

Paper: "[Length Scaling in Spacecraft Dynamics](#)" by Atchinson, Peck 2012

- A. Three sample spacecraft geometries are considered: a sphere, a cube, and a thin square plate, at three near-Earth altitudes: 500, 1000, and 10,000 km.
- B. This analysis offers a guide for orbit and attitude simulations of small bodies, by suggesting which effects can and cannot be neglected for a given environment and error tolerance.
- C. This paper presents a method for comparing the length scales of arbitrary spacecraft and uses this approach to evaluate the relevance of 12 environmental forces and torques.
- D. Length-scaling, i.e. changing spacecraft size, represents a new degree of freedom for spacecraft mission design.
- E. At higher altitudes, solar pressure and residual magnetic interactions become increasingly important.

- F. Gravitational accelerations are uniquely length-independent and the opportunities and challenges associated with gravity gradient torques, n-body maneuvers, and planetary oblateness effects are present at any length scale.
- G. This work is inspired by research in interplanetary dust dynamics as well as advances in microfabrication techniques.
- H. At low-Earth orbit (LEO) altitudes, aerodynamic drag can dominate the angular accelerations for small bodies.
- I. This approach to length scaling may enable extremely small spacecraft to exploit unfamiliar dynamic behaviors that result in solar sail maneuvers, atmospheric reentry, and Lorentz propulsion.
- J. A framework of scaling is introduced that generalizes an arbitrary spacecraft geometry to a series of non-dimensional coefficients.

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