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FORENSIC TESTING PROGRAM

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Shotgun Distance Determination
Test No. 25-5306/7 Summary Report

Each participant received a sample pack consisting of either physical printed photographs (5306) or downloadable digital images (5307) of known shotgun distance patterns (3' to 30'), along with one questioned shotgun pattern and additional known-distance standard patterns provided as supplemental digital images to both participant groups. Participants were asked to examine and report the range of distances that the muzzle of the shotgun could have been from the questioned target at the time of discharge. Data were returned from 47 participants: 29 for 25-5306 and 18 for 25-5307 and are compiled into the following tables:

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 pack consisted of a set of known shotgun distance standard patterns, one questioned shotgun pattern, and additional known distance standard patterns provided as supplemental digital images. Participants were asked to examine and report the range of distances that the muzzle of the shotgun could have been from the questioned target at the time of discharge.

PATTERN PREPARATION: The selected shotgun was set on a fixture and a paper target was placed at a predetermined distance from the shotgun muzzle. For the known standards, three consecutive shots were fired at each distance. For the questioned pattern, one shot was fired. After firing, all paper targets were photographed.

SAMPLE PACK ASSEMBLY: For the photo version, the first shot of each known distance standard and the questioned pattern were printed, rolled up, and placed into a pre-labeled sample pack plastic sleeve. Additionally, the first, second, and third consecutive shots of each known standard distance were then uploaded to the CTS Portal as supplemental digital images. For the digital download version, all items were uploaded to the CTS Portal.

VERIFICATION: Predistribution results were consistent with each other and the manufacturer's preparation information. All laboratories reported a greater than/less than distance range that was in close proximity to the preparation distance for the questioned pattern.

Item	Distance (ft)	Firearm	Ammunition
Known Standards	3 - 30 (3' increments)	Mossberg 590M 12-GA Shotgun	Remington 12-G 2-3/4" Copper Plated, 6 Shot Nitro Pheasant Birdshot
Questioned Pattern	11	Mossberg 590M 12-GA Shotgun	Remington 12-G 2-3/4" Copper Plated, 6 Shot Nitro Pheasant Birdshot

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. Participants were supplied with a set of known shotgun distance standard patterns (3' to 30'), one questioned shotgun pattern, and additional known distance standard patterns provided as supplemental digital images. The questioned shotgun pattern was placed 11 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, 46 (98%) of the 47 responding participants reported a "greater than" distance between 6 and 10 and a "less than" distance between 11 and 18. The remaining participant reported a "greater than" distance between 6 and 10 and a "less than" distance of 24. 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 ranges between responses as calculated by CTS.

CTS then reviewed the ranges based on participants' reported values and determined the most commonly reported "greater than/less than" ranges, the modes, were 9 and 12 respectively. For the CTS Calculated Range, the most common range was 3. The mode +/- two measurement increments were applied in all reporting fields (Greater Than, Less Than and Calculated Range), therefore any measurement or range of measurements outside of these values was 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 participant's results based on their own policies and procedures.

Distance Determination Results

What is the distance range, in feet, that the muzzle of the shotgun could have been from the target (Questioned) at the time of discharge? Please report a numerical response (e.g. "3") for the supplied distance standards?

TABLE 1 (Distance in Feet)

WebCode-Test	Greater Than	Less Than	Calc. Range
37XBEY-5307	9	12	3
3AXLAY-5307	6	15	9
3BT6CZ-5307	9	12	3
3TDVBZ-5307	9	15	6
443AN2-5306	9	15	6
4DQ3ZX-5307	9	12	3
76CX2X-5307	9	12	3
7LWN2X-5307	9	15	6
8JPQ6V-5307	9	12	3
8PBL7Y-5307	9	15	6
8QLNTX-5306	6	15	9
9YFTLY-5306	10	11	1
B43KLR-5307	9	12	3
B6X3NT-5306	6	15	9
CK4PNU-5307	9	12	3
CUUAUR-5306	9	12	3
DKZJMQ-5306	6	15	9
DTWGAT-5306	6	15	9
DVYGAP-5306	6	15	9
EGW6EQ-5306	10	12	2
FGCNYN-5307	9	15	6
FP7URP-5306	6	15	9
J4TBAJ-5306	9	12	3
JBUPVK-5306	9	15	6
JKJDQM-5306	6	18	12
K2N8WM-5306	9	12	3
M8N7KG-5306	6	15	9
MY7XWK-5306	9	12	3
NFANEF-5306	9	15	6
PEVJFH-5306	9	12	3
PHVVCH-5306	9	15	6
PNL6LF-5306	8	13	5
RMYDMF-5307	9	12	3
T9DKCE-5307	9	12	3
TJYPJD-5306	9	15	6
UEYZFC-5306	9	12	3
V72PK7-5306	6	12	6
VJ7L49-5306	6	18	12
VXTT2A-5306	9	12	3
W6MKL9-5307	9	12	3
XCZTMA-5306	9	12	3
XUKGX6-5307	9	12	3

