3rd EASN Association International Workshop on AeroStructures

Experimental research of aerodynamic characteristics of the ESTOLAS hybrid aircraft prototype

Speaker
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9th-11th October 2013, Milan, Italy

A novel concept for an extremely short take off and landing all-surface (ESTOLAS) hybrid aircraft: from a light passenger aircraft to a very high payload cargo/passenger version. Work programme topics addressed: AAT.2012.6.3-1, AAT.2012.6.3-2

Key Ideas

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

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Model Manufacture (1)

- “ESTOLAS” CAD model

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Model Manufacture (2)

- Modular design

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Model Manufacture (3)

- 3D milling machine

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Model Features (1)

- Cruise flight mode
- Radio controlled surfaces (ailerons, flaps, rudder, elevator)
- Internal strain gage balance system
- Model dimensions in accordance with the wind tunnel specifications (L×W×H): 0.59×0.75×0.13 (m)

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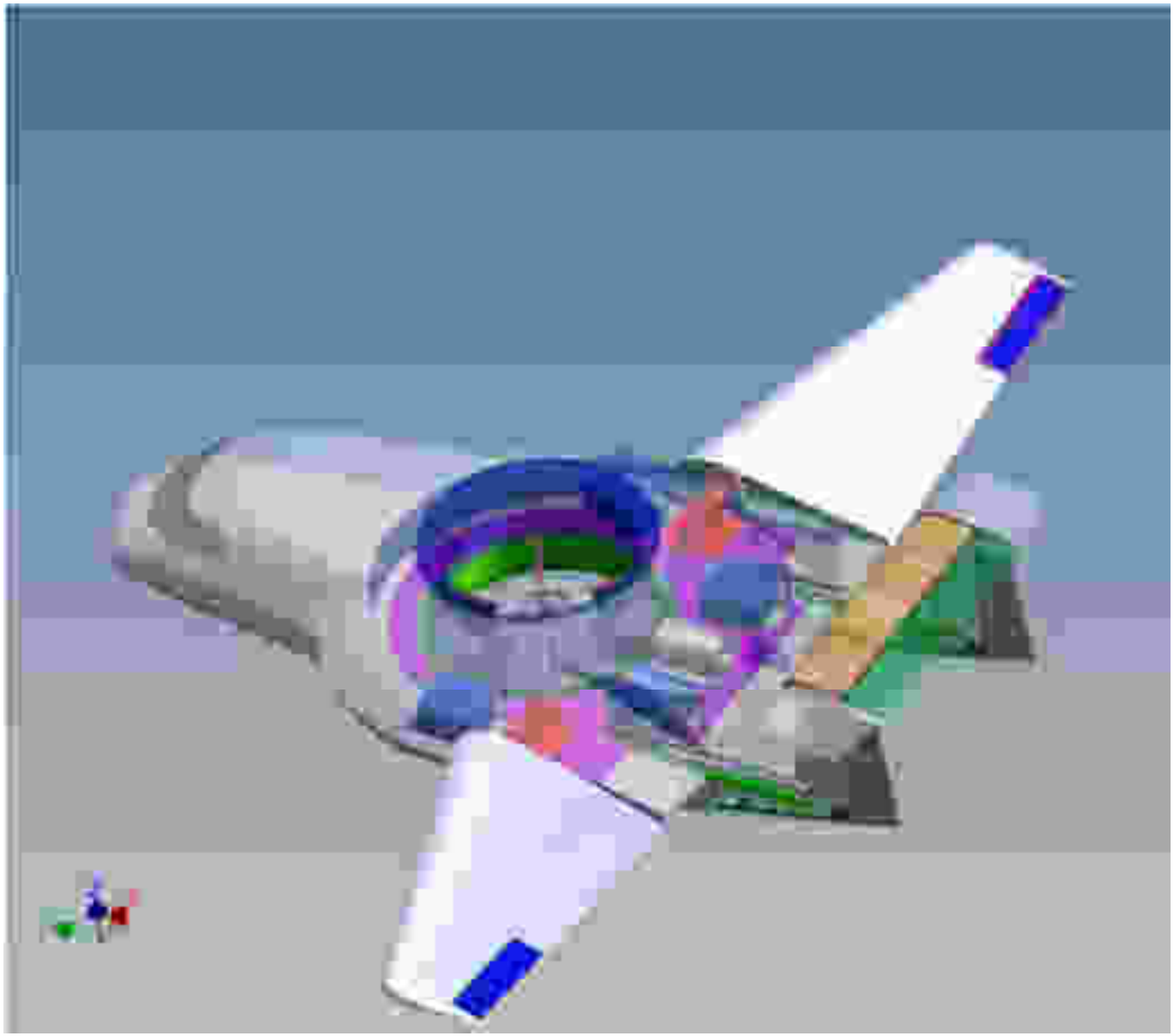
Model features (2)



