



Shotgun Distance Determination Test No. 21-5306 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 45 participants and are compiled into the following tables:

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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 distances. 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 Tac-14 shotgun and the ammunition was Winchester Super X 3 inch #2 steel shot 1 1/4 load.

DISTANCE STANDARDS: Item 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 20 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 20 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 20 feet away from the muzzle of the shotgun (Refer to the Manufacturer's Information for preparation details).

Wherever distance is discussed below, the unit of measurement is feet. In Table 1, all 45 responding participants (100%) reported a greater than distance between 3 and 18 and a less than distance between 18 and 27. However, the majority fell within a range of greater than 12 and less than 24.

For greater than/less than distances, a +/-3 allowance from the known shot distance (20) was used as the baseline. Any reported "greater than" values which were larger than 23 and reported "less than" values which were smaller than 17 would be highlighted as inconsistent. All participants reported a greater than/less than range that included the known target distance of 20.

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 number of feet between the participants' ranges as calculated by CTS.

Most participants (93%) provided a range of distances that spanned from 3 - 12. Reported ranges with a distance span of greater than 12 were highlighted 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
2GBY7T	15	24	9	DWNAZJ	15	21	6	P9D64D	15	21	6
2UWBH3	12	24	12	EKNZUL	15	24	9	PFX7LB	18	21	3
38FDDZ	15	21	6	EMX83	12	24	12	PT6ATQ	15	24	9
3P2YZC	15	21	6	EZGPPH	12	21	9	Q4F3F4	15	24	9
3PWGYR	12	24	12	F2P6WN	18	21	3	Q8JYZR	12	27	15
6FK38A	15	21	6	GAJR4E	12	24	12	QMTKNN	18	21	3
6JJD4A	18	21	3	GDH7NH	18	21	3	QZHE6N	15	21	6
7LAWN9	18	24	6	H4843H	18	24	6	RFQTYQ	12	24	12
8846F9	15	21	6	J8ZKTG	18	24	6	RPEQJ6	15	24	9
ABD6Q6	18	21	3	KHFVJJ	15	21	6	UQYGJZ	12	24	12
AC9MPL	18	21	3	KW27AV	15	24	9	UXMZ7N	15	21	6
AJA3BM	15	21	6	M4U39H	6	27	21	V9FZXJ	15	24	9
BTCHY7	12	24	12	P6EU9D	12	24	12	VFUU69	3	27	24

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
VFY46L	15	24	9								
VJZ8VM	15	21	6								
VXG3BJ	15	18	3								
WH34X6	15	21	6								
X7K2QX	12	24	12								
XYJM8H	18	21	3								

Response Summary				Participants: 45	
Greater Than Distance	Participants Reporting	Less Than Distance	Participants Reporting	CTS Calculated Range	Participants Reporting
1	0 (0.00%)	1	0 (0.00%)	3	9 (20.00%)
3	1 (2.22%)	3	0 (0.00%)	6	15 (33.33%)
6	1 (2.22%)	6	0 (0.00%)	9	9 (20.00%)
9	0 (0.00%)	9	0 (0.00%)	12	9 (20.00%)
12	11 (24.44%)	12	0 (0.00%)	15	1 (2.22%)
15	21 (46.67%)	15	0 (0.00%)	18	0 (0.00%)
18	11 (24.44%)	18	1 (2.22%)	21	1 (2.22%)
21	0 (0.00%)	21	21 (46.67%)	24	1 (2.22%)
24	0 (0.00%)	24	20 (44.44%)	27	0 (0.00%)
27	0 (0.00%)	27	3 (6.67%)	30	0 (0.00%)
30	0 (0.00%)	30	0 (0.00%)	Other	0 (0.00%)
33	0 (0.00%)	33	0 (0.00%)		
Other	0 (0.00%)	Other	0 (0.00%)		
No Response	0 (0.00%)	No Response	0 (0.00%)		

