MATHEMATICAL STATISTICAL ANALYSIS OF THE PROBABILITY OF A BULLET HITTING A TARGET AND ITS CAUSAL BEHAVIOR

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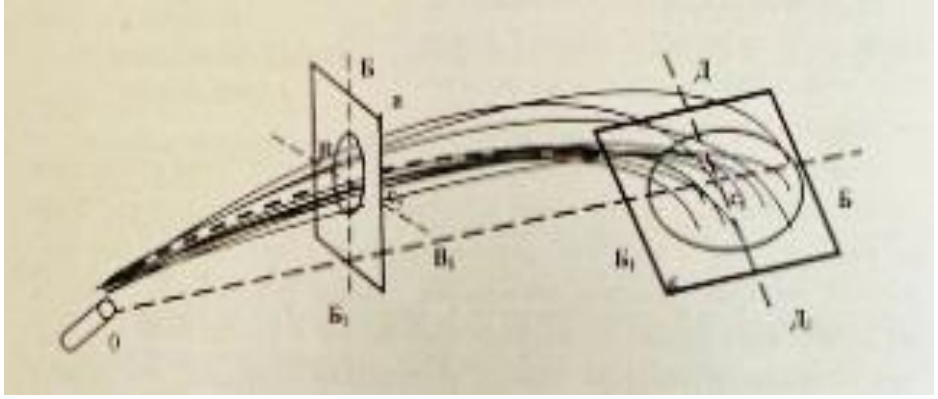
https://doi.org/10.5281/zenodo.20643016

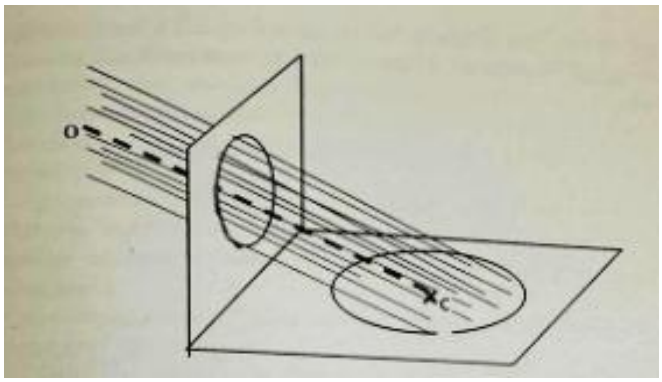
Annotation: In this article, the compatibility of the theory of firing with practice is examined in military examples. The deviations of the bullet in the horizontal and vertical axes as it moves away from the weapon are analyzed mathematically. Also, the dispersion and mean square deviations of bullets fired from the Makarov pistol and the Kalashnikov assault rifle are analyzed mathematically. In addition, the deviations from the target of bullets fired from the Kalashnikov assault rifle in single (sequential) and automatic firing are compared, and the results of the study are presented in a table.

Key words: Shooting theory, horizontal, vertical, mathematical statistics, mean square deviation.

Introduction: As is well known from firing practice, any projectile or incident fired at a target does not always achieve a high degree of success. The probability of hitting the target indicates that under the same conditions, even if the bullets are fired from the same weapon, they are located at different distances from the center of the target (the hit), and the probability of the bullet hitting the target is also correct. One of the reasons for this probability being straight is its horizontal and vertical deviations along the trajectory of the flying axis (Fig. 1).



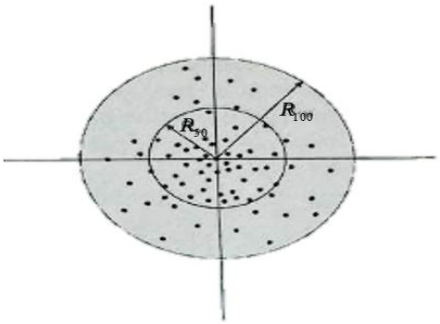
There are reasons related to the probability of a bullet hitting the center of the target, the size of the target, its distance (flight range), the accuracy of the weapon's firing, and under what conditions, by whom, what combat psychological training it has, and so on. It is not difficult to understand the reason for the horizontal and vertical shortening of the bullet: the projectiles fired under several identical conditions have their own trajectories (they do not repeat each other's trajectories) (see Fig. 1). It is not difficult to form an idea of the ellipse's surface area from the figure of centrifugal dispersion and from the difference between the height and ground values. The area of the sum of the scattering (deviation) trajectories of projectiles fired at a target is called the snope trajectory, which acquires great statistical significance in practice. The surface formed by the intersection of firing trajectories and shot trajectories is called the scattering (deflection) surface (Fig. 2).



From the intersection of the average trajectory (shown by broken lines) and the vertical and horizontal planes, the CTP is called the point of tangency with the center. The reasons for the diversity of the scattering law are practically studied in the literature "Points Belonging to the Mean Center" for specialists studying "Basic Arrows" and "Higher Mathematics".

Scientific research and results: Regardless of which scattering cause we study, it has been established that the system's errors and laws fade away. As an example, let us determine the cause of the following scattering.

