

2015-2020 Academic, Research and Service Report of the Aeronautical Department of the National University of Córdoba

¹Walkiria Schulz, ²Guillermo Cid, ³Sergio Elaskar

^{1,2,3}FCEfYn-National University of Córdoba, Argentina

³IDIT, CONICET-UNC, Argentina

ABSTRACT: The Aeronautical Department of the National University of Córdoba has the task of training professionals to develop the activities that correspond to the aerospace field with integrity, suitability and social responsibility while preserving the environment. It also promotes research and development by actively participating in innovative projects, making progress known through publications and scientific dissemination. The Department' staff also works on establishing multicultural ties through cooperation agreements with national and international institutions. This article aims to report the performance of the Department in the academic, scientific and management fields in the last 5 years.

KEYWORDS: Aeronautical Engineering, Engineer Education, Technological Development.

I. BRIEF HISTORY AND INTRODUCTION

In October of 1927, the "Fábrica Militar de Aviones" (Military Aircraft Factory) was founded in the vicinity of the city of Córdoba in Argentina. This event established the need to train specialized engineers, given that the few aeronautical engineers in the country were graduates of foreign universities, mostly from France. Attentive to this, in 1934 and under the Dean of Engineer Daniel E. Gavier, the School of Electro Mechanical Engineer and Aeronaut (sic) of the National University of Córdoba (UNC) was created with a five-year curriculum in which the first four years corresponded to the curriculum valid for the School of Mechanical Electrical Engineer and "... the last year is integrated by subjects of the specialty of the aircraft itself." It is important to highlight that the School created at that time for the study of flight science was the first of this kind not only in the country but in Latin America.

In 2005 emerges the curriculum of the Aeronautical Engineering degree, currently in force and that meets all the standards set forth in Resolution 1232/01 of the Ministry of Education Science and Technology of the Argentine Republic. Nowadays, the Aeronautical Department is the executing agency that specifies the activity of teachers and researchers due to the affinity of their disciplines in the tasks of teaching, research, technical development, and/or extension. In this paper we pretend to expose the academic, scientific and development activity held in the Department in the quinquennium 2015-2020.

II. OBJECTIVES AND ACTIVITIES

The Aeronautical Department is based in the Faculty of Exact, Physical and Natural Sciences (FCEfYn) of the UNC and has activities that concern both teaching and researching. Regarding teaching activities, the Department works in collaboration with:

- School of Mechanic-Aeronautical Engineering of the FCEfYn for the 5-year degree course in Aeronautical Engineering.
- School of Mechanical Electrical Engineering and the School of Industrial Engineering of the FCEfYn for the Fluids Mechanics area courses.
- Magister in Sciences of Engineering – Aerospace Mention of the FCEfYn that organizes courses to specialize aeronautical engineers in aerospace (a 2-year graduation course that includes a thesis).
- Doctorate in Sciences of Engineering of the FCEfYn (PhD level 5-year course with final thesis).
- Institute of Advanced Studies in Engineering and Technology (IDIT) that seeks to strengthen and stimulate the joint actions of the FCEfYn and National Council of Scientific and Technical Research (CONICET) in research and transfer, teaching and training of human resources.

In this context the teaching staff holds regular lectures and supervises theses.

Department research and teaching is broadly based and covers several traditional disciplines of aeronautical and aerospace engineering, such as study, feasibility, project, planning, direction, construction, installation, commissioning, operation, tests, measurements, maintenance, repair, modification, transformation, and inspection of:

- Aircraft, space vehicles and flight machines.
- Installation of aeronautical and space propellants and auxiliary plants.
- Control systems.
- Aeronautical and maintenance workshops and laboratories.

Allied research themes are also developed, such as aerodynamics, ultralight flight, computational fluid dynamics, attitude, and orbital dynamics.

III. 2020 STAFF MEMBERS

The 2020 staff of the Aeronautical Department consisted of the 22 persons listed below, where in parentheses is the detail of the management positions held by these members, as well as the academic area under their responsibility, since 2015 in the FCEFyN.

Professor Emeritus: Dr. José Tamagno (Advisor of Magister in Sciences of Engineering – Aerospace Mention Board of Directors).

