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NAVIGA: A MODULAR LOW-COST SPACE NAVIGATION UNIT FOR SPACE TRANSPORTATION

**Abstract**

Nowadays, due to the increasing amount of satellites of different types to be orbited and the high cost of the launching missions, the manufacturers are demanding lower cost units that could operate, with similar performances and reliability that the traditional space hard-rad units. NAVIGA is an electronic sensing/processing unit that responds to these needs and will provide a GNSS-INS hybrid navigation solution to the GNC subsystem of the VEGA-C launcher. Besides, through its modular configuration, NAVIGA can be adapted to the needs of other transportation systems.

The NAVIGA development started in 2017, driven by the risk of obsolescence of the former VEGA navigation unit, its high recurring cost, and the potential orbital injection performance increase that could be achieved with a hybrid GNSS-INS system. The project successfully passed the Preliminary Design Review in 2019 and is currently in phase C.

Since the beginning, the recurrent cost (RC) has been one of the main requirements of the NAVIGA unit. The design of an unit capable to achieve the same performances than similar space navigation units with a reduced recurrent cost has been possible by combining the knowledge and experience in space navigation solutions together with the know-how in developing high-precision harsh-environment aviation products. The three key factors to reduce the unit RC, maintaining good performances, are the use of sensors hybridization techniques to provide a robust navigation solution, the inclusion of radiation tolerant (new space) and automotive parts, and the adoption of the military manufacturing processes for the production of this unit. Other remarkable features of the unit are its modularity and growth capabilities

that allow adapting the unit configuration to different missions by replacing the quality of the components, interfacing to external sensors (e.g. STR, radar altimeter), and providing different navigation solutions (GNSS, Inertial and Hybrid).

NAVIGA is a full European product that ensures the non-dependability from ITAR restriction nor from third party rights and obligations. This paper presents NAVIGA as a fully European navigation unit that responds to demanding performance requirements and recurrent cost for the vehicle composing the VEGA Space Transportation System (VSTS), with a flexible architecture that can be easily adapted to other environments and space transportation missions.