

## HISTORY OF THE DEPARTMENT

The University "Politecnico di Milano" was founded in 1863. Its mission is to teach technologies and educate students to become researchers. The University is continuously updating its tradition as a school that focuses on quality and innovation in teaching and research. Scientific research at Politecnico di Milano has always been oriented toward innovation and quality, always seeking a strong relationship with the industrial world through technology transfer. Attuning to the needs of the industrial sector helps research to continuously explore new areas and stay at the leading edge of science and technology.

The scientific community of Politecnico di Milano is made of more than 1,300 professors and research fellows, with 38,200 students (2013 update). According to QS World University Rankings 2012/2013, Politecnico di Milano ranked 28th worldwide in the area of Engineering and Technology. On a worldwide scale, it is the first Italian university entering the QS ranking among the top 30 technical universities. Furthermore, Politecnico di Milano participates in the coveted "club" of universities ranked in the top 100 in the world in the most prominent international rankings, along with only 15 other European universities.

Politecnico di Milano is currently articulated in 12 departments, where research is co-ordinated and carried out, and 6 schools, where education is co-ordinated and implemented. Several service Centres provide support for technical and administrative purposes.

## DIPARTIMENTO DI SCIENZE E TECNOLOGIE AEROSPAZIALI

The Dipartimento di Scienze e Tecnologie Aerospaziali (Department of Aerospace Science and Technology, DAER-PoliMi) was established within Politecnico di Milano as an autonomous institute in the 1950s. The personnel of DAER-PoliMi currently consists of 43 faculty, 27 technical and administration staff, 70 research assistants and Ph.D. students. The main activity within the Department is scientific research.

The Department itself is the main reference body for the B.Sc. (Laurea) course in Aerospace Engineering, the M.Sc. (Laurea Magistrale) course in Aeronautical Engineering and Space Engineering, and the Ph.D. (Dottorato di Ricerca) course in Aerospace Engineering. M.Sc. and Ph.D. courses are offered in English. Each year, about 250 students complete the B.Sc., 180 the M.Sc., and 15 the Ph.D. In parallel, DAER-PoliMi staff is strongly involved in several research activities with academia, industries and research bodies worldwide.

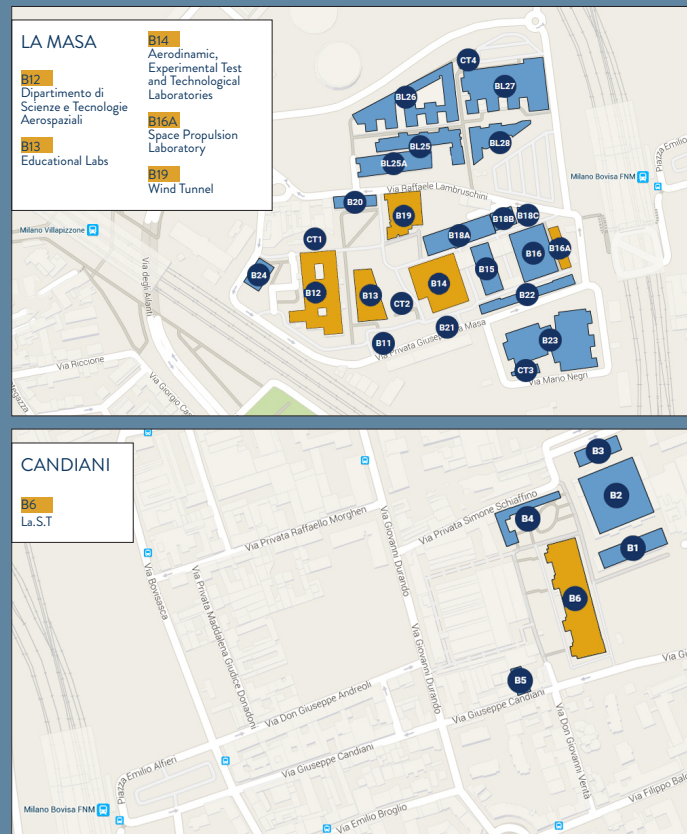
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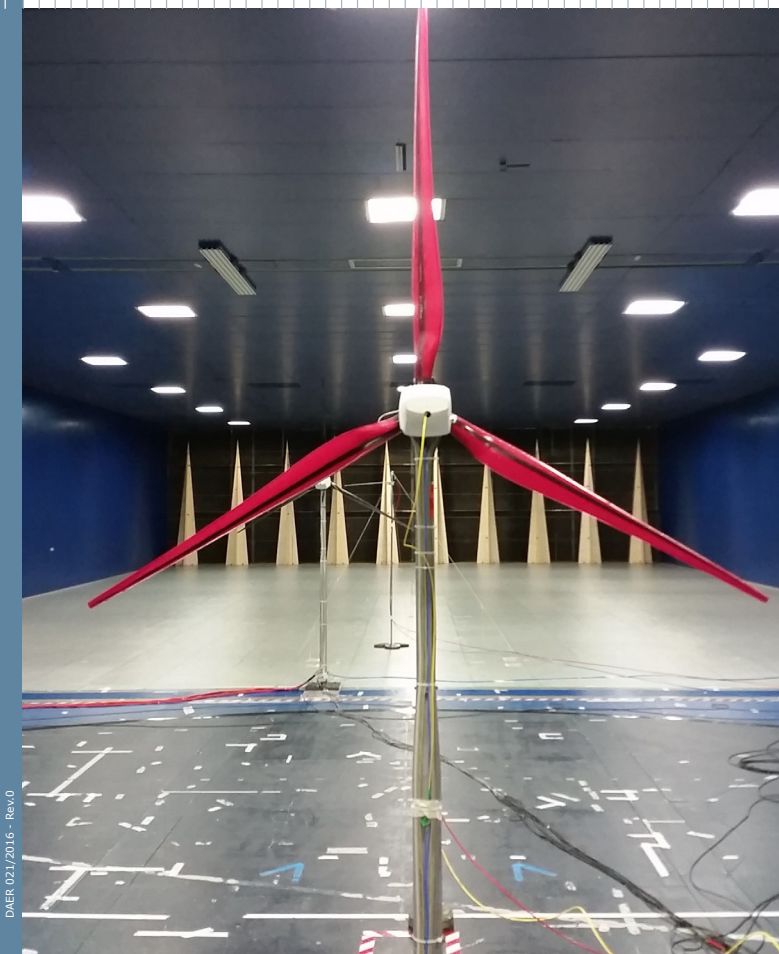