Full Professors: Dr. Sergio Elaskar (Director of Doctorate in Sciences of Engineering; Director of the Institute of Advanced Studies in Engineering and Technology, IDIT; Head of Gas Dynamics Chair); and Prof. Eduardo Zapico (former Academic Secretary of FCEFyN; Head of Flight Mechanics and Space Systems Chairs).

Associated Professors: Prof. Omar Elaskar (Head of Aircraft Project and Construction Chair); Prof. Jorge García (Vice Director of the Aeronautical Department; Head of General Aeronautics, Instruments and Avionics, Aircraft Systems and Equipment, Seminars and Airports Chairs); and Dr. Walkiria Schulz (Director of Magister in Sciences of Engineering – Aerospace Mention; Head of Aerospace Vehicles Dynamics Chair).

Adjunct Professors: Prof. Eugenio Bonvin (Director of the School of Mechanic-Aeronautical Engineering; Head of Aerodynamics Chair); Prof. Guillermo Cid (Director of the Aeronautical Department; Head of Aircraft Maintenance Chair); Prof. Mario D'Errico (Head of Fluid Mechanics Chair); MD. Carlos Fernández; Prof. Angel Galeasso (Head of Aeronautical Laboratory); Dr. Luis Felipe Gutiérrez Marcantoni; Dr. José Inaudi (Head of Dynamics of Mechanical Systems and Random Vibrations Chairs); Dr. Gustavo Krause (Member of the Board of Directors of the Magister in Sciences of Engineering – Aerospace Mention; Head of Computational Fluid Dynamics Chair); Prof. Maria Luisa Malano; Dr. Juan Pablo Saldía; and Prof. Martin Pilati.

Assistant Professors: Dr. Luis Soria Castro; Dr. Andrés Cimino; MD. Emmanuel Gómez; Prof. Pedro Giraudó; and Prof. Santiago Centeno.

IV. EXPERIMENTAL FACILITIES

The Laboratory of Aeronautics Eng. Teobaldo Luis Aguirre provides the following facilities to the Department's teachers and students:

- Vertical water tunnel: test chamber 220mm x 220mm x 600mm; speed according to opening of the outlet valve 0,0108-0,362m/sec, Re 2194-73444.
- Hydraulic load loss bench: used by professors of Aeronautics, Industrial, Mechanical, Electrical, Civil, and Chemistry Engineering.
- Hele-Shaw cell: 2D potential flow display; 770mm x 680mm; used by General Aeronautics Chair.
- Smoke tunnel: flow visualization around bodies; test chamber 300mm x 560mm x 28mm; 6m/s speed; used by General Aeronautics Chair.
- Axial fans test bench: fan diameter 400mm.
- Tunnel no. 1: speed measurement, probe calibration, pressure distribution on wing profiles; open test chamber outlet diameter 270mm; maximum speed 25m/s; used by chairs of General Aeronautics and Aerodynamics I.
- Tunnel no. 2: low turbulence tunnel with Eiffel camera; test chamber 520mm x 480mm x 680mm; entrance diameter 240mm; speed 37m/s.
- Tunnel no. 3: speed profile limit layer measurement; test chamber 50mm x 50mm x 270mm; speed 45m/s; used by the General Aeronautics Chair.
- Tunnel no. 4, portable open circuit: measurement of lift and moment in bodies by means of mechanics balance; test chamber 100mm x 100mm x 250mm; speed 17.34m/s; used by the General Aeronautics Chair.
- Tunnel no. 5, portable closed circuit: measurement of aerodynamic forces in bodies; test chamber 100mm x 100mm x 250mm; speed 13m/s; used by the General Aeronautics Chair.

- Tunnel no. 6, supersonic with Schlieren visualization system: supersonic flow visualization; test chamber 15mm x 45mm x 55mm; speed Mach 1.9; used by the Chairs of Gas Dynamics, General Aeronautics and Aerodynamics I.
- Tunnel no. 7, test tunnel model: static pressure measurement in model tunnel; speed 80m/s; used by the General Aeronautics Chair.
- 4 axis foam cutter: cut foam from prismatic bodies (wings, fuselages, etc.)
- 3D printer: print 3D figures in PLA or ABS; dimensions 10cm x 10cm x 8cm.

