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Aerodynamics of a Dimpled Vehicle JASON ORTEGA, KAMBIZ SALARI, Lawrence Livermore National Laboratory — Automobiles consume approximately two billion barrels of fuel each year throughout the United States. A significant portion of this fuel is used to overcome aerodynamic drag at highway speeds. As a result, even small improvements made to the aerodynamics of automobiles can result in sizeable fuel savings. Since the shape of a vehicle is often dictated by design, economics, and function, aerodynamic improvements by means of obvious body streamlining are not always possible. However, minor modifications can be made to the vehicle, such as changing the behavior of the boundary layer to delay flow separation or installing small components either to reduce underbody flow or to mitigate induced drag. In this study, we examine the effect that dimples have upon the aerodynamics of a simplified vehicle. Reynolds-averaged Navier-Stokes simulations are performed on a full-scale Ahmed body at a Reynolds number of 9.5e6 based upon the vehicle length. The dimples, which have a uniform diameter of 0.1 m and a dimple depth-to-diameter ratio of 0.14, are distributed across the vehicle surface. The results of the simulations demonstrate that the dimples modify both the recirculation zone and the strength and location of the counter-rotating vortex pair in the vehicle wake. Although an increase in base pressure can occur for a dimpled configuration, the net drag change is sensitive to both the number and placement of the dimples on the vehicle body.

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