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SPACE PROPULSION SYMPOSIUM (C4)
New Missions Enabled by New Propulsion Technology and Systems (6)

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APPLICATION FOR SPACECRAFT IN VERY LOW ORBITS BASED ON AIR-BREATHING ELECTRIC PROPULSION SYSTEM

Abstract

Rocket propulsion needs to consume two fundamental terms: energy and mass. Every spacecraft using rocket or electric propulsion has carried all of the propellant mass needed for their mission from the ground. No spacecraft has ever collected propellant in-situ. These have limited application range and mission capabilities due to having no on-orbit source of propellant. This work focuses on air-breathing electric propulsion system and examines the feasibility of collecting the oncoming flow and using it to produce thrust to counteract aerodynamic drag. Spacecraft based on air-breathing electric propulsion system can execute many aerospace missions in very low orbits, such as high-resolution earth observation, measurements of the gravity field and gas resources supplement in-situ for space station. However, spacecraft will emerge a lack of solar energy over a period of 20 days due to precession caused by earth oblateness in large inclination, but will not occur in small inclination (¡10). In large inclination, air-breathing electric propulsion system can uses a part of collected gas to produce thrust to counteract air drag and uses residual collected gas to produce thrust to maintain orbit in best direction for absorbing solar energy. From comprehensively analyzing missions in very low orbits, it can be found that spacecraft flying in small inclination (¡10) are suitable for executing the mission of gas storage and gas resources supplement, while it flying in large inclination are suitable for executing the mission of observation and measurement.