DATE	July 7, 2022

Part A. Personal Information

Surname(s)	AHEDO GALILEA	
Forename	EDUARDO	
ID number		
Sex	MALE	
Age		
Researcher codes	WoS Researcher ID	Q-7854-2018
	SCOPUS Author ID	6603894814
	ORCID	0000-0003-2148-4553

A.1. Current position

Post/ Professional Category	Professor	
UNESCO Code	3324	
Key Words	Aerospace Engineering, Space Electric Propulsion, Plasma Physics	
Name of the University/Institution	Universidad Carlos III de Madrid (UC3M)	
	Department/Centre	Bioingeniería e Ing. Aeroespacial
	Full Address	Av. Universidad 30
	Email Address	eduardo.ahedo@uc3m.es
	Phone Number	916248234
Start date	September 1, 2013	

A.2. Education

Year	*University*	*Degree*	*Title*
1982	Universidad Politécnica de Madrid	BSc+MSc	Aeronautical Engineer
1988	Universidad Politécnica de Madrid	PhD	PhD in Aeronautical Engineering

A.3. Indicators of Quality in Scientific Production

- JCR articles = 92 (most in Q1 and Q2 categories)
- Peer-reviewed book chapters = 7
- Publications in international conference proceedings (AIAA, IEPC, ESA, ...) >200
- Citations= 2000 (WOS), 2650 (SC), 5000 (Google Scholar)
- Average citations per year (last 5 years) = 240 (Scopus), 430 (GS)
- h-index = 25 (WOS), 27 (SC), 35 (GS)
- i10-index= 116 (GS)
- Supervised Theses = 13 (total); 9 (ongoing)
- Accredited Research Sexennia = 6 (+ 1 Transfer)

Part B. Free Summary of CV

Eduardo Ahedo (EA) is Engineer and PhD in Aerospace Engineering (1988) from the Universidad Politécnica de Madrid (UPM), receiving an Outstanding PhD Thesis award. In 1989-90, he was a Fulbright Postdoctoral Fellow at the Massachusetts Institute of Technology (MIT). Later, EA has been Research Scholar at the same institution during several periods; in particular, in 2007-08, supported by Sabbatical Leave grants by the Government of Spain and UPM.

From 1988 to 2013, EA developed his academic career at the Aeronautical Engineering School (ETSIA) of UPM, being Full Professor since 2007. From 1999 to 2004, he was Deputy to the Director of the ETSIA Aeronautics for External Relations. Since 2013, EA is Professor of Aerospace Engineering at

UC3M and holder of a Permanent Excellence Chair, granted by Banco Santander, with the commission to develop the Aerospace Engineering Area at UC3M. For 6 years in the period 2014-22, he has been Head of the Department of Bioengineering and Aerospace Engineering.

His teaching experience covers Applied Mathematics, Combustion, Plasma Physics, and Space Propulsion. He has supervised several Master Theses, their students receiving well-recognized awards (Arquímedes, EUCASS, PEGASUS-AIAA). EA has also been Visiting Lecturer at Supaero (2004-09), U. di Pisa (2006), and U. Politécnica de Cataluña (2008-11).

His PhD Thesis was in the field of laser-plasma interaction for inertial confinement fusion. The next decade he researched in ElectroDynamic Tethers (EDT) for space missions. He was co-inventor with Prof. Sanmartín (UPM) and Martínez-Sánchez (MIT) of the non-coated EDT, now the standard configuration of this disruptive technology.

Since 1998, his research is focused on Plasma Space Propulsion and it is intimately linked to the Equipo de Propulsión Espacial y Plasmas (EP2), the research group he founded in 2000 and continues to lead actively. EP2 is the main scientific research group in its field in Spain and is widely recognized internationally. EP2 gathers now 20-25 researchers, 60% of them doctoral students and half of them foreigners. EA has participated in about 50 competitive projects, with leading roles in more than half of them. A significant number of projects have been funded by FP7 and H2020, the European Space Agency, and the US AFOSR, in addition to basal funding from Spanish R&D Plans. International projects have allowed to build productive collaborations with relevant research institutions (MIT, Ecole Polytechnique-Paris, CNRS, ONERA, CNR-Italia) and with European space companies (Airbus DS, Safran, Sitael, Sener Aeroespacial, Deimos, Tecnalia, Thales…), and to match basic and applied research. EA was the main promoter of the UC3M-Sener Aeroespacial Chair (2018), dedicated to new space technologies, such as the joint EP2-SENER development of the first industrial plasma thruster.