V. INTERNATIONAL COOPERATION PROJECTS

The Department' staff is currently carrying out research and academic projects within multiple frameworks with several international and national, scientific and educational institutions:

- Agreement between the Doctorate in Sciences of Engineering (FCEFYN-UNC) and the Doctorate in Aerospace Engineering of the Universidad Politécnica de Madrid (Spain) for educational and academic exchanges.
- Agreement between the Magister in Sciences of Engineering – Aerospace Mention (FCEFYN-UNC) and the graduation career in Aerospace Engineering of the Universidade Federal de Minas Gerais (UFMG, Brazil) for mutual research in science, technological development, and academic projects.
- ArFITec Program to perform academic mobility between Argentina and France.
- Double Degree Agreements with ISAE (Toulouse, France) and ENIM (Metz, France).
- Double Degree Agreement with the Polytechnic Institute of Torino (Italy).
- Agreement between the Magister in Sciences of Engineering – Aerospace Mention (FCEFYN-UNC) and the Argentinean National Commission of Space Activities (CONAE, Argentina) for mutual research, technological development, and academic projects.

VI. RESEARCH ACTIVITIES

Research projects developed in the Department in the quinquennium 2015-2020 are organized per start year in the following list with the respective publications:

1. Dr. S. Elaskar, Dr. J. Tamagno, Dr. J.P. Saldía, Dr. G. Krause, Dr. L.F. Gutiérrez Marcantoni, Dr. L. Soria, Dr. A. Cimino, and Prof. J. García, "Development and application of theoretical, numerical studies and computational codes in gas dynamics for aerospace engineering," SECyT-UNC, 2014–2015 [1]-[4].
2. Prof. E. Zapico and Prof. L. Murgio, "Development of miniaturized systems technologies to withstand high accelerations with aerospace applications," ETASAT-IE, 2014.
3. Prof. E. Maligno, Prof. E. Bonvin, Prof. G. Cid and M. Goddio, "Generalization of the application of simulation methods to the maintenance planning of a complete aircraft," SECyT-UNC, 2014-2015.
4. Dr. W. Schulz and Prof. G. Cid, "Evaluation of the risks associated with the impact of hypervelocity particles on nano-satellites," SECyT-UNC, 2014-2015.
5. Dr. A. Costa, Dr. S. Elaskar, and Dr. G. Krause, "Theoretical-numerical study of compressible astrophysical flows and their comparison with observations," CONICET-PIP, 2014-2017 [5]-[10].
6. Dr. S. Elaskar, Dr. J.P. Saldía, Dr. G. Krause, Dr. L.F. Gutiérrez Marcantoni, Dr. L. Soria Castro, Dr. A. Cimino, Dr. D. Lorenzón, and Dr. J. Tamagno, "Development and application of theoretical, numerical tools and computational codes in gas dynamics for aeronautical engineering," Ministry of Science and Technology, Córdoba Province, 2014–2016 [1]-[4], [7], [11]-[16].
7. Dr. L. Conde (UPM, Spain) and Dr. S. Elaskar, "Development and characterization of a hybrid system of space propulsion by plasma of low electrical consumption," Ministry of Science and Technology of Spain, 2014-2018 [17]-[30].
8. Prof. E. Zapico and Prof. L. Murgio, "Development of miniaturized systems technologies to withstand high accelerations with aerospace applications," ETASAT-IE, 2016.
9. Prof. E. Bonvin, Prof. E. Maligno, and Prof. G. Cid, "Optimization of aircraft maintenance project management through the application of advanced performance measurement and prediction systems," SECyT-UNC, 2016-2017 [31]-[33].
10. Dr. S. Elaskar, Dr. J. Tamagno, Dr. J.P. Saldía, Dr. G. Krause, Dr. L.F. Gutiérrez Marcantoni, Dr. L. Soria Castro, Dr. D. Lorenzón, and Prof. J. García, "Development and Application of Theoretical, Numerical Studies and Computational Codes in Gas Dynamics and Chaotic Intermittency," SECyT-UNC, 2016–2017 [7], [11]-[16], [22]-[26], [34]-[39].
11. Dr. S. Preidikman and Dr. J. Inaudi, "Development of high-fidelity numerical tools for studying strongly non-linear aeroservoelastic nonstationary problems," SECyT-UNC, 2016-2017 [40]-[46].
12. Dr. W. Schulz and Prof. G. Cid. "Study of hypervelocity particle impacts on satellites in re-entry situations," SECyT-UNC, 2016-2017 [47], [48].

