CEAS Space J (2015) 7:69–70
DOI 10.1007/s12567-015-0097-x

EDITORIAL

Editorial: International ESA Conference on Guidance, Navigation & Control Systems 2014

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Published online: 12 June 2015

This special issue of the CEAS Space Journal has been prepared from a selection of the most interesting presentations delivered throughout the different sessions of the 9th International ESA Conference on Guidance, Navigation & Control Systems.

Every three years, this conference offers a unique window into the most recent experiences and innovations of the international GNC community, as well as a detailed insight into the demanding requirements of future missions. The latest conference, held in June 2014 in Porto, was attended by more than 250 GNC engineers, managers and decision makers from around the globe. A broad range of GNC-related topics was covered by presentations of the highest calibre.

Thanks to the authors who accepted to submit their papers to the CEAS Space Journal, and thanks to the reviewers, we are happy to provide a representative and up-to-date survey covering challenging missions and associated GNC developments, new sensors including miniaturisation efforts as well as techniques for advanced estimation, control and verification.

Two very high accuracy missions, namely Euclid and GOES-R, are presented in the first two papers. They provide a good illustration of the overall engineering process, which includes mission objectives flow down to Attitude and Orbit Control System (AOCS) requirements, sensors and actuators selection, control design analysis and performance verification. Euclid is a medium-class mission of the ESA Cosmic Vision 2015–2025 plan. Operating around the L2 Lagrangian point of the Sun–Earth system, it will seek to understand the origin of the universe's accelerating expansion. GOES-R will be the first of the next-generation geostationary weather satellites, managed by NOAA and NASA. Both missions have unprecedented pointing performance and image quality requirements, which require innovative pointing architecture and implementation.

Planetary exploration missions are also highly inspirational and demanding in terms of GNC-enabling techniques. Mars exploration is addressed in three papers: firstly, with the Exomars 2016 mission and the Orbiter GNC implementing aerobraking strategies; secondly, with the in-flight experience gained from the Entry, Descent and Landing of the Mars Science Laboratory; and lastly with vision-based autonomous Rendezvous and Capture technologies under development for future Mars sample and return missions. Lunar exploration is then covered by a paper on autonomous landing with hazard detection and avoidance techniques.

New challenges related to space debris mitigation are presented in two papers on active debris removal. The first is a general survey of the GNC-related needs, followed by a student paper on the combined control of a chaser and its robotic arm.

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The following four papers illustrate recent advances, arising from technology developments or in-flight experience, in the area of AOCS and GNC sensors: a miniature 3D camera for RendezVous, Rover navigation or even landing; an APS-based star sensor flown on Alphasat; a low-cost GNSS receiver targeting geostationary telecom satellites and the electric orbit raising phase; a miniature MEMS-based accelerometer detector.

The last three papers cover advanced estimation, control and verification techniques. Analysis of data fusion strategies between optical navigation camera and lidar for planetary landing is first presented. Then the application of linear parameter varying techniques to a single adaptive controller, removing the complexity of switching logics between multiple controllers, is illustrated with an end-of-life experiment on Picard microsatellite. Finally, recent advances in verification and validation techniques are presented for the Vega launcher during its atmospheric ascent phase, with nonlinear and linear worst-case tools complementing traditional Monte Carlo approaches.

Last but not least, special acknowledgements are due to the Conference Organising Committee: Alain Benoit, Steeve Kowaltschek, Roger Jansson and Guillermo Ortega and all staff members of the Control Systems Division in the Technical and Quality Management Directorate of the European Space Agency.

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