Conclusions

TABLE 2

WebCode	Conclusions
2GBY7T	CTS Q1 "poster" exhibits multiple perforating defects consistent with a single shot from a shotgun. When using the reported Remington 870 Tac-14 shotgun in combination with Winchester Super X 3 inch #2 steel shot 1 1/4oz load ammunition, the pellet pattern on the "poster" is most consistent with test patterns reportedly produced when the muzzle of the shotgun is at a distance greater than 15 feet and less than 24 feet from the "poster's" surface.
2UWBH3	In my opinion, based on the material available to me, the muzzle of the gun was between 12 feet and 24 feet from the poster at the time it was discharged - that is, no closer than 12 feet and no further than 24 feet. It may be possible to provide a more definitive range of firing with additional tests to determine the variability in pattern size at each given distance. Only one test shot provided at each distance.
38FDDZ	The shotgun pattern indicated in Q1 is consistent with the patterns greater than 15 and less than 21.
3P2YZC	The questioned shot spread pattern (Q1) had a calculated diameter of 275 millimetres. The shot spread patterns at known distance of 15', 18' and 21' had calculated diameters of 233 millimetres, 268, millimetres and 301 millimetres respectively. The shot spread patterns at known distances either side of the 15' - 21' range were visually significantly smaller or larger than the questioned shot spread pattern (Q1). As result of these observations, I formed the opinion that the distance between the muzzle of the shotgun and the target at the time of discharge was greater than 15' but less than 21'.
3PWGYR	D). RESULTS OF EXAMINATION: 1. Identification and location of questioned hole(s) a. Laboratory item #2 (questioned shotgun pattern): i. Q1 – a circular pattern of small questioned holes consistent with the discharge of a firearm was observed. 2. Creation of Test Fire Targets: a. A Remington 870 Tac-14 shotgun and Winchester Super X 3 Inch #2 steel shot 1 1/4 oz. load ammunition were used to produce test patterns at 1', 3', 6', 9', 12', 15', 18', 21', 24', 27', and 30' (Laboratory item #1 (K1)). E) INTERPRETATION OF RESULTS: 1. The patterns observed on the known distance standards (Laboratory item #1 (K1)) were compared to the pattern observed on Q1 (Laboratory item #2). It is the opinion of the undersigned that the pattern from Q1 indicates a muzzle-to-target distance between 12' and 24'.
6FK38A	I conducted a comparison examination between the questioned shot spread (Q1) which had a calculated diameter of 280 millimetres. The shot spread at the known distance of 15 feet, 18 feet and 21 feet had calculated diameters of 231 millimetres, 269 millimetres and 301 millimetres respectively. The shot spread at known distances at 15 feet was visually significantly smaller and the shot spread at known distance at 21 feet was visually significantly larger than the questioned shot spread (Q1). As a result of this examination I formed the opinion that the muzzle of the shotgun and the target at the time of discharge was greater than 15 feet but less than 21 feet.
6JJD4A	Following conducting the range determination, I formed the opinion that the muzzle of the shotgun was more than 18 feet but less than 21 feet from the target at the time of discharge.
7LAWN9	The distance from the poster marked "Q1" to the muzzle of the shotgun used to produce the known patterns marked "K1", at the time of discharge, was estimated to be between 18 feet and 24 feet.
8846F9	Item Q1 was visually compared with the twelve distance standards, K1. The results shows that the shooting distance is greater than 15" and less than 21".

TABLE 2

WebCode	Conclusions
ABD6Q6	I conducted a comparison examination between the provided range charts (ItemK1) and the questioned pattern collected from the armed robbery (ItemQ1). As a result of this examination I formed the opinion that the muzzle of this shotgun at the time of discharge was more than 18 feet and less than 21 feet when discharged at this poster.
AC9MPL	[No Conclusions Reported.]
AJA3BM	Supplied test patterns (Sample Pack SDD) indicate they were fired from one foot and 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 between 15 and 21 feet.
BTCHY7	For the defects on the Item QA-02 poster, if the recovered shotgun and ammunition were used then the muzzle was greater than 12 feet and less than 24 feet at the moment of discharge.
DWNZJ	Supplied test patterns indicate they were fired from one foot and 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 between 15 and 21 feet.
EKNZUL	Examination of the Q1 (questioned distance for shotgun dispersion pattern) disclosed one questioned shot bearing multiple holes from shot pellets, which measured approximately 11 to 11.5 inches in diameter. Furthermore, the holes were observed to be circular in shape and consistent with being caused by a discharge occurring straight on or 90 degrees in front of the shooter at the time of discharge. Using the known given standards compared to the Q1, it was determined that the pattern on Q1 was consistent with being fired at a distance between 15 and 24 feet.
EMXX83	Items Q1, K1: The questioned shotgun distance pattern is consistent with the known distance tests fired at a distance of greater than 12 feet and less than 24 feet.
EZGPPH	After analysis of the known distance standard provided, the distance from the muzzle of the shotgun to the poster would have been between 12 feet and 21 feet.
F2P6WN	the examination was started by comparing control patterns with the questioned pattern visually in order to eliminate the patterns having significantly different pattern shapes, after this, only 4 control patterns ranging from 15 to 24 feet were nominated for comparison. transparent papers were used to sketch the control patterns and questioned pattern in order to conduct the comparison visually and by calculation of outer circle size. as a result, it was concluded that the questioned pattern ranges from 18 to 21 feet. the difference of the outer circle on questioned pattern to control patterns is 1 to 2 cm approx.
GAJR4E	RESULTS OF EXAMINATION: 1. Identification and location of questioned holes/areas: a. Laboratory item #2 (Questioned shotgun pattern): i. Q1 – One questioned area consisting of a pattern of numerous small questioned holes in the center of the sheet. 2. Creation of Test Fire Targets: a. A Remington 870 Tac-14 shotgun and Winchester Super X 3 Inch #2 steel shot (1 1/4 oz. load) were used to produce test patterns into paper targets at 1', 3', 6', 9', 12', 15', 18', 21', 24', 27', and 30'. E) INTERPRETATION OF RESULTS: 1. The patterns of damage produced by the known distance standards were compared to the pattern of damage of Q1. It is the opinion of the undersigned that the pattern of damage from Q1 indicates a muzzle-to-target distance between 12' and 24'.
GDH7NH	The sample posters which were sent have been examined. It was reached a conclusion that according to the dispersal area the shoot is between 18 feet and 21 feet.
H4843H	1. The distance range that the muzzle of the shotgun could have been from the target (Q1) at the time of discharge is greater than 18 feet and less than 24 feet, probably from 21 feet.

