A Proposed Method to Standardize the Scoring of Plate Array Damage

Presentation #14130

Jim Talley

Senior Director – Technology
and Advanced Development Projects

Problem and Objective

- There does not appear to be a standard means of characterizing and reporting the results of plate array tests that would enable results obtained using different ammunition types to be compared
- The objective is to present a quantitative means of representing plate array damage in order to stimulate discussion in this area

Disclaimer

Although the technique presented in this paper has been used to characterize the results of real plate array tests, all of the “data” in this presentation has been artificially generated to illustrate the method

The information in this presentation does not, and is not intended to, represent the performance of any actual ammunition

Plate Arrays

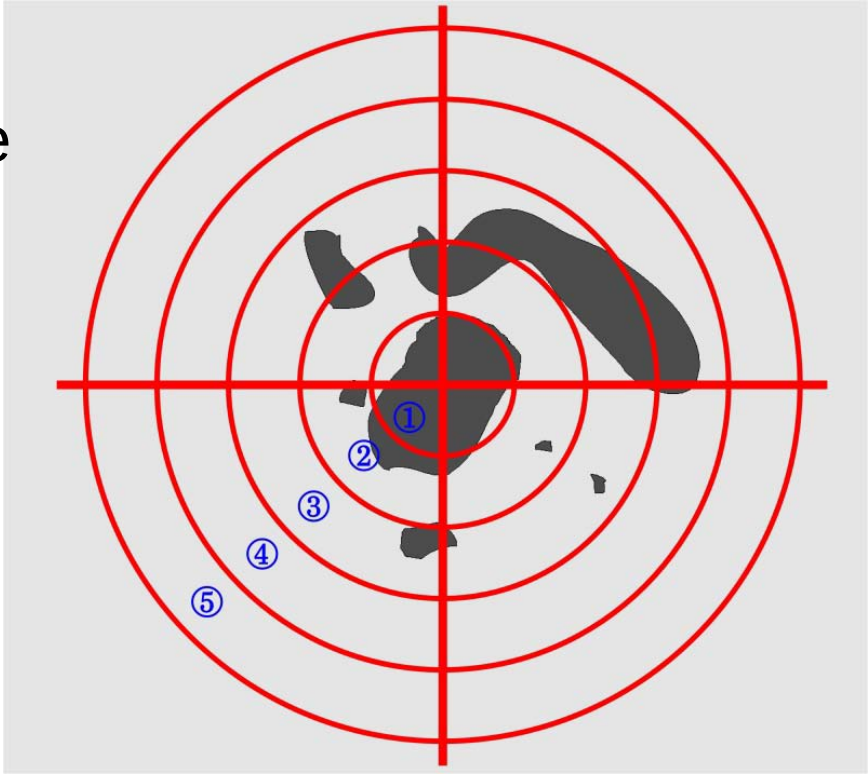
- Typically mimic the behavior of real targets
- Enable terminal effects tests to be carried out without requiring expensive, authentic target hardware
- Frequently used to enable unclassified testing whereas the identification of the “real” target would require classification
- Doesn’t directly indicate lethality or effectiveness

Plate Arrays

- Previous characterizations:
  - ↗ Number of holes
  - ↗ Total plate area removed
  - ↗ Deepest penetrated plate
- We did not find a sound, quantitative method to characterize plate damage so that ammunition types could be compared
- GDATP derived the Interval Damage Factor method which considers both the amount of material removed and the location of the damage