13. Dr. S. Preidikman and Dr. J. Inaudi, "Development of a computational co-simulation platform for aeroservoelastic modeling of intelligent drones that change in a way inspired by natural flight: a multiphysics formulation," PICT-UNC, 2016-2018 [49].
14. Dr. S. Elaskar, Dr. J.P. Saldía, Dr. L.F. Gutiérrez Marcantoni, and Dr. L. Soria Castro, "Vulnerability of infrastructure and physical environment associated with storage and transport of combustible fluids," CONICET-PUE, 2016–2021 [13]-[16], [34], [38], [39], [50]-[61].
15. Dr. S. Elaskar, Dr. P. Bruel (CNRS, France), Dr. L.F. Marcantoni, Dr. J.P. Saldía, and Eng. M. Grioni "Experimental numerical study of wind flow around liquid fuel storage tanks," ECO Sud (France) and MINCyT (Argentina), 2017-2020 [53], [54], [56]-[60].
16. Prof. O. Elaskar, Prof. J. García, Prof. E. Bonvin, and Prof. A. Galeasso, "Configuration analysis and structural and aerodynamic design of navigable probes in non-terrestrial atmospheres," SECyT-UNC, 2018-2019 [62], [63].
17. Prof. E. Maligno, Prof. G. Cid, and Prof. E. Bonvin, "Analysis, evaluation and simulation of the factors involved in the modernization projects of aircraft avionics, within the framework of programs to extend their useful life," SECyT-UNC, 2018-2021 [64].
18. Dr. S. Preidikman and Dr. J. Inaudi, "Development of numerical tools to study strongly nonlinear nonstationary aerosol problems," SECyT-UNC, 2018-2021.
19. Dr. W. Schulz, Prof. E. Zapico, and Dr. A. Cimino, "Resilience in aerospace missions: development of numerical tools for improvement," SECyT-UNC, 2018-2021 [65].
20. Dr. S. Elaskar, Dr. J.P. Saldía, Dr. G. Krause, MD. C. Fernández, Dr. L.F. Gutiérrez Marcantoni, Dr. L. Soria Castro, and Dr. J. Tamagno, "Development and application of theoretical, numerical, experimental studies and computational codes in fluid mechanics and chaotic intermittency," SECyT-UNC, 2018–2022 [27]-[30], [53], [54], [56]-[60], [66]-[84].
21. Dr. S. Elaskar, Dr. G. Krause, Dr. L.F. Gutierrez Marcantoni, Dr. J.P. Saldía, Eng. M. Grioni, and Dr. J. Tamagno, "Study of the structural vulnerability of fuel storage tanks and pipelines due to wind-generated loads and explosions," MINCyT-PICT-2017, 2018–2022 [55]-[61], [71], [72], [77], [81], [83].
22. Dr. J. Inaudi, "Application of seismic isolation in critical structures," Catholic University of Córdoba, 2019 [85]-[88].

VII. ACADEMIC ACTIVITIES

In 2020, all the courses of the Aeronautical Department have been taught in remote mode. This is because of the sanitary measures adopted by the National University of Córdoba (Rectoral Resolutions n° 334/20 and 447/20) in accordance with the decrees of necessity and urgency issued by the National Executive Power of the Argentine Republic. The measures attend the public emergency in health matters that the national and international community is going through due to the COVID-19 pandemic.

Although the academic activity of the first semester of 2020 began with in-class teaching as usual, from the third week of march all activities foreseen in the academic calendar were migrated to be taken virtually via distance learning due to the need to comply with preventive and compulsory social isolation. This exceptional situation affected the regulations on instances of studying and evaluating students, so it was necessary to adapt them to the conditions set forth in the current teaching regimes.

The professors evaluated the situation of each one of the courses in charge of the Aeronautical Department in order to make the adjustments to the teaching program proposals, establishing conditions to achieve regularity and promotion in a completely virtual way, preserving the academic quality.

