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FORENSIC TESTING PROGRAM

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Shooting Reconstruction - Angle Determination
Test No. 21-5620 Summary Report

Each sample set contained a wooden box that consisted of one entrance hole, one exit hole, and a "TOP" label to distinguish the orientation of the box. In addition, one "A" label and one "1" label was placed on opposing sides of the box to assist participants when reporting the entrance/exit holes and direction of travel. Participants were requested to determine the alphanumeric character associated with the entrance hole, the direction of travel, and calculate the angles. Data were returned from 103 participants 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 set contained a wooden box that consisted of one entrance hole, one exit hole, and a "TOP" label to distinguish the orientation of the box. In addition, one "A" label and one "1" label were placed on opposite sides of the box to assist participants when reporting the entrance/exit holes and direction of travel. Participants were requested to determine the entrance hole, the direction of travel and calculate the angles. The front of the box containing the "1" label was associated with the entrance hole and the direction of travel was left to right, downward. The angles as measured during production are described below.

PRODUCTION: The sample was placed onto a fixed angle set up (jig). A 9mm CZ Scorpion EVO firearm was affixed above the jig and a digital angle finder was placed on the jig to confirm the angle to be shot.

The Horizontal (Azimuth) angle was measured at 10° from perpendicular, 80° left to right or 100° right to left. The Vertical angle was measured downward at 42° or 48°.

SAMPLE SET ASSEMBLY: After each sample was shot, it was securely placed in a sample pack box. This process was repeated until all of the desired samples were produced.

VERIFICATION: All three predistribution laboratories reported Horizontal and Vertical angles within +/-5° from the expected responses.

Summary Comments

This test was designed to allow participants to assess their proficiency in shooting reconstruction, with a focus on angle determination. Each sample set consisted of a wooden box (Item 1) containing an entrance and exit hole. The wooden box was designated with a "TOP" label to assist participants with the orientation of the sample. In addition, one "A" label and one "1" label were placed on opposite sides of the box to assist participants when reporting the entrance/exit holes and direction of travel. (Refer to Manufacturer's Information for preparation details.)

ENTRANCE HOLE: All 103 responding participants identified the side labeled "1" as being the area containing the entrance hole.

DIRECTIONALITY: Of the 103 responding participants, 101 (98.1 %) reported a left to right direction, one participant reported a right to left direction, and one participant provided no response. In regard to upward/downward directionality, all 103 participants reported a downward direction.

ANGLE DETERMINATION-

HORIZONTAL: Any reported horizontal angles that fell outside ranges 5°-15° (from perpendicular), 75°-85° (left to right) or 95°-105° (right to left) were highlighted as inconsistent. Of the 93 participants that reported horizontal angles, 72 (77.4 %) reported angles ranging from 75° to 85° (left to right), 15 (16.1 %) reported angles ranging from 5° to 15° (perpendicular), and 1 (0.1 %) reported angles ranging from 95° to 105° (right to left). Five participants reported angles that did not fall within +/-5° from the expected response and were marked as an outlier.

VERTICAL: Any reported vertical angles that fell outside ranges 37°-47° or 43°-53° (downward) were highlighted as inconsistent. Of the 93 participants that reported vertical angles, 90 (96.8 %) reported angles ranging from 37° to 47° or 43° to 53° (downward). Three participants reported angles that did not fall within +/-5° from the expected response and were marked as an outlier.

Ten participants did not report any angles. CTS is aware that some labs will report directionality only and will not report any angle measurements.

Currently, reported angles are reviewed using the uncertainty factor of +/-5° as well as the participant's reported uncertainty. CTS is actively researching and validating our review process of these reported angle measurements. It should be noted that in future cycles of this test, CTS may use En Analysis as part of the review process.

Entrance Hole

Which label on the box represents the entrance hole?

