A STATUS AND CAPABILITY REPORT ON NUCLEAR AIRBLAST SIMULATION USING HEST

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With the advent of the Atmospheric Nuclear Test Ban Treaty (1963), it became necessary to develop a non-nuclear technique to simulate high-yield nuclear overpressure loads over relatively large areas for testing strategic structures. The high explosive simulation technique, or HEST, was developed to satisfy this simulation requirement. The HEST consists of an earth-covered explosive-loaded cavity which, when detonated, will reproduce the peak pressure, shock front velocity, and pressure decay of a nuclear detonation. This paper will address the development of the HEST from its inception to the present with emphasis on its current status and capability. Various applications of the HEST for simulating a wide variety of nuclear airblast waveforms will be discussed to include details of the current HEST simulation state-of-the-art in terms of pressure levels, yields, and simulation times. The current HEST design procedures used to determine cavity depth, overburden heights cavity size, and other details of the HEST will be described. Problems associated with HEST diagnostic data will be identified and current analysis techniques will be included in the paper. Due to the cost and construction difficulties associated with the HEST in the past, recent achievements in reducing costs and construction problems by using low-cost expanded polystyrene foam and commercial ammonium nitrate-based slurry explosives will be reported.

Finally, the potential for further development of the HEST to improve waveform quality, extend waveform "shaping" capability, extend yield/pressure/ simulation time capability, and minimize construction costs will be discussed.