In addition, the necessary recommendations and resources were generated to provide instances of consultations in advance of the evaluations in which the teachers explain to the students the methodologies for the exams in a virtual way with the possibility of carrying out a pilot test beforehand. Only in duly justified cases and endorsed by the School of Aeronautical Engineering, the professors who request it are authorized to complete the final exam with the development of a face-to-face evaluation activity. This physical presence assessment must take place within a period not exceeding one month from the date when attendance and free movement through the national territory is authorized, and the date must be previously coordinated with the students within a period of not less than one week.

The adaptations of the training proposals for the virtual modality are made using the platforms declared in the registry of virtual classrooms of the Faculty with the corresponding endorsement of the Department and the School of Aeronautical Engineering being the most used: Moodle, Google Meet, Zoom, among others. For evaluations in general, a virtual examination supervision system is available. To this end, the FCEfYN acquired the *Respondus* software license, and its use is left to the discretion of each teacher.

The presentation of final thesis, dissertations and doctoral theses are also carried out in a virtual way, integrating ad hoc tribunals in remote mode using one of the aforementioned platforms.

As a result of these experiences in the application of distance learning methodologies that should have been taken in a hurry at first, it is important to note that there are no significant differences in the academic performance of students, maintaining the percentages of approval and desertion registered prior to the implementation of this system.

Courses in charge of the Department's teaching staff: For the 5-year undergraduate degree course in Aeronautical Engineering: General Aeronautics; Fluid Mechanics; Gas Dynamics I [89]; Aeronautics and Airports Seminars; Aerodynamics I; Instruments and Avionics; Flight Mechanics I; Airplane Systems and Equipment; Aircraft Construction; Aerodynamics II (selective); Gas Dynamics II (selective); Dynamics of Mechanical Systems (selective); Flight Tests (selective); Aerodynamics Laboratory (selective); Aircraft Maintenance (selective); Aviation Engines (selective); Aircraft Project (selective); Flight Simulation (selective); Space Systems (selective); and Random Vibrations (selective). For the undergraduate degree courses in Industrial Engineering, Mechanical Engineering and Electrical Engineering: Fluid Mechanics. For the graduation courses Magister in Sciences of Engineering – Aerospace Mention and Doctorate in Sciences of Engineering: Aerodynamics of Supporting Surfaces and Bodies; Advanced Gas Dynamics; Aerospace Vehicle Dynamics; Aerospace Vehicle Simulators; Computational Fluid Dynamics; Dynamics of Mechanical Systems; Introduction to Nonlinear Dynamics and Chaos; and Random Vibrations.

Academic Statistics: As an example of the performance of different chairs of the Department of Aeronautics, Tables I and II show results of approval, failure and percentage rate of students who dropped the Fluid Mechanics and Gas Dynamics courses for Aeronautical Engineering.

Table I - Fluid Mechanics for Aeronautical Engineering

| Year | Students | Passed | Incomplete | Failed |
|------------------|----------|--------|------------|--------|
| 2015 | 39 | 51.3% | 10.3% | 38.4% |
| 2016 | 28 | 64.3% | 7.1% | 28.6% |
| 2017 | 26 | 53.9% | 11.5% | 34.6% |
| 2018 | 44 | 63.7% | 13.6% | 22.7% |
| 2019 | 29 | 62.2% | 3.4% | 34.4% |
| Weighted average | 33.2 | 59.1% | 9.2% | 31.7% |

Some aspects must be considered when analyzing the data in the tables. Fluid Mechanics (FM) approval is a necessary condition for the Gas Dynamics (GD) course. In fact, students who pass FM in one year usually take GD in the following year. Thus, GD students can be considered filtered by FM, resulting in a better approval coefficient ($67.6\% > 59.1\%$).