TABLE 1

WebCode	Character	WebCode	Character
2649ZJ	1	9UKZJJ	1
299UTP	1	A7T666	1
2FRZPW	1	AZL2RC	1
2RWFBR	1	BK9MEK	1
3DXV8A	1	BNMM86	1
3JLJ3E	1	BXVUCL	1
3X3A6N	1	BXXM42	1
4FFFPH	1	CRNQW8	1
6BFA9D	1	D6AHYL	1
6GTA6J	1	DETWZ4	1
6LM7RN	1	DFMKHY	1
6YADPP	1	DHT8V4	1
7PGH8L	1	DVJ28W	1
7RJFFT	1	E3WA9Y	1
83KZHK	1	ECJ7CK	1
8AG3HB	1	EDW3F4	1
8JADT7	1	EEQQXZ	1
8KHP9M	1	EHRRZH	1
8RGAEP	1	ET7P4Z	1
994QHL	1	EZ9YCE	1
9C34YJ	1	EZV6WE	1
9H7AEL	1	F7TF6F	1
9H9XXL	1	FEKWRY	1

WebCode	Character	WebCode	Character
FME4B6	1	PKJBTR	1
FMYKQ8	1	PQQY7U	1
FU2R8V	1	PRKMPP	1
FWP7W6	1	Q3X2A3	1
G8G9D4	1	Q8PD6Y	1
GKQPLU	1	QC3BD8	1
GMUK4C	1	QHP4NL	1
HQNX48	1	QVVZ63	1
HR8KZ4	1	RLHKDK	1
HY6EX2	1	TAA46U	1
HZFGKZ	1	U8WURM	1
J9MBGE	1	U9R8G2	1
JEFBVA	1	UTD8HP	1
JU6JT8	1	UTFWLM	1
KZRTFB	1	UXBNW6	1
L47PKC	1	V3HGMU	1
LB6C97	1	V8RU4T	1
LE22QY	1	VJ7PNX	1
LZ3WM8	1	VLC8MU	1
M7NA2Z	1	VTA2FL	1
MY67UX	1	W3UU6N	1
NYNA2Y	1	W8BVQV	1
P3279L	1	WVERKF	1
PA3LUM	1	WYGRJR	1
PDZ6X7	1	X6E27V	1
PGLRQU	1		

WebCode	Character	WebCode	Character
XCY2KM	1		
XMK7RM	1		
XZ7FGD	1		
YL3EGG	1		
ZQVZKP	1		
ZR3D3Q	1		

Response Summary

Participants: **103**

Which label on the box represents the entrance hole?

Character:	A	1
Total:	0	103
Percent:	0.0%	100.0%

Direction of Travel

What is the direction of travel of the bullet through the box? (check all that apply)

TABLE 2

WebCode	Left / Right	Upward / Downward
2649ZJ	Left to Right	Downward
299UTP	Left to Right	Downward
2FRZPW	Left to Right	Downward
2RWFBR	Left to Right	Downward
3DXV8A	Left to Right	Downward
3JLJ3E	Left to Right	Downward
3X3A6N	Left to Right	Downward
4FFFPH	Left to Right	Downward
6BFA9D	Left to Right	Downward
6GTA6J	Left to Right	Downward
6LM7RN	Left to Right	Downward
6YADPP	Left to Right	Downward
7PGH8L	Left to Right	Downward
7RJFFT	Left to Right	Downward
83KZHK	Left to Right	Downward
8AG3HB	Left to Right	Downward
8JADT7	Left to Right	Downward
8KHP9M	Left to Right	Downward
8RGAEP	Left to Right	Downward
994QHL	Left to Right	Downward
9C34YJ	Left to Right	Downward
9H7AEL	Left to Right	Downward
9H9XXL	Left to Right	Downward
9UKZJJ	Left to Right	Downward
A7T666	Left to Right	Downward
AZL2RC	Left to Right	Downward
BK9MEK	Left to Right	Downward
BNMM86	Left to Right	Downward
BXVUCL	Left to Right	Downward
BXXM42	Left to Right	Downward

