

***M<sup>a</sup> Angeles  
Aragón Angel***

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## ACADEMIC BACKGROUND

Since November 2006

back **to Ph.D studies** continuing with the implementation of radio occultation (RO) techniques for ionospheric and tropospheric profiling sponsored by means of a full-time research support contract with gAGE/UPC (Astronomy and Geomatics Research group/ Technical University of Catalonia).

Since October 2002- April 2004 (in background from May 2004 until October 2006)

**Ph.D studies** (Aerospace Science and Technology doctoral programme) at the gAGE/UPC (Astronomy and Geomatics Research group / Polytechnic University of Catalonia) under a EUROCONTROL\* full-time scholarship. Thesis topic: **Contributions to the 3D ionospheric imaging with GPS data.**

\*EUROCONTROL is the European Organization for the Safety of Air Navigation.

Since September 2001

**Master in Pedagogical Resources addressed to Learning disabilities** the University of Vic and ISEP (Institut Superior de Estudios Pedagógicos), Barcelona.

September 2002

**Degree in Physics** by the University of Barcelona.

June 1998

**Degree in Mathematics** by the University of Barcelona.  
Speciality: **Fundamental Mathematics**

## PROFESSIONAL BACKGROUND

From September 2007

Lecturer at the Escola Tècnica Superior d'Enginyeria de Telecomunicacions de Barcelona (ETSETB), UPC, for the Telecommunication Engineering degree. Subject: Vector Analysis.

From October 2006

Contractor at the gAGE/UPC group providing research support and performing management task. Actively involved in the FES-WARTK project: "Feasibility study of

WARTK based on EGNOS and Galileo” among many other precise navigation and ionosphere related projects.

From July-September 2006

Satellite image processing to provide map of use of soil in the framework of an international project to study water reservoirs coordinated by the non governmental organization “Geòlegs del Món”. San Salvador, El Salvador.

From May 2004-April 2006

Performing **R+D** activities at the Radionavigation Systems & Techniques Section of the European Space Agency (ESA) at the European Space Research and Technology Centre (ESTEC) as Staff Member under the Young Graduate Trainee Scheme (YGT). Main tasks: Ionospheric propagation (NeQuick model revisited for Galileo) and assessment for future single frequency users in the framework of Galileo. Distributed computing environment design to perform ionospheric corrections. Collaboration with the Wave, Interaction & Propagation section regarding the Galileo ionospheric algorithm for single frequency users.

From October 2003-February 2005

Involved in the ESEAS-RI (European Sea Level Service Observation) project, area: research infrastructure. Under the leadership of Dr. J.J. Benjamin. To follow the developed activities check:

<http://www.eseads.org/eseads-ri/management/meetings/>

From October 2002-April 2004

Involved in the UPC activities on **ESTB** (EGNOS System Test Bed) **Data Collection and Evaluation** project founded by EUROCONTROL. To follow the developed activities check:

<http://www.eurocontrol.fr/projects/sbas>

From October 2002-April 2004

Assistant professor at the Polytechnic University of Catalonia (UPC) (subjects: Linear Algebra and Practical course on GPS data processing).

Assistant teacher at the “GPS data processing” courses held at the Geomatic Institute of Castelldefels Campus.

## MISCELLANEOUS

### Programming & Operating Systems

- High level in MS-DOS, Windows 98/NT/2000/XP, Linux (Both user and administrator level).
- High level in FORTRAN, shell script, awk text-processing programming language and C

“Turbo codes course” by the École Nationale Supérieure des Télécommunications de Bretagne held at ESA/ESTEC from 18<sup>th</sup> until 20<sup>th</sup> of May 2005

“GPS data processing: code & phase. Algorithms, techniques and abilities” course held at the Geomatic Institute of Castelldefels Campus

### Software

- High level using mathematical analysis tools (gnuplot, octave and MATLAB).
- High level using Microsoft Office Suite and **LaTeX**.
- High knowledge of **GMT** (Global Mapping Tools).