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ESTOLAS Finished model

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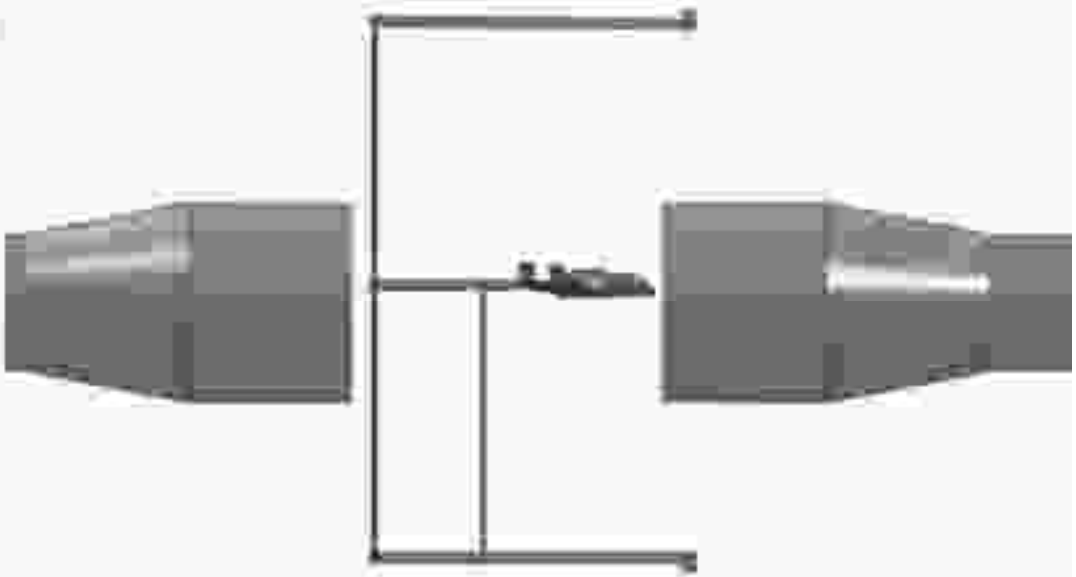
Measurement Complex (1)

- Wind tunnel ($V_{max} \sim 45 \frac{m}{s}$)
- Differential micromanometer and pitot tube
- Model positioning mechanism (α, β)
- Strain gage balance
- Multichannel Signal Amplifier
- Software - LaBVIEW
- Futaba FX-40



