



**POLITECNICO**  
MILANO 1863

**PhD School - Politecnico di Milano**

**Regulations of the PhD Programme in:**

***Aerospace Engineering***

**Cycle XLI**

# 1 General information

PhD School - Politecnico di Milano

PhD Programme: **Aerospace Engineering**

Course start: September 2025

Location of the PhD Programme: [Milano Bovisa](#)

Department promoting the PhD programme: Aerospace Science and Technology

Scientific Disciplinary Sectors:

- IIND-01/C Flight Mechanics
- IIND-01/D Aerospace Structures and Design
- IIND-01/E Aerospace Equipment and Systems
- IIND-01/F Fluid Dynamics
- IIND-01/G Aerospace Propulsion
- PHYS-03/A Experimental Physics of Matter and Applications

PhD School Website:

<https://www.dottorato.polimi.it/en/phd-school>

PhD Programme Website:

<https://www.aero.polimi.it/en/phd>

<https://www.dottorato.polimi.it/en/phd-programmes/engineering/aerospace-engineering>

E-mail: [phd-daer@polimi.it](mailto:phd-daer@polimi.it)

## 2 General presentation

The PhD Programme in Aerospace Engineering aims at educating students and creating world-class researchers in all the main technological disciplines of the aerospace field, but not limited to it, preparing them for tomorrow's scientific and technical challenges, but also for cultural, societal, and environmental ones. The Programme is proposed by the Department of Aerospace Science and Technology (DAER) and is part of the PhD School of the Politecnico di Milano.

The PhD Programme covers a wide range of topics related to Aerospace Engineering. Based on classical aerospace disciplines such as, for example, Aerodynamics and Fluid Mechanics, Structures and Materials, Flight Mechanics and Control, the Programme includes emerging disciplines requiring an enhanced multidisciplinary approach such as rotary wing aircraft, electric airplanes, drones, innovative materials and structures, space mission design, space trajectory design, space situation awareness, innovative propulsion technologies, advanced fluid dynamics, etc. The considered problems require the understanding of the underlying physical processes, the integration of multiple disciplines, the effective use of sophisticated mathematical models and of numerical and experimental methods. Successful programme graduates are expected to be able to conduct and manage original, cutting-edge research in the aerospace science and technology domain, with the ability to cover also neighbouring areas, such as wind energy, automotive engineering, data analytics, human-machine interaction, Earth observation, and other related high-tech engineering fields. Indeed, over the years PhD students in Aerospace Engineering have developed research relevant to aircraft and space applications, and to technical areas not strictly related to the aerospace field.

Examples of research topics in which PhD theses have been recently developed are:

- Computational and experimental fluid mechanics;
- Passive and active control of turbulence;
- Aeroservoelasticity, dynamics and control of aerospace structures;
- Passive structural safety of both aerospace and non-aerospace vehicles;
- Space missions analysis and planning;
- Space trajectory design and control;
- Space economy;
- Distributed spacecraft missions;
- Space situational awareness;
- Advanced materials and structures: analysis, design and testing;
- Innovative space propulsion systems;
- Identification, dynamic and control of complex systems;
- Mechatronics;
- Advanced rotors;
- Maintenance-based design;
- Mathematical modelling and simulation;
- Software development;
- Artificial intelligence application to the aerospace sector;
- Airworthiness and certification;
- Design and control of wind turbines

The PhD course is run by an elected Coordinator and a Faculty Board. The Coordinator chairs the

Faculty Board, coordinates the preparation of the annual Educational Programme, and organises the general educational activities of the PhD course (see Attachment A3). The Faculty Board is responsible for the Educational programme, for teaching and administrative activities related to the PhD course (see Attachment A1).

### 3 Objectives

The aim of the PhD programme is the acquisition of the high level of competence required to carry out innovative research and/or state of the art advanced applications in industries, start-ups, research centres, Universities and service companies operating in the aerospace industrial and research area, including all fields having any connection with aerospace. The level of the programme allows graduates to highly compete in both the European and International aerospace environment.

One of the distinctive skills developed during the PhD program is the ability to effectively transfer knowledge, adapting it to the context, the audience, and the various communication occasions. This skill allows PhD graduates to work effectively in teams and disseminate the results obtained both within their field's community and to broader, more diverse audiences.

During the PhD program, the goal is to provide all candidates with the ability to communicate technically, both orally and in writing, in a way that can be tailored to the recipient of the communication (academic or non-academic). This objective is pursued within the training courses offered by the PhD School, which includes Technical Communication courses. Furthermore, candidates are involved in activities that promote experiential learning ('learning by doing'), a typical learning method used during the PhD journey.

More specifically, each candidate, within their PhD path, must experiment with each of the three modes of technical-scientific communication described below:

1. Oral presentation to experts in the field and topic, aimed at developing the ability to communicate advanced content within a limited timeframe, highlighting key aspects of the research/project and justifying methodological choices in front of an audience with high evaluative capacity. This skill, aimed at sharing projects among colleagues, is achieved by participating in at least one conference/workshop where the research results are presented.
2. Oral presentation to stakeholders with expertise in the field but not the specific topic, to transfer content with an appropriate level of detail in unlimited time frames. This skill is aimed at the ability to transfer research/project content to non-expert collaborators and is achieved through training experiences with specific goals and typical timelines of both academic and corporate training.
3. Written communication aimed at a community of experts. This skill is focused on developing the ability to organize the content of a document, shorter than a book or thesis but still broad in scope, with an appropriate level of technical-scientific detail. This communication mode, typical of internal reports or technical notes, is experienced through the creation of at least one written piece addressed to a relevant scientific community. This could include, for example, a scientific article or a contribution to conference proceedings.

Each candidate is therefore required to participate as a speaker in at least one international conference or workshop, to complete at least one training activity, and to publish at least one scientific or technical contribution aimed at an expert community. Any exceptions must be justified and authorized by the Faculty Board.

## 4 Professional opportunities and job market

Due to the breadth and interdisciplinary nature of the aerospace arena, the professional skills attainable span a wide area. The PhD therefore aims to create high level specialists in most domains related to aerospace activities.

In such a context, a high level of competence can be gained either in a single subject or in the integration of multiple subjects such as dynamics and control, fluid mechanics, systems and equipment, flight mechanics, passive structural safety, intelligent and automated systems, structures and materials, aeroservoelasticity.

The following examples illustrate the professional skills acquired throughout the PhD programme in the past 30 years:

- 1) expert in computational and/or experimental fluid mechanics, with capabilities to develop methods and models for both aerospace applications and generic vehicles;
- 2) expert in active and passive control of the dynamics of aerospace structures, integrating global and subsystem design;
- 3) expert in active and passive safety of vehicles, both aerospace and non-aerospace;
- 4) expert in vibration and noise control, including modelling, analysis, system design and implementation of specific subsystems;
- 5) expert in the dynamics and control of aerospace vehicles and related operational missions;
- 6) expert in integrated design of complex aerospace systems.
- 7) expert in space propulsion development and control
- 8) expert in space mission analysis and design, spacecraft design, flight dynamics engineer
- 9) expert in spaced debris modelling and tracking, space sustainability engineer
- 10) expert in drone design and applications

Based on past experience, graduates have pursued careers in the following roles: highly qualified activities in spin-off companies and/or small and medium high technology enterprises;

- research in public institutions, e.g.: Italian or foreign Universities;
- management of research in medium and large industries.

## 5 Enrolment

### 5.1 Admission requirements

Italian and International citizens can apply. They are requested to have graduated in accordance with the pre-existing laws D.M. 3.11.1999 n. 509, or to have a Master of Science degree in accordance with D.M. 3.11.1999 n. 509, or a Master of Science in accordance with D.M. 22.10.2004 n. 270, or similar academic title obtained abroad, equivalent for duration and content to the Italian title, with an overall duration of university studies of at least five years.

The certified knowledge of the English language is a requirement for admission. Please refer to the PhD School website for details. The admission to the programmes will be established according to the evaluation of the candidates' curricula, motivation letters, and an illustrative report about the development of a possible PhD research, which candidates will send contextually with their application to the admission announcement.

## 5.2 Admission deadlines and number of places available

The number of positions is indicated in the Call for admission to the 41<sup>st</sup> PhD cycle Programmes: <https://www.dottorato.polimi.it/en/phd-school>

Scholarships both on general and on specific themes are available, in accordance with what is specified in the call for admission.

# 6 Contents

## 6.1 Requirements for the PhD title achievement

The achievement of the PhD title in Aerospace Engineering requires a study and research activity of at least three years equivalent of full-time study, research and development of PhD thesis.

PhD candidates in Aerospace Engineering must earn **a minimum of 20 credits** from PhD level courses (see Section 6.3 below) and to continuously conduct studies and research.

Candidates will be asked to demonstrate **knowledge of the Italian language**, equal to at least A1 level of the Common European Framework of Reference for the knowledge of languages. This requirement will be needed to **register for the final exam**. Italian native speakers and all those who can demonstrate knowledge of the Italian language to the required level will be exempt.

The Faculty Board identifies one of its members to act as “tutor” (academic co-supervisor). The role of this tutor is to assist them in the overall training programme and support the representation of their instances in case of contrast with the supervisor, acting as their “ombudsman”, or first point of contact for addressing issues. Along with the supervisor, the tutor supports the candidate in the choice of courses to be included in the study plan, which is eventually submitted for approval to the Coordinator of the PhD Programme (see also Section 6.4 below). The Faculty Board may assign extra course credits to one or more candidates in case they need to complete their preparation in specific topics, relevant for their research projects. In addition to the above requirements, the PhD candidates must complete, during the program, *at least one* of the following activities:

1. present a paper, as co-author, at an International Conference
2. submit a manuscript, as co-author, to an International Peer-reviewed Journal

In case none of these objectives is met, the candidate and the supervisor must justify it in front of the Faculty Board.

## 6.2 Research development

The main aim of all Politecnico di Milano PhD programmes is the development in the candidates of a research-oriented mind-set, with expertise and skills in a specific research topic. To this end, candidates develop a problem-solving capability in complex contexts, including the capacity of performing in-depth analysis of the problem, identifying original solutions, and evaluating their applicability in practical contexts. These skills provide PhD candidates with major opportunities of development in their research both in the academic field and in public and private organisations.

PhD candidates are requested to develop an original research contribution. The PhD thesis must thus contribute to increasing the knowledge in the candidate’s research field. Besides, it must be

coherent with the research topics developed in the Department where the PhD Programme is carried out. The original research results are collected in the PhD thesis, where the candidate's contribution is put in perspective with respect to the research state of the art in the specific research field.

The PhD research is developed under the guidance of a supervisor, who supports the candidate in the setting-out and in the everyday activities related to their thesis development. The supervisor is not necessarily a member of the Faculty Board and may also belong to an institution other than Politecnico di Milano. The supervisor can be supported by one or more co-supervisors.