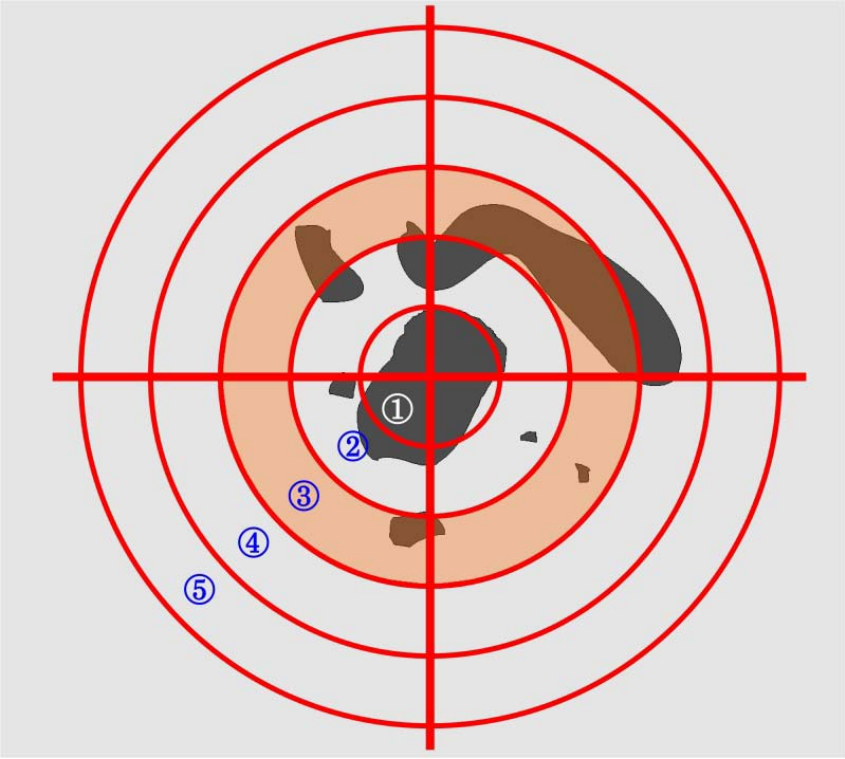
The Interval Damage Factor Method

- As an array is assembled, each plate is off-axis boresighted so that the alignment of plates is known
- After firing, concentric circles are superimposed on each plate – centered on the impact point of the first plate
- Enough circles are superimposed to capture all the damage in each plate

