

# LAUNCH VEHICLE DESIGN AND GNC SIZING WITH ASTOS

*Francesco Cremaschi, Sebastian Winter, Valerio Rossi, Andreas Wiegand*

[francesco.cremaschi@astos.de](mailto:francesco.cremaschi@astos.de), [sebastian.winter@astos.de](mailto:sebastian.winter@astos.de), [valerio.rossi@astos.de](mailto:valerio.rossi@astos.de),  
[andreas.wiegand@astos.de](mailto:andreas.wiegand@astos.de)

Astos Solutions GmbH, +49 711 89263300, Meitnerstrasse 8, 70563 Stuttgart (DE)

## ABSTRACT

The European Space Agency (ESA) is currently involved in several activities related to launch vehicle designs (Future Launcher Preparatory Program, Ariane 6, VEGA evolutions, etc). Within these activities ESA has identified the importance of developing a simulation infrastructure capable of supporting the multi-disciplinary design and preliminary Guidance Navigation and Control (GNC) design of different launch vehicle configurations.

Astos Solutions has developed the Multi-Disciplinary Optimization (MDO) and Launcher GNC Simulation and Sizing Tool (LGSST) under ESA contract. The functionality is integrated in the Analysis, Simulation and Trajectory Optimization Software for Space Applications (ASTOS) and is intended to be used from early design phases up to Phase B1 activities. ASTOS shall enable the user to perform detailed vehicle design tasks and assessment of GNC systems, covering all aspects of rapid configuration and scenario management, sizing of stages, trajectory dependent estimation of structural masses, rigid and flexible body dynamics, navigation, guidance and control, worst case analysis, launch safety analysis, performance analysis and reporting.

This paper is based on a presentation at the 6th International Conference on Astrodynamics Tools and Techniques, March 14–17, 2016, Darmstadt, Germany.

### Electronic supplementary material

The online version of this article (doi:10.1007/s12567-017-0160-x) contains supplementary material, which is available to authorized users.

A full-text view-only version of this paper is available by using the link below. The readers of this article via the shared link will also be able to use Enhanced PDF features such as annotation tools, one-click supplements, citation file exports and article metrics.

[https://link.springer.com/epdf/10.1007/s12567-017-0160-x?author\\_access\\_token=ut\\_TelZT6MYdBTOaJl4T0fe4RwIQNchNByi7wbcMAY5nYIZIOOvKyrbGh9\\_ENjmZWwyzcvQwpW30kPaWNfrSUN-Masrn6w\\_v--w4svHDudog114g0e5tR5tDQEQTa1P8zExzAJa7SZf4Qx3wcC6DA==](https://link.springer.com/epdf/10.1007/s12567-017-0160-x?author_access_token=ut_TelZT6MYdBTOaJl4T0fe4RwIQNchNByi7wbcMAY5nYIZIOOvKyrbGh9_ENjmZWwyzcvQwpW30kPaWNfrSUN-Masrn6w_v--w4svHDudog114g0e5tR5tDQEQTa1P8zExzAJa7SZf4Qx3wcC6DA==)

## KEYWORDS

Launcher, GNC, ASTOS, ESA, Ariane, safety.