Table II - Gas Dynamics for Aeronautical Engineering

| Year | Students | Passed | Incomplete | Failed |
|------------------|----------|--------|------------|--------|
| 2015 | 34 | 79.4% | 14.7% | 5.9% |
| 2016 | 26 | 80.8% | 19.2% | 0.0% |
| 2017 | 23 | 69.6% | 17.4% | 13.0% |
| 2018 | 15 | 46.7% | 46.7% | 6.6% |
| 2019 | 31 | 61.3% | 29.0% | 9.7% |
| Weighted average | 25.8 | 67.6% | 25.4% | 7.0% |

Human Resources: During the 2015-2020 five-year period, various undergraduate and graduate students were trained in the Aeronautical Department (Table III).

Master's thesis presented:

1. J.C. Costa Aymar, "Analysis of the fracture tenacity of metals from the numerical simulation of impact tests," 2015.
2. D. Antonelli, "Stationary and nonstationary analysis of aerodynamic profiles to ultra-low Reynolds numbers ($Re < 10000$)," 2015.

3. M. Argüello, "Pre-processing of finite element models - static analysis of aeronautical structures: elementary trainer aircraft," 2017.
4. E. Gomez, "Optimization of Teflon ablative pulsing plasma propellants using genetic-type evolutionary algorithms," 2018.
5. M. Perez Segura, "Computational implementation of the unstable vortex network method: a version based on the paradigms of object-oriented programming and co-simulation," 2018.
6. G. Robiglio, "Thermo-fluid analysis at system level with aerospace application," 2020.

Table III - Number of Graduates

| Year | Aeronautical Engineering (5-year undergraduate course) | Magister in Sciences of Engineering – Aerospace Mention | Doctorate in Sciences of Engineering |
|------|--|---|--------------------------------------|
| 2015 | 11 | 2 | 3 |
| 2016 | 20 | 0 | 1 |
| 2017 | 8 | 1 | 1 |
| 2018 | 9 | 2 | 0 |
| 2019 | 18 | 0 | 0 |
| 2020 | - | 1 | 2 |

Doctoral thesis presented:

1. J.P. Saldía, "Design and development of a high-performance code for the numerical simulation of reactive hypersonic flows," 2015.
2. C. Francile, "Development of data processing algorithms for analysis and automatic detection of oscillatory phenomena in images of the chromosphere and solar corona. Application to HASTA and MICA telescopes," 2015.
3. A. Cimino, "Characteristic based boundary conditions for gasdynamic and magnetohydrodynamic equations. Application to the dynamics of the magnetic arcs of the solar corona," 2015.
4. L.F. Gutiérrez Marcantoni, "Numerical simulation of reactive processes in gas mixtures with multiple compressible flow components with OpenFoam," 2016.
5. D. Antonelli, "Stationary and stationary analysis of rigid and flexible aerodynamic profiles at ultra-low Reynolds numbers ($RE < 10000$)," 2016.
6. D. Lorenzón, "Numerical simulations of plasma kinetics using the Vlasov-Poisson model," 2020.
7. G. Corrado, "Orbital dynamics, attitude, and control of space vehicles with compound solar sails," 2020.

VIII. CONFERENCES, COURSES AND CONGRESS PARTICIPATION

Lectures offered by the members of the Aeronautical Department in other institutions and/or scientific meetings:

- Dr. S. Elaskar, "Advances in aerospace engineering at UNC," Federal University of Paraná, Curitiba, Brazil, September 2016.
- Dr. S. Elaskar, "Advances in aerospace engineering at UNC," Positiva University, Curitiba, Brazil, September 2016.
- Dr. S. Elaskar, "New advances on chaotic intermittency," University of Pau, France, October 2016.
- Dr. J.P. Saldía, "Work of the aeronautical engineer and experimentation with wind tunnels," FCEfN-UNC, November 2016.
- Dr. S. Elaskar, "Considerations on postgraduate studies in Argentina," Research and Graduate Secretariat, FCEfN, National University of Córdoba, October 2017.
- Dr. J.P. Saldía, "On the development and validation of a parallel hypersonic solver for thermochemical nonequilibrium gases," Séminaire de Mathématiques et de leurs Applications, Université de Pau et des Pays de l'Adour, France, 2018.
- Dr. S. Elaskar, "New theory about chaotic intermittency," Rey Juan Carlos University, Madrid, Spain, May 2018.
- Dr. S. Elaskar, "Intermittency with and without noise," Polytechnic University of Madrid, Spain, June 2018.
- Prof. A. Galeasso, "Liquid air," seminars Let's Improve the Teaching of Physics, FCEfN-UNC, 2019.
- Prof. G. Cid, "Airports mini course," V Semana Professor Cláudio Barros de Engenharia Aeroespacial - AeroCB, Engineering School, Federal University of Minas Gerais, Belo Horizonte, Brazil, 2019.