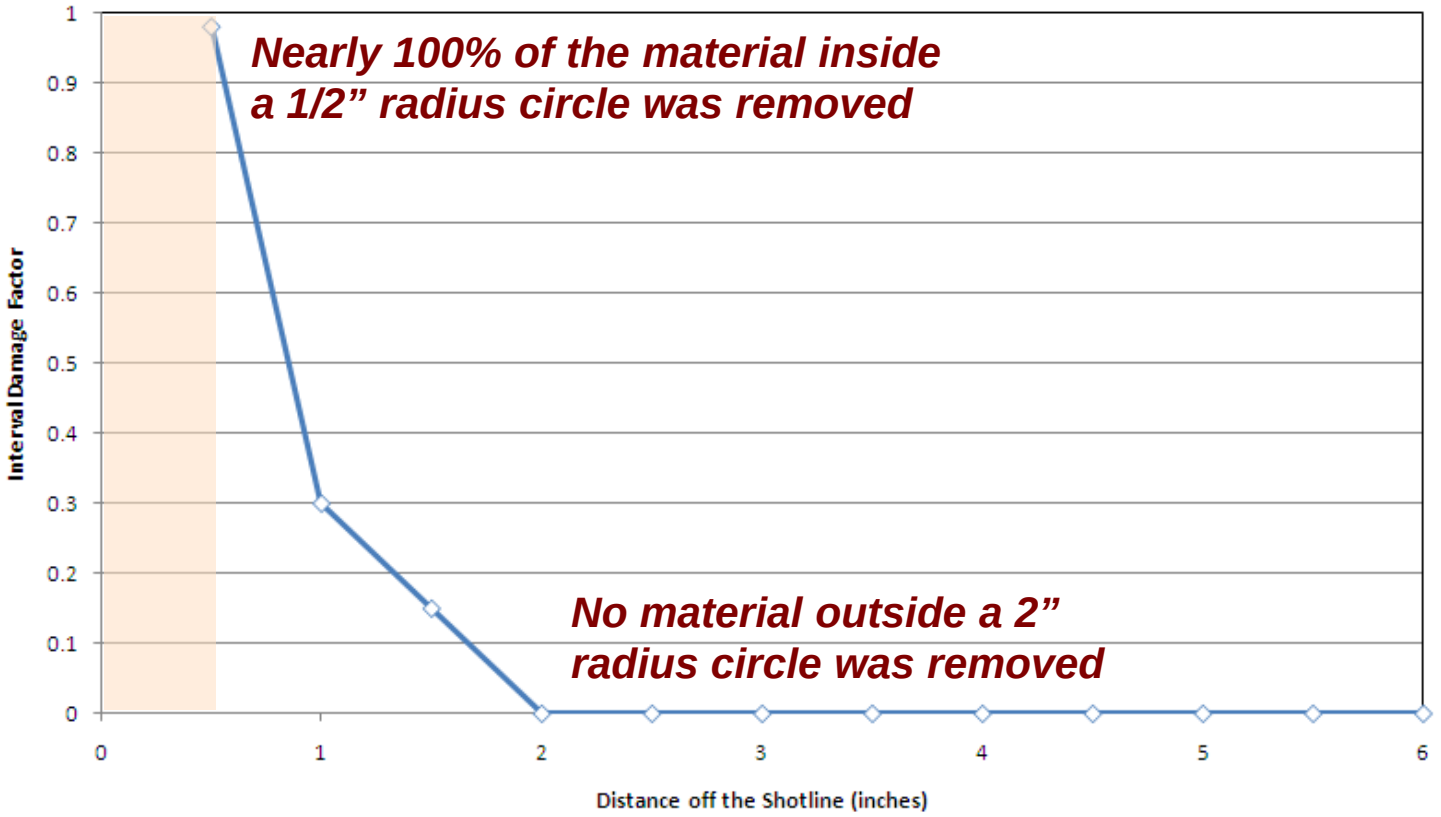


The Interval Damage Factor Method

- The fraction of material removed is measured in each annular area of each plate and tabulated
- For each array, curves can be drawn that indicate the fraction of the material removed as a function of the distance off the shotline and the depth into the array



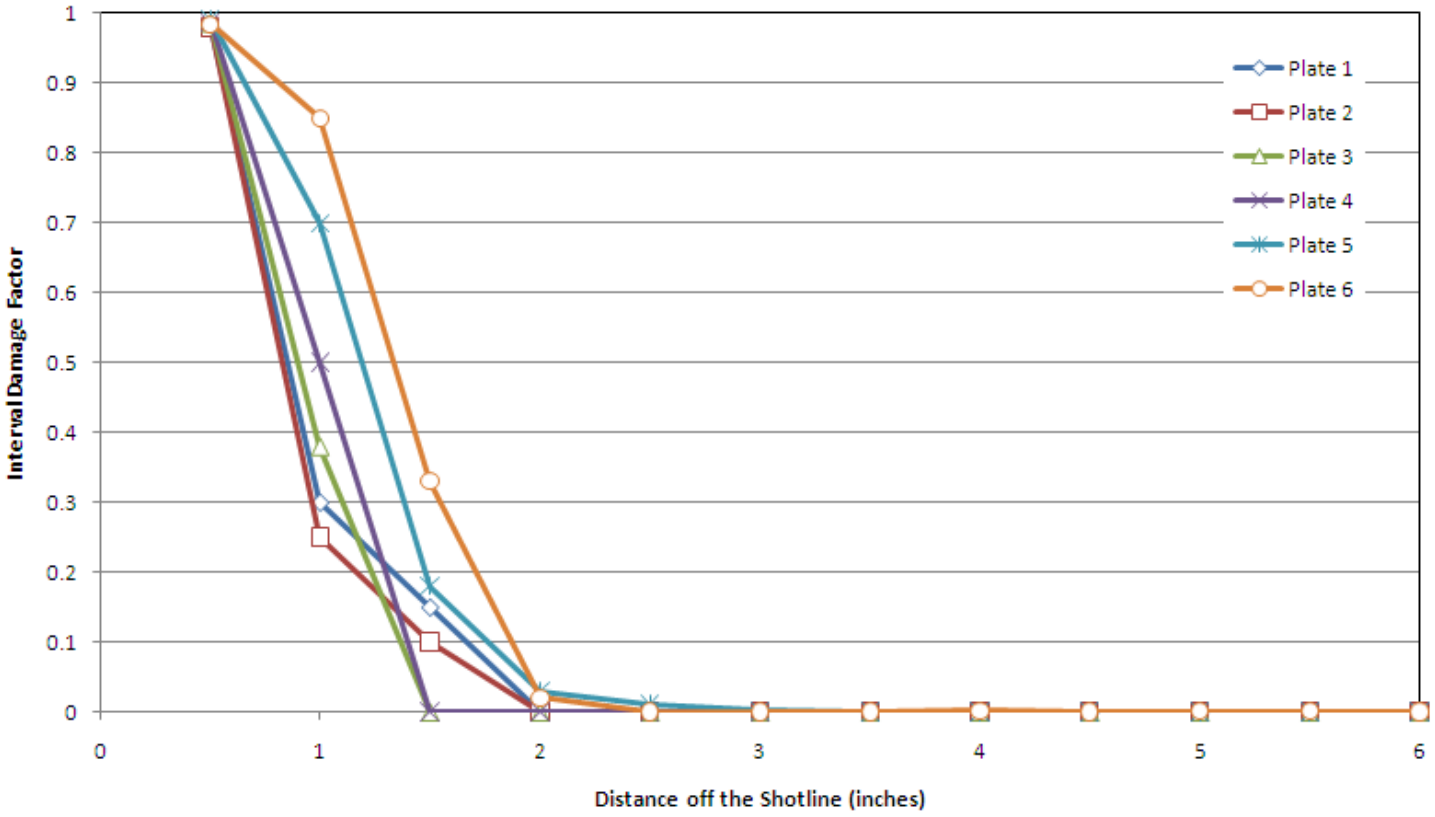
The Interval Damage Factor Method



Example:

Hypothetical full-bore projectile against a front plate with high ballistic overmatch

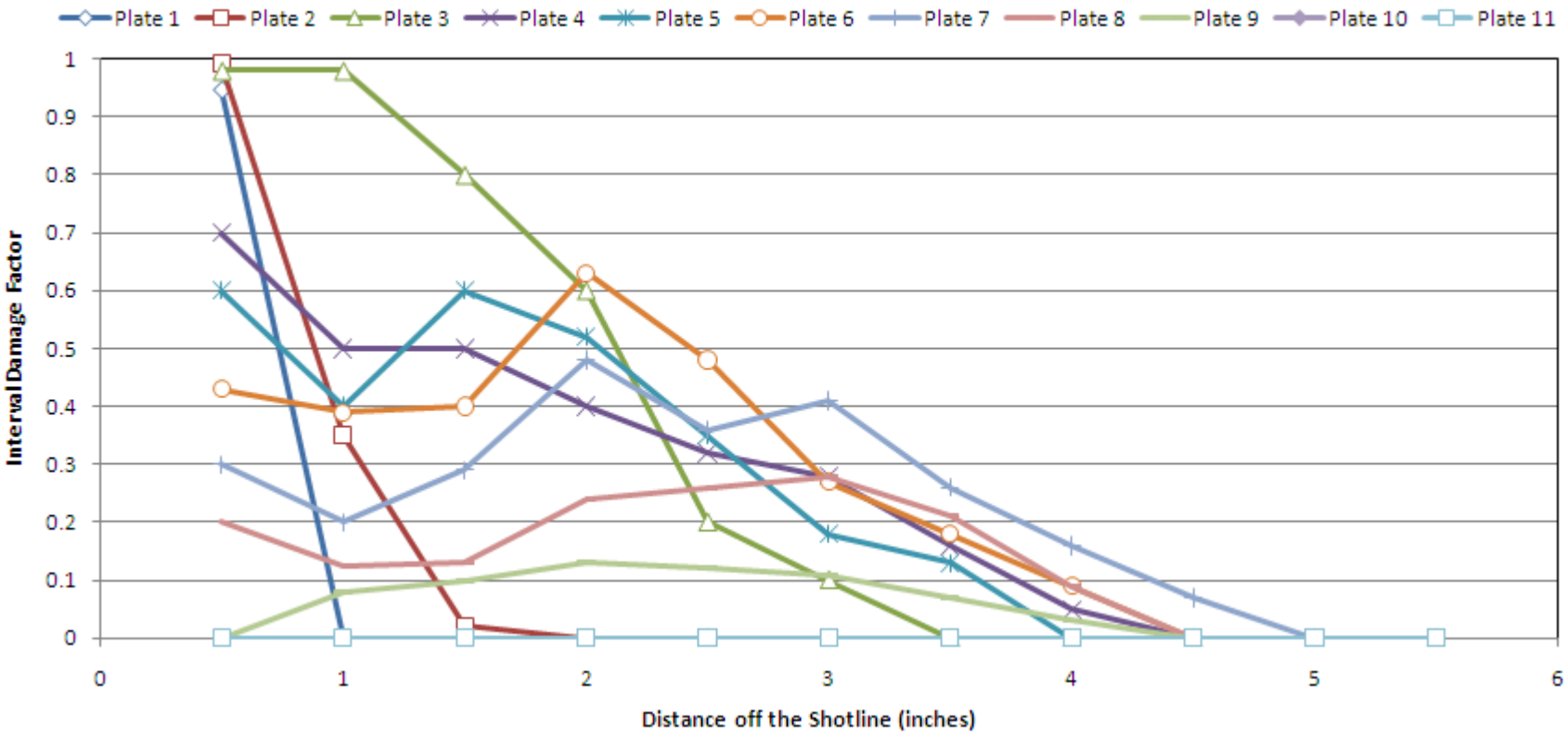
The Interval Damage Factor Method



Example:

Hypothetical full-bore projectile with high ballistic overmatch that starts to tumble in a multiple plate array