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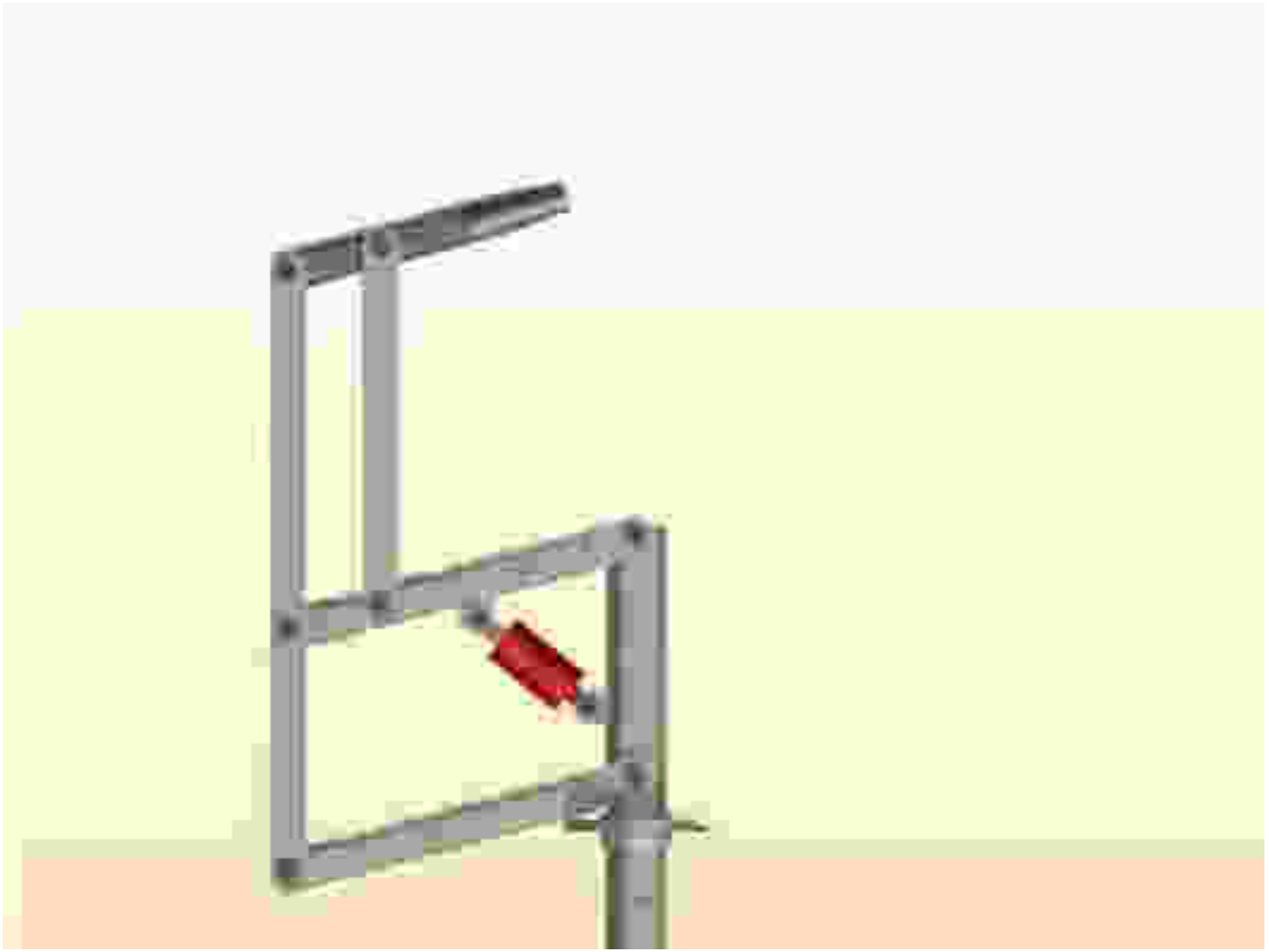
Measurement Complex (2)

Model positioning mechanism (α, β)



