New Challenges and Opportunities of Passive Deorbiting Systems: Emulation of Micro-Gravity for the ESA-Dragliner

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Introduction

The ESA-Dragliner project, led by the Finnish Meteorological Institute in partnership with Aurora Propulsion Technologies, GRADEL, and the University of Luxembourg, seeks to develop, produce, assemble, and test a prototype of a tether-based system for deorbiting Low Earth Orbit (LEO) telecommunication satellites. The Dragliner project has chosen the PB (Plasma Brake) microtether, a novel propellant-free technology designed to efficiently deorbit LEO satellites. This system, which utilizes Coulomb drag, is lightweight, compact, requires minimal power, and operates independently without using resources from the host satellite during deorbiting (Fig. 1). The project's goal is to preliminarily design this tether-based deorbiting system for LEO satellites, and to produce, assemble and test a Breadboard Model demonstrating the most critical functions (Fig. 3). Additionally, the project aims to analyze and optimize a deorbiting strategy using this technology to successfully deorbit a LEO spacecraft weighing up to 250 kg, reducing its altitude to a maximum of 400 km within 2 years from an initial altitude of 850 km, or within 100 days from an initial altitude of 550 km.

Objectives

The Technology Readiness Level (TRL) of the satcom PB to level 4. This requires choosing a deployment strategy, selecting the tether material, finalizing the tether design, performing simulations for deorbiting performance and tether

Fig. 1: The high-level block diagram

dynamics, testing the tether material in zero-friction lab conditions, and creating the initial breadboard model of the essential components of the Dragliner, including the main tether reels, the main tether itself, and the supporting tape tether and its housing.

Test, verification and validation in the Zero-G Lab

As depicted in Fig. 2, the Base Unit is linked to the floating platform, whereas the Remote Unit is linked to a stationary UR10 robotic manipulator. Throughout deployment, the Base Unit and the floating platform will move away from the manipulator, facilitating the simultaneous deployment of the Main Tether connected to the Base Unit.