### Languages

English – Fluent (CAE degree)  
Spanish, Catalan (mother tongues)  
French (basic knowledge)

### Other

Negotiation Techniques course, held by the “Associació d'amics de la UPC”, November 2007.

### Interests

Reading, rowing, jogging, astronomy.

## **TECHNICAL REPORTS**

The User Domain Integrity Assessment Technique (UDIAT). Application to the analysis of potential UDER MIs after EGNOS CPF switching. Prepared by J. Sanz, A. Aragón Ángel, P. Ramos-Bosch. Date: 24<sup>th</sup> September 2007.

APPENDIX: [The User Domain Integrity Assessment Technique (UDIAT). Application to the analysis of potential UDRE MIs after EGNOS CPF switching]. Prepared by J. Sanz, A. Aragón Ángel, P. Ramos-Bosch. Date: 24<sup>th</sup> September 2007.

Analysis of potential UDRE MIs using the Stanford-ESA technique in the position domain. Prepared by J. Sanz, P. Ramos-Bosch, A. Aragón Ángel. Date: 24<sup>th</sup> September 2007.

EGNOS integrity analysis using the Stanford-ESA and gAGE/UPC derived techniques in the position domain. Prepared by J. Sanz, A. Aragón Ángel, P. Ramos-Bosch, A. García Rigo. Date: 24<sup>th</sup> September 2007.

Analysis of POTSIS data carried out by gAGE/UPC. Prepared by M. Juan Zornoza, R. Orús, P. Ramos, A. Aragón. Date: 11<sup>th</sup> June 2007

The user domain integrity assessment technique (UDIAT). Application to the analysis of potential UDRE MIS after CPF switch. Prepared by: J. Sanz, P. Ramos-Bosch, A. Aragón Angel. Date: 10 January 2007

M. Hernandez-Pajares, J.M. Juan, J. Sanz, A. Aragon, "Overview of results from UPC", Working Group 9 Meeting, Instituto Superior Tecnico, Lisbon, Portugal, 22<sup>nd</sup> - 23<sup>rd</sup> March 2004

M. Hernandez-Pajares, J.M. Juan, J. Sanz, A. Aragon, X. Prats "Overview of results from UPC", ESTB Data Collection and Evaluation 8<sup>th</sup> Working Group, Bretagne sur Orge, France, 11<sup>th</sup> December 2003

M. Hernandez-Pajares, J.M. Juan, J. Sanz, A. Aragon "Analysis of LOIs and other Anomalies Detected in UPC 1 from October 2<sup>nd</sup> to December 4<sup>th</sup>", ESTB Data Collection and Evaluation 8<sup>th</sup> Working Group, Bretagne sur Orge, France, 11<sup>th</sup> December 2003

R. Orús, A. Aragón, "Study of several interpolation schemes to provide ionospheric corrections for navigation", checked by M. Hernández-Pajares, J. M. Juan, J. Sanz, Contract n° C/1.057/CE/JR/03, 29<sup>th</sup> August 2003

## **PROCEEDINGS**

J.Sanz, P. Ramos-Bosch, A Aragon-Angel, M. Ciollaro, F. Toran, J. Ventura-Traveset, C. López, "The User Domain Integrity Assessment Technique", NAVITEC 2008, December 2008, Noordwijk (The Netherlands)

M. Hernández-Pajares, J. M. Juan, J. Sanz, A. Aragon-Angel, P. Ramos-Bosch, D. Odijk, P. F. de Bakker, H. van der Marel, S. Verhagen, I. FernándezHernández, M. Toledo, J. Samson, "Feasibility Study of a European Wide Area Real Time Kinematic System", NAVITEC 2008, December 2008, Noordwijk (The Netherlands)

M. A. Aragon-Angel, "A New Technique to Improve the Electron Density Retrieval Accuracy: Application to FORMOSAT-3/COSMIC Constellation", ION GNSS 2008, September 16<sup>th</sup> -18<sup>th</sup> 2008, Savannah (Georgia), USA

M. A. Aragón Ángel, F. Amarillo Fernández, "Advanced Ionospheric modelling for GNSS single frequency users", IEEE/ION PLANS 2006, April 24<sup>th</sup>-27<sup>th</sup>, Coronado (San Diego), CA, USA