Various snipers and shells of various weights fired. If the first reason is the error of the sniper system per unit of time, the second reason is the permissible limits of (admission) shells, that is, the accuracy of it According to the law of firing theory, as the projectile moves away from the firearm, the -vertical and -horizontal scattering coordinates increase (see Fig. 1). As an example, let's calculate the difference and errors of the scattering of the pistalite center at the target center and at distances; As seen in Figure 3, the number of points hit by the bullet is almost twice as large as the distance in the radius:



We use Table 1 for the statistical analysis of the experimental values in Figure 3. Makarov's pistachio is the scattered nature of the fired bullets.

№	Uzoqlik (m)	$R_{100}(sm)$	$R_{50}(sm)$
1.	20	5,5	4,0
2.	25	7,5	4,5
3.	30	9,0	6,0
4.	40	12,0	7,0
5.	50	16,0	8,0

The mean square error is calculated using the following formula:

$$\Delta E = \sqrt{\frac{\Delta_1^2 + \Delta_2^2 + \Delta_3^2 + \ldots + \Delta_n^2}{n-1}} \qquad (1)$$

then the mean $R_{100}(sm)$ square error of the distance

$$\Delta E_{100} = \sqrt{\frac{30,25 + 56,25 + 81 + 144 + 256}{4}} = 11,91sm.$$

$R_{50}(sm)$ and the mean square error in the radius

$$\Delta E_{50} = \sqrt{\frac{16 + 20,25 + 36 + 49 + 64}{4}} = 6,81sm$$

$K = \frac{\Delta E_{100}}{\Delta E_{50}} = \frac{11,91}{6,81} = 1,75$ is times larger. In firing theory, as the projectile moves away from the weapon, the horizontal and vertical dimensions of its scattering surfaces increase as it moves away from the target. From the results of Table 1, it can be seen that when the target is from the pistol, the deviation from the center is equal to , and when the distance is the same, the law of direct proportionality of the weight loss theory to the number of weight loss of the L-distance is confirmed in practice. $\left(K = \frac{16sm}{5,5sm} = 2,9marta \right)$

A Kalashnikov assault rifle can fire in two modes: single-shot and automatic (sequential). Conducted scientific research shows that in both cases, although the scattering is the same in the vertical (height) and horizontal (side) positions, there is information that when firing automatically (sequentially), the scattering from the center is 1.5 times greater than when fired individually. However, this information has not been fully proven theoretically. For this reason, we aimed to compare the scattering characteristics of Kalashnikov machine-gun bullets (according to Table 2). Scattering characteristic of Kalashnikov projectiles

№	Firing distance (m)	Dispersion measurement (single-shot)		Dispersion during automatic firing (m)	
		$B_b(sm)$	$B_r(sm)$	$B_b(sm)$	$B_r(sm)$
1.	100	4	4	6	6
2.	200	7	7	11	11
3.	300	10	10	17	17
4.	400	14	14	23	23

5.	500	19	18	30	30
6.	600	25	23	38	38

To perform a mathematical-statistical analysis of the results of Table 2, compiled on the basis of a large number of experiments, we use formula (1).

Scattering single-shot mean square error

$$\Delta E_{bittalab} = \sqrt{\frac{16+16+49+49+100+100+196+196+361+324+625+529}{4}} =$$

Scatter

$$= \frac{\sqrt{2561}}{2} = \frac{50,61}{2} = 25,30(sm).$$

Mean Squared Error for consecutive shots

$$\Delta E_{ket-ket} = \sqrt{\frac{2\cdot 36+2\cdot 121+2\cdot 289+2\cdot 529+2\cdot 900+2\cdot 1444}{4}} =$$

$$= 40,74(sm)$$

$$K = \frac{\Delta E_{k-k}}{\Delta E_b} = \frac{40,74}{25,30} = 1,60 \qquad marta \qquad ekan.$$

For example, at a distance of 50 cm from the center of the target, the position of the bullets is dense, and at a distance of 100 cm, the position of the bullets is sparse, and the scattering is large. Knowing that the area of a circle is equal, multiplication means that the number of axes is less than the ratio.

$$S_{100} = \pi R_{100}{}^2 = \pi(2R_{50})^2 = 4\pi R_{50}{}^2; \qquad S_{50} = \pi R_{50}{}^2 \; S_{100} = 4S_{50} \;\; K = 16,0$$

Conclusion: We have considered the deviation of a bullet (about a projectile) fired from weapons, starting from a certain distance, in the vertical and horizontal directions of its trajectory, and their errors have been identified and compared with theoretical data.

Mathematical and statistical analysis of the data from tables compiled on the basis of numerous scientific studies was conducted, comparing the standard deviations of single and consecutive shots of assault rifles operating in two modes with theoretical results.

Law of dispersion: It was proven through mathematical and statistical calculations that as a bullet moves further away from the weapon, its vertical and horizontal dispersion (deviation) area proportionally increases.

Makarov pistol indicators: When firing at distances from 20 to 50 meters, it was confirmed using the mean square error that the radius of deviation from the center of the target increases as the distance increases.

Difference in firing modes: It was determined that when firing the Kalashnikov assault rifle in automatic (sequential) mode, the dispersion of bullets from the center is approximately 1.5 times greater compared to the single-shot mode.

Theory and practice: It was demonstrated that the results of all conducted analyses and practical experiments fully comply with the established rules of shooting theory.

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