



# PhD in INGEGNERIA AEROSPAZIALE / AEROSPACE ENGINEERING - 39th cycle

**THEMATIC Research Field: CHARACTERIZATION AND DESIGN STUDIES OF A TAIL-SITTER AIRCRAFT CONFIGURATION**

**Monthly net income of PhDscholarship (max 36 months)**

**€ 1400.0**

In case of a change of the welfare rates during the three-year period, the amount could be modified.

## Context of the research activity

**Motivation and objectives of the research in this field**

Personal aerial vehicles (PAV) are currently in the focus of many research efforts. The novelty of the mission profile, featuring constraints not typical to the aeronautical field and including the virtual suppression of any dedicated ground facility, put stringent and challenging constraints on the preliminary design and sizing. This has fostered the investigation of unusual configurations, capable of complying with these requirements, while also granting good general flight performance and affordable cost. At the current stage of research, no configuration has emerged as a standard baseline, and a significant part of the space of design configurations can still to be explored. A promising configuration which has not been thoroughly investigated in recent years is that of tail-sitter winged aircraft. The focus of the research will be on understanding and building the proper tools for predicting the inherent response and performance of this type of system, allowing to set up a standard design and sizing procedure for this aircraft configuration.

**Methods and techniques that will be developed and used to carry out the research**

The current project will face several technological issues associated with the design configuration of interest. Among them, an understanding of contra-rotating propellers and their interaction with the wing and tail of a compact fuselage (as that of a PAV needs to be) will be in the focus from the start. An insight in this topic will be obtained through computational methods and experiments as required, ideally ending up with the synthesis of



	as required, ideally ending up with the synthesis of methods for the estimation of aerodynamic coefficients, and the ensuing build-up of a dynamic model. The dynamics and controllability of a tail-sitter will be investigated next. With the understanding of the effects of sizing on dynamic and control performance, design procedures will be proposed and tested conceptually and, if possible, aiming to the manufacturing of field testbeds. Further activities shall involve certification considerations as well as the investigation of acoustic footprint.
<b>Educational objectives</b>	Expertise in the modeling and analysis of contra-rotating propellers, interaction effect in unusual aircraft configuration, dynamic characterization of winged aircraft and performance evaluation, synthesis of sizing procedures. Familiarization with certification guidelines, operational needs and regulations.
<b>Job opportunities</b>	Research project investigator/manager. Senior aeronautical engineer for manned/unmanned aircraft design, analysis and testing. Expertise in propeller-based propulsion, interaction effects, dynamic/control performance.
<b>Composition of the research group</b>	0 Full Professors 2 Associated Professors 1 Assistant Professors 3 PhD Students
<b>Name of the research directors</b>	Prof. Carlo E. D. Riboldi

<b>Contacts</b>	
Dipartimento di Scienze e Tecnologie Aerospaziali - Politecnico di Milano - via La Masa 34, 20156 Milano - Italy - tel. +390223998323 - fax +390223998334 - email: carlo.riboldi@polimi.it - web site: www.aero.polimi.it	

<b>Additional support - Financial aid per PhD student per year (gross amount)</b>	
<b>Housing - Foreign Students</b>	--
<b>Housing - Out-of-town residents (more than 80Km out of Milano)</b>	--

<b>Scholarship Increase for a period abroad</b>
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<b>Amount monthly</b>	700.0 €
<b>By number of months</b>	6

**Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information**

The PhD candidate will receive a desk, possibly through a hot-desking procedure, and a personal computer, if needed. Apart from the compulsory ones, the PhD candidate will have the opportunity to follow additional courses and receive economic support to attend summer schools and participate in conferences. There will be the possibility of paid teaching assistantship.