ICDERS 2017, Work-In-Progress Poster Session TITLE: A Statistical Representation of Pyrotechnic Igniter Output AUTHORS: Shuyue Guo, Marcia Cooper

The output of simplified pyrotechnic igniters for research investigations is statistically characterized by monitoring the post-ignition external flow field with Schlieren imaging. The focus is to relate the tolerances of multiple manufacturing features to the statistical deviation in the igniter output. All measurable manufacturing parameters are quantified, such as bridgewire length and resistance, charge cavity dimensions, and powder bed density, which are then tied to shock-motion variability in the tested igniters. Schlieren imaging gives a full-field view of the output as opposed to a binary go/no-go, and includes quantitative data of the shock front development from outbreak to decay, as well as qualitative data on the subsequent cloud motion and observance of solid particulate.

To demonstrate experimental precision of the recorded Schlieren images and developed image processing methodologies, commercial exploding bridgewires (EBWs) offering nominally instantaneous output were tested. The two populations of EBWs tested differ only by 0.28 mm in bridgewire diameter, but the resulting shock data resolves into two distinct populations. Finally, a statistically-significant population of manufactured pyrotechnic igniters are tested within the Schlieren arrangement resulting in a characterization of the nominal output. Comparisons between the variances measured throughout the manufacturing processes and the calculated output variance provide insight into the critical device phenomena that dominate performance.

KEYWORDS: pyrotechnic, schlieren, shockwave, variance analysis, high-speed imaging

FUNDING STATEMENT: Sandia National Laboratories is a multi-mission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC., a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

Approved for Unclassified Unlimited Release, SAND2017-4302 C.