Trajectory Analysis of Discarded Sabot Petals

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ABSTRACT:

Sabot petals discarding from a fired kinetic energy round are potentially lethal to friendly forces forward of the firing tube. FM 17-12 currently restricts activity 70 meters lateral (both sides) of the gun target line out to 1000 meters to account for the effects of sabot discard. The concern is that future heavy/light operations may require friendly forces inside this "box". The National Training Center at Fort Irwin is also interested in applying adjudication rules for training based on a more refined understanding of where the sabot petals land. Research has been conducted to ensure that the petals do not interfere with the flight of the kinetic energy penetrator during separation. No work is currently known that addresses the exact flight path of the discarded sabot petals.

This research seeks to quantify the probability of sabot petal impact at locations forward of the firing tube. The initial conditions of the sabot petal trajectory vary because the kinetic energy round is loaded arbitrarily with respect to the sabot petal orientation and the petals are often split or damaged as they leave the muzzle. This paper presents a methodology to compute the sabot petal trajectory based on the equations of projectile motion and statistical variation of key parameters. An empirical estimate of the sabot petal drag is used and the sabot trajectory is obtained by integrating the model equations in time. Trajectory results are presented for the sabot petals of the M865 training round. The results of the model compare well with experimental radar data. By computing numerous simulations with statistical variation of key parameters, probability of impact charts are developed for several different gun elevations.

Preliminary work on the analysis of the sabot petal for the 120mm M829A2 APFSDS-T kinetic energy round is also presented. Initial results using computational fluid dynamics to characterize the petal drag are discussed.

KEY WORDS: Sabot, Projectile, Fluid Mechanics, Computational, Drag, Trajectory

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