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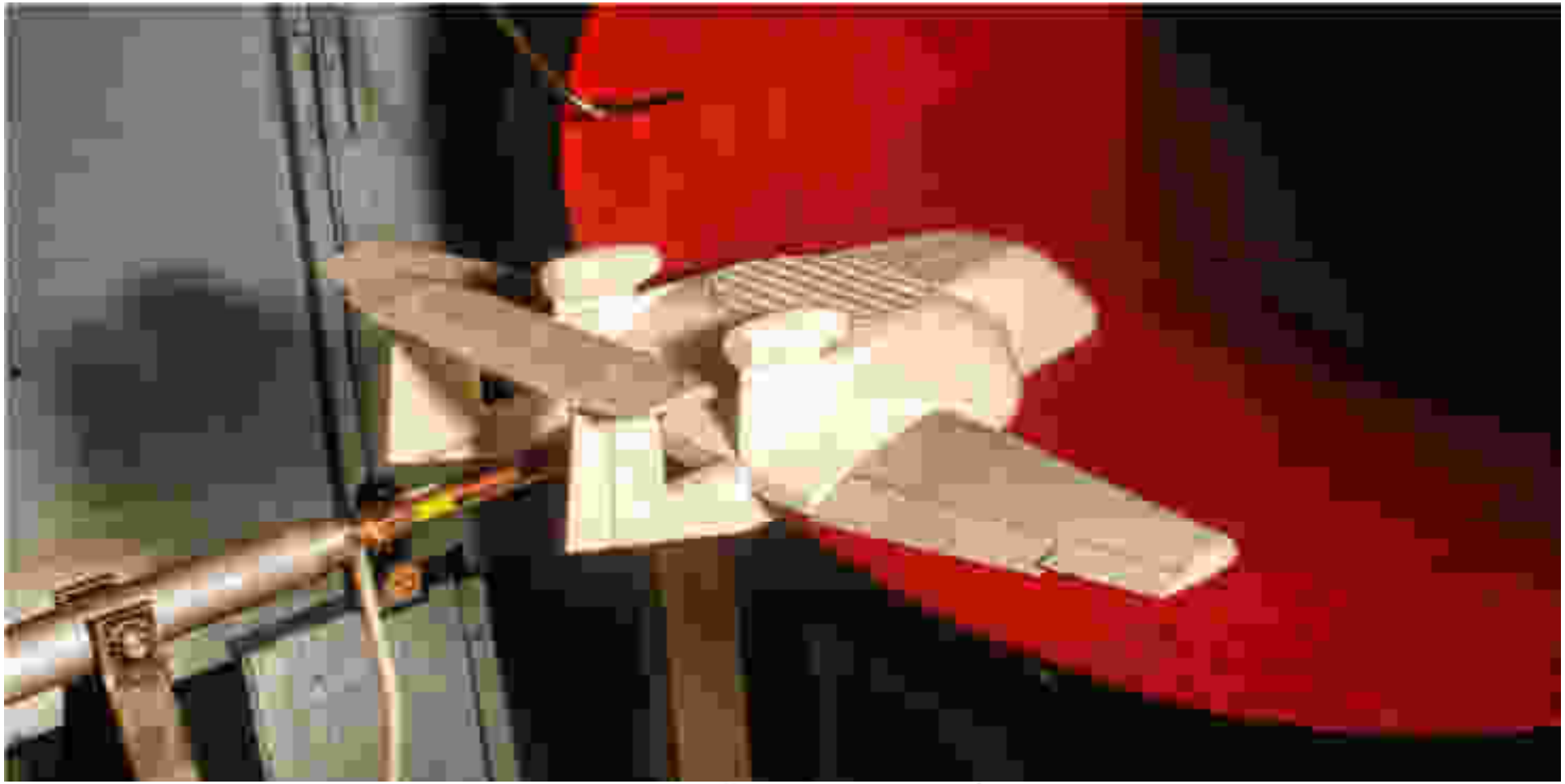
ESTOLAS finished model into the WT



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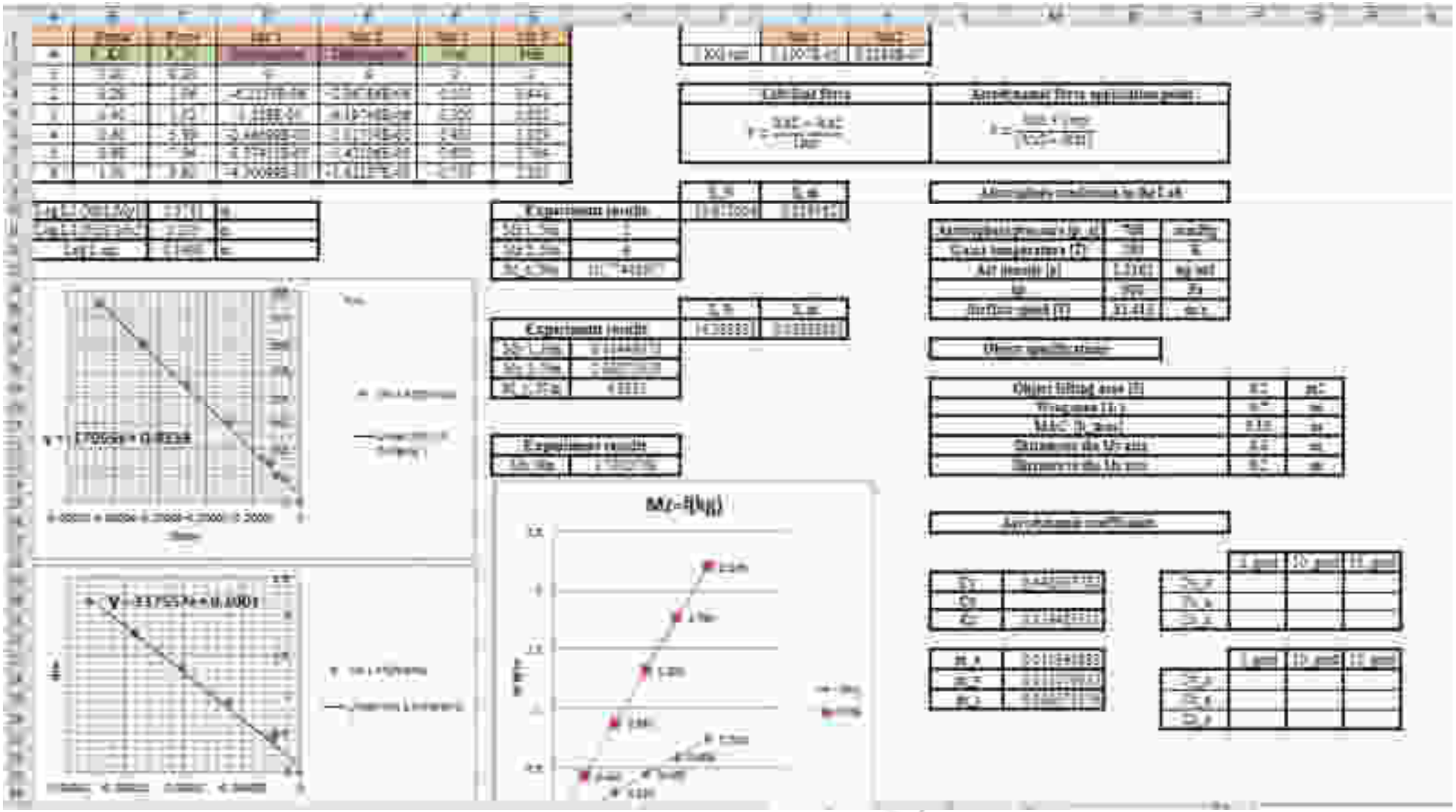
Data Processing



