



Shotgun Distance Determination Test No. 22-5306 Summary Report

Each sample set contained images of a questioned shotgun pattern and known shotgun pattern distances. Participants were requested to examine and report the range of distances that the muzzle of the shotgun could have been from the target at the time of discharge. Data were returned from 40 participants and are compiled into the following tables:

	<u>Page</u>
<u>Manufacturer's Information</u>	<u>2</u>
<u>Summary Comments</u>	<u>3</u>
<u>Table 1: Distance Determination Results</u>	<u>4</u>
<u>Table 2: Conclusions</u>	<u>6</u>
<u>Table 3: Additional Comments</u>	<u>9</u>
<u>Appendix: Data Sheet</u>	

This report contains the data received from the participants in this test. Since these participants are located in many countries around the world, and it is their option how the samples are to be used (e.g., training exercise, known or blind proficiency testing, research and development of new techniques, etc.), the results compiled in the Summary Report are not intended to be an overview of the quality of work performed in the profession and cannot be interpreted as such. The Summary Comments are included for the benefit of participants to assist with maintaining or enhancing the quality of their results. These comments are not intended to reflect the general state of the art within the profession.

Participant results are reported using a randomly assigned "WebCode". This code maintains participant's anonymity, provides linking of the various report sections, and will change with every report.

Manufacturer's Information

Each sample set contained a questioned shotgun pattern image (Unknown) and known shotgun pattern distance images. Participants were requested to examine and report the range of distances that the muzzle of the shotgun could have been from the questioned shotgun pattern (Unknown) at the time of discharge.

SAMPLE PREPARATION: The shotgun used to produce the distance standards and evidence item was a Remington 870 with an aftermarket Mossberg 18.5" Breacher barrel with cylinder bore and the ammunition was Sellier & Bellot 12 gauge 2 3/4" Buckshot 21 pellets.

DISTANCE STANDARDS: Items designated as "Known" consisted of a collection of shotgun patterns on 24" wide, white printer paper. The shotgun was locked into a fixture and the paper was placed at a predetermined distance from the shotgun. This was done for each of the predetermined distances. After firing, the shot patterns were scanned.

QUESTIONED ITEM: Item designated as "Unknown" consisted of a shot pattern on 24" wide, white printer paper. The shotgun was locked into a fixture and the paper was placed 13 feet away from the muzzle of the shotgun. After firing, the shot pattern was scanned.

SAMPLE SET ASSEMBLY: The unknown and known patterns were rolled up and placed into a pre-labeled sample pack plastic sleeve.

VERIFICATION: All predistribution laboratories reported a greater than/less than distance range that was in close proximity to the expected target distance of 13 feet.

Summary Comments

This test was designed to allow participants to assess their proficiency in determining the muzzle to target distance using known shotgun pattern distances. Each sample set contained images of a questioned shotgun pattern and known shotgun pattern distances. Participants were requested to examine and report the range of distances that the muzzle of the shotgun could have been from the target at the time of discharge. The questioned shotgun pattern was prepared with the firearm locked into a fixture and the white paper target placed 13 feet away from the muzzle of the shotgun (Refer to the Manufacturer's Information for preparation details).

In all areas below where distance is discussed, the unit of measurement is feet.

In Table 1, all 40 responding participants (100%) reported a greater than distance between 6 and 9 and a less than distance between 12 and 21. However, the majority fell within a range of greater than 9 and less than 15. In the Summary of this table, CTS has grouped the responses provided by the participants based on their greater than/less than distance results and provided a tally of the participants' ranges as calculated by CTS.

For greater than/less than distances, a +/-3 allowance from the known shot distance (13') was used as the baseline. Any reported "greater than" values which were larger than 16 and reported "less than" values which were smaller than 10 would be highlighted as inconsistent. All participants reported a greater than/less than range that included the known target distance of 13.

Of the 40 responding participants, 35 (88%) reported a range of distances that span from 3 to 9. Reported ranges with a distance span of greater than 12 were boxed as inconsistent.