A. Aragón, R. Orús, F. Amarillo, M. Hernández-Pajares, J.M. Juan, J. Sanz, "Preliminary NeQuick assessment for future single frequency users of GALILEO", 6<sup>th</sup> Geomatic Week, 8<sup>th</sup>-11<sup>th</sup> February 2005, Barcelona

R. Orús, A. Aragón, J.J. Martínez-Benjamín, "Precise coordinates time series determination in the ESEAS project", 6<sup>th</sup> Geomatic Week, 8<sup>th</sup>-11<sup>th</sup> February 2005, Barcelona

Martinez-Benjamin, J.J., Orus, R., A. Aragon, "Precise GPS time series determination in the European Sea Level Service ESEAS", Universitat Politècnica de Catalunya (UPC). [Spain] -

A. Aragon, M. Garcia-Fernandez, M.Hernandez-Pajares, J.M. Juan, J. Sanz, V.H. Rios, "Topside ionosphere estimation and other key issues in ionospheric profiling with GPS data from CHAMP and SAC-C". 2nd CHAMP Science Meeting, Potsdam September 2003

## **PRESENTATIONS/MEETINGS**

A. Aragon-Angel, M. Hernandez-Pajares, J. M. Juan, J. Sanz. "Mejora de la transformada inversa de Abel: aplicación a ocultaciones ionosféricas de COSMIC/FORMOSAT-3". Jornadas Internacionales Hispano-Argentinas sobre la Influencia de la anomalía ecuatorial de la ionosfera. Universidad Complutense de Madrid, 24<sup>th</sup>-26<sup>th</sup> September 2008

M.A. Aragon-Angel, "A New Technique to Improve the Electron Density Retrieval Accuracy: Application to FORMOSAT-3/COSMIC Constellation". ION GNSS 2008, September 16<sup>th</sup> -18<sup>th</sup> 2008, Savannah (Georgia), USA

Aragon-Angel, A.; Hernández-Pajares, M.; Juan, J. M.; Sanz, J., D. Altadill, Y. Liu, C. Lee, "Improved Abel transform inversion: application to COSMIC/FORMOSAT-3 ionospheric occultations". 4th Asian Space Conference 2008, Taipei (Taiwan), 1<sup>st</sup>-3<sup>rd</sup> October 2008

A. Aragon-Angel, M. Hernández-Pajares, J. M. Juan, J. Sanz, P. RamosBosch, "Direct determination of electron density profiles from GNSS occultation data". Poster at the XXIXth URSI General Assembly, Chicago, Illinois, USA, August 7th-16th, 2008

Aragon-Angel, A.; Hernández-Pajares, M.; Juan, J. M.; Sanz, J.; Ramos-Bosch, R., "Validation of ionospheric density retrievals using Abel transform improvement with COSMIC/FORMOSAT-3", European Geophysics Union (EGU) General Assembly 2008. Poster session G8: Monitoring of the lower atmosphere and ionosphere by space geodetic techniques. April 2008

A. Aragon-Angel, M. Hernandez-Pajares, J. Juan, J. Sanz, Obtaining accurate worldwide distributed electron density profiles from GPS occultation data: COSMIC/FORMOSAT-3 constellation, IRI/COST 296 Workshop, Prague, July 10<sup>th</sup>-14<sup>th</sup> 2007

A. Aragon-Angel, M. Hernandez-Pajares, J. Juan, J. Sanz, Improved Abel transform inversion: First application to COSMIC/FORMOSAT-3, (Invited Oral Presentation), AGU 2007 Joint Assembly, Acapulco, Mexico, 22<sup>nd</sup> 24<sup>th</sup> May, 2007

A. Aragon-Angel, M. Hernandez-Pajares, J. Juan, J. Sanz, Preliminary results on new Radio Occultation Techniques applied to COSMIC/FORMOSAT-3 data, (Poster), International Beacon Satellite Symposium, Boston, 11<sup>th</sup>-15<sup>th</sup> June, 2007