Further activities intended to develop the candidate's personal skills and research expertise are encouraged during the PhD path. Candidates must acquire the capability to present and discuss their work in their research community. Consequently, both the participation to international conferences and the publication of the research results in peer-reviewed journals, in accordance with internal procedures, are encouraged (see requirements in Section 6.1).

The PhD programme favours the candidates' research interactions with other groups in their research field, preferably abroad. Research visits of at least three months are strongly encouraged, as through them the candidates may acquire further skills to develop their research work and thesis (such internships may be required for some specific grants). The duration of the programme is normally three years.

### 6.3 Objectives and general framework of the teaching activities

The PhD Programmes and the PhD School activate teaching forms of different kind and credit value, including courses, seminars, project workshops, laboratories. Teaching activities both cover basic research issues (problems, theories, methods), which represent the founding element of the PhD Programme and identify clearly its cultural position and deepening in a specialist way some research issues connected with the problems developed in the theses.

Lessons are usually in English, except when indicated otherwise. The PhD programme includes at least one complete path delivered in English language.

Structured teaching activities allow to earn ECTS credits. Other activities, typically specialised and for which it is difficult to evaluate the learning and its quantification, fall within the scientific activities of which the Faculty Board considers in the overall evaluation, but they do not allow to earn ECTS.

Courses and activities are developed as follows:

- 1. Main courses:** they are designed to develop PhD students' expertise in structuring research programmes in the area of their thesis. These courses should be attended in the first two years (mainly in the first year) to refine tools and methods to fully develop high-level research in the last part of the PhD period.
- 2. Other activities:** internships, external courses (held by companies or other institutions), national and international seminars, conferences and workshops, participation in national and international research projects, scientific paper writing and paper presentations on research results, support to teaching activities.
- 3. Development of the PhD thesis:** all thesis related activities.

A typical scheduling of PhD activity is given in Figure 1.

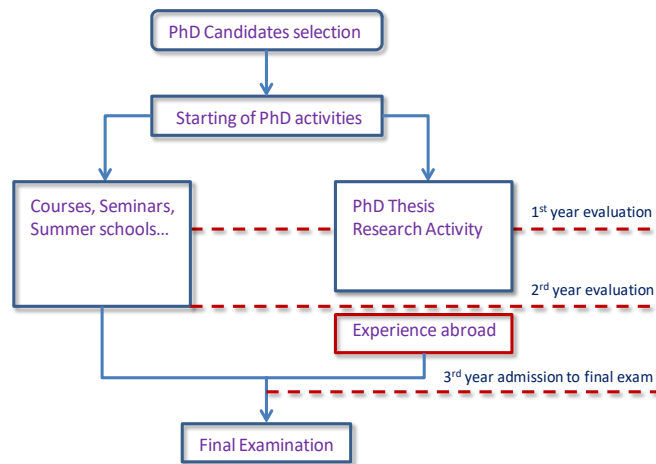


Figure 1. PhD activity schedule.

Among the 20 credits required, **at least 10 credits** of doctoral level must be acquired through PhD School Courses (Type A), **at least 5 credits** from PhD courses characterising the PhD program in Aerospace Engineering (Type B) and the remaining 5 or less credits may be acquired through external PhD courses, e.g. from other PhD programmes (Type C). All the mentioned courses foresee an evaluation of the PhD student to acquire the corresponding credits. Master of Science courses may be inserted in the curriculum of the student, in agreement with the Supervisor (see below) and the Tutor, but do not contribute to the acquisition of doctoral credits.

Table 1 shows the foreseen path for candidates and refer only to coursework activities. At the same time, the programme foresees that the candidate is devoted to research activity in a continuous way, following the guidelines of their supervisors and of the Faculty Board.

*First/Second Year (proposed structure to be personalised)*

Table 1. PhD credits and courses.

Courses	Reference following tables	to	Number of credits (min-max)	Note
PhD School Courses	A		Min 10	See: <a href="http://www.dottorato.polimi.it/en/during-your-phd/phd-school-courses/">http://www.dottorato.polimi.it/en/during-your-phd/phd-school-courses/</a>
Courses characterising the PhD Programme	B		Min 5	These must be selected from the PhD courses offered by the PhD Programme in Aerospace Engineering.
Other PhD Courses				These should be selected on topics connected with the research subject from PhD courses offered by the Politecnico di Milano and/or other Universities, subject to approval of the Faculty Board.

*Second and Third year*

In the second half of the second year and during the whole of the third year the candidate should be devoted entirely to research and development of the PhD thesis.

## PhD Course List

The PhD School of Politecnico di Milano proposes a set of courses aiming to train the PhD candidates in soft and transferable skills. The skills and abilities provided by these courses are expected to help candidates across different areas of their career to respond to the rapidly evolving needs of the global economy and society at large. The PhD School courses activated for the 2024-2025 Academic Year are summarised in Table 2.

Table 2. PhD School courses.

Course name	Professor	ECTS
ADVANCED INTERACTION SKILLS FOR ACADEMIC PROFESSIONALS	ARNABOLDI MICHELA	5
COMMUNICATION STRATEGIES THAT SCORE IN WORLDWIDE ACADEMIA	CONCI CLAUDIO	5
CREATIVE DESIGN THINKING	CANINA MARIA RITA	5
DIGITAL HUMANISM	SCHIAFFONATI VIOLA	5
ENGLISH FOR ACADEMIC COMMUNICATION	BISCARI PAOLO	5
ETHICAL ASPECTS OF RESEARCH ON DUAL-USE TECHNOLOGIES	MASARATI PIERANGELO	5
ETHICS OF ARTIFICIAL INTELLIGENCE	ROCCHI DANIELE	5
HOW TO SUPPORT COMPLEX DECISIONS: APPROACHES AND TOOLS	OPPIO ALESSANDRA	5
INDUSTRIAL SKILLS	BISCARI PAOLO	5
INNOVATIVE TEACHING SKILLS	BRUNETTO DOMENICO SAVIO	5
INTRODUCTION TO ACADEMIC RESEARCH	VOLONTE PAOLO GAETANO	5
LA COMUNICAZIONE NELLA SCIENZA	PAGANONI ANNA MARIA	5
POWER OF IMAGES AND VISUAL COMMUNICATION FOR RESEARCH DISSEMINATION	IAROSSI MARIA POMPEIANA	5
PRACTICING RESEARCH COLLABORATION	PIZZOCARO SILVIA LUISA	5
PROFESSIONAL COMMUNICATION	DI BLAS NICOLETTA	5
PROJECT MANAGEMENT (IN ACTION)	MANCINI MAURO	5
PROJECT MANAGEMENT BASICS	FUGGETTA ALFONSO	5
RECORDING WORK 4 BUILDING MEMORY: METHODS, PRACTICES, TOOLS, SKILLS TO MANAGE THE KNOWLEDGE	BOERI ELISA	5
RESEARCH COMMUNICATION. ISSUE MAPPING: EXPLORING PUBLIC DEBATES SURROUNDING ACADEMIC TOPICS	COLOMBO GABRIELE	5
RESEARCH SKILLS	BISCARI PAOLO	5
SCIENCE DIPLOMACY FOR RESEARCHERS. FILLING THE GAP BETWEEN SCIENCE AND POLICY WITHIN THE GLOBAL CHALLENGES	SHENDRIKOVA DIANA	5
SCIENCE, TECHNOLOGY, SOCIETY AND WIKIPEDIA	RAOS GUIDO	5
SCIENTIFIC/ACADEMIC ENGLISH: WRITING AND PRESENTING WITH AND WITHOUT THE SUPPORT OF LLMS	JACCHETTI EMANUELA	5

SCIENTIFIC COMMUNICATION IN ENGLISH	BISCARI PAOLO	5
STRENGTHENING CRITICAL SPATIAL THINKING	ARMONDI SIMONETTA	5
SULLA RESPONSABILITÀ ETICA DELLA TECNICA	OSSI PAOLO MARIA	5
SUSTAINABILITY METRICS, LIFE CYCLE ASSESSMENT AND ENVIRONMENTAL FOOTPRINT	LAVAGNA MONICA	5
TEACHING METHODOLOGIES, STRATEGIES AND STYLES	SANCASSANI SUSANNA	5
THE COPERNICUS GREEN REVOLUTION FOR SUSTAINABLE DEVELOPMENT	OXOLI DANIELE	5

As already mentioned, at least **10 of the 20 course credits** that each candidate is required to earn **shall be obtained through soft and transferable skills courses** organized by the PhD School.

The Aerospace Science and Technology Department organises specific courses (Table 3), characterising the PhD program in Aerospace Engineering. Courses proposed in cooperation with other departments may be included as well in the PhD program in Aerospace Engineering. The acquisition of **at least 5 credits is mandatory among the PhD courses characterising the PhD Programme**. The courses scheduled for the 2243254 academic year are listed in Table 3.

*Table 3. PhD courses characterising the PhD Programme.*

Course name	Professor	ECT S	Semester	Language	SSD
ADVANCED AEROSPACE CONTROL	INVERNIZZI D.	5	2	Eng	IIND-01/E - IMPIANTI E SISTEMI AEROSPAZIALI
ADVANCED MATERIALS FOR AERONAUTICAL AND SPACE APPLICATIONS	GRANDE A. M.	5	2	Eng	IIND-01/D - COSTRUZIONI E STRUTTURE AEROSPAZIALI
ADVANCED MONITORING SYSTEMS FOR AEROSPACE APPLICATIONS	ACETI P.	5	1	Eng	IIND-01/D - COSTRUZIONI E STRUTTURE AEROSPAZIALI
ADVANCED SIMULATION AND TESTING OF GNC ALGORITHMS	COLAGROSSI A.	5	2	Eng	IIND-01/C - MECCANICA DEL VOLO
AERODYNAMICS AND AEROACOUSTICS OF ROTORS	GIBERTINI G.	5	2	Eng	IIND-01/F - FLUIDODINAMICA
AUTOMATIC DIFFERENTIATION FOR ENGINEERING PROBLEMS	MAESTRINI M.	5	2	Eng	IIND-01/E - IMPIANTI E SISTEMI AEROSPAZIALI
FUNDAMENTALS OF NUMERICAL METHODS FOR CFD	AUTERI F.	5	2	Eng	IIND-01/F - FLUIDODINAMICA
IN-FLIGHT ICING	GUARDONE A.	5	2	Eng	IIND-01/F - FLUIDODINAMICA
MECHANICS OF ELASTIC SOLIDS	MORANDINI M.	5	2	Eng	IIND-01/D -

					COSTRUZIONI STRUTTURE AEROSPAZIALI	E
MULTIBODY DYNAMICS	MASARATI P., CHELI M.	10	2	Eng	IIND-01/D COSTRUZIONI STRUTTURE AEROSPAZIALI	- E
NONLINEAR OPTIMAL CONTROL WITH APPLICATIONS	GIORDANO C., TOPPUTO F.	5	2	Eng	IIND-01/E - IMPIANTI E SISTEMI AEROSPAZIALI	
PERCEPTION AND NAVIGATION WITH GEOMETRICAL AND MACHINE LEARNING APPROACHES	PANICUCCI P., SILVESTRINI S.	10	2	Eng	IIND-01/E - IMPIANTI E SISTEMI AEROSPAZIALI, IIND- 01/C - MECCANICA DEL VOLO	
SPACECRAFT OPERATIONS	MORSELLI A.	5	2	Eng	IIND-01/E - IMPIANTI E SISTEMI AEROSPAZIALI	
SPACE TRAFFIC MANAGEMENT	BORELLI G., MONTARULI M. F.	5	2	Eng	IIND-01/E - IMPIANTI E SISTEMI AEROSPAZIALI, IIND- 01/C - MECCANICA DEL VOLO	
TECHNOLOGIES FOR SMART AEROSPACE STRUCTURES	SALA G.	5	1	Eng	IIND-01/D COSTRUZIONI STRUTTURE AEROSPAZIALI	- E
THE ADVANCED AIR MOBILITY REVOLUTION	QUARANTA G.	5	2	Eng	IIND-01/D COSTRUZIONI STRUTTURE AEROSPAZIALI	- E

### Preparatory courses

If the supervisor and the tutor find it useful or necessary, that the candidate attends preparatory courses (chosen among the courses activated at the Politecnico di Milano) the Faculty Board of the PhD programme may assign some extra-credits to be acquired to complete the training path. The credits acquired in this way will be considered as additional, in relation to the mandatory credits to be acquired with the PhD courses.