CTS is aware that laboratory reporting policies differ and there are varying acceptable ranges. It will therefore be at the discretion of the laboratory to further evaluate participants' results based on their own policies and procedures.

Distance Determination Results

What is the distance range that the muzzle of the shotgun could have been from the target (Q1) at the time of discharge? Please report a numeral response (e.g. "6") from the supplied Distance Standards.

TABLE 1 (Distance in Feet)

WebCode	Greater Than	Less Than	Calc. Range	WebCode	Greater Than	Less Than	Calc. Range	WebCode	Greater Than	Less Than	Calc. Range
28NRP7	9	12	3	KBMJWK	6	15	9	XVPQT7	9	15	6
4AB2ZJ	6	15	9	KVWGFG	9	15	6	XW2GTA	9	12	3
6UN9NH	9	12	3	LV7YJK	9	15	6	YEED6G	9	12	3
772ND3	6	15	9	MAQKXC	6	15	9	YHHADN	9	12	3
8GF6KY	6	18	12	MMNXPU	9	15	6	YWFBY3	9	12	3
987Y2G	9	15	6	MPZDJU	6	15	9	ZPVD79	6	15	9
A2BP7A	9	15	6	NPW7XE	9	15	6				
DTAENA	6	18	12	RDLCNW	9	15	6				
EFZBKQ	6	21	15	RE37QQ	6	15	9				
EJD6AW	9	12	3	RPH69F	9	12	3				
FNAZXP	9	15	6	UNH42F	9	15	6				
G9TLVH	9	15	6	V4TVUC	6	15	9				
GWG4F9	9	15	6	WFVZ3B	6	15	9				
HZ9PL2	8	12	4	WKWMB8	9	15	6				
JE4HJM	6	15	9	WRTN8R	9	15	6				
JPUWV7	9	12	3	XFWX86	9	15	6				
K2FQK6	9	12	3	XQXLY3	6	18	12				

Response Summary				Participants: 40	
Greater Than Distance	Participants Reporting	Less Than Distance	Participants Reporting	CTS Calculated Range	Participants Reporting
1	0 (0.00%)	1	0 (0.00%)	3	10 (25.00%)
3	0 (0.00%)	3	0 (0.00%)	6	15 (37.50%)
6	14 (35.00%)	6	0 (0.00%)	9	10 (25.00%)
9	25 (62.50%)	9	0 (0.00%)	12	3 (8.00%)
12	0 (0.00%)	12	11 (27.50%)	15	1 (2.50%)
15	0 (0.00%)	15	25 (62.50%)	18	0 (0.00%)
18	0 (0.00%)	18	3 (7.50%)	21	0 (0.00%)
21	0 (0.00%)	21	1 (2.50%)	24	0 (0.00%)
24	0 (0.00%)	24	0 (0.00%)	27	0 (0.00%)
27	0 (0.00%)	27	0 (0.00%)	30	0 (0.00%)
30	0 (0.00%)	30	0 (0.00%)	Other	1 (2.50%)
33	0 (0.00%)	33	0 (0.00%)		
Other	1 (2.50%)	Other	0 (0.00%)		
No Response	0 (0.00%)	No Response	0 (0.00%)		

