

Abstract Submitted
for the SHOCK13 Meeting of
The American Physical Society

Experimental Measurement of the Scaling of the Diameter- and Thickness-Effect Curves for Ideal, Insensitive, and Non-Ideal Explosives
SCOTT JACKSON, MARK SHORT, Los Alamos National Laboratory — Numerous two-dimensional high-explosive slab rate sticks were fielded for explosives that exhibit ideal (PBX 9501), slightly non-ideal (PBX 9502), and highly non-ideal (ANFO) detonation. Detonation velocity versus slab thickness t (thickness-effect curves) are compared to previous diameter-effect measurements obtained by varying the diameter d of cylindrical rate sticks. The scale factors d/t necessary to overlay the diameter- and thickness-effect curves were computed for each explosive formulation. We observe that the scale factor varies with detonation velocity (or level of detonation “ideality”). The measured scale factors range from 1.89–2.20, 1.41–1.87, and 1.79–1.05 for PBX 9501, PBX 9502, and ANFO formulations, respectively, as detonation velocity varies from the (near failure) critical velocity to the Chapman-Jouget velocity. These results support our previous theoretical prediction that the scale factor relating the diameter- and thickness-effect curves will increasingly deviate from two as the detonation structure becomes increasingly non-ideal.

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Date submitted: 21 Feb 2013

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