### Specialistic courses long-training seminars

The attendance of Specialist Courses, Workshops, Schools, Seminars cycles is strongly encouraged and (if these seminars, workshops are certified and evaluated) may permit to acquire credits according to the modalities established by the Faculty Board and previous approval of the study plan submitted by the candidate. These courses and workshops can be inserted in the study plan, even if they are not evaluated (and therefore not qualified as credits), as optional “additional teaching”.

## 6.4 Presentation of the study plan

PhD candidates must submit a study plan, which may be revised periodically (approximately every three months), to align them to possible changes in the course list, or to needs motivated by the development of their PhD career. The study plans must be approved by the PhD programme Coordinator, according to the modalities established by the Faculty Board of the PhD Programme itself.

## 6.5 Yearly evaluations

Candidates present their work to the Faculty Board at least once a year. In particular, the candidates must pass an annual evaluation to be admitted to the following PhD year. The third-year evaluation establishes the candidate's admission to the final PhD defence.

As a result of each annual evaluation, the candidates who pass the exam receive an evaluation (A/B/C/D) and may proceed with the enrolment at the following year. Candidates who do not pass the exam are qualified either as “Repeating candidate” (Er) or “not able to carry on with the PhD” (Ei). In the former case (Er), the candidates are allowed to repeat the PhD year at most once. The PhD scholarships – if any – are suspended during the repetition year. In the latter case (Ei) the candidates are excluded from the PhD programme and lose their scholarships – if any.

In case the Faculty Board holds appropriate to directly assign an exclusion evaluation (Ei) without a previous repetition year, the request must be properly motivated, and validated by the PhD School. After the final year, candidates who have achieved sufficient results but need more time to draw up their theses, may obtain a prorogation of up to 12 months.

## 6.6 PhD thesis preparation

The main objective of the PhD career is the development of an original research contribute. The PhD thesis is expected to contribute to the advance of the knowledge in the candidate's research field. The PhD study and research work is carried out, full time, during the three years of the PhD course. Stages or study periods in (Italian or International) companies or external Institutions may complete the candidate's preparation. The resulting theses need to be coherent with the research issues developed in the Department where the PhD programme is developed.

The candidate must present an original thesis, discuss its contribution to the state of the art in the research field in the research community.

The PhD research is developed following the lead of a supervisor, who supports the candidate in the setting out and in the everyday activities regarding the thesis development. At the conclusion of the PhD studies, the Faculty Board evaluates the candidates. Candidates who receive a positive evaluation submit their theses to two external reviewers for refereeing. If the evaluation provided by the reviewers is positive (or after the revisions required by the external reviewers), the candidates defend their thesis in a final exam, in front of an examination Committee composed by three members (at least two of which must be external experts).

## 7 Laboratories, PhD Services

The Department of Aerospace Science and Technology is equipped with many experimental and research labs, including:

- Aerodynamics
- Composites and smart structures
- Crashworthiness
- Flight simulation
- Space systems
- Spacecraft autonomy
- Space propulsion
- Structural testing

Secretary:

Luca Zioni

Tel: 02-23998323, Fax: 02-23998334

e-mail: [luca.zioni@polimi.it](mailto:luca.zioni@polimi.it)

Head of Administration:

Ing. Andrea Milanese

Tel: 02-23998331, Fax: 02-23998334

e-mail: [andrea.milanese@polimi.it](mailto:andrea.milanese@polimi.it)

## 8 Internationalisation and other activities

A research period between three and six months to be spent at foreign universities, research laboratories and industries is not compulsory but strongly recommended for all PhD candidates. Politecnico di Milano supports joint PhD paths with International Institutions, as well as Joint and Double PhD programmes. Further information can be found on the PhD School and PhD programme websites.

More specifically, the PhD programme in Aerospace Engineering is actively participating in the following Marie-Curie European programs:

- coordinator of EJD program **NITROS** (Network for Innovative Training on Rotorcraft Safety), in collaboration with Delft University, University of Liverpool and University of Glasgow – <https://www.nitros-ejd.org/>
- partner in ETN program **UTOPIAE** (Uncertainty Treatment and Optimisation In Aerospace Engineering), in collaboration with University of Strathclyde, University of Durham, Ghent University – <http://utopiae.eu/>
- partner in ETN program **STARDUST-R** (Stardust Reloaded), in collaboration with University of Strathclyde, Università degli Studi di Roma Tor Vergata, Universitatea Alexandru Ioan Cuza Din Iasi, Università di Pisa, Universidad Autonoma de Madrid, Academy of Athens, University of Belgrade, Technische Universiteit Delft – <http://www.stardust-network.eu/>
- partner in EID program **EDEM** (Experimentally Validated DNS and LES Approaches for Fuel Injection, Mixing and Combustion of Dual-Fuel Engines), in collaboration with City University of London, Friedrich-Alexander-Universität Erlangen-Nürnberg, Brunel University, Technische Universität München, Chalmers University of Technology
- partner in ETN program **FLOAWER** (FLOAting Wind Energy netwoRk), in collaboration with

Centrale Nantes, Carl von Ossietzky Universität Oldenburg, University of Stuttgart, CNRS-LEGI - S. Barre, University College Cork, Norwegian University of Science and Technology - E. Bachynski, Technical University of Denmark, University of Rostock – <https://www.flower-h2020.eu/>

- partner in ETN program **ASCenSlon** (Advancing Space Access Capabilities - Reusability and Multiple Satellite Injection), in collaboration with Università degli Studi di Roma La Sapienza, Université Libre de Bruxelles, Hochschule Bremen, Università di Pisa, Technische Universität Braunschweig – <https://ascension-itn.eu/>
- coordinator in DN program **TRACES** (TRAIning next generation iCe Engineers and Scientists), in collaboration with Technical University Braunschweig, Technical University Darmstadt, ONERA/ISAE, Ecole Polytechnique IPPARIS – <https://traces-project.eu>
- and is associated with the ETN program **MIGRATE**, in collaboration with Karlsruher Institut fuer Technologie, University of Limerick, Università di Bologna, Institut National Des Sciences Appliquées de Toulouse and University of Thessaly, providing training and secondments.

It is also carrying out joint/double PhD programs with Beihang University, Istanbul Technical University, Nanjing University of Science and Technology, Technische Universiteit Delft, Universidade de São Paulo, University of Glasgow, University of Liverpool, Vrije Universiteit Brussel, Warsaw University of Technology, and Xi'an JiaoTong University, and more.

Interaction with and exposure to non-academic sectors provides significant benefits to doctoral candidates as well as to research and innovation intensive employment sectors. Direct exposure to the challenges and opportunities in non-academic sectors of the economy and society at large is fostered by networking, connectivity, inter-sectoral mobility, and wide access to knowledge. In particular, the PhD programme in Aerospace Engineering collaborates with several Research Agencies and Industrial partners, including:

- D-Orbit Spa
- European Space Agency, ESA
- Italian Space Agency, ASI
- Istituto Nazionale di Astrofisica, INAF
- Leonardo SpA
- Eumetsat
- Italian Air Force

through the activation of thematic scholarships.

## Attachment A1 – PhD Faculty Board

Description of the composition of the Faculty Board.

*Table 4. Faculty board.*

Name	Position	SSD
Camilla Colombo (Coordinator)	Full Prof.	IIND-01/C
Alessandro Airoidi	Associate Prof.	IIND-01/D
Franco Auteri	Full Prof.	IIND-01/F
Marco Belan	Associate Prof.	IIND-01/F
Franco Bernelli	Full Prof.	IIND-01/E
Paolo Bettini	Associate Prof.	IIND-01/D
Chiara Bisagni	Full Prof.	IIND-01/D
Stefano Cacciola	Associate Prof.	IIND-01/C
Andrea Colagrossi	Researcher	IIND-01/C
Giovanni Consolati	Associate Prof.	PHYS-03/A
Alessandro De Gaspari	Associate Prof.	IIND-01/D
Fabio Ferrari	Associate Prof.	IIND-01/E
Gabriella Gaias	Associate Prof.	IIND-01/E
Antonio Grande	Associate Prof.	IIND-01/D
Alberto Guardone	Full Prof.	IIND-01/F
Davide Invernizzi	Associate Prof.	IIND-01/E
Michèle Lavagna	Full Prof.	IIND-01/C
Paolo Lunghi	Researcher	IIND-01/E
Filippo Maggi	Full Prof.	IIND-01/G
Pierangelo Masarati	Full Prof.	IIND-01/D
Mauro Massari	Associate Prof.	IIND-01/E
Marco Morandini	Associate Prof.	IIND-01/D
Christian Paravan	Associate Prof.	IIND-01/G
Federico Piscaglia	Associate Prof.	IIND-01/G
Maurizio Quadrio	Full Prof.	IIND-01/F
Carlo Riboldi	Associate Prof.	IIND-01/C
Francesco Topputo	Full Prof.	IIND-01/E
Riccardo Vescovini	Associate Prof.	IIND-01/D
Andrea Zanoni	Researcher	IIND-01/D
Alex Zanotti	Associate Prof.	IIND-01/F