TABLE 2

WebCode	Left / Right	Upward / Downward
CRNQW8	Left to Right	Downward
D6AHYL	Left to Right	Downward
DETWZ4	Left to Right	Downward
DFMKHY	Left to Right	Downward
DHT8V4	Left to Right	Downward
DVJ28W	Left to Right	Downward
E3WA9Y	Left to Right	Downward
ECJ7CK	Left to Right	Downward
EDW3F4	Left to Right	Downward
EEQQXZ	Left to Right	Downward
EHRRZH	Left to Right	Downward
ET7P4Z	Left to Right	Downward
EZ9YCE	Left to Right	Downward
EZV6WE	Left to Right	Downward
F7TF6F	Left to Right	Downward
FEKWRY	Left to Right	Downward
FME4B6	Left to Right	Downward
FMYKQ8	Left to Right	Downward
FU2R8V	Left to Right	Downward
FWP7W6	Left to Right	Downward
G8G9D4	Left to Right	Downward
GKQPLU	Left to Right	Downward
GMUK4C	Left to Right	Downward
HQNX48	Left to Right	Downward
HR8KZ4	Left to Right	Downward
HY6EX2	Left to Right	Downward
HZFGKZ	Left to Right	Downward
J9MBGE	Left to Right	Downward
JEFBVA	Left to Right	Downward
JU6JT8	Left to Right	Downward
KZRTFB	Left to Right	Downward
L47PKC	Left to Right	Downward
LB6C97	Left to Right	Downward

TABLE 2

WebCode	Left / Right	Upward / Downward
LE22QY	Left to Right	Downward
LZ3WM8	Left to Right	Downward
M7NA2Z	Left to Right	Downward
MY67UX	Left to Right	Downward
NYNA2Y	Left to Right	Downward
P3279L	Left to Right	Downward
PA3LUM		Downward
PDZ6X7	Left to Right	Downward
PGLRQU	Left to Right	Downward
PKJBTR	Left to Right	Downward
PQQY7U	Left to Right	Downward
PRKMPP	Left to Right	Downward
Q3X2A3	Left to Right	Downward
Q8PD6Y	Left to Right	Downward
QC3BD8	Left to Right	Downward
QHP4NL	Left to Right	Downward
QVVZ63	Left to Right	Downward
RLHKDK	Left to Right	Downward
TAA46U	Left to Right	Downward
U8WURM	Left to Right	Downward
U9R8G2	Left to Right	Downward
UTD8HP	Left to Right	Downward
UTFWLM	Left to Right	Downward
UXBNW6	Left to Right	Downward
V3HGMU	Left to Right	Downward
V8RU4T	Left to Right	Downward
VJ7PNX	Left to Right	Downward
VLC8MU	Left to Right	Downward
VTA2FL	Left to Right	Downward
W3UU6N	Left to Right	Downward
W8BVQV	Left to Right	Downward
WVERKF	Left to Right	Downward
WYGRJR	Left to Right	Downward

TABLE 2

WebCode	Left / Right	Upward / Downward
X6E27V	Left to Right	Downward
XCY2KM	Left to Right	Downward
XMK7RM	Left to Right	Downward
XZ7FGD	Left to Right	Downward
YL3EGG	Left to Right	Downward
ZQVZKP	Left to Right	Downward
ZR3D3Q	Right to Left	Downward

Response Summary

Participants: 103

What is the direction of travel of the bullet through the box?

Direction:	Right to Left	Left to Right	No Response	Upward	Downward	No Response
Total:	1	101	1	0	103	0
Percent:	0.97%	98.1%	0.97%	0.0%	100.0%	0%

Angles

TABLE 3 - Horizontal (Azimuth)

WebCode	Angle Measurement	Uncertainty (in degrees)
2649ZJ	82	5
299UTP	81	5
2FRZPW	82	5
2RWFBR	82	.3
3DXV8A	82	5
3JLJ3E	85	5
3X3A6N	84	5
4FFFPH	98.1	5
6BFA9D	82	
6GTA6J		
6LM7RN	83	5
6YADPP	81	5
7PGH8L	83	5
7RJFFT	7.4	0.1
83KZHK	80	.3
8AG3HB		
8JADT7	81	5
8KHP9M	82 degrees	5
8RGAEP	11	5
994QHL	86	5
9C34YJ	82	
9H7AEL	82	5
9H9XXL	~80	5
9UKZJJ	82	5
A7T666	83-85	5
AZL2RC	11	
BK9MEK	80	5
BNMM86		

TABLE 3 - Horizontal (Azimuth)