A. Aragón, R. Orús, F. Amarillo, M. Hernández-Pajares, J. M. Juan, J. Sanz, "Preliminary NeQuick assessment for future single frequency users of GALILEO", 6<sup>th</sup> Geomatic Week, 8<sup>th</sup>-11<sup>th</sup> February 2005, Barcelona, Spain

A. Aragón, R. Orús, F. Amarillo, M. Hernández-Pajares, J. M. Juan, J. Sanz, "Performance of NeQuick ionospheric predictions compared with different ionospheric data", Navitech'04, December 2004, ESTEC/ESA, Noordwijk, The Netherlands

J.J. Martinez-Benjamin, R. Orus, A. Aragon, "Data Processing Results for the ESEAS stations at the UPC" (Poster), Workshop on Observing and Understanding Sea Level Variations, 1<sup>st</sup>-3<sup>rd</sup> November 2004, St. Julians, Malta

J.J. Martinez-Benjamin, R. Orus, A. Aragon, "UPC processing activities at ESEAS RI project", 4<sup>th</sup> ESEAS WG Meeting, Barcelona, Spain, 15<sup>th</sup> October 2004

L. Acero, A. Aragon, X. Giro, X. Prats "The Moonlight Project" (Poster), 55<sup>th</sup> International Astronautical (IAC) Congress 2004, Vancouver, Canada, October 2004

L. Acero, A. Aragon, X. Giro, X. Prats , "The Moonlight Project: bringing light to our satellite" (Poster), Solar Power From Space (SPS'04) Conference together with the 5<sup>th</sup> Wireless Power Transmission Conference co-sponsored by ESA, 30<sup>th</sup> June-2<sup>nd</sup> July 2004, Granada, Spain

M. Hernandez-Pajares, J.M. Juan, J. Sanz, A. Aragon, M. Garcia, R. Orus, P. Roldan, "gAGE/UPC GNSS Ionosphere Activities: Real-time, Galileo, EGNOS and Tomography" 2004 IGS Technical Meeting, Bern, Switzerland, March 2004.

M. Hernandez-Pajares, J.M. Juan, J. Sanz, A. Aragon, "Overview of results from UPC", ESTB Data Collection and Evaluation 8<sup>th</sup> Working Group Meeting, 22<sup>nd</sup>-23<sup>rd</sup> March, 2004, Lisbon, Portugal

J.J. Martinez-Benjamin, R. Orus, A. Aragon "ESEAS-RI-TASK 2.3 UPC-Activities", ESEAS WG Meeting, February 2004, Madrid, Spain

M. Hernandez-Pajares, J.M. Juan, J. Sanz, A. Aragon "Analysis of LOIs and other Anomalies Detected in UPC 1 from October 2<sup>nd</sup> to December 4<sup>th</sup>", ESTB Data Collection and Evaluation 8<sup>th</sup> Working Group, Bretagne sur Orge, France, 11<sup>th</sup> December 2003

M. Hernandez-Pajares, J.M. Juan, J. Sanz, A. Aragon, X. Prats "Overview of results from UPC", ESTB Data Collection and Evaluation 8<sup>th</sup> Working Group, Bretagne sur Orge, France, 11<sup>th</sup> December 2003

M. Hernandez-Pajares, J.M. Juan, J. Sanz, A. Aragon, X. Prats "Overview of results from UPC", ESTB Data Collection and Evaluation 7<sup>th</sup> Working Group, Barcelona, Spain, 9<sup>th</sup>-10<sup>th</sup> October 2003

L. Acero, A. Aragon, X. Giro, X. Prats "Moonlight Project". 1<sup>st</sup> Aurora Student Design Contest, Barcelona, Spain, 8<sup>th</sup>-9<sup>th</sup> September 2003.

## **R+D PROJECTS**

EPPP project: Enhanced Precise Point Positioning for GPS and Galileo. ESA funded project. Coordinator Manuel Hernández-Pajares (gAGE/UPC). Consortium formed by UPC (Spain), Imperial College of London (ICL), CTAE (Spain).

