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Bachelor / Master Thesis Announcement

Development and assessment of novel mission concepts using ABEP and aerodynamic drag and lift

Atmosphere-breathing electric propulsion (ABEP) is a potential enabling technology for satellites orbiting in Very Low Earth Orbits (VLEO). An ABEP system ingests residual atmosphere through an intake and uses it as propellant for an electric thruster to compensate the satellite's drag and might allow a satellite to orbit for unlimited time without carrying propellant on-board.

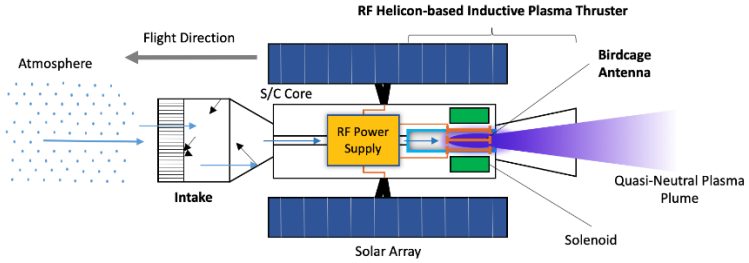

Figure 1: ABEP system schematics. Reference: F. Romano

A second option to exploit the residual atmosphere in VLEO is to use aerodynamic lift and drag for the propellant-less orbit control of a single satellite or the relative motion control of several satellites flying in formation.

In this study, it shall be investigated if a simultaneous application of both technologies is beneficial (in terms of criteria which have to be defined within the thesis as well) and if so how both technologies can best possibly be exploited simultaneously. Therefore, different possible mission concepts ranging from individual satellite mission to more complex formation flight missions shall be designed, developed and assessed via MATLAB based simulations. To derive realistic results, the mission concepts shall take all relevant limitations and characteristics of the different methodologies (power requirements, system mass, flow alignment, etc.) into account. Via a comparison to traditional satellite mission, conclusions shall be drawn. A successful implementation of the task would represent a promising first step towards enhanced VLEO satellite missions.

Task description of the Bachelor / Master thesis work:

- Familiarization with the ABEP concept as well as the methodology of differential lift and drag;
- Development of different mission scenarios including both technologies;
- Assessment of the scenarios in MATLAB based simulations;
- Derive maneuver recommendations based on the results;
- Critical assessment of the results and documentation.

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