The Effect of Dimples on a Mid-Sized Automobile's Aerodynamics

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The dimple effect is a phenomenon that occurs when divots, or dimples, on an object create a turbulent boundary of air over the object leading to air moving further across the object, lowering drag forces. This study examined the hypothesis that dimples on a mid-size automobile reduced drag forces normally produced and its drag coefficients. Two cars were designed on Autodesk Fusion 360 and tested on an Autodesk CFD wind tunnel simulation. One car was the control with no dimples, while the other was the experimental car with dimples, with a depth of 2 mm and diameter of 17 mm, placed on the roof and trunk. The cars were tested in different simulations which had three different wind velocities, 70 mph, 55 mph, and 40 mph, and were all under the normal atmospheric pressure of 1 atm. All simulations were set to finish at 300 iterations. The results displayed that the cars with dimples produced fewer drag forces and drag coefficients in all three situations compared to the control cars without the dimples. Lower drag forces due to the dimple effect could increase fuel efficiency in mid-size cars. More fuel-efficient vehicles would benefit the environment as there would be fewer carbon dioxide emissions from the vehicles.