Results after Aerodynamic Research

- Dependence of lift coefficient C_l and induced drag coefficient $C_d i$ on the angle of attack α up to flow separation
- Dependence of moment m_z on the angle of attack α
- Dependence of moment m_z on elevator deflection δ (to evaluate AV directional control capability)
- Characteristics of feather moment m_y and transverse moment m_x from sliding angle β for different values of the angle of attack α (to evaluate AV lateral stability and steer ability)
- Dependence of moments m_x and m_y on rudder travel and ailerons

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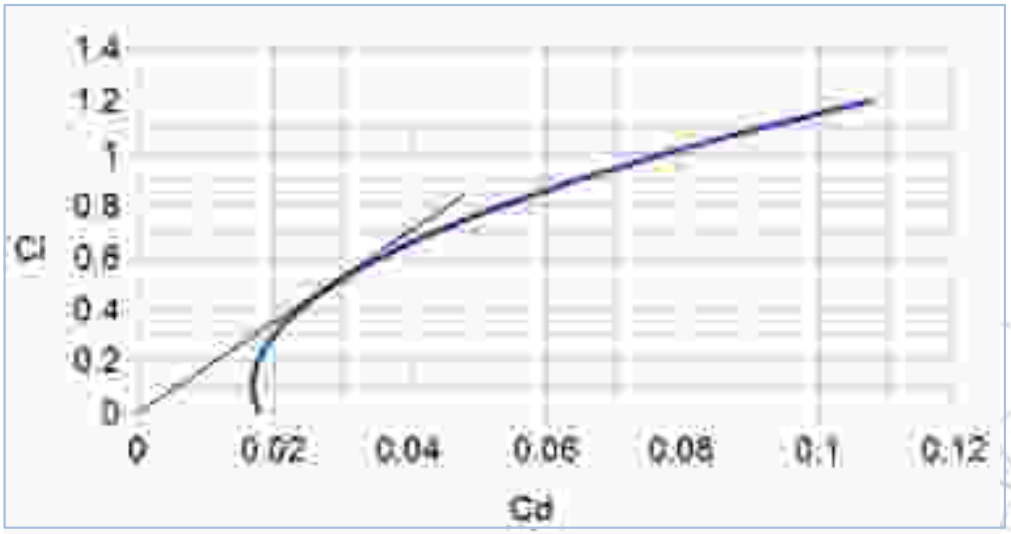

Object Lift-Drag polar curve

= f (α)

