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Corresponding author: KATSONIS Konstantinos
e-mail of corresponding author: katsonis.dedalos@gmail.com
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Title

Earth atmosphere remnants as an electric propulsion propellant

Authors

Chloe BERENGUER [1] , Konstantinos Katsonis [2]*

** Corresponding author*
[1] DEDALOS Ltd, Vasilissis Olgas 128, Thessaloniki, Greece, berenguer.dedalos@gmail.com
[2] DEDALOS Ltd, Vasilissis Olgas 128, Thessaloniki, Greece, katsonis.dedalos@gmail.com

Abstract

In view of feeding electric thrusters after their condensation for propulsion of satellites in various altitudes and also of s/c involved in near Earth missions, evaluation of the Atmospheric Remnants (AtRems) composition is mandatory. We use here the Four Component {N, N_2, O, O_2} Detailed Global Model 4CDGM for evaluating AtRems in the 140 km - 260 km region altitudes exceeding the Karman line, for theoretical characterization of various types of electric thrusters fueled by atmospheric remnants and for non-intrusive diagnostics of the modeled thrusters. 4CDGM provides Electric Thruster (ET) support in case of fueling by AtRems following an In Situ Resources Utilization (ISRU) scheme giving :
(I) Earth atmospheric composition analysis [1].
(II) Evaluation of O_2/N_2 ratios for thruster fueling in experiments meant to simulate the AtRems constitution in various altitudes.
(III) Characterization of various types of ETs [2].
(IV) ET diagnostics based on Optical Emission Spectroscopy (OES) [3].
Atmospheric composition is also important for satellite drag and for re-entry studies.
In a general way, the thermosphere exhibits high temperatures (say from 600 K to 1400 K) and quite low pressures (e.g. of about 10-9 Atm at 200 km altitude) [1].
Results obtained by 4CDGM for important constituents of the AtRems in altitudes within 140 km to 240 km in case of low, mean, high and extremely high solar & geomagnetic activities are sought. Further to VLEO related work [4], development of air-breathing electric propulsion for missions in extremely low altitudes is also addressed. More generally, properties of any {N_2, N, O_2, O} mixture can be analyzed and diagnosed by 4CDGM. In the Conference, modeling of ETs fed by AtRems and the corresponding OES results will be presented and discussed.

References

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