Conclusions

TABLE 2

WebCode	Conclusions
28NRP7	[No Conclusions Reported.]
4AB2ZJ	[No Conclusions Reported.]
6UN9NH	the questioned mark was compared with the standard controls visually. After comparison the standard controls with large difference were excluded leaving behind a short list to compare. The remaining standard controls were then furthermore compared. A transparent sheet were placed on the questioned mark and on standard control. we sketched the pattern for pellets on these sheets and after comparing these sheets it was concluded that the questioned mark falls between 9 feet to 12 feet.
772ND3	Visually comparing the question shotgun patter to the known distance patterns, it was determined that the shot came from a distance greater than 6' and less than 15'.
8GF6KY	The shot pellet pattern found on Q1 is consistent in size and density with the muzzle of the suspect shotgun having been greater than approximately 6 feet and less than approximately 18 feet from Q1 at the time of firing.
987Y2G	The muzzle of the shotgun was no nearer than 9 feet and no further than 15 feet from the poster when the shot was discharged but most likely 10-11 feet.
A2BP7A	The distance from the muzzle of the shotgun to "Q1" at the time of discharge was estimated to be between 9 feet and 15 feet.
DTAENA	Comparisons have been made between the questioned pattern (Q1) and control patterns on the assumption that the incident gun and same ammunition type was used to generate the control patterns. The findings indicate that the firing distance between the gun muzzle and surface of the questioned item pattern (Q1) was between 6 and 18 feet. The best correspondence with the questioned item was found for control patterns at firing distances 9 to 12 feet. A more refined distance assessment may be possible if more tests were conducted as smaller intervals.
EFZBKQ	Using the measured pellet spread diameter and visual comparison of the pellet patterns of the questioned sample, Q1 (item 1.1), to the known samples, K1 (item 1.2), it was determined that the pattern of item 1.1 could be reproduced at distances of greater than 6 feet but less than 21 feet.
EJD6AW	Shooting the Q1 banner was done from a distance of 9-12 feet The traces on the banner are similar to the traces on the sheet Item K1 at 9 feet and Item K1 at 12 feet presented for examination as comparative material
FNAZXP	The distance from the muzzle of the shotgun to the poster is greater than 9 feet and less than 15 feet.
G9TLVH	A muzzle-to-target distance determination was conducted using the submitted question and known shot patterns. A similar shot pattern to what is present in the question pattern can be observed on the known distance shot patterns at distances greater than 9 feet and less than 15 feet.
GWG4F9	The damage is consistent with the discharge of a shotgun with a muzzle to target range of between 9 feet to 15 feet.

TABLE 2

WebCode	Conclusions
HZ9PL2	The dispersion patterns on the ten reference panels (standards) were measured using a method described by Maitre et. al (2021). Based on an interpolation of those measurements, the estimated shooting distance from the muzzle to the questioned target (Q1) was 10 feet. The 95% confidence interval for individual shots was estimated to range from 8 to 12 feet.
JE4HJM	In my opinion the muzzle to target (poster) distance at the time the shot was fired was between 6 and 15 feet.
JPUWV7	According to the dispersion pattern given, we conclude that the shooting distance range could have been greater than 9 feet and less than 12 feet.
K2FQK6	After analysis of the known distance standards, I determined that the distance from the muzzle of the shotgun to the recovered poster was estimated to be between 9 feet and 12 feet.
KBMJWK	Examination of Item Q1 revealed the presence of a shot pellet pattern in the center area. The shot pellet pattern found in the center of Item Q1 is consistent in size and density with having been produced at an approximate distance between 6 feet and 15 feet from the muzzle of the suspect firearm.
KVGWFG	Item Q1 was visually compared with the ten distance standards, K1. The shooting distance is estimated to be greater than 9 feet and less than feet.
LV7YJK	From the information provided to me for range-of-fire analysis, in my opinion, the shot pellet damage from the scene was what I would expect to see if a 12 Bore Remington 870 fitted with an aftermarket Mossberg 18.5" breecher barrel (cylinder bore), firing a factory-produced Sellier & Bellot brand 12 gauge shotgun cartridge containing size #4 buckshot, was discharged at a muzzle-to-target distance of between 9 and 15 feet.
MAQKXC	The questioned shot pattern marked Q1 was compared to provided known patterns marked K1 and was determined to be consistent with having been produced at a muzzle to target distance of greater than 6 feet and less than 15 feet based on observed differences in pattern size and density.
MMNXPU	Considering the unknown shotgun pattern and the known distances patterns observed, we strongly support that the shooting range, between the muzzle of the shotgun and the target, is between 9 feet and 15 feet
MPZDJU	The shot discharged from the shotgun is consistent with a distance of greater than 6ft and less than 15ft from muzzle to target muzzle, and also a tighter spread of between 9 - 12ft.
NPW7XE	The poster image of a shotgun pattern, Exhibit ITEM Q1, has damage that is consistent with having been caused by the passage of multiple projectiles fired from a shotgun. This damage is consistent with having been caused by a shot fired at a muzzle to target distance between 9 ft and 15 ft, using the firearm and ammunition combination indicated in the scenario.
RDLCNW	Test patterns were fired with the 12 gauge Remington 870 pump action shotgun (evidence firearm) at 3 foot intervals from 3 feet to 30 feet inclusive. The distance was measured from the muzzle to the target. A comparison of the test patterns against the shot pattern exhibited on the banner (Q1) indicates a muzzle to target distance of greater than 9 feet, but less than 15 feet.
RE37QQ	The distance range between the muzzle of the shotgun and the target (Q1) was from 6' to 15'.
RPH69F	the shot was fired at a distance between 9 and 12 feet from the barrel of the shotgun.

