Journal of Testing and Evaluation, Vol. 34, No. 6
Paper ID JTE100134
Available online at: www.astm.org

TECHNICAL NOTE

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Evaluation of the FN 303 Less Lethal Projectile

ABSTRACT: FN 303 less lethal launcher is at the forefront of less lethal weapons technology and exceeds the standards for accuracy and range. While the manufacturer stated maximum effective range for the FN 303 against a point target is 55 yards (50.29 m), this study found that it was possible to strike a point target at even greater ranges. Additionally, as the projectile descends quickly due to gravity and slowing velocity, an operator cannot rely on sights that are zeroed at 30 yards (27.43 m) to achieve point target strikes at 60 yards (54.86 m) . This study produced a linear model to adjust an operator's point of aim to achieve the desired point of impact. At distances of 40 yards and greater, point of aim should be adjusted 13.7 in. (34.80 cm) for every additional 10 yards (9.14 m) of distance between shooter and target.

KEYWORDS: less lethal, FN 303, nonlethal, accuracy, projectile

Introduction

Police use of force has tremendous implications on the law enforcement agency and its administration. Some of the unintended consequences of force may include civil disturbances, riots, property damage, political jeopardy, and civil liability for all interested parties [1]. Thus, uses of force may frequently impact the development of public policy and how it is administered in practice. Current public policy permits officers to use the minimum amount of force necessary to affect the arrest or quell the disturbance, and to do so they utilize the tools available to the profession such as traditional less lethal weapons, e.g., OC spray, impact weapons like the baton/asp, TASER, and compressed air weapons (FN 303® and Pepperball®).

Unfortunately to date, there is no less lethal weapon than fits every circumstance. While some options like the TASER appear to offer a number of benefits, they are severely limited by their range. Accordingly, in order to use the TASER, it is necessary for officers to place themselves well within a 21-ft range of the suspect, creating additional risks and tactical concerns.

Kinetic weapons, on the other hand, respond quite well at distances over 21 ft but suffer the limitation of transferring excessive energy at close range. A number of deaths and serious injuries have been documented from these weapons at various close ranges [2]. As a result, the greatest weakness in the existing less lethal arsenal is the distance that each tool can be safely deployed.

FN 303 Less Lethal Launcher

Compressed air weapons propel less than lethal munitions with a burst of compressed air. The two main products in this category are the FN 303 and the Pepperball® launchers. This study focuses upon the accuracy of the FN 303 and its projectiles.

The FN 303 is built by FNH USA and utilizes fin stabilized, 68 rounds to deliver paint marking rounds and oleoresin capsicum rounds on target. Since FNH USA also manufactures the M16 family of weapons for the U.S. military, many of the components on the weapon will be familiar to anyone who has handled an M16 or AR15. The pistol grip is right off of the M16 and the iron sights are from the M16A2. In addition, the launcher has a picatinny rail for mounting optics and the upper receiver of the launcher can be mounted beneath the M16 in place of the M203 grenade launcher [3]. Independent tests by Bertomen [4] have found the FN 303 to be accurate to over 50 yards (45.72 m) shooting 4 in. (10.16 cm) steel plates and the primary drawback is the launcher's 15 round magazine capacity.

According to the FN Herstal [5] FN303 Instructor/Armorer manual, the 3000 psi air reservoir will allow 110 firings before the air tank must be refilled. Personal communication with an FN 303 rep placed the number of shots at 79 before a refill is necessary. The proprietary fin stabilized projectiles have a muzzle velocity of 280–300 ft (85-91m) per second and 25 ft pounds of energy at the muzzle.

Methodology

A research design was created to measure the accuracy of the FN 303 system. Ten projectiles were fired at each distance, which were in 10 yard (91.44 m) increments. The compressed air reservoir (air tank) was refilled after every 15 shots to maintain a relatively constant air pressure in the weapon. In order to reduce the effect of human error during testing, the weapon was supported by a fixed object during testing. Two shooters were utilized to further limit the effect of individual skill differences during identical courses of fire (Table 1). Measurements and photographs of the target were taken after each shooter fired five rounds at each distance. The point of

TABLE 1—*Shooter means comparison.*

	Shooter	N	mean	Std. Deviation
Distance between	Thompson	30	16.8417	15.09603
POA and POI	Mesloh	30	16.2333	18.24391

Manuscript received December 6, 2005; accepted for publication March 13, 2006; published online May 2006.

