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A design of experiments approach for sensitivity screening of mesoscale simulations of explosive impact GEORGE BUTLER, AFRL/RWME/TEAS, JOHN COX, AFRL/RWME, TERESA DAILY, AFRL/RWWL, KEITH GONTHIER, LSU — This paper discusses a Design of Experiments (DOE) approach for planning inert mesoscale simulations to establish how microstructure and composition affect the uniaxial impact sensitivity of metalized Plastic Bonded Explosives (PBXs). Simulations are performed using an explicit, 2D, cohesive finite and discrete element code (CODEX), developed at Georgia Institute of Technology, and account for nonlinear deformation and fracture of PBXs: explosive crystals (HMX) and aluminum particles (Al) in a polymeric binder. The relative sensitivity of PBX formulations is established by critical hot-spots formed in the microstructure. The code has flexibility in prescribing material properties, but this initial screening examines five independent variables: impact speed, initial size of HMX crystals and Al particles, and initial volume fractions of HMX and Al (the binder ensures saturation). Input settings are prescribed by the DOE approach, which plans the experiments to ensure an ability to reach statistically valid, objective conclusions with minimal runs. A full factorial matrix of simulations requires 296 runs, and each run takes up to a week. DOE reduced the matrix to 101 runs, while retaining the ability to estimate dominant variable effects and the effect of variable interactions on hot spot formation. These analyses provide a qualitative validation of CODEX, and a framework for subsequent simulations. DISTRIBUTION A. Approved for public release, distribution unlimited. (96ABW-2013-0054)

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