**POLITECNICO**  
MILANO 1863

DIPARTIMENTO DI SCIENZE  
E TECNOLOGIE AEROSPAZIALI

## SCIENTIFIC LAB

POLI-Wind  
Wind Energy Lab



# SCIENTIFIC LABS

## DEPARTMENT OF AEROSPACE SCIENCE AND TECHNOLOGY (DAER)

Research activities within the Aerospace Science and Technology Department (DAER) of Politecnico di Milano are organized in scientific laboratories. These laboratories represent the core of the research competences developed at DAER over the years. They are highly specialized, agile and vital competence centers.

### SCIENTIFIC LABS

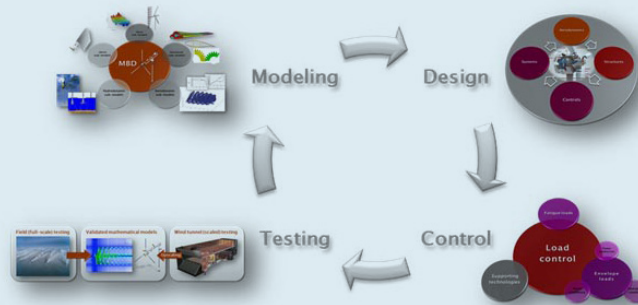
The Department has formed 14 research laboratories, which contribute to the majority of research activities.

- AMATECH - Aerospace MATERIALS and TEChnologies
- ASCL - Aerospace Systems and Control Lab
- ASDL - AeroStructures Design Lab
- AVLab - Aeroelasticity and Vibroacoustics Lab
- CrashLab
- FlowCon - Instability and Flow Control Lab
- FMSlab - Flight Mechanics & Flight Systems Lab
- FRAME - Fixed and Rotary-wing Aircraft Multidisciplinary Eng.
- PFDLab - Physical Fluid Dynamics Lab
- POLI-Wind - Wind Energy Lab
- RAL - Rotorcraft Aerodynamics Lab
- SIAMS - Structural Integrity of Advanced Materials and Structures
- SME - Space Missions Engineering
- SPLab - Space Propulsion Laboratory and Nanoenergetics

# POLI-WIND

## WIND ENERGY LAB

The POLI-Wind Laboratory conducts research in the area of wind energy engineering, mainly in two focus areas: development of technology for wind tunnel testing and design of wind energy systems. In the first focus area, the Lab has developed the first aeroelastically-scaled and actively controlled models expanding the use of wind tunnels towards the domains of aeroelasticity and control. In the latter area, the Lab develops high-fidelity modeling and simulation techniques, wind turbine design tools, advanced model-based control laws and observers, passive control systems for load alleviation, stability analysis and identification methods.



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## ONGOING ACTIVITIES

- In the area of wind tunnel testing, the experimental equipment has now reached full maturity and complete operational capabilities. Major milestones have been represented by experiments conducted with two machines in wake interference conditions and with a rotor designed with aeroelastically-scaled blades equipped with bending-torsion coupling for load alleviation and also with individual blade pitch control.
- Regarding design, the automated tools have now reached the ability to conduct coupled aerostructural optimization of rotor blades integrated with passive control systems, and also including the simultaneous optimization of the tower. With respect to the supporting technologies, major progress has been made on the periodic stability. A second important breakthrough has been the demonstration of a wind misalignment observer in the boundary layer wind tunnel as well as using actual field data.

## FUTURE PLANS

- In the area of design, two EU funded projects INNWIND and AVATAR give the opportunity to test the technology developed at the Lab on extremely large rotors (10-20 MW), including the design with bend-twist coupling and other forms of passive load alleviation and the integration of these concepts with active full span and distributed controllers. The Lab is also actively pursuing opportunities for the demonstration in the field and further maturation of its wind observers and stability analysis tools. In the area of control, work will be expanding towards the control of wind farms.
- The work in the experimental focus area will accompany the methodological and numerical developments. Within the rotor design projects, the Lab has tested the aeroelastically-scaled blade with bend-twist coupling with the aim to validate and calibrate the aeroservoelastic tools developed at the Lab. Work is also well underway on the expansion of the experimental equipment and on the flow measurements (LIDAR, PIV) to allow for the testing and verification of wind farm control algorithms.

## ERC KEYWORDS

PE8\_6 Energy system (production, distribution, application)  
PE8\_4 Computational engineering  
PE7\_1 Control Engineering  
PE8\_1 Aerospace Engineering

## FREE KEYWORDS

- Wind energy.
- Numerical and experimental aeroservoelasticity.