TABLE 1 (Distance in Feet)

WebCode-Test	Greater Than	Less Than	*Calc. Range*	WebCode-Test	Greater Than	Less Than	*Calc. Range*	WebCode-Test	Greater Than	Less Than	*Calc. Range*
YDQEU7-5306	9	15	*6*								
YKAFC4-5306	6	24	*18*								
YV7NU8-5307	6	15	*9*								
Z9PPQ4-5307	9	12	*3*								
ZHZRB6-5306	6	15	*9*								

Response Summary

Participants: 47

Greater Than Distance	Participants Reporting	Less Than Distance	Participants Reporting	CTS Calculated Range	Participants Reporting
3	0 *(0.00%)*	3	0 *(0.00%)*	3	20 *(42.55%)*
6	14 *(29.79%)*	6	0 *(0.00%)*	6	11 *(23.40%)*
9	30 *(63.83%)*	9	0 *(0.00%)*	9	10 *(21.28%)*
12	0 *(0.00%)*	12	22 *(46.81%)*	12	2 *(4.26%)*
15	0 *(0.00%)*	15	20 *(42.55%)*	15	0 *(0.00%)*
18	0 *(0.00%)*	18	2 *(4.26%)*	18	1 *(2.13%)*
21	0 *(0.00%)*	21	0 *(0.00%)*	21	0 *(0.00%)*
24	0 *(0.00%)*	24	1 *(2.13%)*	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	3 *(6.38%)*	Other	2 *(4.26%)*	Other	3 *(6.38%)*

Conclusions

TABLE 2

WebCode-Test	Conclusions
37XBEY-5307	After test firing the exhibit shotgun at known distances from a range of 3 to 30 feet at 3 feet intervals, it is my opinion that the exhibit pattern occurred at a range of between 9 and 12 feet.
3AXLAY-5307	Using the known standard shotgun patterns, Item KS, reportedly created with a Mossberg 590M 12 gauge pump action shotgun and Remington 12 gauge 2-3/4" copper plated 6 shot nitro pheasant birdshot ammunition, the questioned shotgun pattern, Item Q, is consistent with having been fired at a muzzle to target distance of greater than 6 feet and less than 15 feet.
3BT6CZ-5307	I conducted a visual and quantitative comparison between the questioned shot pattern and the test patterns created at known distance of 0 (contact), 3, 6, 9, 12, 15, 18, 21, 24, 27 and 30-feet. All spread measurements were determined using the square root of the area of a rectangle method. During my comparison, I observed: The questioned shot pattern had a spread of 131-millimetres. The test patterns of distances less than 9-feet were clearly significantly smaller and different in appearance to the questioned shot pattern. - The three test patterns at the 9-foot interval demonstrated a range of spread of between 94 - 106 millimetres. The three test patterns at the 12-foot interval demonstrated a range of spread of between 152 - 164 millimetres. The three test patterns at the 15-foot interval demonstrated a range of spread between 176 - 221 millimetres. The test patterns at distance greater than 18-feet were clearly significantly larger and different in appearance to the questioned shot spread pattern. Based upon my observations, I determined that the muzzle of the shotgun was located at a distance of greater than 9-feet but less than 12-feet from the target at the time of discharge.
3TDVBZ-5307	Testing of the exhibit shotgun and ammuntion showed that the questioned shot pattern was produced at a distance of between 9 feet and 15 feet from the muzzle.
443AN2-5306	Comparisons have been made between the questioned pattern and the control patterns. The findings indicate that the firing distance between the gun’s muzzle and the surface of the questioned item pattern was between 9 and 15 feet.
4DQ3ZX-5307	I compared a series of shot spread patterns taken from the exhibit shotgun at a series of known distances against the questioned shot spread. As a result of these comparisons i formed the opinion that the muzzle of the exhibit shotgun was between nine (9) and twelve (12) feet from the target at the time of discharge.
76CX2X-5307	The distance of firing between the muzzle of the shotgun used to produced the known distance standards and the questioned shotgun pattern was estimated to be between 9 feet and 12 feet.
7LWN2X-5307	The questioned shot pattern is consistent with a shot pattern produced at more than 9 inches and less than 15 inches from the muzzle of the shot gun at the time of discharge.
8JPQ6V-5307	The examination of the questioned shot spread agaist the the shotspreads taken from the exhibit shotgun indicated the muzzle to taget was greater than 9foot and less than 12foot.
8PBL7Y-5307	The questioned shotgun pattern was compared to the submitted patterns fired at different distances. The questioned pattern was determined to have been fired from between 9 feet and 15 feet with the pattern produced at 12 feet displaying the most similarity to the questioned pattern. There was nothing to indicate an angled shot.
8QLNTX-5306	I concluded that the distance range the muzzle of the shotgun could have been from the target, based on the questioned shotgun pattern, at the time of discharge, is greater than 6 feet and less than 15 feet.
9YFTLY-5306	[No Conclusions Reported.]

