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Abstract #XXX (to be filled by the organizers)

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### Title

## The use of Computational Fluid Dynamics methods to improve aerodynamic properties of a newly designed twin-jet engine aerial target

### Authors

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### Abstract

The main purpose of this work was to obtain, using Computational Fluid Dynamics methods, a reliable information on aerodynamic properties of a newly designed twin-jet engine aerial target. In past decades a massive improvement of computational fluid dynamics methods and the rapid increase of computational resources made it possible to simulate a lot of phenomena appearing during the flow of fluid around an object. Aerodynamic analysis was performed using specialized software based on solving partial differential equations using the Finite Volumes Method. What is more, to perform tests in wind tunnel, scaled model of an airplane has been prepared using the modern and fast manufacturing technologies, including 3D printing and CNC machining. The aerodynamic analysis results were presented in the form of diagrams showing aerodynamic force and moment components as a function of the angle of attack. In addition, qualitative results of the flow around the plane have been presented. In order to confirm the correctness of the chosen method the obtained results have been compared with the results of experimental tests carried out in the wind tunnel. It will also prove that adopted method is sufficient for solving this type of problems.

The design process of an airplane that meets the imposed criteria in the set of acceptable solutions controlled by the constraints resulting from the planned missions is a complex process. It is inevitable in the design process that the assumptions made do not meet the expectations in terms of the “perfection” of airplane aerodynamic layout. Such a phenomenon forces changes to the adopted values and proceeding to the next iteration of the design process. The use of Computational Fluid Dynamics methods and scaled models at the stage of designing the airplane aerodynamic layout significantly accelerates the implementation of the project at particular stages of the design spiral. Moreover, it speeds up the variation process and facilitates the evaluation of further project development. The design process of an airplane aerodynamic layout at the stage of conceptual and preliminary design must be preceded by a stage of assumptions and determination of the most important criteria, the fulfilment of which is a necessary condition in the subsequent stages of aircraft design.

The paper is concluded by the best configuration choice and the discussion on the influence of certain parameters on the whole design, for which all the aerodynamic improvements also have to be discussed and evaluated in terms of its

cost and structural design of the airframe. In addition, the obtained aerodynamic characteristics can be used at the stage of determining loads acting on the structure of the aircraft during the flight and to determine conditions for safe flight.