- Prof. G. Cid, “Aeronautical maintenance criteria applied to aircraft design,” V Semana Professor Cláudio Barros de Engenharia Aeroespacial - AeroCB, Engineering School, Federal University of Minas Gerais, Belo Horizonte, Brazil, 2019.
- Dr. W. Schulz, “Aeroassited maneuvers,” V Semana Professor Cláudio Barros de Engenharia Aeroespacial - AeroCB, Engineering School, Federal University of Minas Gerais, Belo Horizonte, Brazil, 2019.

Congresses that counted with Aeronautical Department staff participation:

- First Pan American Congress on Computational Mechanics - PANACM 2015 and XI Congreso Argentino en Mecánica Computacional, Buenos Aires, Argentina, April 2015 [1], [4], [17].
- 8th Chaotic Modeling and Simulation International Conference - CHAOS 2015, Henri Poincaré Institute, Paris, France, May 2015 [20].
- Earthquake Risk and Engineering towards a Resilient World - SECED 2015 Conference, Homerton College, Cambridge University, UK, July 2015 [90].
- XII Congreso Nacional de Expresión Gráfica en Ingeniería, Arquitectura y Carreras Afines, Facultad de Ingeniería, Universidad Nacional de Río Cuarto, October 2015.
- 9th Chaotic Modeling and Simulation International Conference - CHAOS 2016, University of London, UK, May 2016 [22].
- IEEE Argencón, UTN-BA, Buenos Aires, Argentina, June 2016 [91].
- VI Congreso Internacional de Expresión Gráfica en Ingeniería, Arquitectura y Carreras Afines - EGraFIA, Facultad de Arquitectura, Urbanismo y Diseño de la Universidad Nacional de Córdoba, September 2016 [31].
- XXII Congreso sobre Métodos Numéricos y sus Aplicaciones - MECOM, Córdoba, Argentina, November 2016 [12], [13].
- V Congreso Argentino de Ingeniería Aeronáutica - CAIA 2016, Facultad de Ingeniería del Instituto Universitario Aeronáutico, Córdoba, Argentina, November 2016 [34].
- 1st IAA Latin American Symposium on Small Satellites, Institute Colomb, UNSAM, Argentina, March 2017 [92].
- IX Congreso Argentino de Tecnología Espacial - CATE, Instituto Universitario Aeronáutico, Córdoba, Argentina, April 2017 [36].
- XIV Congresso dell’Unione Italiana per il Disegno; 39° Convegno Internazionale dei Docenti della Rappresentazione, Napoli, Italy, September 2017.
- XIV Congreso Nacional de Expresión Gráfica en Ingeniería, Arquitectura y Áreas Afines - EGraFIA, Gral. Pico, La Pampa, Argentina, October 2017 [33].
- XXIII Congreso sobre Métodos Numéricos y sus Aplicaciones - ENIEF 2017, La Plata, Argentina, November 2017 [43].
- IV Jornadas del Departamento de Física de la FCEfYN-UNC, Córdoba, November 2017.
- 3° Jornadas Nacionales de Seguridad contra Incendios, FCEfYN-UNC, Córdoba, November 2017.
- 15th Experimental Chaos and Complexity Conference - ECC15, Rey Juan Carlos University, Madrid, June 2018 [67], [68].
- 7th World Conference on Structural Control and Monitoring, Qingdao, China, July 2018.
- XVIII SEPROSUL - Semana de la Ingeniería de la Producción Sudamericana “Tecnologías y estrategias competitivas”, FCEfYN-UNC, Córdoba, Argentina, August 2018.
- XXII Congreso Argentino de Mecánica Computacional - MECOM 2018, Tucumán, Argentina, November 2018 [46].
- Organization of the V Congreso Argentino de Ingeniería Aeronáutica - CAIA 2018, FCEfYN-UNC, Córdoba, Argentina, November 2018 [55], [64], [93]-[96].
- 38° Convención Anual de Vuelo de la EAA, Buenos Aires, Argentina, March 2019.
- VII Congreso de Matemática Aplicada, Computacional e Industrial - MACI 2019, Río IV, Argentina, May 2019 [72], [73].
- 2nd International Conference on Natural Hazards & Infrastructure - ICONHIC 2019, Chania, Greece, June 2019 [85].
- XXIV Congreso sobre Métodos Numéricos y sus Aplicaciones - ENIEF 2019, Santa Fe, Argentina, November 2019 [49], [58], [69]-[71], [80], [86], [87].
- V Semana Professor Cláudio Barros de Engenharia Aeroespacial - AeroCB, Engineering School, Federal University of Minas Gerais, Belo Horizonte, Brazil, November 2019 [97]-[99].
- 1er Jornada de Divulgación en Ciencias del Espacio y Tecnología Aeroespacial, UTN-FRC, Córdoba, November 2019 [83].