TABLE 2

WebCode	Conclusions
J8ZKTG	The suspect fires the shotgun at a distance between 18 feet and 24 feet.
KHFVJJ	Evidence : Poster having an approximately 9"x 9" shot gun pellet pattern. Performed a shot gun distance determination test using Shot Gun S-1 Remington 870 Tac 14 Shot Gun, ammunition: Winchester Super X 3", #2 steel shot, 1 1/4 oz. Desistance test was from 1' to 30' with 3' intervals. Results: Muzzle to target was not less then 15' and no greater then 21'.
KW27AV	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 15 feet and less than 24 feet based on observed differences in pattern size and density.
M4U39H	The questioned shotgun pattern, Exhibit Item Q1, has damage that is consistent with having been caused by the passage of fired projectiles traveling in a front to back direction. This damage is consistent with having been caused by a shot fired using the submitted firearm/ammunition exhibits at a muzzle to target distance greater than 6 ft. and less than 27 ft.
P6EU9D	Based on the evidence and test patterns received, it would indicate the shotgun muzzle to target distance was greater than 12 feet and less than 24 feet.
P9D64D	Using the subject shotgun and ammunition to create distance standards, it was determined that the Q1 pattern was produced at a muzzle distance between 15 feet and 21 feet.
PFX7LB	using our method we concluded that the distance range is between 18 feet and 21 feet.
PT6ATQ	According with the tests made in our Lab, we could come to the conclusion that the shooting might have been produced between 15 and 24 feet.
Q4F3F4	The questioned pattern was discharged from a range of no less than 15ft and no more than 24ft (measured between the muzzle of the shotgun and the target).
Q8JYZR	At the time of discharge, the muzzle of the shotgun was greater than 12 feet and less than 27 feet from the poster at the time of discharge.
QMTKNN	I conducted range determination tests using the exhibit 12 gauge, Remington brand, Model 870 Tac-14, shotgun, loaded with Winchester brand Super X, number 2 size shot, cartridges. These test were conducted with a muzzle to target distance of 18 feet and 21 feet. The shot spread at the distance of 18 feet measured approximately 260 millimetres, and at a distance of 21 feet, an approximate diameter of 330 millimetres. The result of this examination showed that the damage caused to the exhibit poster was as a result of a single discharge of shot, where the muzzle to target distance is between 18 and 21 feet.
QZHE6N	In my opinion the distance range of the muzzle of shotgun from the target (Q1) was greater than 15ft, but less than 21ft.
RFQTYQ	The questioned Item Q1 shot gun pattern was produced at a muzzle-to-target distance of between 12 to 24 feet when visually compared against the Item K1 known distance standards.
RPEQJ6	The minimum and maximum distances between the muzzle of the suspect shotgun and the poster were 15 feet and 24 feet respectively.
UQYGJZ	the muzzle to target range at the time of discharge is estimated to be greater than 12 feet and less the 24 feet. These values may after further repeat testing be narrowed.
UXMZ7N	The shot pellet pattern found on Item Q1 is consistent in pattern size and density with having been produced at a muzzle-to-target distance that is further than 15 feet and closer than 21 feet.