## Attachment A2 – PhD Advisory Board

*Table 5. Advisory board.*

Name	Company-Organization	Position
Valerio Cioffi	Leonardo Aircraft Division	Chief Technology Officer
Gian Paolo Dallara	Dallara Automobili	President
Luca Medici	Leonardo Helicopter Division	Head of Aircraft Systems Integration
Marco Molina	SITAEL	Space Commercial Director
Franco Ongaro	Leonardo	Technical Director
Matteo Ragazzi	Leonardo Helicopter Division	Chief Technology Officer
Grazia Vittadini	Rolls-Royce	Chief Technology Officer

# Attachment A3 – PhD Programme Coordinator

## Personal information

Dr. Colombo Camilla  
Department of Aerospace Science and Technology  
Politecnico di Milano  
Via La Masa 34, 20156 Milano  
E-mail: [camilla.colombo@polimi.it](mailto:camilla.colombo@polimi.it)

**ORCID** 0000-0001-9636-9360 <http://orcid.org/0000-0001-9636-9360>  
**ReseracherID** J-4719-2012  
**ScopusID** 16052232100  
**ReserachGate** [www.researchgate.net/profile/Camilla\\_Colombo](http://www.researchgate.net/profile/Camilla_Colombo)  
**LinKedIn** [www.linkedin.com/pub/camilla-colombo/7/40/852](http://www.linkedin.com/pub/camilla-colombo/7/40/852)  
**GSD:** 09/IIND-01 - INGEGNERIA AEROSPAZIALE E NAVALE  
**SSD:** IIND-01/C - Meccanica Del Volo

## Professional experience

- 13 Jan. 2025 – current **Full Professor**  
Department of Aerospace Science and Technology,  
Politecnico di Milano (Italy)  
IIND-01/C – Flight Mechanics, disciplinary scientific group 09/IIND-01 – Aerospace and naval engineering  
Main line of investigation: Orbital dynamics under the effects of perturbations, long-term orbit propagation, space debris modelling, space sustainability, space situational awareness, space safety, space traffic management and space debris mitigation, mission analysis, space trajectory design and optimisation, asteroid deflection, planetary protection, solar sails, space mission design in particular for asteroid deflection, remote sensing through formation flying, in-orbit inspection through formation flying, in-orbit space safety and space debris validation.  
web: [www.compass.polimi.it](http://www.compass.polimi.it)
- 4 Mar. 2024 – 05 Aug. 2024 **Maternity leave**
- 22 Jul. 2016 – current **Associate Professor**  
Department of Aerospace Science and Technology,  
Politecnico di Milano (Italy)  
ING-IND / 03 Flight Mechanics, 09/A1 - Aeronautical, aerospace and naval engineering  
Main line of investigation: Orbital dynamics under the effects of perturbations, long-term orbit propagation, space debris modelling, space sustainability, space situational awareness, space safety, space traffic management and space debris mitigation, mission analysis, space trajectory design and optimisation, asteroid deflection, planetary protection, solar sails, space mission design in particular for asteroid deflection, remote sensing

through formation flying, in-orbit inspection through formation flying, in-orbit space safety and space debris validation.

web: [www.compass.polimi.it](http://www.compass.polimi.it)

10 Apr. 2019 – 09 Sep. 2019 **Maternity leave**

22 Jul. 2016 – Dec. 2020 **Visiting Lecturer in Spacecraft Engineering, Visiting Academic**

Aeronautics, Astronautics and Computational Engineering Research Unit, Faculty of Engineering and the Environment,

University of Southampton, Southampton (UK)

Main duties: Co-supervision of PhD students on space debris modelling and mitigation, microwave radiometer using formation flight interferometry for geostationary atmospheric sounding.

web: <https://www.southampton.ac.uk/engineering/about/staff/cc2r11.page>

1 Mar. 2016 – 21 Jul. 2016 **Associate Professor in Spacecraft Engineering**

Aeronautics, Astronautics and Computational Engineering Research Unit, Faculty of Engineering and the Environment, University of Southampton, Southampton (UK)

Main line of investigation: Space debris modelling, space situational awareness, space safety and space debris mitigation, mission analysis, space trajectory design and optimisation, asteroid deflection, planetary protection, solar sails.

1 Jun. 2012 – 29 Feb. 2016 **Lecturer in Spacecraft Engineering**

Aeronautics, Astronautics and Computational Engineering Research Unit, Faculty of Engineering and the Environment, University of Southampton, Southampton (UK)

Main line of investigation: End-of-life disposal of highly elliptical orbit and Libration point orbit missions, space debris modelling and mitigation, spacecraft design for demise, fragment clouds propagation, solar sail missions.

1 Jun. 2013 – 31 May. 2015 **Marie Curie Research Fellow**

Department of Aerospace Science and technology, Politecnico di Milano, Milano (Italy)

Position funded by the FP7/EU Marie Curie grant 302270 (SpaceDebECM - Space Debris Evolution, Collision risk, and Mitigation).

Main line of investigation: End-of-life spacecraft disposal, space debris modelling and mitigation, debris clouds propagation, semi-analytical methods, global and local optimisation of space trajectories.

web: [www.polimi.it](http://www.polimi.it)

1 Aug. 2009 – 31 May. 2012 **Research Fellow**

Advanced Space Concepts Laboratory, Department of Mechanical and Aerospace Engineering, University of Strathclyde, Glasgow (UK)

Position funded by the European Research Council, as part of project VISIONSPACE, Visionary Space Systems: Orbital Dynamics at Extremes of Spacecraft Length-Scale (227571) (PI: Prof. Colin McInnes).

1 Nov. 2005 – 31 Oct. 2008 **Research Associate**

Space Advanced Research Team, Department of Aerospace Engineering, University of Glasgow, Glasgow (UK), web: [www.gla.ac.uk](http://www.gla.ac.uk)

Position funded by the Engineering and Physical Sciences Research Council, grant GR/S83999/01 on Optimal Interception & Deviation of Potentially Hazardous Near Earth Objects (PI: Prof. Gianmarco Radice).

web: <https://webarchive.nationalarchives.gov.uk/ukgwa/20100709092224/http://gow.epsrc.ac.uk/ViewGrant.aspx?GrantRef=GR/S83999/01>

2006 – current                      **University lecturing** for undergrad, postgrad, Master-level and PhD-level courses

2012 – current                      **Lecturer for continuous development courses for professionals**

## Education

- Nov. 2005 – Jan. 2010              Ph.D. in Aerospace Engineering  
Department of Aerospace Engineering, University of Glasgow, Glasgow, UK  
web: [www.gla.ac.uk](http://www.gla.ac.uk)  
Ph.D. thesis: “Optimal trajectory design for interception and deflection of near-Earth objects” (Supervisors: Dr. Gianmarco Radice, Dr. Massimiliano Vasile).  
<https://theses.gla.ac.uk/1819/1/2010colombophd.pdf> Ph.D. awarded 1 Jul. 2010.
- Jan. – Mar. 2008                      Ph.D. Part Appointment  
Department of Energy, Politecnico di Torino, Torino (Italy), web: [www.polito.it](http://www.polito.it)  
“Optimisation methods for space trajectories” (Advisor: Prof. Lorenzo Casalino).
- Sep. 1999 – Oct. 2005              B.Eng, M.Eng in Aerospace Engineering (Laurea 5 anni Vecchio ordinamento)  
Politecnico di Milano, Milano (Italy), web: [www.polimi.it](http://www.polimi.it)  
M.Sc. thesis: “Development of an optimiser for low-thrust trajectories based on differential dynamic programming” (Supervisor: Dr. Massimiliano Vasile, Co-supervisor: Dr. Paolo De Pascale). Grade: 100/100.

## Scientific recognitions

This section contains scientific awards and recognitions, fellowships and participation in international technical committees.

## Qualifications and accreditations

- Jun. 2020                              Italian National Scientific Qualification at a level of assistant professor 09/A1 Aeronautical and Aerospace Engineering and Naval Architecture - I Level.  
Conseguimento dell’**Abilitazione Scientifica Nazionale alle funzioni di professore di prima fascia**, conseguita in data 30/06/2020, BANDO D.D. 2175/2018 (Domanda 29860 - Prima Fascia 09/A1 - INGEGNERIA AERONAUTICA, AEROSPAZIALE E NAVALE trasmessa in data 13/01/2020).
- 03 Feb 2014                              Italian National Scientific Qualification at a level of assistant professor 09/A1 Aeronauti-

cal and Aerospace Engineering and Naval Architecture - II Level.

Conseguimento dell'**Abilitazione Scientifica Nazionale alle funzioni di professore di seconda fascia**, conseguita in data 03/02/2014, BANDO D.D. 222/2012 (Domanda 82485 - Seconda Fascia 09/A1 - INGEGNERIA AERONAUTICA, AEROSPAZIALE E NAVALE trasmessa in data 20/11/2012)

27 July 2016

**Associate Fellow recognition with the UK Higher Education Academy** in recognition of attainment against the UK Professional Standards Framework for teaching and learning support in higher education, Recognition reference: PR110341

## Scientific awards and fellowships

Jan. 2024

Outstanding Paper Award for Young Scientist for 2023 by the Committee on Space Research (COSPAR) for the manuscript: Giudici L., Trisolini M., C. Colombo, "Probabilistic multi-dimensional debris cloud propagation subject to non-linear dynamics", *Advances in Space Research*, Vol. 72, n. 2, 15 July 2023, pp. 129-151

<https://doi.org/10.1016/j.asr.2023.04.030>.

web:

[https://cosparhq.cnes.fr/assets/uploads/2024/04/ASR\\_best\\_papers\\_2023\\_final.pdf](https://cosparhq.cnes.fr/assets/uploads/2024/04/ASR_best_papers_2023_final.pdf)

2023

**European Research Council Consolidator Grant** 101089265, GREEN SPECIES: "Robust control of the space debris population to define optimal policies and an economic revenue model for sustainable development of space activities". Total grant contribution: EUR 2M.

web:

<https://erc.europa.eu/sites/default/files/2023-01/erc-2022-cog-results-all-domains.pdf>

2019 – 2021

**Young Scientist community at the World Economic Forum**

Selected among scientist in Europe aged under 40 to be part of the Young Scientist cohort (40 scientists). The Young Scientists community was created in 2009 to engage rising-star researchers in the work of the World Economic Forum [Link](#). The mission is to:

- communicate cutting-edge research and position science discourse within the context of scientific evidence,
- develop leadership skills and a fuller understanding of global, regional and industry agendas.
- build a diverse global community of next-generation scientific leaders, committed to engaging in collaborations related to collectively identified issues

web: <https://www.weforum.org/communities/young-scientists>

2018

Selected **100 best Italian scientists "Cartaditalia: New frontiers for Italian Scientific Research"** [https://iicamsterdam.esteri.it/it/gli\\_eventi/calendario/presentazione-di-cartaditalia-terza/](https://iicamsterdam.esteri.it/it/gli_eventi/calendario/presentazione-di-cartaditalia-terza/)

Nov. 2019

Gave **Inaugural Lecture for the Opening of the 157<sup>th</sup> Academic Year** at Politecnico di Milano.

video: <https://www.youtube.com/watch?v=FQhNw0vF0mY&feature=youtu.be>

2015

**European Research Council Starting Grant** 679086, [COMPASS Control for orbit manoeuvring through perturbation for application to space systems](#). Total grant contribution: EUR 1.5M.

