Modeling and Simulation of Engraving and Gun Launch of a 40mm Sensor Grenade

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Abstract: The U.S. Army Armament Research, Development and Engineering Center (ARDEC) at Picatinny Arsenal, NJ is developing an inert 40mm sensor grenade which houses an array of sensors and electronic components. This grenade is intended to be fired from a hand held launcher and relay sensory information back to the user. To accomplish this task, the internal electronic components must be structurally housed and guarded from impact induced g-levels. Also, radio transmitting components within the grenade require unimpeded ability to transmit RF signal, thus prohibiting the use of conductive metallic materials in the grenade's design. These unique design requirements create significant challenges for engineers developing the projectile. Component designs had to be screened for performance and survivability before costly prototypes were fabricated. Abaqus Explicit was used to analyze the grenade during gun launch and engraving events and predict projectile performance. The technical report details the finite element simulation of, specifically, the grenade pusher (a separate sabot-like component) and the engraving band on the grenade body. The results of the simulation give a prediction of the projectile response during the engraving and gun launch events; as well as an indication of the overall structural integrity of grenade components. Analysis results of the engraving pattern are compared with actual recovered live fire grenades.

Keywords: grenades, Sensors, Impact, Dynamic, Response, 40 mm, engraving, gun launch

1. Description of Sensor Grenade

The sensor projectile is meant to deploy and transmit an assortment of sensory data from its local surroundings back to the user via RF transmission. To accomplish this task, the projectile uses an onboard array of sensors coupled with a stack of printed circuit boards which process and transmit the data. The complete projectile design is shown in Figure 1.