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Corresponding author: DE MAGNEVAL Eliot
E-mail of corresponding author: eliot.demagneval@ctingenierie.com
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INSIDeR: Innovative Net & Space Inflatable structures for active Debris Removal

Authors

Eliot de Magneval[1], Issam Hrazmi[2], Killian Beuret[3]*
** Corresponding author*
[1]CT INGENIERIE, 78280 GUYANCOURT, France, eliot.demagneval@ctingenierie.com
[2]AIRCAPTIF, GROUPE MICHELIN, 78190 TRAPPES, France, issam.hrazmi@aircaptif.com
[3]MICHELIN RECHERCHE ET TECHNIQUE, 1762 Givisiez, Suisse, killian.beuret@cd-michelin.ch

Abstract

Because of the new space industry paradigm, consisting in sending constellations of commercial satellites, the number of objects in Low Earth Orbit (LEO) has increased drastically since 2020 and is expected to follow this trend in the coming years.

The INSIDeR solution is developed to tackle the issue raised by a large number of objects put into the same orbital region: the rise of debris number if spacecrafts are not de-orbited properly or placed in graveyard orbits after their end-of-life, resulting in a greater risk of chain collisions that may prevent from using orbits of interest.

The INSIDeR solution is a kit one plugs on a space platform, which otherwise has its own mission. It could be on a satellite platform or an upper stage of a launcher, for instance. When the host spacecraft reaches its end-of-life, it will use the INSIDeR kit to capture a debris before performing a de-orbitation maneuver.

The kit depends on the host space vehicle for propulsion, attitude knowledge and control, telecommand, telemetry and tracking, thermal management and power generation. The debris capture relies on the combination of two key technologies: a flexible net deployed thanks to an inflatable structure, both previously folded inside the kit. The debris relative position and velocity along with its attitude are measured with a set of sensors inside the kit to ensure it is compliant with what the capture system can endure. A tether ensures a mechanical link between the net and the kit, and will be used once the capture is made to de-orbit the debris together with the satellite platform.

A ground demonstration of the inflation of the structure and deployment of the net, the debris capture and the net closing and locking mechanism is planned for autumn 2023.

The article presents the design constraints considered and the current design of the inflatable structure and the net. It also presents the mission analysis of a typical INSIDeR mission.

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