Jun. 2013 – May 2015 **Intra-European Fellowship - FP7 EU Marie Curie grant 302270: SpaceDebECM - Space Debris Evolution, Collision risk, and Mitigation.** Total contribution: EUR 185,763.  
 web: [http://cordis.europa.eu/projects/rcn/104431\\_en.html](http://cordis.europa.eu/projects/rcn/104431_en.html)

## Participation to international scientific and policy boards

Participation to international scientific and policy boards as technical expert.

<b>Dates</b>	<b>Role, International Board</b>
Nov. 2023 – current	<b>EPFL eSpace Center Advisory board.</b> <a href="#">Advisory Board &amp; Steering Committee – eSpace – EPFL Space Center</a>
2023 – current	Advisory board of ERC project “Planetary stewardship in view of earth-space sustainability (PlanetStewards)”, PI: Xiao-Shan Yap, Utrecht University.
2020 – current	Scientific Advisor for Vyoma Space Company. <a href="https://www.vyoma.space/">https://www.vyoma.space/</a>
2017 – current	Delegate for the Italian Space Agency at the <b>Inter-Agency Space Debris Coordination Committee (IADC)</b> as part of the working group 2 on modelling of the space debris environment. <a href="https://iadc-home.org/what_iadc">https://iadc-home.org/what_iadc</a>
2017 – current	Delegate for the Italian Space Agency at the <b>COPUOS Science and Technical Subcommittee Space Mission Planning Advisory Group (SMPAG)</b> on threat to Earth by hazardous Near-Earth Objects. <a href="https://www.cosmos.esa.int/web/smpag">https://www.cosmos.esa.int/web/smpag</a> .
2018 – current	Member of the International Astronautical Federation Space Traffic Management Committee (TC26). <a href="https://www.iafastro.org/about/iaf-committees/technical-committees/space-traffic-management-committee.html">https://www.iafastro.org/about/iaf-committees/technical-committees/space-traffic-management-committee.html</a>
2015 – 2016	Delegate for UK Space Agency at the <b>Inter-Agency Space Debris Coordination Committee (IADC)</b> as part of the working group 2 on modelling of the space debris environment.
2015 – 2016	Delegate for the UK Space Agency to the <b>COPUOS Science and Technical Subcommittee Space Mission Planning Advisory Group (SMPAG)</b> on threat to Earth by hazardous Near-Earth Objects.
2015 – 2016	Member of the “Regulatory Advisory Group” from the UK Space Innovation and Growth Strategy to discuss the competitiveness of the UK’s space regulatory regime
2015	UK Space Agency representative at “European Campaign on Mega Constellations” meeting at ESA

## Participation in editorial committees of journals

<b>Dates</b>	<b>Role, Editorial Board</b>
Dec. 2023 – current	Associate editor for The Journal Spacecraft and Rockets <a href="https://arc.aiaa.org/jsr/about">https://arc.aiaa.org/jsr/about</a>
2020 – 2024	Associate editor for The Journal of the Astronautical Sciences <a href="https://www.springer.com/journal/40295/editors">https://www.springer.com/journal/40295/editors</a>

2020 – 2022	Associate editor for Frontiers in Space Technologies (Space Debris) <a href="https://loop.frontiersin.org/people/557721/overview">https://loop.frontiersin.org/people/557721/overview</a>
2017 – current	Reviewer for the European Commission (Europe Horizon programme): FET Open.
2008 – current	Reviewer for international journals: Journal of Guidance, Control, and Dynamics; Journal of Spacecraft and Rockets; Celestial Mechanics and Dynamical Astronomy; Advances in Space Research; Acta Astronautica; Institute of Electrical and Electronic Engineers (IEEE) Spectrum; Frontiers in Space Technologies, Space Debris section (Reviewer Editor); Astronomy and Astrophysics.

## Organisation of scientific conferences and technical events, chair at conference sessions

Dates	Role, Event/Conference/Committee
2024 – 2025	<b>Scientific Programme Committee</b> , Ninth European Conference on Space Debris (1 – 4 April 2025)
2024 – 2025	<b>Technical Committee</b> for the 11 <sup>th</sup> EUCASS European Conference for AeroSpace Sciences, Rome. Responsible and chair for the Sustainable Space: Logistics and Space Debris SUSTSP Sections
2024	Supported to AIDAA for <b>Local organising committee for IAC 2024 Milano</b> .
25-28 Jun. 2024	Organisation of “THEMIS – Final presentation and demonstration” within the <b>ESA Zero Debris Week</b> <a href="https://indico.esa.int/event/511/page/823-themis-final-presentation-and-demonstration">https://indico.esa.int/event/511/page/823-themis-final-presentation-and-demonstration</a>
6-8 Jun. 2023	<b>Organizing committee</b> for the 1 <sup>st</sup> Space capacity allocation for the sustainability of space activities Workshop, Politecnico di Milano <a href="https://indico.esa.int/event/460/">https://indico.esa.int/event/460/</a> .
18-20 May 2022	<b>Organising committee</b> for the 6 <sup>th</sup> European Workshop on Space Debris Modeling and Remediation, Politecnico di Milano, Italy <a href="https://www.aero.polimi.it/en/magazine/6th-european-space-debris-modelling-and-remediation-workshop-by-cnes-and-politecnico-di-milano">https://www.aero.polimi.it/en/magazine/6th-european-space-debris-modelling-and-remediation-workshop-by-cnes-and-politecnico-di-milano</a> .
2021 – current	Member of <b>Space Debris Symposium International Programme Committee</b> for the International Astronautical federation at the International Astronautical Congress.
Oct. 2024	Chair for Joint Technical Session IAC-24 A6.10/E9.4 “Space carrying capacity assessment and allocation” at the 75 <sup>th</sup> International Astronautical Congress 2024, Milano.
Oct. 2023	Evaluator for Interactive Presentation Session at the 73 <sup>rd</sup> International Astronautical Congress 2022, Baku.
2023	<b>Technical Committee</b> for the Joint 10th EUCASS – 9th CEAS Aerospace Europe Conference Lausanne. Responsible and chair for the Sustainable Space: Logistics and Space Debris SUSTSP Sections
Oct. 2022	Chair for Joint Technical Session IAC-22 A6.10/E10.2. “Near-Earth Objects & Space Debris” and Evaluator for Interactive Presentation Session at the 73 <sup>rd</sup> International Astronautical Congress 2022, Paris.

- 2019-12-11 Chairman of a technical session at “International Orbital Debris Conference”, Sugar Land, Texas, 9-12 Dec. 2019
- 14 May – 8 Jun. 2018 **Organising Committee** of the 4-week workshop “Near-Earth Objects: Properties, Detection, Resources, Impacts and Defending Earth”, Organised by Andreas Burkert, Camilla Colombo, Robert Jedicke, Detlef Koschny, Richard Wainscoat, Munich Institute for Astro and Particle Physics (MIAPP), Munich, Germany. <http://www.munich-iapp.de/programmes-topical-workshops/2018/near-earth-objects-properties-detection-resources-impacts-and-defending-earth/>
- 25-27 Jun. 2018 Chairman of a technical session on “Modelling and dynamics” at the Workshop on Debris Modelling and Remediation, 26 Jun. 2019, CNES, Paris.
- 20 Jan. 2016 Chairman of a technical session at “2<sup>nd</sup> Stardust Global Virtual Workshop (SGVW-2) on Asteroids and Space Debris”, Southampton, UK, 19-22 Jan. 2016.

### Fellow of scientific societies and commission of trust

- 2017 – current Member of the Italian Association of Aeronautics and Astronautics (AIDAA).
- 2009 – current Member of the Società Italiana di Meccanica Celeste e Astrodinamica (SIMCA).
- 2006 Member of the American Institute of Aeronautics and Astronautics (AIAA).








## Research

### Grants and industrial contracts









The Table in the page below lists the current and past grants I am (Principal Investigator) PI of, or I lead the contribution of for my Host Institution (HI). All research activities are entirely financed by the projects reported in Table through funding from the European Commission (EC), or the European Space Agency (ESA), or the Italian Space Agency (ASI). For each project the period, the total funding, and the funding from the Host institution (HI) and the role I held in leading the projects is shown. The table lists both the responsibility for studies and scientific research entrusted by qualified public or private institutions, and the scientific responsibility for international and national research projects, admitted for funding based on competitive calls that include peer review. Some selected projects are described in the following in Section.




Table 6. Past and on-going successful grants.

Amount: T = Total amount of the grant, HI = sum granted to Host Institution. ESA = European Space Agency. EC: European Commission.

ID	Funding body	Programme	Logo	Project title	Start	End	Duration	Role	Consortium
1	European Research Council Executive Agency (ERCEA)	ERC Consolidator grant		GREEN SPECIES: Robust control of the space debris population to define optimal policies and an economic revenue model for sustainable development of space activities	01/07/2023	31/12/2028	5 yrs	Principal investigator	<b>Politecnico di Milano</b>
2	ESA	ESA Space Safety		S2-SD-02: Extended Methods for Space Debris Consequence and Space Capacity Analysis	03/09/2024	02/09/2026	24 m	Principal investigator and consortium coordinator	<b>Politecnico di Milano</b> , GMV UK
3	ASI	Next Generation EU/PNRR		Servizi inerenti alla realizzazione di un'infrastruttura HW e SW presso il CGS/Matera	26/05/2023	25/05/2026	3 yrs	Coordinator of Poli-Mi contribution	<b>Telespazio S.p.A.</b> , Politecnico di Milano, OHB, SpaceDyS, Stellar Project, Leonardo S.p.A., NEXT, Università Federico II Napoli, Università Roma Tor Vergata
4	European Research Council Executive Agency (ERCEA)	ERC Starting grant		COMPASS: Control for orbit manoeuvring through perturbations for application to space systems	01/08/2021	31/04/2022	5 yrs	Principal investigator	<b>Politecnico di Milano</b>
5	ESA	ESA Space Safety		S1-SC-01: Design, development, and deployment of software infrastructure to assess the impact of a space mission on the space environment	20/01/2021	28/02/2022	18 m	Principal investigator and consortium coordinator	<b>Politecnico di Milano</b> , DEIMOS UK
6	ESA			On-Orbit Break-up Forensics – T711-802SD	22/12/2023			Principal investigator and consortium coordinator	Politecnico di Milano, GMV Poland, SpaceDyS, IFAC-CNR
7	ASI			Detriti spaziali e sostenibilità delle attività spaziali a lungo-termine	28/11/2023	01/12/2026	3 yrs	Coordinator of Poli-Mi contribution	<b>INAF</b> , IFAC-CNR, IST-CNR, Università la Sapienza Roma, Politecni-