WebCode	Angle Measurement	Uncertainty (in degrees)
BXVUCL	42	4
BXXM42	76	
CRNQW8	79	5
D6AHYL	80	5
DETWZ4	79	undetermined
DFMKHY	81	
DHT8V4	80	undetermined
DVJ28W	80 (10 from orthogonal)	5
E3WA9Y	81	5
ECJ7CK	83	
EDW3F4	82	5
EEQQXZ	80	
EHRRZH	52	4
ET7P4Z	83	5
EZ9YCE	81.10	5
EZV6WE	81	.2
F7TF6F	10	4
FEKWRY	9	5
FME4B6	79	5
FMYKQ8	10	5
FU2R8V	82.6	5
FWP7W6	85	
G8G9D4	84	3
GKQPLU	8	
GMUK4C	10	
HQNX48		
HR8KZ4	83	
HY6EX2	83	undetermined
HZFGKZ	82	5

TABLE 3 - Horizontal (Azimuth)

WebCode	Angle Measurement	Uncertainty (in degrees)
J9MBGE	80	
JEFBVA	81	5
JU6JT8	87	3
KZRTFB	79	5
L47PKC	10	5
LB6C97	81	5
LE22QY	82	Undet.
LZ3WM8	7.8	2.5
M7NA2Z		
MY67UX	84	
NYNA2Y	84	5
P3279L	80	5
PA3LUM	81	5
PDZ6X7	6.1	5
PGLRQU	83	5
PKJBTR		
PQQY7U	84	5
PRKMPP	80	2
Q3X2A3	9	
Q8PD6Y	84	5
QC3BD8	84	2
QHP4NL	80	5
QVVZ63	9	5
RLHKDK	82	5
TAA46U		
U8WURM	85	5
U9R8G2	45	2
UTD8HP	79	Undetermined
UTFWLM		

TABLE 3 - Horizontal (Azimuth)

WebCode	Angle Measurement	Uncertainty (in degrees)
UXBNW6	78	n/a
V3HGMU	85	5
V8RU4T		
VJ7PNX	5	
VLC8MU	82	3
VTA2FL	82	5
W3UU6N	83	
W8BVQV	80	5
WVERKF	83	5
WYGRJR		
X6E27V	6.4	5
XCY2KM	82	5
XMK7RM	80	undetermined
XZ7FGD	83	5
YL3EGG	81	5
ZQVZKP	80	3
ZR3D3Q	82	5

TABLE 3 - Vertical

WebCode	Angle Measurement	Uncertainty (in degrees)
2649ZJ	41.5	5
299UTP	49	5
2FRZPW	42	5
2RWFBR	41	.3
3DXV8A	45	5
3JLJ3E	47	5
3X3A6N	45	5
4FFFPH	43.5	5
6BFA9D	44	
6GTA6J		
6LM7RN	41	5
6YADPP	43	5
7PGH8L	43	5
7RJFFT	41.7	0.1
83KZHK	44	.3
8AG3HB		
8JADT7	42	5
8KHP9M	44 degrees	5
8RGAEP	43	5
994QHL	40	5
9C34YJ	43.3	
9H7AEL	44	5
9H9XXL	~47	5
9UKZJJ	43	5
A7T666	44-46	5
AZL2RC	41	
BK9MEK	45	5
BNMM86		
BXVUCL	10	4

TABLE 3 - Vertical

WebCode	Angle Measurement	Uncertainty (in degrees)
BXXM42	47	
CRNQW8	-42	5
D6AHYL	42.5	5
DETWZ4	45	undetermined
DFMKHY	49	
DHT8V4	43	Undetermined
DVJ28W	45	5
E3WA9Y	-43.5	5
ECJ7CK	45	
EDW3F4	-45	5
EEQQXZ	-45	
EHRRZH	6	4
ET7P4Z	-44	5
EZ9YCE	45.13	5
EZV6WE	41	.2
F7TF6F	48	4
FEKWRY	47	5
FME4B6	45	5
FMYKQ8	45	5
FU2R8V	42.9	5
FWP7W6	44.0	
G8G9D4	45	3
GKQPLU	42	
GMUK4C	45	
HQNX48		
HR8KZ4	41.5	
HY6EX2	44	undetermined
HZFGKZ	-44	5
J9MBGE	41	

