Abstract Submitted
for the SHOCK05 Meeting of
The American Physical Society

On the Detonation of an Explosive by the Shock Resulting from Projectile Impact PETER LEE, Peter Lee Consulting Ltd, JOHN CURTIS, JOHN MILLS, QinetiQ — A model that addresses the shock physics resulting from high velocity projectile normal impact upon a layered target containing explosive, with a view to determining whether detonation occurs, is presented. Unlike many earlier entirely empirical criteria for shock-induced detonation, the formulation includes a simple treatment of the resultant chemistry in the explosive, while retaining the benefits of an analytical, as compared with hydrocode, formulation. The impact on the confined explosive generates shocks in the front target layer and in the projectile. The Rankine-Hugoniot relations are used to calculate the characteristics of these shocks and then to determine the shock propagation into the subsequent target layers. In particular the mechanical shock contribution to the internal energy in the explosive, is calculated. The total rate of supply of internal energy to explosive is then determined by the addition of an expression for the heating that would result from the chemical reaction, drawing upon the Lee and Tarver explosive burn model. Based on the total rate of energy supply and some asymptotic considerations, a semi-empirical detonation criterion is postulated. Predictions with the new model are in good agreement with the corresponding experimental data.

John Curtis
QinetiQ

Date submitted: 11 Apr 2005 Electronic form version 1.4