

Assessment of kinetic non-lethal elements effect

© D.P. Levin

Bauman Moscow State Technical University, Moscow, 105005, Russia

The paper focuses on the method for assessing the effect kinetic non-lethal elements produce on a multicomponent target, and introduces some exposure characteristics combining up to five characteristics of a striker and the target. The study stresses that it is necessary to choose a characteristic depending on specific nature of damage occurring in a certain target component. The calculated parameters of kinetic elements were compared with the thresholds of exposure characteristics. This yields a conclusion on safe and efficient range of operation. The thresholds of exposure characteristics were compared with the injury severity ranging, which enable us to identify the non-effectiveness characteristics. The dependencies of exposure effect for chest traumas of various severities were estimated, and logistic distribution was used as an interpolation formula. Based on the assessment done, the paper makes technical recommendations to improve the kinetic element both by increasing the area of element-target interaction and decreasing the element's kinetic energy.

Keywords: non-lethal weapon, kinetic element, operation assessment, multicomponent target

REFERENCES

- [1] Levin D.P., Lyushnin S.A. *Inzhenernyi vestnik — Engineering Bulletin*, 2013, no. 10. Available at: <http://engsi.ru/doc/631502.html> (accessed May 30, 2018).
- [2] Levin D.P., Lyushnin S.A. *Inzhenernyi vestnik — Engineering Bulletin*, 2013, no. 9. Available at: <http://engsi.ru/doc/618729.html> (accessed May 30, 2018).
- [3] Selivanov V.V., Levin D.P., Ilyin U.D. *Voennaya mysl — Military Thought*, 2015, no. 2, pp. 10–22.
- [4] Lyon D.H., Bir C.A., Patton B.J. *Injury Evaluation Techniques for Non-Lethal Kinetic Energy Munitions*. Army Research Laboratory, Aberdeen Proving Ground MD, Report № ART-TR-1868, January 1999. Available at: <http://www.dtic.mil/docs/citations/ADA360135> (accessed May 30, 2018).
- [5] Sturdivan L.M., Viano D.C., Champion H.R. Analysis of Injury Criteria to Assess Chest and Abdominal Injury Risks in Blunt and Ballistic Impacts. *J. of Trauma and Acute Care Surgery*, 2004, vol. 56, no. 3, pp. 651–663. DOI: 10.1097/01.TA.0000074108.36517.D4 (accessed May 30, 2018).
- [6] Bir C.A., Viano D.C. Design and injury assessment criteria for blunt ballistic impacts. *J. of Trauma and Acute Care Surgery*, 2004, vol. 57 (6), pp. 1218–1224.
- [7] Papy A., Lemaire E. Evaluation of kinetic energy non-lethal weapons: an aggregated method. *Proc. of the 5th European Symposium on Non-Lethal Weapons*. Ettlingen, Germany, Fraunhofer Institut Chemische Technologie, May 11–13, 2009, pp. 48.1–48.7.
- [8] *GOSTR 50744–95. Broneodezhda. Klassifikatsiya i osnovnye tekhnicheskie trebovaniya* Armoured clothes. Classification and basic technical requirements]. Moscow, Izdatelstvo standartov Publ., 2003, 64 p.

- [9] Gennarelli T.A., Wodzin E. AIS 2005: A Contemporary Injury Scale. *Injury*, 2006, vol. 37, no. 12, pp. 1083–1091. DOI: 10.1016/j.injury.2006.07.009 (accessed May 30, 2018).

Levin D.P., Cand. Sc. (Eng.), Assoc. Professor, Department of High-Precision Airborne Devices, Bauman Moscow State Technical University, a corresponding member of Russian Academy of Natural Sciences. Research interests: solid mechanics, gas dynamics.
e-mail: dlevin@bmstu.ru