TABLE 3 - Vertical

WebCode	Angle Measurement	Uncertainty (in degrees)
JEFBVA	-44	5
JU6JT8	45	3
KZRTFB	47	5
L47PKC	43	5
LB6C97	42	5
LE22QY	41	Undet.
LZ3WM8	43.6	2.5
M7NA2Z		
MY67UX	41	
NYNA2Y	42	5
P3279L	-43	5
PA3LUM	-43.5	5
PDZ6X7	43.6	5
PGLRQU	-43	5
PKJBTR		
PQQY7U	-45	5
PRKMPP	42.5	2
Q3X2A3	43	
Q8PD6Y	-42	5
QC3BD8	41	2
QHP4NL	44	5
QVVZ63	43	5
RLHKDK	-43	5
TAA46U		
U8WURM	44	5
U9R8G2	9	2
UTD8HP	41	Undetermined
UTFWLM		
UXBNW6	41	n/a

TABLE 3 - Vertical

WebCode	Angle Measurement	Uncertainty (in degrees)
V3HGMU	39	5
V8RU4T		
VJ7PNX	40	
VLC8MU	43	3
VTA2FL	42.5	5
W3UU6N	43.1	
W8BVQV	40	5
WVERKF	-43	5
WYGRJR		
X6E27V	43.3	5
XCY2KM	44.5	5
XMK7RM	43	undetermined
XZ7FGD	44	5
YL3EGG	45	5
ZQVZKP	40	3
ZR3D3Q	43	5

Conclusions

TABLE 4

WebCode	Conclusions
2649ZJ	The defect in the partition wall is consistent with a bullet hole. The bullet path is from front to back (side 1 to side A), slightly left to right at 82 degrees and downward at a 41.5 degree angle.
299UTP	Side 1 contains apparent bullet entry defect (labeled A1) with its corresponding apparent exit defect on side A (labeled A2). The apparent bullet appeared to be traveling left to right and downward. We do not report on angle measurements (recorded only in notes). If a customer requests the angle measurements, these may be provided on an un-accredited report template. Angles were measured from the baseline. All measurements are approximate. This section may contain the opinions, conclusions, or interpretations of the CSI whose signature appears at the end of the report.
2FRZPW	When viewed from side "1" of the submitted wall section: One semi-circular, perforating entrance defect with a smooth margin at the top in the side labeled "1" of the submitted wall section. A gray in color marginal abrasion is visible around the periphery of the upper portion of the defect. The defect at the outer margin measures approximately 11m x 8mm. Wood is broken away from the surface at the lower margin. The defect is approximately 8.5 cm from the right side and approximately 11.2 cm upward from the bottom. When viewed from the opposite side, labeled "A", of the submitted wall section: One generally semi-circular, perforating exit defect. The perimeter of the defect has wood broken away from the surface at the periphery, with a rough margin, and wood protruding outward at the upper margin. The defect at the outer surface measures approximately 8 mm x 8 mm. The defect is approximately 6.5 cm from the right side and approximately 4 cm upward from the bottom. Trajectory is side "1" to side "A", left to right when viewed from side "1" and downward: Horizontal angle 82 degrees right to left, +/- 5 degrees; vertical angle 42 degrees upward from the horizontal plane, +/- 5 degrees. Angles were determined using a trajectory rod centered via centering cones through the corresponding entrance and exit defects. An angle finder was utilized to determine the vertical angle and a 180 degree protractor and plumb bob were used to determine the horizontal angle.
2RWFBR	After the analysis, the entrance hole is in front label #1, thought label A, with a direction of left to right, and downward. Angles of 82 degrees horizontal azimuth and 41 degrees of vertical.
3DXV8A	The submitted section of wall from the garage (001-01) contains an entrance hole on side 1. The bullet traveled through this section of wall in a downward trajectory from left to right. The horizontal (azimuth) and vertical angles of trajectory are approximately 82° and 45°, respectively.
3JLJ3E	The box item 1 has been shot in an angle of 47 degrees (+-5 degrees) downwards and 85 degrees (+-5 degrees) from left to right measured from the surface of the box. Bullets entrence hole is on side 1 and exit hole is on side A.
3X3A6N	The hole type defect observed in the section of garage wall submitted is consistent with the passage of a projectile traveling thru the wall in a slightly left to right and downward direction.
4FFFPH	The projectile entered the partitioned wall on Side 1 and exited on Side A. The projectile traveled from left to right at a downward angle.
6BFA9D	Trajectory 1 entered H1 (side 1) and moved left to right in a downward direction and exited at H2 (side A).
6GTA6J	Pathway T (including impacts T, T1) is consistent with a bullet traveling from side 1 to side A, left to right and in a downward direction.
6LM7RN	At BS A, there is a perforating circular entrance hole on side "1". The hole is smooth around the edges with bullet wipe present. There is an exit hole on side "A", irregular in shape with rough/blown out edges. BS A had a vertical angle of ~41° downward and an azimuth angle of ~83° from left to right.
6YADPP	I observed a perforating impact point to the target, entering the side labeled "1" and exiting the side labeled "A". The direction of travel was left to right (approximately 81° degrees) and downward (approximately 43°).