									co di Milano, Università di Padova; Osservatorio di Palermo
8	ASI	Alcor programme	 SPACE EYE - SpEye mission - Phase A	13/03/2023	29/09/2023	6 m	Coordinator of Poli-Mi contribution	<b>Techno System Developments</b> , D-Orbit, T4i, planetec, Politecnico di Milano, Università di Napoli Federico II	
9	European Research Council Executive Agency (ERCEA)	Marie Skłodowska-Curie Individual Fellowships	 CRADLE: Collecting asteroid-orbiting samples: enabling a safer, sustainable, and autonomous exploration of asteroids	15/03/2021	19/03/2023	32 m	Supervisor of MSCA research fellow	<b>Politecnico di Milano</b> , JAXA	
10	ESA		 Radiation Environment Monitor for Energetic Cosmic rays (REMEC)	12/07/2022	28/02/2024	1 yrs	Coordinator of Poli-Mi contribution	<b>Czech Technical University in Prague</b> , Politecnico di Milano, University of Genève	
11	ESA		 ACTIVA – Advanced Control Techniques for Increased On Board Autonomy	22/05/2024			Team member	<b>GMV (Portugal)</b> , GMV (Romania), GMV (Spain), Politecnico di Milano	
12	ESA		 Deployable Surface-Based Debris Monitoring – DSBDM	22/03/2022	16/11/2022	8 m	Coordinator of Poli-Mi contribution	<b>OHB Germany</b> , Etamax, HPS, Politecnico di Milano	
12	ESA		 ELECTROCAM: Assessment of collision avoidance manoeuvre planning for low-thrust missions	08/10/2021	27/07/2023		Co-investigator	<b>GMV (Spain)</b> , Politecnico di Milano, Universidad Carlos II de Madrid	
13	UK Space Agency		 FTSLS - Future Tracking of Satellites & Launcher Stages	01/11/2021	01/04/2022	4 m	Coordinator of Poli-Mi contribution	<b>UKLSL</b> , Altarange UK, Politecnico di Milano	
14	GenerGo		 Modelling of GenerGo engine and investigation of space mission applications	01/02/2022	14/04/2023	1 yr	Principal investigator	<b>Politecnico di Milano</b> , D-Orbit	
15	ESA	European Space Agency, Network partner initiative for PhD	 Robust trajectory design techniques accounting for generic evolving uncertainties	26/08/2021	11/09/2023	2 yrs	Principal investigator, supervisor of co-funded PhD	<b>Politecnico di Milano</b>	

	project co-supervised with ESA							
15	ESA	ESA AO/1-10411/20/NL/MP	 NAVISP-EL1-038: Application of Machine Learning Technology for GNSS IoT Data Fusion - CAMALIOT	18/01/2021	12/10/2022	18 m	Coordinator of Poli-Mi contribution	<b>RINA consulting</b> , Politecnico di Milano, Intelligentia, GReD
16	ASI		 Detriti Spaziali Supporto alle attività IADC e SST 2019-2021	24/04/2020	21/06/2023	3 yrs	Coordinator of Poli-Mi contribution	<b>INAF</b> , IFAC-CNR, IST-CNR, Università la Sapienza Roma, Politecnico di Milano, Università di Padova
17	ESA		 Formation Flying L-Band Aperture Synthesis (FFLAS)	01/12/2019	01/02/2022	14 m	Coordinator of Poli-Mi contribution	<b>Airbus Defence and Space</b> , Politecnico di Milano
18	ESA co-financed by One-Web	European Space Agency's ARTES programme	 Sunrise	04/09/2019	25/02/2022	1	Coordinator of Poli-Mi contribution	<b>D-Orbit</b> , Politecnico di Milano.
19	ASI		 SST Fragmentation Services, within the activities that the Italian Space Agency (ASI) carries out within the EUSST consortium	23/11/2018	25/01/2021	9	Principal investigator and consortium coordinator	<b>Politecnico di Milano</b> , IFAC-CNR, Uni. of Padova
20	ESA	European Space Agency, Network partner initiative for PhD project co-supervised with ESA	 Space debris and small satellites constellation evolution model through density approach	01/02/2017	01/01/2022	3 yrs	Principal investigator, supervisor of co-funded PhD	<b>Politecnico di Milano</b>
21	ESA		 Environmental aspects of passive de-orbiting devices	01/01/2017	20/11/2021	8	Principal investigator and consortium coordinator	<b>Politecnico di Milano</b> , IFAC-CNR, Lux Space, Uni. di Padova, Uni. Politécnica de Madrid.
22	ESA	European Space Agency, Network partner initia-	 Orbit propagation and uncertainty modelling for planetary protection compliance	01/11/2016	01/10/2021	3 yrs	Principal investigator, supervisor of co-funded PhD	<b>Politecnico di Milano</b>

			tive for PhD project co-supervised with ESA						
23	ESA		Life cycle assessment of space debris	01/06/2016	01/02/2018		Coordinator of PoliMi and Uni of Southampton contributions	<b>Deloitte Sustainability</b> , Politecnico di Milano, Uni. of Southampton.	
24	EU H2020 EC H2020-PROTEC-2015	 <small>Horizon 2020 European Union Funding for Research &amp; Innovation</small>	ReDSHIFT: Revolutionary Design of Spacecraft through Holistic Integration of Future Technologies	01/01/2016	01/03/2019	3 yrs	Coordinator of PoliMi contributio. Leader of task on Dissemination	<b>IFAC-CNR</b> , Belstead Research Ltd, Deimos Space, Deimos Castilla La Mancha, DLR, LUXSpace, PHS Space Limited, Uni. of Thessalonikis, Technical Uni. of Braunschweig, Uni. of Koeln, Uni. of Padova, Uni. of Southampton, Politecnico di Milano	
29	Horizon FP7	FP7/EC Marie Curie Grant 	SpaceDebECM: Space Debris Evolution, Collision risk, and Mitigation	01/06/2013	01/05/2015	2 yrs	Researcher (Personal grant: intra-European fellowship)	<b>Politecnico di Milano</b>	

## Description of selected projects

In this Section some selected projects listed in the Table above are described. The research line that connects all the project is Space Sustainability seen along three aspects:

**Space for Sustainability of Earth:** Space assets offer services of social and economic benefit for humankind and enable monitoring the condition of our planet. As recognised by the UN and space agencies, space missions for Earth observation, geolocation, telecommunication, science, and technology contribute to the achievement of the Sustainable Development Goals.

**Sustainability of Space environment:** As our lives become more and more interconnected thanks to satellites and space is more easily accessible, Space can be seen as the extension of our planet biosphere. As such, long-term sustainability of space activities will be possible only if a change of behaviour is put in place by space faring nations. The growth of space debris is following an exponential trend, which is typical of many other environmental stressors of Earth system trends. Immediate actions are needed to mitigate the increasing risk of collisions and enable the future use of Space as a common. Analysis and mitigation action to mitigate the space debris problem need to be in place not only for the Earth centred environment, but also for the cislunar space and the interplanetary space, involving also planetary protection and defence.

**Sustainable Space missions:** To ensure a sustainable space, the orbital slots as a complex ecosystem need to be controlled and good practices for space debris mitigation and space traffic management need to be defined and enforced. Moreover, missions by themselves need to be sustainable also from the system design point of view, therefore advancement in spacecraft design for demise need to be followed.

My research interconnects these three research lines.

I was the grantee of a European Research Council (ERC) Strating Grant on the **COMPASS, “Control for Orbit Manoeuvring through Perturbations for Application in Space Systems”** (project ID 4 in Table 2). The project run from Aug. 2016 till Apr 2022. This project allowed me to create the COMPASS research group at Politecnico di Milano within the Space Mission Engineering Laboratory ([www.compass.polimi.it](http://www.compass.polimi.it)), composed, in average over the years of around 15 researchers (PhD and Postdocs), entirely financed by the project. The COMPASS project bridged over the disciplines of orbital dynamics, dynamical systems theory, optimisation and space mission design by developing novel techniques for orbit manoeuvring by “surfing” through orbit perturbations. The use of semi-analytical techniques and tools of dynamical systems theory laid the foundation for a new understanding of the dynamics of orbit perturbations. I developed an optimiser that progressively explores the phase space and, through spacecraft parameters and propulsion manoeuvres, governs the effect of perturbations to reach the desired orbit. It was the ambition of COMPASS to radically change the current space mission design philosophy: from counteracting disturbances, to exploiting natural and artificial perturbations. The COMPASS project led to breakthrough results published in ~70 conference proceedings and ~40 publications. With my group I developed a new approach for surfing in orbit and investigated several applications in space mission design: in-orbit transfer, asteroid deflection mission and space debris mitigation. In this project the PlanODyn software for long term orbit propagation and the STARLING V.2.0 software for the propagation of a single fragmentation clouds were developed

The COMPASS project allowed me to understand that the next open challenge in Space is Space Sustainability. However, many more disciplines that the one covered in COMPASS need to be considered especially control engineering, economic and policy, making the **GREEN SPECIES project “Robust control of the space debris population to define optimal policies and an economic revenue model for sustainable development of space activities”** a truly interdisciplinary project with completely different challenges. In the GREEN SPECIES project (project ID 2 in Table 2), kicked off in Jul. 2023, with my group, I will devise a new interdisciplinary framework for the modelling of the space debris population, and the forecast of its evolution. A probabilistic space debris model was created for the overall space debris environment, implemented in the software COMETA. All uncertainties of physical, economic, and political nature will be modelled, and the forecast of future launch traffic and compliance to guidelines included via economic approaches and evidence theory. As unique feature, the project will incorporate the management of the debris environment through a robust time-delayed controller, applied to the space debris model, described as a complex dynamical system. Ideal feedback control actions will be transformed into policies and guidelines, via quantitative indicators, assessing both the environmental impact and the social and economic benefit of space missions. Policies will act as the actuator of a real controlled system. GREEN SPECIES will propose one of

the first economic model for a revenue system for Sustainable Space by leveraging approaches from the management of the global climate.

Through the **ESA funded project “S1-SC-01: Design, development, and deployment of software infrastructure to assess the impact of a space mission on the space environment”** (project ID 5 in Table 2) I lead the development of the THEMIS ESA operational software for “Tracking the Health of the Environment and Missions in Space”. THEMIS was conceived to assess the impact of a space mission on the space debris environment, and to determine the share of the capacity of Space used by the mission under analysis. It also allows the computation of the overall share of the Space capacity used by orbiting spacecraft and to analyse possible definitions of the capacity of orbital space and what its threshold should be. The software was presented in Jun. 2024 and around 20 spacecraft operators were selected to act as beta testers (<https://indico.esa.int/event/511/page/823-themis-final-presentation-and-demonstration>). The THEMIS software will be enhanced to compute the overall space capacity within the **ESA funded project “S2-SD-02: Extended Methods for Space Debris Consequence and Space Capacity Analysis”** and the software frontend will be released at Politecnico di Milano.