TABLE 2

WebCode	Conclusions
UNH42F	It would be something like: The shot was fired on a distance that was more than 9 feet and less than 15 feet and approx. 12 feet.
V4TVUC	A VISUAL PATTERN RECOGNITION COMPARISON WAS PERFORMED ON THE SHOTGUN DISTANCE STANDARDS FROM 3' TO 30' AND THE DISTANCE RANGE THAT THE MUZZLE OF THE SHOTGUN COULD HAVE BEEN FROM THE TARGET AT THE TIME OF DISCHARGE WAS GREATER THAN 6 FEET AND LESS THAN 15 FEET.
WFVZ3B	Based on testing of the evidence shotgun, it would indicate the shotgun muzzle to target (store banner) distance was greater than six feet and less than 15 feet.
WKWMB8	The shot was discharged between 9 and 15 feet from the target.
WRTN8R	Supplied test patterns (sample pack SDD) indicate they were fired from three feet to thirty feet at three foot intervals. A comparison of test patterns to the Q1 pattern indicates the muzzle to target distance was greater than 9 but less than 15 feet.
XFWX86	I examined the series of shots at known distances (items K1), and compared the pellet patterns obtained at these distances to the pellet pattern present on the recovered poster (item Q1). It is expected that for any distance estimation experiments, replicates at each known distance should be carried out. As replicates were not carried out, my reported distance estimation range is conservative. Based this experiment, it is my opinion, that the muzzle of the shotgun was unlikely to have been closer than 9 feet nor further than 15 feet from the poster when this shot was fired.
XQXLY3	The questioned shotgun pattern, ITEM Q1, has damage that is consistent with having been caused by a shot fired using a Remington model 870 with an aftermarket Mossberg 18.5" Breecher barrel (cylinder bore) and Sellier & Bellot 12 gauge 2 ³ / ₄ #4 Buckshot 21 Pellets ammunition at a muzzle to target distance beyond 6 feet and within 18 feet.
XVPQT7	Items – Description/Visual Examination: Item K1: Ten (10) test shot patterns from distances of approximately 3' to 30' feet. Item Q1: One (1) questioned shot pattern. Examination Results: Item Q1 – question shot pattern. Based on visual comparison, the question shot pattern (Item Q1) is consistent with test patterns (Item K1) produced between 9 and 15 feet. The approximate distance of the firearm muzzle from Item Q1 at the time of firing is greater than 9 feet and less than 15 feet.
XW2GTA	Impact pattern comparison allows us to indicate that questioned shotgun pattern presents morphological characteristics compatible with a shooting distance greater than 9 feet and less than 12 feet.
YEEB6G	[No Conclusions Reported.]
YHHADN	I concluded that the muzzle of the shotgun was at a distance range of greater than 9 feet and less than 12 feet at the time of discharged from the target (Q1).
YWFBY3	Based on the measurements taken of the questioned crime scene shot pattern, as well as the test shot witness cards, the questioned shot pattern was fired between 9 and 12 feet distance.
ZPVD79	The Item Q1 shotgun pattern is consistent with tests fired at a muzzle-to-target distance greater than 6 feet and less than 15 feet using the supplied Item K1 known distance standards.