The research led by EA in EP2 covers the full research cycle from theory to simulation, prototyping and testing, and most of the main technologies in plasma propulsion. In 2015, EA got public funds to build a large vacuum facility for testing of plasma thrusters, and recently participated in getting new funds for a second laboratory on satellite development at UC3M.

EA is better known internationally by his advances on modeling and simulation of the complex plasma discharge of plasma thrusters. Main theoretical achievements are: the first complete fluid models of the discharge in a Hall Effect Thruster (HET), now the dominant technology in space propulsion; a novel and broad theory of Propulsive Magnetic Nozzles (PMNs); and a recent theory on near-collisionless plasma plumes. Main in-house developed simulation tools are: HPHALL-2 for HET, in cooperation with MIT and used by US companies; DIMAGNO for PMNs; EP2PLUS for plumes interacting with spacecraft and nearby objects (e.g., space debris control); and HYPHEN, a versatile tool for several electromagnetic thrusters (HET, Helicon Plasma Thruster, Electron Cyclotron Resonance Thruster…). EA coauthors a patent on magnetic plasma plume vector control.

EA has also relevant contributions on plasma-surface interaction in magnetized environments and on plasma instabilities. EA has always been interested in the synergies of those matters between plasma fusion and plasma propulsion. This was the aim of the stay at the MIT Plasma Physics and Fusion Center (2007) and the CAM-PROMETEO project (2018-22) with CIEMAT.

Part C. Relevant accomplishments

C.1. Publications (more than 100 citations in SC and 10 ones in 2019-22)

1. J.R. Sanmartín, M. Martínez-Sánchez, E. Ahedo; Bare wire anodes for electrodynamic tethers, Journal of Propulsion and Power 9, 353-360, (1993)
2. E. Ahedo, M. Merino; Two-dimensional supersonic plasma acceleration in a magnetic nozzle, Physics of Plasmas 17, 073501, (2010)
3. F.I. Parra, E. Ahedo, J.M. Fife, M. Martinez-Sanchez; A two-dimensional hybrid model of the Hall thruster discharge, Journal of Applied Physics 100, 023304, (2006)
4. E. Ahedo; Plasmas for space propulsion, Plasma Phys Cont. Fusion 53, 124037, (2011)
5. E. Ahedo, J.M. Gallardo, M. Martínez-Sánchez; Effects of the radial plasma-wall interaction on the Hall thruster discharge, Physics of Plasmas 10, 3397-3409, (2003)
6. E. Ahedo, P. Martínez-Cerezo, M. Martínez-Sánchez; One-dimensional model of the plasma flow in a Hall thruster, Physics of Plasmas 8, 3058-3068, (2001)

7. S. Barral; E. Ahedo; Low-frequency model of breathing oscillations in Hall discharges, Physical Review E 79 (4), 046401, (2009)
8. Zhou, J., Pérez-Grande, D., Fajardo, P., Ahedo, E., Numerical treatment of a magnetized electron fluid model within an electromagnetic plasma thruster simulation code, Plasma Sources Sci. Tech., 28, 115004 (2019).
9. Li, M., Merino, M., Ahedo, E., Tang, H., On electron boundary conditions in PIC plasma thruster plume simulations, Plasma Sources Sci. Tech., 28, 034004 (2019).
10. S. Correyero, J. Jarrige, D. Packan, E. Ahedo, Plasma beam characterization along the magnetic nozzle of an ECR thruster, Plasma Sources & Science Technology 28, 095004, 14pp (2019)
11. Cichocki, F., Merino, M., Ahedo, E., Three-dimensional geomagnetic field effects on a plasma thruster plume expansion, Acta Astronautica, 175, 190 (2020).
12. E. Ahedo, S. Correyero, J. Navarro, M. Merino, Macroscopic and parametric study of a kinetic plasma expansion in a paraxial magnetic nozzle, Plasma Sources Sci. Tech. 29, 045017, 17 pp (2020)
13. Cichocki, F., Domínguez-Vázquez, A., Merino, M., Fajardo, P., Ahedo, E., Three-dimensional neutralizer effects on a Hall-effect thruster near plume, Acta Astronautica, 187, 498 (2021).
14. Sánchez-Villar, Á., Zhou, J., Ahedo, E., Merino, M., Coupled plasma transport and electromagnetic wave simulation of an ECR thruster, Plasma Sources Sci. Tech., 30, 045005 (2021).
15. Zhou, J., Sánchez-Arriaga, G., Ahedo, E., Time-dependent expansion of a weakly-collisional plasma beam in a paraxial magnetic nozzle, Plasma Sources Sci. Tech., 30, 045009 (2021).
16. Marín-Cebrián, A; Domínguez-Vázquez, A; Fajardo, P.; Ahedo, E., Macroscopic plasma analysis from 1D-radial kinetic results of a Hall thruster discharge, Plasma Sources Science and Technology 30, 115011 (2021)
17. Zhou J., Domínguez-Vázquez A., Fajardo P., Ahedo E., Magnetized fluid electron model within a two-dimensional hybrid simulation code for electrodeless plasma thrusters, Plasma Sources Sci. Technol. 31, 045021, 16pp (2022)

