SIMULATION OF AIR BLAST, PERCURSORS IN LARGE SHOCK TUBES

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Air blast precursors are a gasdynamic shock diffraction effect caused by the interaction of the main blast wave with a thermal layer, which is formed by pre shock heating of the near surface air by nuclear fireball radiation. 2-D hydrocode calculations reported here demonstrate that it is indeed possible to create the precursor shock structure associated with a nuclear HOB in a shock tube. The precursor scale achievable in a shock tube depends on the precursor run length, layer sound speed, and roof height. A relatively pure but constant helium layer will adequately simulate a hot nuclear layer.

The near-surface precursor environment is shown to be a Mach 3 wall jet flow consisting of a turbulent free shear layer and a turbulent wall boundary layer. The size of the free shear layer scales with the precursor shock structure, but the scaling laws for the wall boundary layer, especially with dust effects included, are not known for this wall jet case.

Hence, clean precursor flows can be studied in smaller shock tubes, but larger scale tests are needed to investigate wall boundary layers, particularly for dusty precursor cases.