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TABLE 2—*Mean scores by distance.*

Distance from Target		Mean			Std. Deviation	
Yards	Meters	Inches	Centimeters	N	Inches	Centimeters
10.00	9.14	1.95	4.95	10	1.04	2.64
20.00	18.29	3.03	7.68	10	2.02	5.13
30.00	27.43	3.95	10.03	10	2.72	6.92
40.00	36.58	16.70	42.42	10	3.35	8.51
50.00	45.72	27.53	69.91	10	3.56	9.05
60.00	54.86	46.08	117.03	10	7.21	18.31

aim was standardized by utilizing a neon orange paste-on target, which contrasted with the rest of the target. This point of aim was not modified for either shooter or distance. Accuracy was measured as the difference between point of aim (POA) and point of impact (POI) in order to assess the drop rate of the projectiles.

A t-test of each shooter's individual results indicated that no significant differences existed. Consequently, we were able to aggregate the results without skewing the results.

The results were placed into a statistical software package (SPSS 11) for quantitative analysis. Average differences between POA and POI were placed in Table 2 shown below. At distances of 30 yards (27.43 m) and closer, the difference between point of aim and point of impact is less than 4 in. (10.16 cm), indicating that there is very little drop and can be consistently and accurately fired on target. Beyond 30 yards (27.43 m), a substantial deteriorating effect is noted. However, while the projectiles were falling below the point of aim, they remained in a relatively tight pattern.

SPSS software made it possible to evaluate the data using advanced statistical methods beyond that of mere comparison of averages. A linear regression was conducted to measure the strength of the relationship between distance from the target and the drop of the projectile from the point of aim (Table 3–5). As shown below, an almost perfect relationship exists. However, when the data were plotted it became clear that at distances closer than 30 yards (27.43 m) there was a very small amount of drop, which impacted the perceived strength of the model ($r=0.909$) (Fig. 1).

While the correlation between distance and spread from point of aim is 0.901 for the entire dataset, there is obviously more activity beyond 30 yards (27.43 m). Consequently, a second regression model was used to examine these greater distances, excluding distances closer than 30 yards (27.43 m). The strength of the model increases as shown in the $r=0.96$. Past 30 yards (27.43 m) (Fig. 2), an actual relationship between distance and projectile drop emerges compared to the extreme flat shooting at distances under 30 yards (27.43 m) (Table 6–8).

The overall goal of this project was to create a predictive model that would allow a FN 303 user to determine where the projectile would strike given a known distance. The unstandardized coefficient of the regression model indicates that at distances of 40 yards (36.58 m) and greater, the drop of the projectile will be 13.72 in. (34.85 cm) for every 10 yards (9.14 m) of distance beyond 40 yards (36.58 m). A simple linear formula for determining projectile drop past 40 yards (36.58 m) is (y-29.93)/0.667 where y is the distance in yards from the target and the resulting output is the drop in inches from point of aim. The constant for this formula (29.93), the y-intercept, was calculated using MS Excel as was the slope (0.667). The predictive outputs for this model were within 1–2 in. (2.54-5.08 cm) as compared to our observations at ranges of 40 (36.58 m) to 60 yards (54.86 m). This allows the forecasting of

TABLE 3—*Linear regression of accuracy.*

Model	R	R Square	Adjusted R Square	Std. Error of of the Estimate
1	0.909[a]	0.827	0.824	6.96487

[a]Predictors: (Constant), Distance from target.

TABLE 4—*Linear regression beyond 30 yards (27.43m)*[a]

Model		Unstandarized Coefficients B	Unstandarized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	−14.150	2.050		−6.901	0.000
	Distant from target	8.768	0.526	0.909	16.653	0.000

[a]Dependent Variable: Distance between POA and POI.

TABLE 5—*ANOVA*[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	13453.181	1	13453.181	277.331	0.000[a]
	Residual	2813.547	58	48.509		
	Total	16266.723	59			

[a]Predictors: (Constant), Distance from target.
[b]Dependent Variable: Distance between POA and POI.

even greater distances limited only by the momentum of the projectile and the forces of gravity. Our predictive models for projectile drop have a greater drop rate than what is stated in the FN 303 Instructor/Armorer manual. For an example, our study observed a mean drop of 16.7 in. (42.42 cm) at 40 yards (36.58 m); our predictive model indicated that the drop would be15.1 in. (38.54 cm) and the factory literature shows that the drop would have been 12.5 in. (31.75 cm). This variation is quite small, and would not affect striking center mass of a suspect. However, as the distance increases, this variance would continue to increase and would eventually affect accurate shot placement.

Corrected Course of Fire

As stated previously, point of aim was never adjusted throughout the data collection process. Obviously, in real-world scenarios, the operator would correct fire based on observed projectile drop. With this in mind, an additional test was created to examine the feasibility of correcting for drop at 60 yards (54.86 m). Each shooter fired ten rounds, correcting their point of aim after each shot. Correction was made solely by observations of projectile impacts with no assistance of optical magnification or "spotter" assistance. In this course of fire, it was possible to recreate a similar drop pattern as noted in 30 yards (27.43 m). Mean projectile drop for this course of fire was less than 12 in. (30.48 cm) after firing and adjusting point of aim based on point of impact. Due to the high quality of this weapon, and its predictive drop rate, there is no reason that a well trained operator would not be able to place rounds on target at 60 yards (54.86 m) or further after observing and adjusting for drop.