TABLE 4

WebCode	Conclusions
7PGH8L	On Monday, August 16, 2021 at approximately 1000 hours, I took custody of a white cardboard box for a Collaborative Testing Services (CTS) "Shooting Reconstruction-Angle Determination" proficiency test from [Name]. A Property and Evidence Form was completed documenting the chain of custody. Upon examination, I noted the white card board box contained one (1) section of a partition wall (Crime Scene (CS) Item 1) from a garage in which a shooting was said to have taken place. The wall section was labeled "Side 1," "Side A," and "Top" for orientation purposes. The wall section appeared to contain two (2) suspected bullet defects. The wall section was photographed on all sides. The bullet defect located on Side 1 appeared to be an entry defect with the corresponding exit defect appearing to be on Side A. A presumptive check for the presence of lead was completed using a "Lead Check" swab according to the manufacturer's instructions on the suspected entry defect. The swab indicated positive for the presence of lead. A flight path rod was inserted through both defects and the vertical and horizontal angles were determined. The bullet appeared to enter Side 1 at an approximate angle of 83 degrees, left to right and at an approximate 43 degree downward angle. Upon completion of documentation, the photographs were transferred to a digital versatile disc (CS Item 2). CS Items 1 and 2 were secured in my temporary storage locker, to which I maintained the key. On Thursday, October 7, 2021 at approximately 1300 hours, CS Item 1 and 2 were relinquished to the custody of [Name]. A Property and Evidence Form was completed documenting the chain of custody.
7RJFFT	An entrance perforation caused by a projectile (bullet) apparently fired by a firearm, located in the upper left part of the surface identified with N° 1, oval shape with a diameter of 12.58 millimeters at its widest part and 9.82 millimeters at its narrowest part, 26.90 millimeters from the upper edge of the box and 61.08 millimeters from the left lateral edge of the box, with a trajectory from left to right as upward to downward, with a horizontal angle of 7.4 ° ± 0.1 ° regarding to the normal of the box surface and with a vertical angle of 41.7 ° ± 0.1 °, the projectile on its way passed through the referred box, causing an exit perforation located in the lower middle part of the surface identified with letter A, oval shape with a diameter of 6.02 millimeters in its widest part and 5.20 millimeters in its narrowest part, 52.90 millimeters from the lower edge of the box and 73.34 millimeters from the right lateral edge of the box, unknowing the final destination of the projectile
83KZHK	Luego de haber observado y analizado la pieza de evidencia y evaluado las características físicas e individuales de la perforación 1 y A, se determinó que las perforaciones son consistentes con el paso de de un proyectil de bala disparado. Presentando una trayectoria de izquierda a derecha y de arriba hacia abajo. After de analysis and observed the piece of evidence, and the characteristics of the bullet hole, I determined the trajectory left to right, downward with an entrance in the side 1 and the exit in the side A.
8AG3HB	At approximately 09:05 on Tuesday, October 5th, 2021, a partition of a wall with suspected bullet holes that had been previously submitted from Collaborative Testing Services (CTS) was requested to be evaluated. This partition was taken to the [Laboratory] Vehicle Processing room to be examined and processing began at approximately 09:07. A sealed box containing one (1) wooden framed box with two (2) square pieces on both sides had been submitted as item 1. Both of the square pieces had one (1) suspected bullet hole in them. The square pieces were also arbitrarily labeled as "1" and "A" and one (1) side of the frame was labeled as "TOP" by CTS prior to submission. The trajectory appeared to be from side "1" to side "A," left to right, and downward when viewing from the side labeled "1" with the frame in the correct orientation. Photographic documentation, including scaled photographs of the suspected bullet holes, was taken of the submitted partition. Processing was completed at approximately 09:18. A DVD was created containing the photographic documentation for this incident (Laboratory Item 2) and submitted into evidence, along with the abovementioned item, under Laboratory Case Name: Shooting Reconstruction: Angle Determination and Laboratory Case Number: 21QMS00039.
8JADT7	The item presents with what appear to be an entry hole at marker 1 and a corresponding exit hole at marker A. The trajectory is downward and left to right at a downward angle of approx. 42 degrees and a horizontal angle of approx 81 degrees left to right.
8KHP9M	Bullet entered side 1 and exited side A traveling at a downward angel of approx. 42 degrees (+/- 5 degrees), left to right, entering side 1 at approx. 82 degrees (+/- 5 degrees).