C.2. Research Projects (main recent ones)

1. '**ECOMODIS:** Electron Cooling Model for Simulation of EP Induced Plasma Interactions with Satellites'. Funded by European Space Agency. Ref. Grant 4000137869/22/NL/RA. PI: P. Fajardo and E. Ahedo. Duration: 2 years (05/2022-05/2024)
2. '**COMIT**: Compact Mini plasma Thruster for New Space applications'. Funded by Spanish National R&D Plan. PDC2021-120911-I00. PI: E. Ahedo and P. Fajardo. Duration: 2 years (2022-23)
3. '**CSAT**: Centro de investigación e integración de tecnología espacial y nano/micro-satélites'. Funded by Ministerio de Ciencia e Innovación. Ref. EQC2021-007562-P. PI: A. Marcos. Duration: 2 years (2022-2023)
4. **'CHEOPS MEDIUM POWER'**, 12 partners, coordinated by Safran. Funded by EC-H2020. Ref. Grant 101004226. PI at UC3M: E. Ahedo. Duration: 3.5 years (03/2021-08/2024)
5. '**CHEOPS LOW POWER'**, 11 partners, coordinated by Safran. Funded by EC-H2020. Ref. Grant 101004331. PI at UC3M: P. Fajardo. Duration: 3 years (02/2021-01/2024)
6. '**ASPIRE**. Advanced Space Propulsion for Innovative Realization of space Exploration'. 8 partners. Coordinated by SITAEL (Italy). PI at UC3M: E. Ahedo. Funded by EC-H2020. Ref. Grant 101004366. Duration: 2.5 years (01/2021-06/2023)
7. '**EDDA**. European Direct-Drive Architecture'. Coordinated by Thales Alenia Space (France). PI at UC3M: E. Ahedo. Funded by EC-H2020. Ref. Grant 870470. Duration: 2 years (11/2019-10/2021)
8. '**HIPATIA**. HelIcon PlasmA Thruster for In-space Applications'. 5 partners, coordinated by Sener. Funded by EC-H2020. Ref. Grant 870542. PI at UC3M: P. Fajardo. Duration: 3 years (2020-23)
9. '**MFOC**. Madrid Flight-On-Chip'. Coordinated by SENER, PI at EP2-UC3M: E. Ahedo. Funded by Madrid Region R&D Plan. Duration: 3 years (2019-21)
10. '**MARTINLARA**. Millimeter wave Array at Room Temperature for INstruments in Leo Altitude Radio Astronomy'. Coordinated by GREMA-UC3M. Funded by Madrid Region R&D Plan. Duration: 4 years (01/2019-12/2022)
11. '**PROMETEO**. Propulsión por plasma y fusión nuclear: innovando el transporte espacial'. 2 partners, coordinated by UC3M. Duration: 3 years (01/2019-12/2021)
12. '**MINOTOR.** MagnetIc NOzzle thruster with elecTron cyclOtron Resonance'**.** 7 partners, coord. by Safran. Funded by H2020. Ref. Grant 730028. PI at UC3M: M. Merino. Duration: 3 years (2017-20)