IBER-WARTK project: Very precise GNSS navigation over the Iberian Peninsula by using the "Wide Area Real-Time Kinematics" technique. Funded by the Spanish Ministry of Science. Principal investigator: Manuel Hernández-Pajares (gAGE/UPC).

PROJECT FES-WARTK: Feasibility study of a Wide Area High-precision Navigation Service (WARTK) for EGNOS and Galileo (FES-WARTK), ESA funded project, Coordinator Manuel Hernández-Pajares (UPC), Consortium formed by UPC (Spain) and TUD (The Netherlands), December 2006 – December 2007

European sea level service (ESEAS) research infrastructure. European Commission (EVR1-CT-2002-40025). Responsible: J. Jose Martinez-Benjamin.

New Techniques for accurate ionosphere analysis including long baseline ambiguity fixing. Eurocontrol. Responsible: Jaume Sanz Subirana.

EGNOS System Test Bed (ESTB) Data Collection and Evaluation. Responsible: Jaume Sanz Subirana.

## **PAPERS**

A. Aragón Ángel, M. Hernández-Pajares, M. Juan Zornoza, J. Sanz Subirana, "WIDE AREA Real Time Kinematics (WARTK): nuevas posibilidades de posicionamiento y navegación GNSS precisa a escala continental". *Topografía y cartografía: Revista del Ilustre Colegio Oficial de Ingenieros Técnicos en Topografía*, ISSN 0212-9280, Vol. 25, N<sup>o</sup> 146, 2008 , pags. 12-15.

A. Aragón Angel, M. Hernández-Pajares, M. Juan Zornoza, J. Sanz Subirana. "Nuevos avances en Wide Area: real time kinematic (WARTK)". *Mapping*, ISSN 1131-9100, N<sup>o</sup> 129, 2008 , pags. 24-27.

Manuel Hernández-Pajares, J.Miguel Juan, Jaume Sanz, A. Aragon-Angel, "MSTID detection, characterization and modeling: key point to improve the precise GNSS navigation", "Física de la Tierra" (FDLT), *Physics of the Earth*, volume of FDLT (2007), dedicated to "The Ionosphere and its Influence on Positioning and Satellite Navigation". In press.

Kierulf, H.P., Plag, H.P., Bingley, R.M., Teferle, N., Demir, C., Cingoz, A., Yildiz, H., Garate, J., Davila, J.M., Silva, C.G., Zdunek, R., Jaworski, L., Martinez-Benjamin, J.J., Orus, R., Aragon, A., "Comparison of GPS analysis strategies for high-accuracy vertical land motion", *Phys. Chem. Earth*. 2007.

Miquel García-Fernández, Angela Aragón-Angel, Manuel Hernandez-Pajares, Jose Miguel Juan, Jaume Sanz, Victor Rios, "Ionospheric Tomography with GPS Data from CHAMP and SAC-C", Book [Earth Observation with CHAMP, Springer Berlin Heidelberg DOI 10.1007/b138105, ISBN 978-3-540-22804-2 DOI 10.1007/3-540-26800-6 71, December 27, 2005, pp. 453-458](#)

## **AWARDS**

**ION GNSS 2008** student paper sponsorship winner, Savannah, Georgia. The submitted paper "A new technique to improve the electron density retrieval accuracy: Application to FORMOSAT-3/COSMIC constellation" has been selected by the conference program committee for presentation and travel sponsorship for the ION GNSS 2008 conference.

Winner of a contract-funding support from the Spanish Ministry of Science and Education within the Technical support program (Programa Personal Técnico de Apoyo: Modalidad Infraestructuras) for three years (2008-2010) to co-finance Ms. Aragon-Angel's salary along with gAGE/UPC.

Poster prize winner in the ESA European Student Outreach Programme, **55<sup>th</sup>** International Astronautical (IAC) Congress 2004, Vancouver, Canada, October 2004.

Special prize for the *Moonlight Project* in the "New Enabling Technologies" category of the **1<sup>st</sup> Aurora Student Design Contest** organized by the European Space Exploration Programme "Aurora", Barcelona, Spain, September 2003.