TABLE 2

WebCode	Conclusions
V9FZXJ	Considering the unknown shotgun pattern and the known distance patterns observed, we very strongly support that the shooting range, between the muzzle of the shotgun and the target, is between 15 feet and 24 feet.
VFUU69	The panel, Exhibit 2, has damage that is consistent with having been caused by the passage of fired projectiles. The resulting firearm discharged shot pattern is consistent with having been caused by a shot fired from an orthogonal, or near orthogonal, front-to-back direction. This damage and firearm discharged shot pattern is consistent with having been caused by a shot fired at a muzzle-to-target distance greater than 3 ft and less than 27 ft, and most resembles a shot fired from 18 feet.
VFY46L	Using the provided distance standards (Item 1.2) and visually comparing them to the unknown pattern (Item 1.1), the unknown pellet pattern was reproduced at a distance greater than fifteen feet and less than twenty-four feet.
VJZ8VM	The distance from the muzzle of the shotgun to the poster was greater than 15 feet and less than 21 feet.
VXG3BJ	[No Conclusions Reported.]
WH34X6	The shot pellet pattern in Item Q1 was compared to known shot pellet patterns in Item K1. The known patterns were created using the submitted Remington shotgun and Winchester shotshells at distances of 1', 3', 6', 9', 12', 15', 18', 21', 24', 27' and 30'. Based on a visual comparison, the pattern in Item Q1 was produced at a muzzle to target distance of 15' to 21'.
X7K2QX	Comparisons have been made between the questioned pattern (Q1) and control patterns (K1) on the assumption that the incident gun and same ammunition type was used to generate the control patterns (K1). The findings indicate that the firing distance between the gun muzzle and the surface of the questioned item (Q1) pattern was between 12 and 24 feet. The best correspondence with the questioned item (Q1) pattern was found for the control patterns (K1) at firing distances 18 to 21 feet. A more refined distance assessment may be possible if more tests were conducted at smaller intervals.
XYJM8H	I say that the muzzle to target distance was not less than 18 feet and not greater than 21 feet.

Additional Comments

TABLE 3

WebCode	Additional Comments
3P2YZC	Shot spread diameters calculated using the equivalent circumference method (ECM). The range determination is based upon measurements of the single shot-spread pattern/sample provided per-distance only and has not taken into account natural variation of shot spread size for a given range, which could be as much as 50 - 75 millimetres (2 - 3") at the distances involved. The author reserves the right to change his opinion based upon larger representative sample sizes, to account for natural variation of shot spread, for each known distance (n per distance ≥ 3).
6FK38A	I used the equivalent circumference method (ECM) to calculate the shot spread diameters.
6JJD4A	Note: This opinion is formed by reviewing one shot spread at each range and does not factor in natural variation between individual shots. If more shot spreads were available it may alter my opinion.
8846F9	Usually we have atleast three known testfires on the same known distance to see variations between the shots.
BTCHY7	LIMITATIONS: The movement of the target surface at the time of firing, the type of target surface, the presence of intermediate objects, and the handling of evidence can result in the loss of firearms discharge residues that could affect the interpretation of the distance determination results.
DWNAAZJ	Q1 pattern displays a pattern of 10 - 1/4" X 8-3/4" The shotgun wadding measured approximately two inches out putting it out to 10". Observed two fliers to the right of the wadding while looking at the shotgun pattern. Test patterns submitted: 1', 3', 6', 9' 12' 15' 18' 21' 24' 30'. Known Patterns: 12 feet – 6"X6". 15 feet – 9" X 9-1/8" with a flier out to the left at 10-1/2". 18 feet – 10" X 10" with a flier out to the bottom at 12". 21 feet – 11-7/8" X 12-7/8". 24 feet – 14-1/4" X 14". The Q1 pattern was fired between 15 and 21 feet. Tape Measure R7 Used. Measured first horizontally and then vertically.
J8ZKTG	After examining the patterns, we could conclude that the shooting distance is very close to 21 feet.
KW27AV	No uncertainty of measurement was reported given that the knowns were produced by a third party. The reported muzzle to target distance was rather conservative due to the inability to reproduce multiple knowns at given distances to evaluate pattern reproducibility.
PT6ATQ	The conclusion indicated in #2 is similar to the one we put in our real reports.
QMTKNN	The measurement of the shot spread at the muzzle to target distance of 18 feet excluded the bottom most shot pellet, or 'flyer'. The elongated shape of the questioned shot spread suggests that the shotgun was not perpendicular to the poster at the time of discharge. the damage to the poster was caused by a complete, uninterrupted, single discharge of shot, that measured approximately 240 millimetres high and approximately 285 millimetres. PPE and a remote firing devise was used to conduct this range determination exercise (Ballistics Method 43 V3).
UQYGJZ	The range quoted is wide due to only one test fire being carried out at each distance. Our normal procedure is to test each distance at least three times to help reduce the uncertainty.

-End of Report-
(Appendix may follow)

Test No. 21-5306: Shotgun Distance Determination

DATA MUST BE SUBMITTED BY **Dec. 6, 2021, 11:59 p.m.** TO BE INCLUDED IN THE REPORT

Participant Code: U1234A

WebCode: 64TBM7

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 bank. The victim stated that the suspect shot at him, missed and hit a poster. The suspect was apprehended later that afternoon and police recovered a Remington 870 Tac-14 shotgun and Winchester Super X 3 Inch #2 steel shot 1 1/4 oz. load 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 1' 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)