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# Non-dimensional approach to aerodynamics and sizing of aero-assisted planetary spacecraft

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Aero-assist, or use of aerodynamic lift by planetary spacecraft during atmospheric flight has a potential of saving propellant, thus increasing the payload mass allocation. We develop an approach to evaluation of aerodynamic effects based on non-dimensional ratios of the mass and airspeed parameters of the vehicle to parameters associated with the column mass and scale height (vertical extent) of the atmosphere. Analytic solutions of the resulting non-dimensional equations of atmospheric flight provide simple parametric relations which are applied to sizing of an aero-assisted ascent stage of the prospective Mars lander spacecraft.