I am leading the contribution from Politecnico di Milano for the **“Realisation of a hardware and software infrastructure at the Space Centre in Matera”, funded by the Italian Space Agency** through Next generation funding from the EU (project ID 3 in Table 2). The team at Politecnico di Milano is responsible of developing the algorithm for orbit propagation, collision risk estimation, collision manoeuvre computation, in-orbit fragmentation reconstruction, re-entry predictions and interactions with the air traffic control, etc. These modules, integrated in the Centre infrastructure will enable the first initiative of Space Traffic Control in Italy. Also, through the projects ID 7 and 16 in Table 2 (**“Detriti spaziali e sostenibilità delle attività spaziali a lungo-termine”** and **“Detriti Spaziali Supporto alle attività IADC e SST 2019-2021”**) funded by the **Italian Space Agency** I have been supporting the Italian Space Agency as Delegate for the Inter Agency Space Debris Coordination Committee, where I am member of the Working Group on debris modelling. In the project ID 16 in Table 2 a one-dimensional model of the space debris population was created. This preliminary effort highlighted the following shortcomings: (1) the model must be representative of the real complex system in 8D; (2) the model can be controlled as a dynamic system; (3) the control action needs to be mapped to policy regulations. These are among the goals of the GREENSPECIES project.

Some of the analytical and numerical development of the COMPASS group research had the chance of being implemented in a mission design such as the design of the **“SPACE EYE - SpEye mission - Phase A”, funded by the Italian Space Agency** (project ID 8 in Table 2) for in-orbit inspection, the design of the **“Radiation Environment Monitor for Energetic Cosmic rays (REMEC)”** mission concept, a Halo orbit in the Sun-Earth system (project ID 10 in Table 2) , and the design of the **“Formation Flying L-Band Aperture Synthesis (FFLAS)”** mission concept (project ID 17 in Table 2), for a formation flying mission. Indeed, the use of multiple satellites flying in close formation in low Earth orbits allows setting-up virtual architectures that may enable several interferometry applications of interest for Earth observation and monitoring. The practical realisation of such typology of missions requires advanced solutions for the relative Guidance Navigation and Control (GNC) systems of the satellites composing the formation, given the requirements posed by the scientific instruments as well as the mission operational constraints. This project aims at investigating possible multi spacecraft formation architectures for the relative navigation subsystem, control strategies for the reconfiguration of the formation, and policies for the safety management to ensure the satellite-satellite collision avoidance in presence of anomalies during the mission lifetime. The European Space Agency (ESA) Formation Flying L-band Aperture Synthesis mission will be considered, which foresees the use of three SMOS (Soil Moisture and Ocean Salinity) like satellites flying in a tight rigid formation in the low Earth orbit region. The GNC algorithms to enable the formation-flying activities required by the interferometry payload will be designed. The performances of such algorithms will be assessed in a high-fidelity simulation environment.

The **project “Deployable Surface-Based Debris Monitoring – DSBDM” funded by the European Space Agency** (project ID 12 in Table 2) lead to the development of an instrument to fly on-board a future mission for detecting sub-millimetre debris particles. Also the **e.Cube mission, funded by the Italian Space Agency**, will kick off in its phase A and B in September 2024, and aims at contributing to the advancement of technologies and methodologies dedicated to space debris mitigation and remediation. More specifically, the scientific objectives of the mission are: (1) to increase spacecraft autonomy in performing Collision Avoidance Manoeuvres (CAM), (2) to support space debris modelling with in-orbit collected data about non-trackable fragment objects, and (3) to characterise the atmosphere for more accurate re-entry predictions as well as the thermomechanical loads experienced by the spacecraft during its re-entry. A 12U CubeSat will be deployed in Low Earth Orbit where the operational phase will be dedicated to three experiments. During the first period of such operational phase, the autonomous CAM experiment will be carried out, consisting of several in-flight CAM tests for simulated

close approaches with a virtual debris. For each test, a sequence of virtual conjunction data messages will be generated on ground and uploaded to the spacecraft. The CAM payload processor will then decide if and how to perform the CAM making use of artificial intelligence and fast semi-analytical models. A particle detection device, exposed in the frontal side of the spacecraft, will collect over the time of one year the highest amount possible of sub-millimetre particles to be used to validate in-use statistical distributions of non-trackable objects. Finally, during the last part of the mission, an end-of-life manoeuvre will be implemented. During the corresponding re-entry phase, an experiment through the re-entry data collector will characterise the thermosphere in the region below 200 km, through some in-situ measurements, in particular temperature and pressure.

The project “Sunrise” funded by the European Space Agency (project ID 18 in Table 2) concerns the Phase 0 and Phase A mission design for an active debris removal for failed satellites in large constellations. At Politecnico di Milano we performed the mission analysis and relative motion payload design for the OneWeb constellation active debris removal.

## Direction or participation in the activities of a research group

Direction or participation in the activities of a research group characterized by collaborations at a national or international level

- **2016 – current. COMPASS group**, research group belonging to the Space Missions Engineering Laboratory, at Politecnico di Milano.  
**Role: Director of research.** I lead the research projects listed in Table 2 (projects ID 1- 22, 24, 29), both in their management and technical lead. I define the research lines within the group, write proposals, ensure all technical tasks in the projects are achieved. In some cases, I was also responsible of leading the whole project consortium. I daily supervise the research activity of the researchers in the COMPASS group composed, in average over the years (2015 – 2024) of around 15 researchers (PhD and Postdocs) and the MSc students. I also personally take part to the development of the research in the projects in Table 2, both on the mathematical development, the derivation of computer codes, performing numerical simulations and preparing scientific reports and presentations. Some selected projects are described above.  
The group is very active in outreach activities and dissemination  
Web: [www.compass.polimi.it](http://www.compass.polimi.it)
- **2016 – current. Space Missions Engineering Laboratory**, at Politecnico di Milano.  
**Role: Member.** The Space Missions Engineering Laboratory contains all the professors working on Space-related research and their research teams.  
Web: <https://www.aero.polimi.it/it/laboratori-scientifici/sme---space-missions-engineering->
- **2012 – 2016. Astronautics research group**, research group within the Aeronautics, Astronautics and Computational Engineering Research Unit, Faculty of Engineering and the Environment, University of Southampton, Southampton (UK)  
Web: <https://www.southampton.ac.uk/engineering/research/groups/astro.page>  
**Role: Director of research.** I led the research projects listed in Table 2 (projects ID 23, 25-28, 30-33), both in their management and technical lead. I defined the research lines within the group (composed of myself and some PhD students, wrote proposals, ensure all technical tasks in the projects are achieved. I daily supervised the research activity of the researchers my group.
- **2009 – 2012, Advanced Space Concepts Laboratory**, Department of Mechanical and Aerospace Engineering, University of Strathclyde, Glasgow (UK)  
**Role: Postdoc Researcher, PhD co-supervision.**
- **2005 – 2009, Space Advanced Research Team**, Department of Aerospace Engineering, University of Glasgow, Glasgow (UK)  
**Role: PhD researcher, MSc co-supervision.** The projects I participated as researcher are described below.

- **2004 – 2005**, Politecnico di Milano, Department of Aerospace Science and Technology  
**Role: MSc student.** The projects I participated as researcher are described below.

## Supervision of research

This section contains the research projects and researchers I have supervised including postdoc fellows and experienced researchers, PhD researchers, master students, visiting PhD students and experienced researchers, internship students.

Supervision of the activity of **13 experience researchers or postdoc fellows.**

Supervision of **12 PhD researchers who completed their PhD thesis, co-supervision of 6 PhD researchers** at Politecnico di Milano, University of Southampton and the University of Strathclyde. **Currently supervising 8 PhD researchers** at Politecnico di Milano.

Topics of PhD supervised: Modelling of cloud of debris fragments, Control with solar radiation pressure, Dynamics and applications of high area-to-mass spacecraft, Self-organising swarm for Earth observation, Optimisation of spacecraft for de-orbit and re-entry, Predictive control of the space debris population, Radiometric forces on satellite on a chip, Planetary protection verification, Interplanetary trajectory optimisation through maps, Design of large constellation of satellites, Planetary protection analysis through HPC applications, Low-thrust optimisation via differential dynamic programming, Continuum approach for debris fragment modelling, Multiple satellite formation flying, Safe operation for satellite servicing and removal, Analytical approach leveraging orbit perturbations for end-of-life design, Space debris environment analysis through continuum mechanics, Space debris index and space capacity estimation, Robust control of the space debris population, constellation design for reactive response, long-term debris modelling through a continuum approach in presence of uncertainties, cislunar dynamics and applications to space situational awareness, fragmentation reconstruction, collision avoidance manoeuvre design.

Supervisor of **11 visiting PhD researchers** at Politecnico di Milano.

Collaborations with **2 experienced fellows** who visited the COMPASS research group at Politecnico di Milano.

Supervision of around **100 MEng theses** at Politecnico di Milano, University of Southampton and the University of Strathclyde.

## Teaching

I have been teaching at Undergraduate and postgraduate university level, Master level and PhD level and for Continuous development courses for professionals.

Teaching as lecturer and module coordinator for master-level and PhD-level courses.

At Politecnico di Milano I have been teaching the MEng level courses of Orbital Mechanics, Introduzione all'Analisi di Missioni Spaziali, Prova finale (Analisi di Missioni Spaziali). At the University of Southampton (UK) I have been teaching the courses of Astronautics (SESA2024), Spacecraft Systems and Design (SESA3025), Spacecraft Orbital Mechanics and Control (SESA6076).

Teaching as lecturer and module coordinator for master-level and PhD-level courses.