- International Conference on Theoretical Approaches in Non-Linear Dynamical Systems, Lodz, Poland, December 2019 [79].
- 2020 AAS/AIAA Astrodynamics Specialist Conference, Lake Tahoe, EEUU, August 2020 [100].
- IEEE Argencon, UTN-FRR, Resistencia, Argentina, December 2020.

IX. SCIENTIFIC DIFFUSION

The members of the Aeronautical Department are constantly called to develop and respond in interviews about their areas of expertise. Below we describe some of the scientific dissemination activities carried out between 2015 and 2020.

- BBC Click, televised interview with Dr. W. Schulz about Space Debris.
- Television and social media interview with Dr. S. Elaskar as Director of the Doctorate in Engineering Sciences of the FCFyN-UNC. https://www.youtube.com/watch?v=BKt8q_gROLQ.
- Television and social media interview with Dr. S. Elaskar as organizer of the CAIA 2018 congress. <https://www.youtube.com/watch?v=f1muyJ0x-qU>.
- Television and social media interview based on Dr. S. Elaskar's experience in foreign universities. <https://www.youtube.com/watch?v=-4aK9ZzjNQo&t=102s>.
- Interview the Department staff in Tecnociencia 3D program of the FCFyN on the Aeronautical Engineering Degree. <https://www.youtube.com/watch?v=3VKP9UZ6XB8>, Dr. J.P. Saldía, Prof. G. Cid, Dr. W. Schulz, Prof. E. Zapico, Prof. E. Bonvin, Dr. S. Elaskar, Dr. G. Krause, Prof. M. Malano.
- Participation in articles and videos produced by UNCIENCIA for the dissemination of UNC scientific activity in social networks:
 - <http://unciencia.unc.edu.ar/2015/mayo/el-carguero-espacial-ruso-en-una-caida-con-destino-incierto>, Dr. W. Schulz.
 - <https://www.facebook.com/unciencia/videos/1621066967913929/>, Dr. W. Schulz.
 - <http://unciencia.unc.edu.ar/2018/septiembre/cientificos-argentinos-proponen-una-nueva-explicacion-para-los-tsunamis-solares>, Dr. G. Krause and Dr. S. Elaskar.

X. CONCLUSIONS

Although the creation of the Aeronautical Engineering career has its origins in the need to meet the requirement of specialized professionals demanded by the nascent aeronautical industry in Argentina, over the years the Aeronautical Department has managed to acquire its own capacity so that its students can carry out in their laboratory the practices related to the theoretical knowledge acquired in the classrooms. In recent years, not only has focus been placed on increasing these capacities, but also efforts have been made to ensure that both the faculty that constitutes it and its most advantageous students at the undergraduate and postgraduate levels participate in research projects of relevance. Research and development work with neighboring academic training centers as Brazilians ones and countries of the European Union such as Spain, France and Italy have been sustainably encouraged.

The facilities provided by virtual connectivity between the various Universities that have related careers, currently allow us a rapid exchange of knowledge that fosters teamwork, achieving a synergy that rapidly pushes the limits of this science towards new horizons. It is in this context that the Aeronautical Department seeks that its members insert themselves into a global market of knowledge of aerospace activity that is increasingly demanding and challenging.

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