TABLE 2

WebCode-Test	Conclusions
B43KLR-5307	The shot spread question shotgun pattern indicates a muzzle to target distance of greater than 9 feet and less than 12 feet. At a muzzle-to-target distance of 9 feet, the observed pattern spread ranged from 98mm to 105mm. At a muzzle-to-target distance of 12 feet, the observed pattern spread ranged from 132mm to 174mm. All remaining reference patterns demonstrated spreads that were either smaller or larger than the questioned pattern and were therefore excluded from consideration.
B6X3NT-5306	The shotgun pattern of Item Q1 is consistent with tests fired at a muzzle-to-target distance greater than 6 feet and less than 15 feet using the supplied known K1 distance standards.
CK4PNU-5307	Questioned shotgun pattern was studied initially, then it was compared with three consecutively fired shots per each known distance standard hence it was found that distance range from muzzle of the shot gun to the target (questioned) is greater than 9 feet and less than 12 feet.
CUUAUR-5306	[No Conclusions Reported.]
DKZJMQ-5306	The submitted image (Exhibit 1.1) was examined, and a shot pattern was found. The submitted images of known standards were compared to the submitted image of an unknown shotgun pattern, and it was determined that the unknown shotgun pattern (Exhibit 1.1) was reproduced at a distance greater than 6 feet and less than 15 feet. No further analysis was conducted on the submitted evidence at this time.
DTWGAT-5306	When the shot was fired, the muzzle of the gun was at a distance of at least 6 feet and no greater than 15 feet from the target.
DVYGAP-5306	The unknown pattern, item 1.2, was visually compared to the known patterns, item 1.1. A similar pattern was seen at distances of greater than six (6) feet but less than fifteen (15) feet with the most similar pattern occurring between the distances of nine (9) to twelve (12) feet.
EGW6EQ-5306	The questioned shotgun pattern was estimated between 10 (ten) feet to 12 (twelve) feet
FGCNYN-5307	The shot patterns in Q1 and K1 through K11 were visually examined. The shot pattern in Q1 is consistent in size and density with having been produced at an approximate distance between 9 feet and 15 feet from the muzzle of the recovered shotgun.
FP7URP-5306	Test shots indicated a muzzle to target distance of 'not closer than 6FT and not further than 15FT. The range at which the test fires most closely resembled the questioned pattern was between 9FT to 12FT.
J4TBAJ-5306	As a result of my examination I formed the opinion that the distance between the muzzle of the 12 gauge Mossberg 590M shotgun and the target surface during discharge of the 12 gauge Remington Nitro Pheasant shotshell containing number 6 birdshot, was greater than 9 feet and less than 12 feet.
JBUPVK-5306	Comparison of the questioned shotgun pattern to known distance shotgun patterns determined that the questioned pattern was created by a shotgun discharge further than 9 feet and closer than 15 feet.
JKJDQM-5306	The questioned panel, Exhibit QUESTIONED, has damage that is consistent with having been caused by the passage of shotshell pellets traveling in a front to back direction. Using the known standard panels, Exhibit KNOWN STANDARD, the shotgun pellet pattern observed on the questioned panel, Exhibit QUESTIONED, is consistent with having been caused by a shot fired at a muzzle to target distance greater than six (6) feet and less than eighteen (18) feet.
K2N8WM-5306	The shot was fired from a distance between 9 and 12 feet, measured from the muzzle of the shotgun found at the scene
M8N7KG-5306	A shot pellet pattern is present in the Item 1.1 photograph. Based on the Items 1.2 through 1.12 photographs of test fired shot pellet patterns at known distances, the shot pellet pattern from Item 1.1