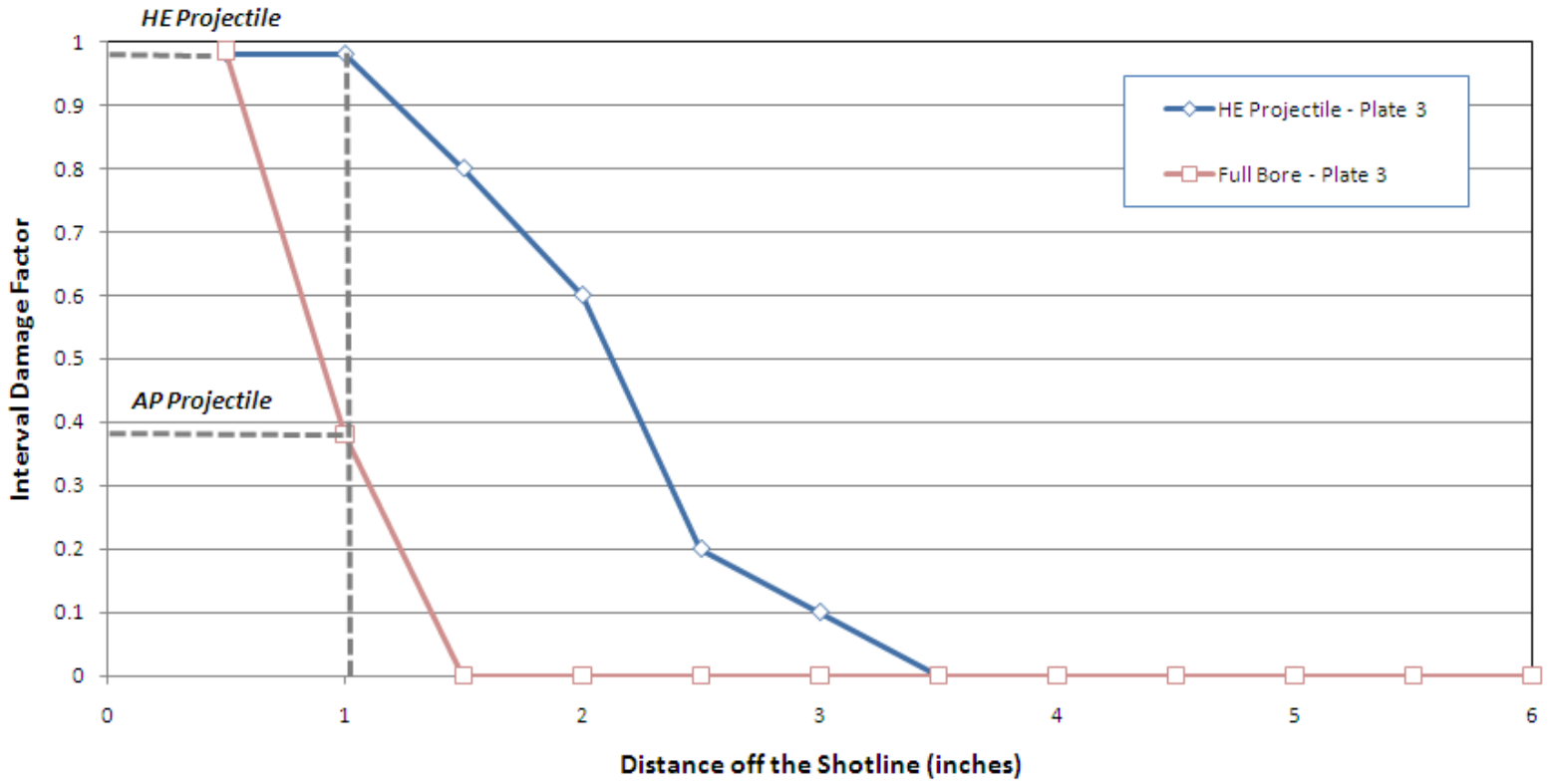
The Interval Damage Factor Method



Example:

Hypothetical HE round exploding between Plates 2 & 3 with fragments running out of energy by Plate 10

Comparing Ammunition Types



Example:

Hypothetical HE and AP projectiles against the third plate in an array indicating how the fragmenting HE projectile pushes the damage to a larger radius

Summary

- A quantitative method to characterize plate array damage was developed
- The Interval Damage Factor method can be used to compare data between ammunition types and between different arrays (targets)
- The method may also be used to quantitatively characterize the target damage as feeder data for lethality and effectiveness analyses

- Contact information:

Jim Talley
General Dynamics Armament and Technical Products
802-662-6013
jtalley@gdatp.com