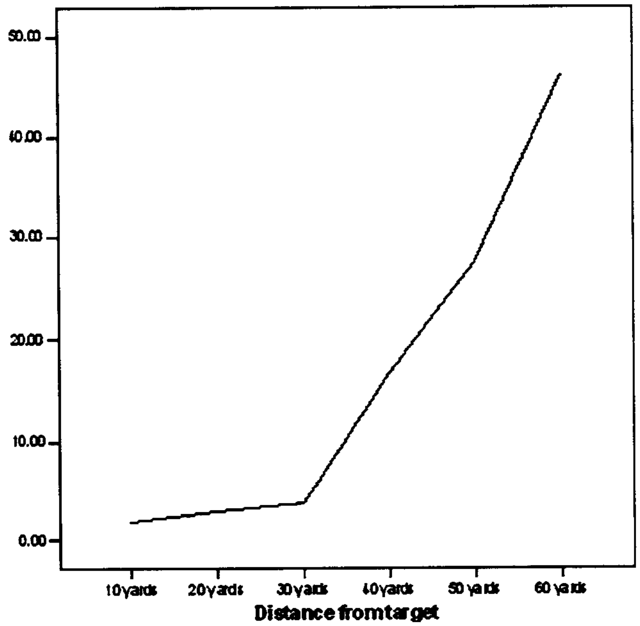

FIG. 1—*Accuracy up to 30 yards.*

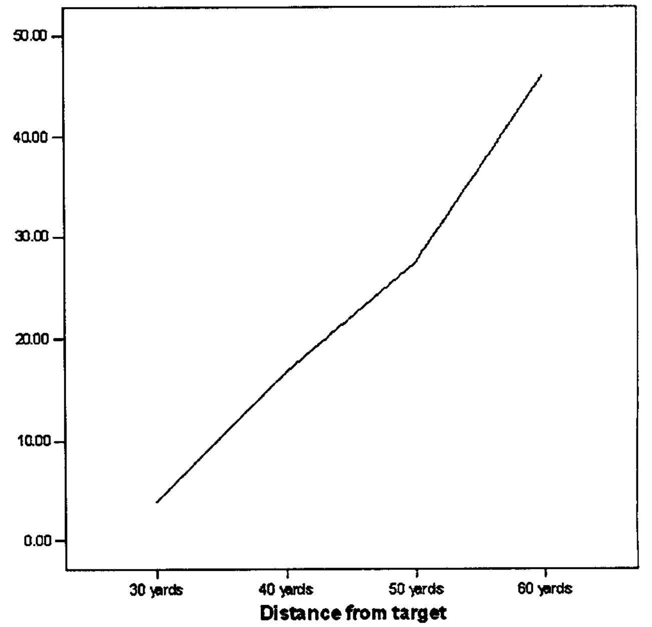

FIG. 2—*Accuracy beyond 30 yards* (27.43 m).

TABLE 6—*Model summary.*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.956[a]	0.914	0.912	4.81377

[a]Predictors: (Constant), Distance from target.

TABLE 7—*ANOVA*[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9411.920	1	9411.920	406.171	0.000[a]
	Residual	880.549	38	23.172		
	Total	10292.469	39			

[a]Predictors: (Constant), Distance from target.
[b]Dependent Variable: Distance between POA and POI.

TABLE 8—*Coefficients*[a]

Model		Unstandarized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	−38.177	3.157		−12.095	0.000
	Distant from target	13.720	0.681	0.956	20.154	0.000

[a]Dependent Variable: Distance between POA and POI.

Conclusions

Based upon this study's findings, the FN 303 has been shown to be capable of delivering its payload to greater distances than most of the other tools in the less lethal arsenal. At distances less than 30 yards, an operator can reliably use the FN 303's iron sights for accurate shot placement. If great accuracy is needed at distances beyond 90 ft (27.43 m), an operator can employ the basic formulas in this study to compensate for projectile and drop and adjust their aim accordingly. While the FN 303 may not be the most suitable weapon for every scenario, these findings suggest that it is more versatile than many of the other less lethal weapons in the law enforcement arsenal. Consequently, to effectively capitalize on the weapon's capabilities, law enforcement end users should be aware of the drop rates and compensate in order to accurately engage point targets at long ranges.

Acknowledgment

This research was supported by a Bureau of Justice Assistance Grant (2004–DD-BX-1457), Office of Justice Programs, U.S. Department of Justice. Points of view in this document are those of the authors and do not necessarily represent the official position or policies of the U.S. Department of Justice.

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