TABLE 2

WebCode-Test	Conclusions
	was fired at a distance greater than 6 feet but less than 15 feet.
MY7XWK-5306	Item Q1 was visually compared with the known distance standards. The results show that the shooting distance is greater than 9 feet and less than 12 feet.
NFANEF-5306	A visual pattern recognition comparison was performed on the unknown shotgun distance pattern compared to the known shotgun distance standards from 3 feet to 30 feet. The distance that the unknown pattern was reproduced at the time of discharge was greater than 9 feet and less than 15 feet.
PEVJFH-5306	The Q1 shot pellet pattern is consistent in pattern, size, and density with having been produced at an approximate distance between 9 feet and 12 feet from the muzzle of the firearm used to produce the distance test patterns.
PHVVCH-5306	[No Conclusions Reported.]
PNL6LF-5306	The test patterns (Items 1B thru 1L) were compared to the pattern observed on Item 1A with the following results: The muzzle of the Mossberg shotgun, when fired, was estimated to be approximately 8 to 13 feet from Item 1A.
RMYDMF-5307	Based on the morphology of the damage, they are of firearm origin. They are the results of shots, fired from a smooth-bore shotgun. The shooting distance is a minimum of "9" feet and a maximum of "12" feet.
T9DKCE-5307	Based on a visual comparison with the provided test patterns at known distances, the questioned shotgun pattern was produced at a muzzle to target distance greater than 9 feet and less than 12 feet.
TJYPJD-5306	Testing conducted of the evidence submitted proved the shotgun muzzle was greater than 9 feet away and less than 15 feet away when it was discharged.
UEYZFC-5306	The shot was made from a distance no less than 9 feet and no more than 12 feet.
V72PK7-5306	In my opinion, the questioned sample was produced with a shotgun with the muzzle situated at a distance between 6 and 12 feet away from the target.
VJ7L49-5306	A visual pattern recognition comparison was performed on the shotgun distance standards from 3 feet to 30 feet and the distance range that the muzzle shotgun could have been from the target at the time of discharge was greater than 6 feet and less than 18 feet.
VXTT2A-5306	we support that the shooting range, between the muzzle of the shotgun and the target, is between 9 feet and 12 feet.
W6MKL9-5307	The muzzle of the shotgun between 9 and 12 feet from the target, about 10.5 feet.
XCZTMA-5306	The questionned shotgun pattern shows a hole in the center surrounded by millimeter-sized holes whose dispersion diameter measures 135 mm. We compare this pattern with the known shotgun patterns. And we can see at 12 feet, the diameter of the pattern measures 155 mm and at 9 feet, the diameter of the pattern measures 105 mm. So we can say for the questionned shotgun pattern the shooting distance was between 9 feet and 12 feet.
XUKGX6-5307	At the time of discharge the muzzle of the exhibit shotgun was greater than 9 feet and less than 12 feet away from the target surface.

TABLE 2

WebCode-Test	Conclusions
YDQEU7-5306	After analysis of the known distance standards, I determined that the distance from the muzzle of the shotgun to the recovered questioned shotgun pattern was estimated to be between 9 feet and 15 feet.
YKAFC4-5306	The shotgun pattern, Exhibit ITEM 2, has damage to the centre that is consistent with having been caused by the passage of shot. In comparison to the known shotgun pattern standards, Exhibit ITEM 1, the damage and firearm discharge residue pattern observed on the shotgun pattern, Exhibit ITEM 2, is consistent with having been caused by a shot fired at a muzzle to target distance greater than six (6) feet and less than twenty four (24) feet.
YV7NU8-5307	[No Conclusions Reported.]
Z9PPQ4-5307	The distance range between the muzzle of the shotgun and the target at the time of discharge was determined to be greater than 9 feet and less than 12 feet. This conclusion was reached by measuring the longest distance between the furthest pellet impacts along both the x- and y-axes in the questioned pattern, and then comparing these measurements to the provided distance standards and the questioned pattern. The observed measurements and pattern similarities support this estimated muzzle-to-target distance.
ZHZRB6-5306	The distance between the muzzle of the shotgun and the target at the time of the discharge was greater than 6 feet, but less than 15 feet.

