CHARACTERIZATION OF UREA NITRATE THROUGH SHOCK VELOCITY MEASUREMENTS AND MODELLING

T. Josey[1], M. Ceh[1], P. Desgagnés[1], L. Donahue[2], R.C. Ripley[2]

Defence Research & Development Canada, Suffield Research Centre, PO Box 4000, Stn Main, Medicine Hat, Alberta, T1A 8K6, Canada; [2]Lloyd's Register Applied Technology Group, 400-1888 Brunswick St, Halifax, Nova Scotia, B3J 3J8, Canada

Key words : Urea Nitrate – Homemade Explosive – Shock Velocity – Numerical Modelling - Blast

An improvised explosive device (IED) has the potential to cause extensive damage and injury, not just in combat situations but against the civilian populace as well. Homemade explosives (HMEs) often constitute the basis of IEDs, and are created using readily-available materials. The increasing prevalence of IEDs makes characterization and development of numerical models of HMEs of critical importance. However, unlike the breadth of knowledge that has been published regarding conventional explosives, relatively little data is available for HMEs.

An experimental trial series was conducted at Defence Research & Development Canada – Suffield Research Centre to gather experimental data on Urea Nitrate, a common HME. Trials involved cylinders of explosive capped with a booster which was separated from the main mix by layers of acrylic glass disks. An array of shock pins positioned along the length of the cylinder were used to measure the shock arrival times. The amounts of booster explosive and the thickness of the acrylic glass spacer were varied to adjust the incident shock conditions impacting the Urea Nitrate, giving conditions ranging from unreacting shock to full detonation.

This information is used to develop a basic numerical model for Urea Nitrate, including both an equation of state and a reaction model. The model was implemented in the Chinook shock physics code, and comparisons to experimental results are given. Reasonable agreement was achieved for test cases involving reaction/detonation of the explosive material.