13. '**CHEOPS.** Consortium for Hall Effect Orbital Propulsion System'. 13 partners, coordinated by Safran. Funded by EC-H2020. Ref. Grant 730135. Duration: 4 years (2016-21)
14. '**PE3**. Propulsores electromagnéticos para la exploración espacial'. Funded by Spanish National R&D Plan. Ref. ESP2016-75887-P. Duration: 3 years (2017-19)
15. '**MODEXVAL**. Model and Experimental validation of spacecraft-thruster Interactions (erosion) for electric propulsion thruster plumes'. 5 partners, coordinated by Airbus DS. Funded by European Space Agency. Ref.: 4000116180/15/NL/PS. Duration: 2 years (2016-18)
16. '**PEPSE**. Propulsión Espacial por Plasma: Simulación y Experimentación'. Funded by Spanish National R&D Plan. Ref.: ESP2013-41052-P. Duration: 3 years (2014-16)
17. '**LEOSWEEP**. Improving Low Earth Orbit Security with Enhanced Electric Propulsion'. 11 partners, coordinated by Sener. Funded by EC-FP7. Ref.: FP7- Grant 607457. Duration: 3 years (2013-16)
18. Cámara de ensayo de propulsión eléctrica. Funded by Spanish National R&D Plan. Ref.: UNC313-4E-1552. Duration: 3 years (2013-15)
19. Helicon Plasma Thrusters for Space Missions. 2 partners, coordinated by Sener. Funded by ESA. Ref.: 4000107292/12/NL/CO. Duration: 1.5 years (2013-14)
20. '**HPH.COM**. HeliconPlasmaHydrazyne.COmbinedMicro'. 15 partners, coordinated by Univ. Padova. PI at UPM: E. Ahedo. Funded by EC FP7. Ref. Grant 218862 Duration: 3 years (2008-11)

C.3. Contracts (Main ones in last 10 years with E. Ahedo as main investigator)

1. Cátedra UC3M-Sener Aeroespacial. PI: E. Ahedo. Funded by Sener. Duration: since 2018
2. Development of an advanced model of the Helicon Plasma Thruster. PI: E. Ahedo. Funded by Airbus DS-F. Ref. CW240050. Duration: 3 years (2016-19).
3. Experimental campaign for characterization & optimization of the HPT-05 Helicon Plasma Thruster prototype. Funded by SENER. PI: J. Navarro. Duration: 5 months (2017-18).
4. Characterization tests on the Helicon Plasma Thruster. PI: E. Ahedo. Funded by Airbus DS-F. Ref.: CW241842 /4500564351. Duration: 4 months (2016-17).
5. 10-kW Hall-Effect Thruster Optimized for Space Transportation. PI: E. Ahedo. Funded by SNECMA. Ref.: 2014-013-G. Duration: 5 months (2014).
6. Analysis of the Rotating-spoke Oscillation in Hall Thrusters and its Role on Turbulent Diffusion. PI: E. Ahedo. Funded by EOARD-AFOSR. Ref.: FA8655-13-1-3033. Duration: 1 year (2013-14).
7. Plasma detachment mechanisms in propulsive magnetic nozzles. PI: E. Ahedo. Funded by EOARD-AFOSR. Ref.: FA8655-12-1-2043. Duration: 1 year (2011-12).

C.4. Patents and other IPR

- Merino, M. & Ahedo, E., "Sistema sin partes móviles ni electrodos y procedimiento para vectorizar el empuje en motores espaciales de plasma," 2013, Spanish Patent Office, Patent no. P201331790.

C.5. Others

- 2022: Co-organizer of '2022 ExB plasmas workshop', Leganés, February 16-18, 2022
- 2017: Organizer of '1st EPIC lecture Series', Madrid, October 26, 2017
- 2015: Appointed member of the Advisory Committee of the EPIC project (for the Strategic Research Cluster in ESP) of H2020, led by ESA and participated by the CDTI
- 2015: Runner-up award in the Actúa-UPM competition for entrepreneurship and creation of technology-based businesses, for the business plan "VECMAN, steerable magnetic nozzle"
- 2014: SENER Foundation special award as supervisor of to best Engineering PhD Thesis
- 2013: Permanent Chair of Excellence at UC3M, granted by Banco Santander.
- 2011: Electric Rocket Propulsion Society, IEPC 2011 Best Paper Award, to "On electron inertia and current ambipolarity in Magnetic Nozzle models," by E. Ahedo & M. Merino, IEPC-2011-050
- 2010: EPS Best Poster at ESCAMPIG XX Congress, awarded by the European Physical Society (2010)
- 2007: Sabbatical Year Grants (2) by Ministry of Education and by UPM
- 1989: Fulbright Postdoctoral Grant, by Ministry of Education
- 1988: Outstanding PhD Thesis award by UPM