- Aerodynamic efficiency
- Glide angle
- Essential Thrust
- Minimal speed
- Maximal speed
- Cruise speed
- Economical efficiency

- Side force coefficient
- Yaw moment coefficient
- Roll moment coefficient
- Pitch moment coefficient

= f (α,β,δ)

- Stability and steer ability

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Conclusions

- Aerodynamic research will help to study ESTOLAS design
- Provides information about ESTOLAS flight characteristics
- Findings will give the possibility for more deep researches

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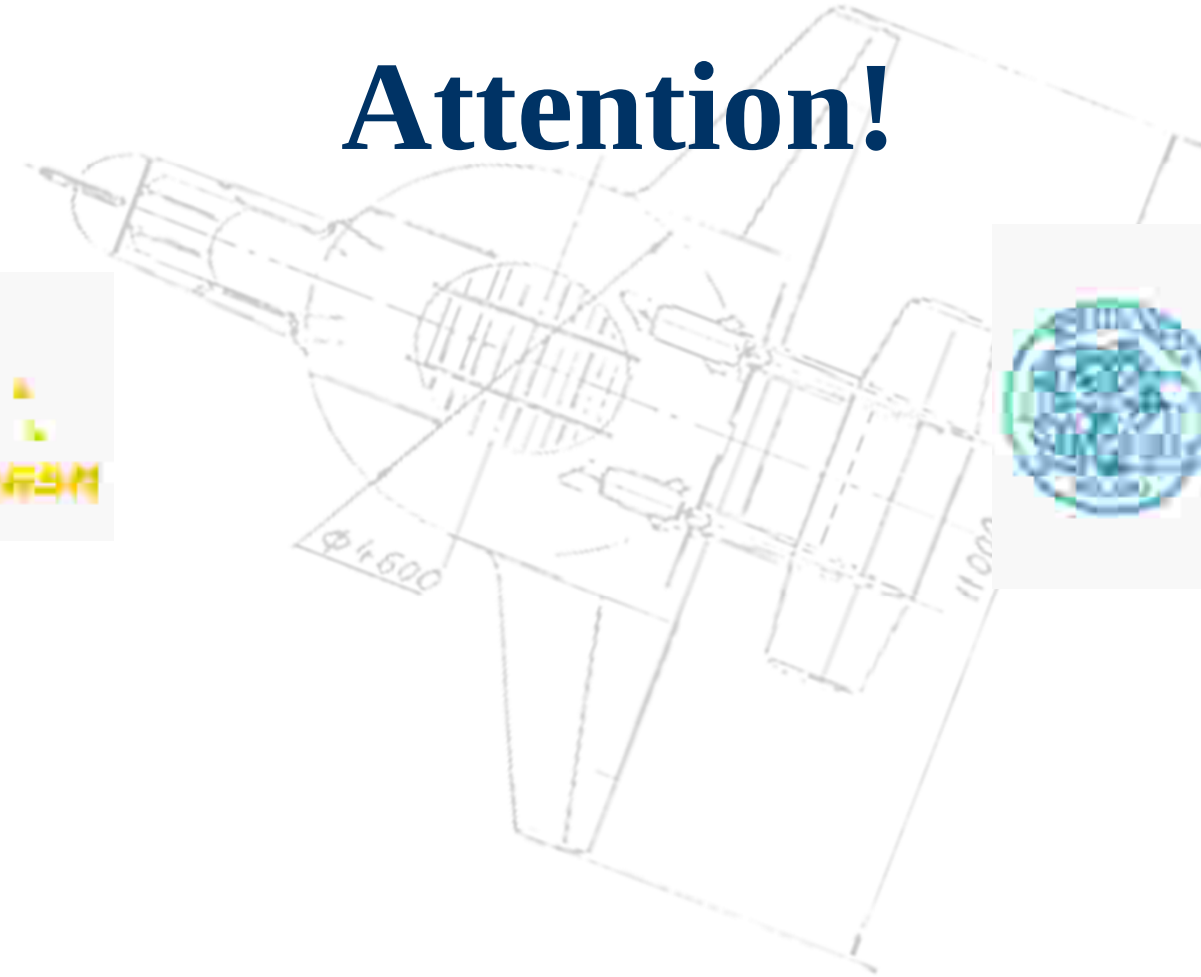
Thank You for Your Attention!



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