TABLE 4

WebCode	Conclusions
8RGAEP	The small size and sharp edges/boundary of the hole on the side pre-labelled as '1' on the evidence item (said to be portion of partition wall) suggests it to be the 'entrance hole'. The relatively large size hole and protruding, irregular edges/boundary of the hole on the side pre-labelled as 'A' on the evidence item suggests it to be the 'exit hole'. The measured horizontal (azimuth) angle is found as 11 degrees Left to Right from shooter's perspective with an uncertainty ±5 degrees. The measured vertical angle is found as 43 degrees, coming from upwards to downwards with an uncertainty of ±5 degrees.
994QHL	The bullet entrance hole on the wall was the strike marked (1).The bullet struck the wall at about a 40 degree downward angle at a slight left to right angle of 86 degree with a +/-5 degree of uncertainly.
9C34YJ	The following defects were located and documented: #1: The defect perforated the plywood box in a left to right and downward directionality. The apparent entrance hole, labeled "1", exhibited an oblique shape with possible lead wipe on the upper left side and material pushed inward. "1" was located approximately 5" up from the bottom of the box and approximately 2 1/4" from the left side of the box. The apparent exit hole, labeled "A", exhibited material pushed outward around the diameter. "A" was located approximately 2 1/8" up from the bottom of the box and approximately 3 1/8" from the left side of the box.
9H7AEL	A bullet struck and perforated Wall 1 (BS1), then struck and perforated Wall A (BS2). The path has a downward trajectory of 44 degrees and a left to right trajectory of 82 degrees.
9H9XXL	A perforating defect into a wall with an entrance defect (Side 1) approximately 1 1/8" from the top and 2 7/8" from right side. The trajectory travels slightly left to right and downward. The exit defect is approximately 1 1/2" up from the rear (Side A) bottom edge. The vertical angle is approximately 47 degrees (Trig method produced an approximate angle of 46 degrees). The horizontal angle is approximately 80 degrees. Both angles were measured using a trajectory rod.
9UKZJJ	Item 1 had two defects that appeared consistent with damage from a projectile. The side labeled 1 appears to be the entrance and the side labeled A appears to be the exit. Trajectory rods were placed, and measurements were taken. The projectile path was left to right and downward. Vertical Angle: 43 +/- 5 degrees. Horizontal Angle: 82 +/- 5 degrees. The reported uncertainty of measurement (+/- 5 degrees) is generally accepted in the field of shooting reconstruction.
A7T666	The cut-out section of wall consisted of a wood/wood composite material bearing two holes in the sides labeled as “A” and “1”, with an additional label indicating the “TOP” side. The edges of the cut-out wall were further identified as left and right, facing side “1”. A bullet had traveled downward in a left to right direction, entered the wall on side “1”, and exited the wall on side “A”.
AZL2RC	The direction of travel of the bullet through the section of the wall was a slight left to right with a downward angle.
BK9MEK	A perforating bullet defect was observed on the wood box (test no. 21-5620). The bullet entered the box at defect 1 and exited at defect A. The direction of travel associated with the trajectory is from left to right and downward.
BNMM86	Pathway B (including impacts B,B1) is consistent with a bullet traveling from side 1 to side A, left to right, and in a downward direction.
BXVUCL	1). The entrance hole labeled on side "1" and exit hole labeled on side "A" of the box. 2. The direction of travel of bullet through the box was Left to Right (Horizontal angle 10 degrees with uncertainty angle 4 degrees) and downward (vertical angle 42 degrees with uncertainty angle 4 degrees).
BXXM42	Analysis of Trajectory T1 indicated the bullet originated on side 1 of the box, traveled from left to right at a downward angle and perforated both sides of the box.
CRNQW8	Side 1 had an entry bullet hole in the upper portion, while Side A had the corresponding exit bullet hole in the lower portion. The path of the bullet’s travel was determined to be left to right at 79° from the vertical plane and at a -42° downward angle. Unless otherwise noted, all trajectories measured in this report reflect a ±5° measurement of uncertainty with a confidence interval of 95%.