Additional Comments

TABLE 3

WebCode-Test	Additional Comments
8QLNTX-5306	Based on the shotgun pattern standards provided, the shooter is estimated to be at a position between 9 to 12 feet.
B6X3NT-5306	Please, in the future, add a digital copy of the questioned pattern along with all of the known distance standards. Also, please use the Imperial system instead of the metric system on the knowns / questioned.
EGW6EQ-5306	[Participant included the CTS portal link.]
FP7URP-5306	We would shoot at least 3 patterns/shoot until we were happy with the results for comparison at these reported distances.
UEYZFC-5306	The difference in the images suggests that the shot occurred at an intermediate range (between 10 and 11 feet), and to determine this more precisely, we would take more additional shots in a real-life case.

-End of Report-
(Appendix may follow)

Collaborative Testing Services ~ Forensic Testing Program

Test No. 25-5306: Shotgun Distance Determination

DATA MUST BE SUBMITTED BY **Dec. 08, 2025, 11:59 p.m. EST** TO BE INCLUDED IN THE REPORT

Participant Code: U1234A WebCode: X9XXZ2

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 recovered a questioned shotgun pattern, along with a Mossberg 590M 12 gauge pump action shotgun and Remington 12 gauge 2-3/4" copper plated 6 shot nitro pheasant birdshot ammunition from an apprehended suspect. Investigators are asking you to compare the recovered questioned shotgun pattern with the known distance standards provided and determine the distance range that the muzzle of the shotgun could have been from the target at the time of discharge.

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.

-CTS provides a digital download supplemental for the Shotgun Distance Determination test series. The supplemental contains the same printed image "a", along with two consecutively fired shots per known distance standard, labeled b and c, accessible through a link on the CTS Portal data entry form (see below). While the photo packet contains all materials necessary to complete the test as presented, the supplemental images are intended to bolster participant confidence in their conclusions.

-For the supplemental images, you are not limited to conducting only on-screen comparisons and may employ any other method you wish. However, because of differences in printing technology, CTS cannot guarantee the quality of images you print from the digital media.

Items Submitted (Sample Pack SDDP):
Known Standard: Contact to 30'.
Questioned: Questioned shotgun pattern.

To verify a complete and accurate download, the hash value for the downloaded .ZIP file is as follows:
25-5306_SDD_Supplemental.zip MD5 hash value: d53170dc971eb03eec85a13dfd6f4964
25-5306_SDD_Supplemental.zip SHA1 hash value: ce4ee53e14198aaaf80379ba53e642303e0eb15e

1.) What is the distance range, in feet, that the muzzle of the shotgun could have been from the target (Questioned) at the time of discharge? Please report a numerical response (e.g. "3") for the supplied distance standards?

Greater than _____ (feet) and Less than _____ (feet)

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

Note: *Please use appropriate punctuation to indicate the end of sentences, sections, and statements in the free-form space below. Extra spacing and returns used for separation within your text will not transfer and may cause your information to be illegible in the Summary Report. The use of lists and tabular formats to deliver information is also cautioned against, as these do not transfer.*

3.) Additional Comments

Note: *Please use appropriate punctuation to indicate the end of sentences, sections, and statements in the free-form space below. Extra spacing and returns used for separation within your text will not transfer and may cause your information to be illegible in the Summary Report. The use of lists and tabular formats to deliver information is also cautioned against, as these do not transfer.*

Participant Code: U1234A
WebCode: X9XXZ2

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

A2LA Certificate No. _____

Step 2: Complete the Laboratory Identifying Information in its entirety

Authorized Contact Person and Title

_____

Laboratory Name

_____

Location (City/State)

_____