Academic year	Course	University, Level		CFU	Number of students
2019 – 2025	Celestial Mechanics and Astrodynamics	University of Torino	Master Universitario di II livello in Mathematical and Physical methods for Space Sciences (MPM Space Sciences). <a href="#">web:</a>		~20

			<a href="https://mpmss.i-learn.unito.it/">https://mpmss.i-learn.unito.it/</a>		
<b>2017 – 2019, 2019 –2020, 2021 – 2022</b>	Perturbation Methods for Astrodynamical and Engineering Applications. Co-teaching with Dr. Martin Lara	Politecnico di Milano	Aerospace Engineering PhD course	5.0	~20
<b>Oct. 2022</b>	Space Traffic Management	Università di Cagliari	Master in Ingegneria dei Sistemi Spaziali		~20

## Dissemination and outreach (invited talks, scientific publications, outreach)

### a. Invited talks (selection)

- 3-5 Dec. 2024 “UN - World Space Forum 2024: Sustainable Space for Sustainability on Earth” 3-5 Dec. 2024 Bonn, Germany [World Space Forum 2024](#). **Invited panelist in Session III: Sustainable Space Activities on Panel 5: Cleaning Space Up – Prospects and Challenges of Active Debris Removal.** Panel moderator: Dr. Manuel Metz, Panelists: Camilla Colombo Politecnico Milano Italy, Pat Mathewson Astroscale United Kingdom, Olga Stelmakh-Drescher Exolaunch Germany, Raman Umamaheswaran DoSpace India.
- 13 Jul. 2023 Keynote speaker at EUCAS-CEAS 2023 “COMPASS Control for Orbit Manoeuvring through Perturbations for Application to Space Systems”
- 11-13 Oct. 2023 Invited presentation “Analysis of the impact of Earth observation missions for humankind through the Sustainable Development goals”, Camilla Colombo, Chiara Zuliani, Valerio Santoro, Marco Nugnes, 7th World Engineers Convention, Prague, Czech Republic, 11 – 13 October 2023
- 25 Sep. 2019 Invited speaker at the ERC session “Empowering scientists to dream the future - the ERC”, [EU Research & Innovation Days](#). Together with other ERC grantees and the ERC president Jen-Pierre Bourguignon, [video](#) and [link](#).
- 19 Sep. 2019 Speaker: “Come sulla Terra, così nello Spazio: #NoPollution #PlasticFree #WaterIsLife”. Environmental sustainability project promoted by the Department of Aerospace Sciences and Technologies, Politecnico di Milano, [link](#).
- 21 Mar. 2019 Keynote speaker at “Numerical Models and Methods in Earth and Space Sciences”  
Università di Tor Vergata, Roma, March 2019, Camilla Colombo and COMPASS team, “COMPASS: Control for orbit manoeuvring enhancing natural perturbations”.
- 31 Mar. 2017 Invited speaker at CNES, “Luni-solar perturbations for missions design in highly elliptical orbits”, CNES CCT ORB Seminar: Highly Elliptical Orbits, 31 March 2017.
- 27-28 Apr. 2017 Invited speaker at University of Barcelona, “Luni-solar perturbations for missions design in highly elliptical orbits”, Barcelona Mathematical Days Conference organized by the Catalan Mathematical Society, 27-28 April 2017.
- 4 Jul. 2017 Invited speaker at ESOC/ESA, “Libration Point Orbit end-of-life disposal in heliocentric orbit:

the Gaia mission”, CNES/ESOC CCT ORB Seminar: Deep Space Missions: End of Life and Planetary Protection, 4 July 2017.

- 4 Jul. 2017 Invited speaker at ESOC/ESA, “Planetary protection with SNAPPshot”, CNES/ESOC CCT ORB Seminar: Deep Space Missions: End of Life and Planetary Protection, 4 July 2017.
- Apr. 2017 Italian Space Agency delegate at the “Inter Agency Debris Committee” at the 35<sup>th</sup> Inter-Agency Space Debris Coordination Committee (IADC) Meeting, Apr. 2017, ESOC/ESA, Darmstadt, Germany.
- Feb. 2017 Italian Space Agency Delegate to the COPUOS Science and Technical Sub-Committee Space Mission Planning Advisory Group (SMPAG) on threat to Earth by hazardous Near-Earth Objects, Feb. 2017, United Nations, Vienna.
- Mar. 2016 UK Space Agency representative and Member of the “Inter Agency Debris Committee” at the 34<sup>th</sup> Inter-Agency Space Debris Coordination Committee (IADC) Meeting, 29 Mar. - 1 Apr. 2016, Oxford, UK.
- 27 Mar. 2016 Public event speaker, “DIY Space Exploration event, Edinburgh International Science Festival”, 27 Mar. 2016, Edinburgh, Scotland.
- 2016-02-29 Member of the “Regulatory Advisory Group” from the UK space Innovation and Growth Strategy to discuss the competitiveness of the UK’s space regulatory regime. Meeting co-chaired by Bird & Bird and UK Space Agency, 26 Feb. 2016, London, UK.
- 2016-02 UK Delegate to the COPUOS Science and Technical Sub-Committee Space Mission Planning Advisory Group (SMPAG) on threat to Earth by hazardous Near-Earth Objects, 16-18 Feb. 2016, United Nations, Vienna.
- 2015-07-16/17 UK Space Agency representative at “European Campaign on Mega Constellations” meeting at the ESOC /European Space Agency.
- 2015-03-30 UK Space Agency representative and Member of the “Inter Agency Debris Committee” at the 33<sup>rd</sup> Inter-Agency Space Debris Coordination Committee (IADC) Meeting, 30 Mar. - 2 Apr. 2015, Houston, Texas.
- 2015-07-15 Invited speaker for a discussion panel on, “Opportunities and Threats: Nanosats and Space Debris”, UK Space Conference 15 Jul. 2015, Liverpool. Panel chair: Prof. Richard Crowther, Chief Engineer, UK Space Agency.

## Scientific publications

My research is published on more than 100 international peer reviewed journal publications, more than 230 publications at international conferences with published proceedings, and several publications in conference symposia with no proceedings. My work is contained in major journals such as the Journal of Guidance, Control, and Dynamics, Celestial Mechanics and Dynamical Astronomy, Acta Astronautica, Advances in Space Research, IEEE Transactions on Aerospace and Electronic Systems and Journal of Spacecraft and Rockets. Among them, one articles on my PhD thesis was rated by AIAA as the most downloaded paper in the AIAA Journal of Guidance, Control and Dynamics in 2013 [127 citations on Google Scholar]. Table 3 shows the H-index from Scopus and Google Scholar.

Table 7. H-index.

Publication database	H-index	Citation number	Checked at date
Google scholar	31	3958	Sep. 2024
Scopus	24	1973	Sep. 2024

A publication list is attached to this application and available at:

[https://re.public.polimi.it/simple-search?location=&query=Colombo%2C+Camilla&rpp=100&sort\\_by=dc.date.issued\\_dt&order=DESC&submit\\_search=Update](https://re.public.polimi.it/simple-search?location=&query=Colombo%2C+Camilla&rpp=100&sort_by=dc.date.issued_dt&order=DESC&submit_search=Update)

## Institutional responsibilities

01-2025 –12-2027 Coordinatore del corso di Dottorato di Ricerca in Ingegneria Aerospaziale attivato presso il Dipartimento di Scienze e Tecnologie Aerospaziali, per il triennio 2025/2027.

2023 – current Department delegate for sustainability and inclusion

2021 – current Vice coordinator of PhD Board in Aerospace Engineering

2020 – 2023 Part of the department selection committee for PhD positions, Politecnico di Milano

2017 – current Member of PhD Board (Collegio di Dottorato) in Aerospace Engineering, Politecnico di Milano

2019 – 2021 responsible sub-commission Space within the PhD Board (Collegio di Dottorato) in Aerospace Engineering, Politecnico di Milano

2017 – current Member for the communication group of the Department, responsible for event organisation

2016 – current Member of Study Program Council for the course of Aerospace Engineering, Politecnico di Milano.

2018 – 2019 Part of the working group for the design of the new MEng programme in Space and Aeronautical Engineering

2016 Selection committee for academic tutors, Politecnico di Milano

2016 – current Selection committee for research positions for junior fellowships, senior postdoc fellowships, RTDA, RTDB at Politecnico di Milano

2015 – current Line manager and supervisor of postdoc and PhD researchers

2015 – 2016 Mentor of New Frontier Fellow, University of Southampton, UK

2015 – 2016 Deputy admission tutor, University of Southampton, UK

2015 – current External examiner for PhD theses at international universities.

2015 – current Internal examiner for PhD theses at international universities:

2012 – 2016 Graduate student advisor, University of Southampton, UK

2012 – 2013 Universities and Colleges Admissions Service, University of Southampton, UK

2012 – 2013 Organiser of the Internal Seminar, Astronautics group, University of Southampton, UK

## Knowledge exchange activities

Since 2022, I am part of the scientific board for the **Space Economy Observatory at Politecnico di Milano**.

I contributed to several knowledge exchange activities within the Advanced Space Concepts Laboratory at the University of Strathclyde, for example I participated to some discussion workshops with representatives from UK companies, and

universities and the European Space Agency (ESA).

## Software development

Several software packages have been developed by myself and within my group for research and dissemination activities.

Table 8. Software tool developed and/or supervised.

Software tool	Description	Programming language	Role
<b>THEMIS</b>	ESA operational software for assessing the impact of a space mission to the space debris environment. <a href="https://indico.esa.int/event/511/page/823-themis-final-presentation-and-demonstration">https://indico.esa.int/event/511/page/823-themis-final-presentation-and-demonstration</a>	Python	Supervisor of research and supervision of code development
<b>PlanODyn (Planetary Orbital Dynamics Suite)</b>	A tool for fast and accurate prediction of the orbital evolution of planetary satellites, including Earth-bound satellites and space debris.	Matlab	Code development
<b>Starling</b>	A tool for propagation of fragment continua stemming from satellite or upper stages explosions and collisions. Any orbital region and force models can be targeted and used as no assumptions are made on the dynamics.	Python	Supervisor of research and supervision of code development
<b>SNAPPshot (Suite for the Numerical Analysis of Planetary Protection)</b>	A tool for the verification of the compliance to planetary protection requirements originally developed at the University of Southampton in the framework of an ESA study and now continued at Politecnico di Milano within COMPASS. It propagates a set of initial condition deriving from an uncertainty distribution and computes the probability of impact with target planets with a given level of confidence.	Fortran	Supervisor of research and supervision of code development
<b>MISS (Manoeuvre Intelligence for Space Safety)</b>	A tool for the fast and efficient design of minimum collision probability or maximum miss distance collision avoidance manoeuvres. Also includes functionalities for uncertainty propagation.	Matlab	Supervisor of research and supervision of code development
<b>The COMPASS Game</b>	Dissemination-oriented app, showing different practical applications of space with a user-friendly graphical interface. It currently consists of four modules: Earth-bound satellite visualisation, including a large database of active satellites; space services exploration, showcasing the multiple services provided by satellites (e.g. navigation, Earth observation and monitoring, etc); interplanetary mission design, including data for actual missions; and space debris evolution.	Matlab	Supervisor of research and supervision of code development. Code development
<b>COMPASS VR experience</b>	A virtual reality tour of the crowded space around Earth, showing active and defunct satellites, rocket bodies, and large debris.	C, Unity	Supervisor of research and supervision of code development
<b>RAPTOR</b>	Software tool for evaluating the planetary protection requirements for interplanetary missions using GPU computation		Supervisor of research
<b>SKILLeD</b>	It exploits the relative orbital elements parametrisation	Matlab, Simu-	Supervisor of re-

	tion for the definition of the control for satellite formation flying with 2 or more spacecraft	link	search
<b>CIELO</b>	Suite for debris Cloud Evolution in Low Earth Orbits	Matlab	Supervisor of research
<b>DiDyPO</b>	Suite for low-thrust optimisation through differential dynamic programming	Matlab	Code development
<b>CRUISE</b>	Control and end-of-life of Libration Point Orbits through solar radiation pressure	Matlab	Supervisor of research

---