The Effect of Nose Cone Geometry on Rocket Aerodynamics

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The aerodynamic efficiency of a rocket is significantly influenced by the geometry of its nose cone. The shape of the nose cone directly affects drag, a resistive force that opposes motion and increases fuel consumption. Minimizing drag is crucial in aerospace engineering, as it leads to improved fuel efficiency, stability, and overall performance. This study investigates the effects of varying nose cone angles on drag force under low-speed conditions, as replicating the high velocities of an actual rocket launch is not feasible in small-scale testing. Four distinct ogive nose cone designs with angles of 15°, 25°, 30°, and 45° were tested. Each nose cone was placed on a mounting structure attached to a vehicle. The vehicle traveled at 40 mph through still or ideal air conditions. Drag force measurements were collected using a Vernier Go Direct Force Sensor, and the drag coefficient (Cd) was calculated using the formula: Cd=2Fd/?V^2A, where F_d is the drag force, ? is the air density (1.225 kg/m³), V is the velocity, and A is the frontal area of the nose cone. Results showed that the 30° nose cone had the lowest drag coefficient (Cd = 0.0213), followed by 25° (Cd = 0.0341), 15° (Cd = 0.1282), and 45° (Cd = 0.0922). These findings suggest that moderately tapered designs (25°–30°) are optimal for reducing drag at low speeds. This research can inform future rocket and UAV designs where aerodynamic efficiency at subsonic speeds is critical for improving fuel efficiency and performance.

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