MICRON-SIZED TEMPERATURE SENSOR TESTS AND CALCULATIONS

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ABSTRACT

A series of tests were conducted in a two-room non-responding test structure at Kirtland Air Force Base, New Mexico, in which micron-sized temperature-sensitive particles were exposed to environments generated by the detonation of PBXN-109 charges. Each charge was placed near the corner of one room in the two-room test structure with thermometer particles placed in five "Packages" at known initial locations. In the third test, particles capable of measuring temperature time histories were placed in the Packages. After each test, particles were collected at 16 "Sites" located throughout the two rooms, and analyzed to yield temperatures. Numerical calculations using the SHAMRC (Second order Hydrodynamic Automatic Mesh refinement Code) hydrocode were conducted to simulate the shock propagation and subsequent translation of simulated 'numerical particles' located at each test package location. Each numerical particle moved by drag with the flow and recorded the pressure and temperature of both the particle and of the fluid through which it was traveling as a function of time, over a period of 0.5 seconds. The calculations were well resolved with detonation and fragmentation of the charge case, propagation of the shock throughout the two room structure as well as flow out the windows and doors, and gravity settling of the particles. Comparisons of results measured by the thermometer particles and calculated by the simulation yield understanding of the many complexities such as particle size-distribution, particle package location and collection-site positions, etc. that influence the temperature experienced by, and therefore measured by, the micron- sized temperature-sensitive particles.