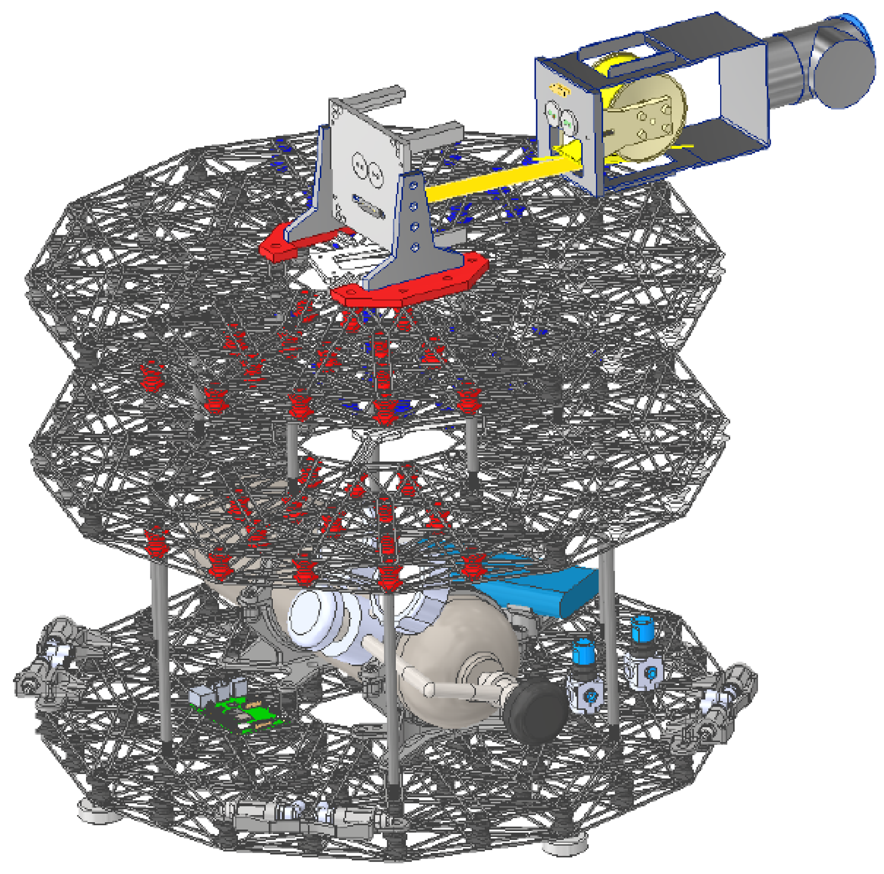

Fig. 2: The floating platform integrated with the tether mechanism

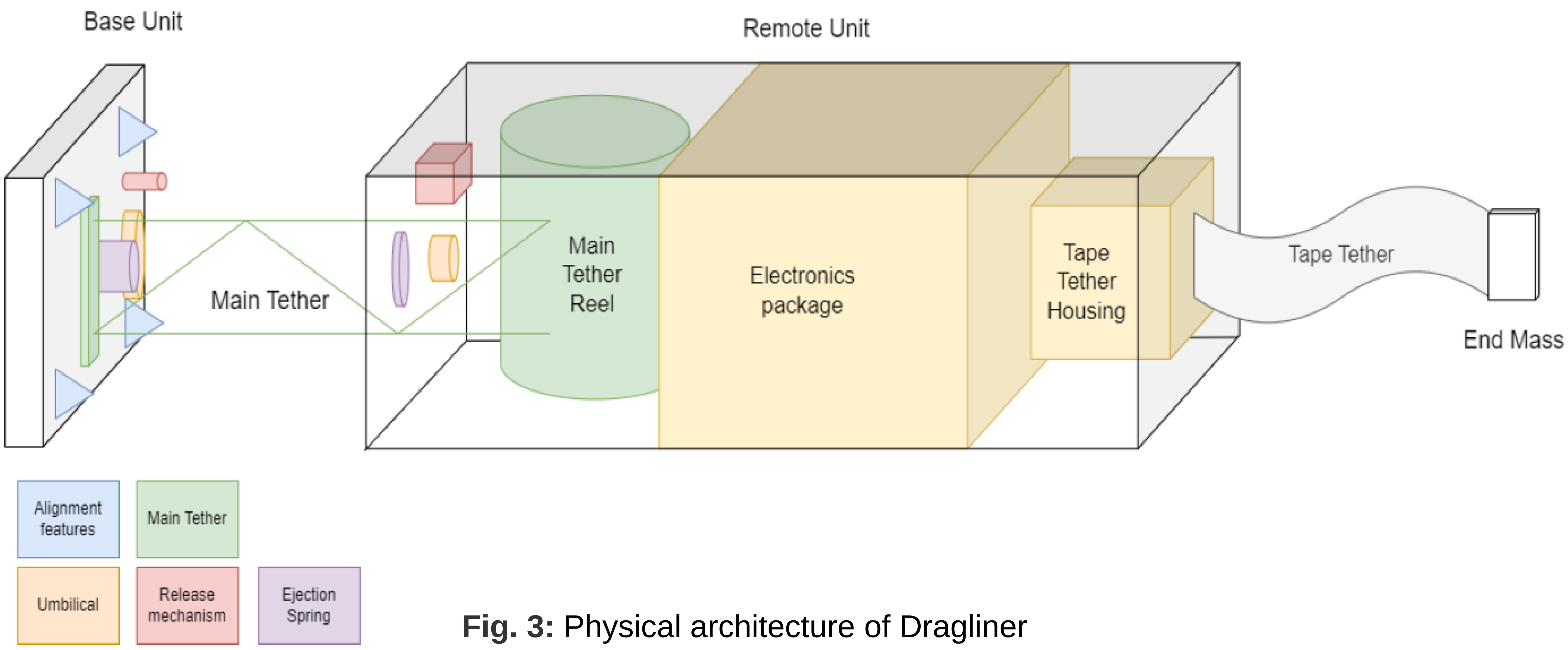

Fig. 3: Physical architecture of Dragliner

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