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**On Delayed Detonation (XDT) Under Fragment Impact – An
Analysis of Experimental Data and a Simple Phenomenological Model**

MALCOLM COOK, PETER HASKINS, Qinetiq — Fragment and bullet impact pose a serious threat for many weapon systems because of their potential to induce violent reactions in the energetic materials (explosives and propellants) contained within them. In some scenarios detonations have been observed under conditions insufficient to cause SDT or DDT. These events have been labelled XDT (X for unknown, Detonation Transition). It has generally been assumed that XDT arises as the result of some combination of damage to the energetic material and re-shock or re-compression of this damaged material. In this paper we review the results of our previous experimental studies aimed at understanding the conditions under which XDT may occur as the result of fragment impact. In addition, we describe some new experiments with improved instrumentation to help elucidate the key processes. Based on the experimental evidence and some simple modelling we then propose a phenomenological model for the XDT process.

Peter Haskins
Qinetiq

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