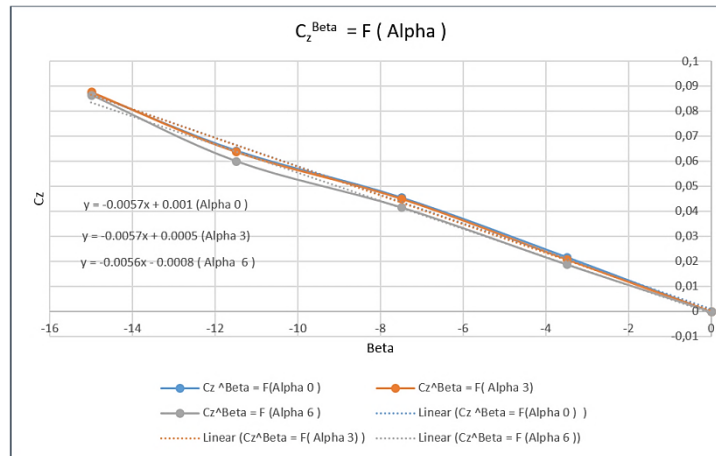


Diagram 17

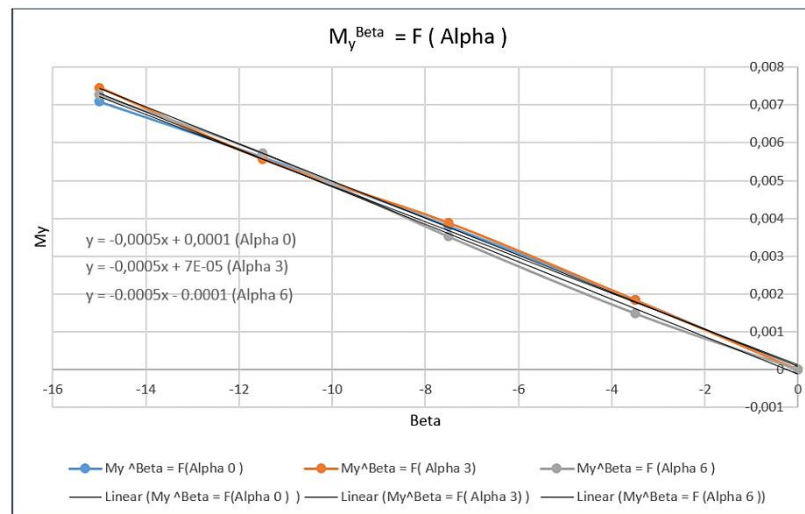
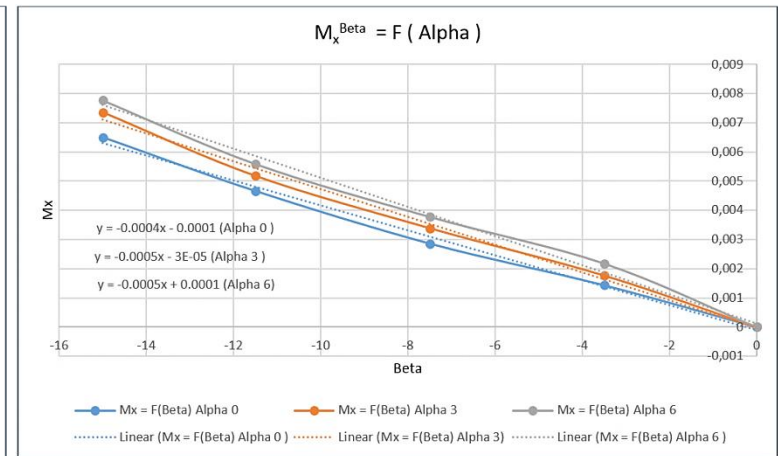
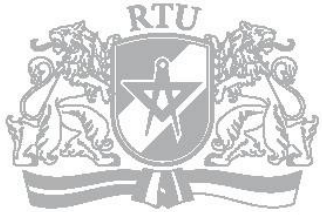



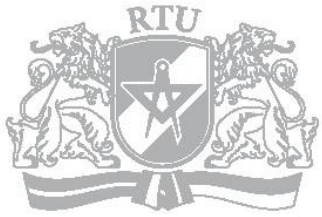
Diagram 18



Conclusion



- Critical angle ($\alpha_{crit} = 12^\circ$, on wing)
- Abrupt stall
- Lifting tail  no balance CD
- Very good stability and steer ability



Thank You for Your Attention!



April 10-11, 2014. Riga, Latvia