DUSTY BOUNDARY LAYER IN A SURFACE-BURST EXPLOSION

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Dusty boundary layers are an inherent feature of explosions over ground surfaces. Detailed knowledge of dusty boundary layer characteristics is needed in explosion safety analysis (e.g., to calculate the drag loads on structures). Also, to predict the amount of dust in the.rising fireball of an explosion, one must know the dusty boundary layer swept up during the positive and negative phases of the blast wave and how much of this boundary layer dust is entrained into the stem of the dust cloud.

For explosion effects analysis, one would like to know the following properties of turbulent, dusty boundary layers (1) the boundary layer thickness, because this scales the boundary layer profiles; (2) the mean-flow velocity and density profiles; (3) turbulent fluctuations in the boundary layer; and (4) the dust mass entrainment rate. Although considerable analytical and experimental studies have been performed, the aforementioned properties are not yet well established for dusty boundary layers in blast waves.

This paper describes the results of numerical simulations of the dusty boundary layer created by a surface burst explosion. The evolution of the flow was calculated by a high-order Godunov code that solves the nonsteady conservation laws. Shock interaction with the dust layer generated vorticity near the surface - similar to viscous non-slip effects found in clean flows.