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TOWARDS THE DEVELOPMENT OF A REUSABLE SMALLSAT SPACECRAFT: THE EARS PROJECT

Abstract

A major challenge in space exploitation is the development of novel technologies that can enable a more responsible use of space, adopting sustainable solutions and reducing pollution. On the other hand, the new space economy, offering unprecedented opportunities with a full range of space-related activities that can create value and benefits to the society at large, generates an increasing need for flight opportunities for scientific and commercial exploitation.

In this paper, we present the EARS project, funded under the Horizon Europe programme, that aims to introduce the disruptive concept of "re-usability" in the small satellite segment for a greener and sustainable access to space. Our main goal is to investigate the concept of a small, reusable spacecraft for commercial and scientific applications, to identify the technical challenges and to develop the relevant key technologies that can enable its development.

The EARS spacecraft is conceived to be launched in Low Earth Orbit to support microgravity manufacturing and a variety of small experiments. The spacecraft is planned to de-orbit after several months in orbit, to perform a controlled re-entry and finally to be recovered in order to deliver its products and results back to the Earth. The spacecraft is also conceived to be re-used with minimal refurbishment, thus minimizing pollution and cost of access to space.

The EARS concept has been developed starting from a commercial SmallSat platform with flight-heritage produced by Kongsberg NanoAvionics, who is partner of the EARS Consortium. The Consortium has then investigated the development of key technologies to be integrated in the commercial platform in order to make it suitable for safe re-entry of the payload and its re-use after refurbishment. These include: (1) a green propulsion system enabling precise maneuver and efficient propulsion, which is under development and test at T4I laboratories; (2) an inflatable heat shield and relevant materials for its implementation that are under investigation and test at Von Karman Institute's Plasmatron facilities; (3) reliable and precise Guidance, Navigation and Control (GNC) solutions for the control of the de-orbit, re-entry, descent and recovery phase of the platform, which are being studied by DEIMOS. The Industrial Engineering Department of the University of Padua addresses system level studies, while the CNR-IFAC coordinates the whole Consortium, supporting also the development of a business model canvas for the EARS spacecraft.