Additional Comments

TABLE 3

WebCode	Additional Comments
G9TLVH	A shot pattern was observed on the question sheet of paper. A similar shot pattern to what is present in the question pattern can be observed on the known distance shot patterns at distances greater than 9 feet and less than 15 feet. The 12 foot pattern most closely resembles the question pattern.
GWG4F9	Our normal procedure is to test each distance at least three times to help reduce the uncertainty.
JE4HJM	I would prefer more than one shot at each distance to help assess variability. In my opinion the shot may have been fired between 9 and 12 feet but I have given a wider range above due to concerns about the variability of the patterns.
KVWGFG	Usually we have atleast three known distance stadards on the same known distance to see variations between the each shot.
NPW7XE	I rejected the Known (K1) 30 ft test sample. It could be a statistical artifact but it is not expected to have a significantly smaller pattern at 30 ft than at 27 feet. I'd suggest giving at least 2 panels at each known distance so that reproducibility and reliability can be evaluated.
WKWMB8	There was only a single reference for each distance and therefore the extremely limited population affects my confidence in the results. Therefore the range was widened to allow for the limited data.
XFWX86	For future distance estimation proficiency tests, it would be beneficial to have at least duplicates at each test distance, however three replicates would be preferable.
YHHADN	The shooter was most likely approximately 10 feet from the target (Q1) at the time of discharge.
YWFBY3	However there exists an amount of variation with shotgun pattern spreads and in this example there is only one test shot at each distance. Therefore a good reliable average spread pattern at each distance cannot be determined.

-End of Report-
(Appendix may follow)

Test No. 22-5306: Shotgun Distance Determination

DATA MUST BE SUBMITTED BY **Dec. 05, 2022, 11:59 p.m. EST** TO BE INCLUDED IN THE REPORT

Participant Code: U1234A

WebCode: BHKTDL

The Accreditation Release section can be accessed by using the "Continue to Final Submission" button above. This information can be entered at any time prior to submitting to CTS.

Scenario:

Police are investigating an armed robbery at a retail store. The victim stated that the suspect shot at her, missed and hit the banner at her register. The suspect was apprehended a few hours later and police recovered a Remington 870 with an aftermarket Mossberg 18.5" Breecher barrel with a cylinder bore and Sellier & Bellot 12 gauge 2 3/4" #4 Buckshot 21 Pellets ammunition from his vehicle. Investigators are asking you to compare the recovered poster with the distance standards provided to determine the distance from the muzzle of the shotgun to the poster.

Please note the following:

-The distance determination for this test should be reported by pattern recognition only. Chemical processing cannot be performed, as the questioned shotgun pattern is a printed image.

Items Submitted (Sample Pack SDD):

Item K1: Known distance standards from 3' to 30'.

Item Q1: Questioned shotgun pattern.

1.) What is the distance range that the muzzle of the shotgun could have been from the target (Q1) at the time of discharge? Please report a numeral response (e.g. "6") from the supplied Distance Standards.

Greater than (feet) and Less than (feet)

Please note: Any additional formatting applied in the free form spaces below will not transfer to the Summary Report and may cause your information to be illegible. This includes additional spacing and returns that present your responses in lists and tabular formats.

2.) What would be the wording of the Conclusions in your report?

3.) Additional Comments

RELEASE OF DATA TO ACCREDITATION BODIES

The Accreditation Release is accessed by pressing the "Continue to Final Submission" button online and can be completed at any time prior to submission to CTS.

CTS submits external proficiency test data directly to ASCLD/LAB, ANAB, and/or A2LA. Please select one of the following statements to ensure your data is handled appropriately.

- This participant's data is intended for submission to ASCLD/LAB, ANAB, and/or A2LA. (Accreditation Release section below must be completed.)
- This participant's data is **not** intended for submission to ASCLD/LAB, ANAB, and/or A2LA.

Have the laboratory's designated individual complete the following steps **only if your laboratory is accredited in this testing/calibration discipline** by one or more of the following Accreditation Bodies.

Step 1: Provide the applicable Accreditation Certificate Number(s) for your laboratory.

ANAB Certificate No.
(Include ASCLD/LAB Certificate here)

A2LA Certificate No.

Step 2: Complete the Laboratory Identifying Information in its entirety.

Authorized Contact Person and Title

Laboratory Name

Location (City/State)