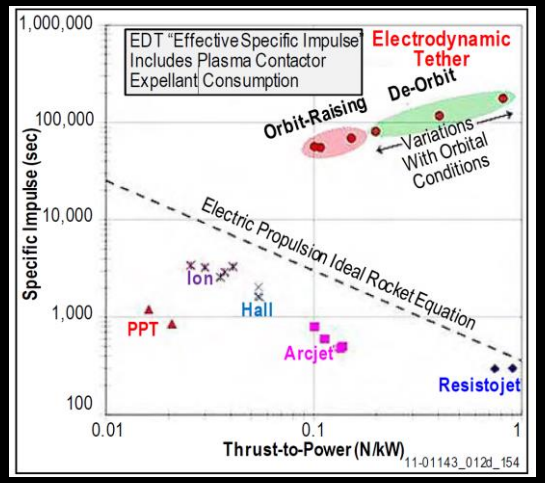
PROPULSION AND POWER USING ELECTRODYNAMICS.

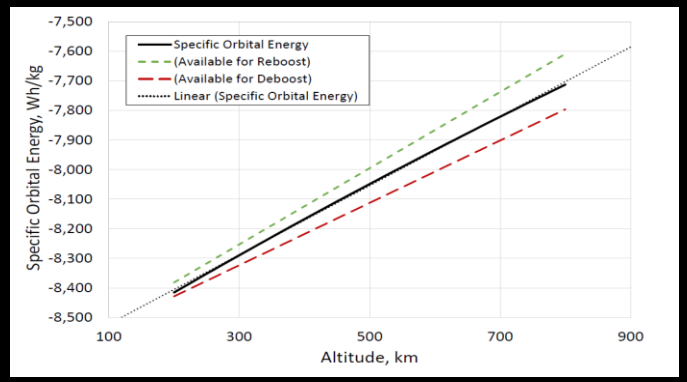
L. Johnson,[1] L. Habash Krause,[1] B. Wiegamnn,[1] S. G. Bilén,[2] and B. Gilchrist,[3]
[1]NASA George C. Marshall Space Flight Center, [2]The Pennsylvania State University, [3]The University of Michigan

Escape the Limits of the Rocket Equation

Electrodynamic tethers provide *both* high-thrust-to-power *and* extremely high specific impulse performance, exceeding the fundamental limits of propellant-based electric thrusters

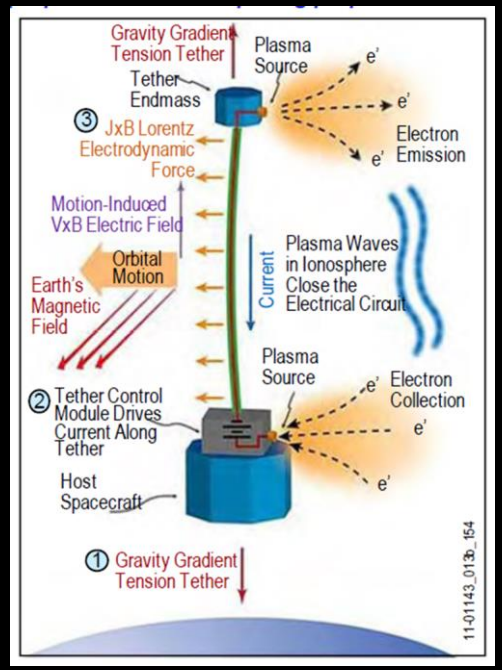


Generate Power without the Sun



Electrodynamic Tethers Can Provide:

- Extremely high efficiency, multi-km/s ΔV for LEO propulsion and station keeping
- Multipoint *in situ* LEO plasma measurements
- MW power generation and propulsion at the gas giants

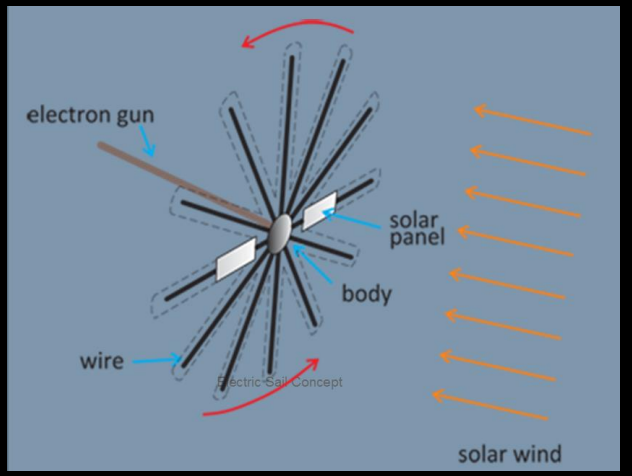


An electrodynamic tether generates thrust using the interaction between current driven along a tether and a planet's magnetic field, enabling propulsion without propellant.

Magnetic field strength and direction varies over each orbit (in and out of plane), allowing fine tuning of the electrodynamic forces my modulating the current in the tether.

Electrostatic Sails Can Provide:

- Propulsive thrust to scientific spacecraft throughout solar system
- Over a period of months, accelerate a spacecraft to enormous speeds—on the order of 10–15 AU/yr



The E-Sail exchanges momentum between an "electric sail" and the solar wind, which flows radially away from the Sun at speeds ranging from 300–700 km/s. The "sail" is an array of long, charged wires that extend radially outward 10 to 30 km from a slowly rotating spacecraft. Momentum is transferred from the solar wind to the array through the deflection of the positively charged solar wind protons by a high voltage potential applied to the wires.

NASA PennState