TABLE 4

WebCode	Conclusions
D6AHYL	The bullet bath is consistent with a bullet that entered side 1 of the wall section (Item AD) and exited side A with a downward angle of approximately 42.5 degrees from horizontal and traveling left to right at an angle of approximately 80 degrees from the wall surface. The distances and angles reported are used as descriptors and are not meant to be interpreted as quantitative forensic test results.
DETWZ4	There was a perforating bullet defect to Side 1 of the wall with a corresponding exit defect to Side A of the wall. The direction of travel of the bullet was from Side 1 to Side A, downward, and left to right.
DFMKHY	Analysis of the trajectory indicated a bullet traveling downwards and slightly left to right entered side 1 and exited side A of the wall.
DHT8V4	Bullet defect A is a perforating bullet defect on the side of the box labeled "1". The exit defect is on the opposite side of the box labeled as "A". The directionality of the bullet was side 1 to side A, slightly left to right, and downward.
DVJ28W	Bullet entered side 1 and exited side A with a downward angle of 45 degrees and left to right directionality of 10 degrees from orthogonal (80 degrees from box surface). +/-5 degree angle uncertainty assumed.
E3WA9Y	As a result of my examination I determined that a projectile has perforated the portion of the garage wall, entering on side 1 and exiting side A. When facing side 1, the projectile has travelled from left to right and downward.
ECJ7CK	Trajectory 1 = Hole 1 (entrance) to Hole 2 (exit). Through the side of the wall section labeled "1" and exits the side of the wall section labeled "A", traveling at a downward angle from a left to right direction.
EDW3F4	All measurements are approximate. Unless otherwise noted, all trajectories measured in this report reflect a +/- 5 degrees measurement of uncertainty with a confidence interval of 95%. Exhibit 1 (Item 1) consisted of a wooden box representing a section of a partition wall from a garage in which a shooting took place. The box was oriented so that the “top” label was upright. It was reported that a projectile penetrated the box. One defect was observed on each of two opposite sides of the box. The defect labeled “1” was located 2 ¼” from the left edge of the box (as viewed) and 1 1/8” from the top edge of the box. This defect was consistent with an entrance hole. The defect labeled “A” was located 3 1/8” from the left edge of the box (as viewed) and 4” from the top edge of the box. This defect was consistent with an exit hole. The path of the bullet’s travel through the box was determined to be slightly left to right at 82 degrees from the vertical plane and at a -45 degrees downward angle.
EEQQXZ	The direction of travel of the projectile thru Item 001 was determined to be from side 1 to side A, left to right and downward. As measured from entrance side of side 1, the vertical angle was determined to be -45 degrees. As measured from the left edge of side 1 towards the right side, the azimuth angle was determined to be 80 degrees.
EHRRZH	1). The entrance hole labeled on side "1" and exit hole labeled on side "A" of the box. 2. The direction of travel of bullet through the box was Left to Right (Horizontal angle 6 degrees with uncertainty angle 4 degrees) and downward (vertical angle 52 degrees with uncertainty angle 4 degrees).
ET7P4Z	Results: There are two (2) areas of damage on the partition wall, ITEM 1, consistent with having been caused by the passage of a single projectile. Conclusion: Damage to side 1 of the partition wall, ITEM 1, is consistent with a primary projectile impact originating from an area to the left of the wall on a downward trajectory. Damage to side A of the partition wall, ITEM 1, is consistent with an exit associated to the damage on side 1 of the wall.

TABLE 4

WebCode	Conclusions
EZ9YCE	I examined the section of the partition wall (box). I observed two holes, one hole on the side labelled "1" and one hole on the side labelled "A". The side labelled "1" was identified as the Entrance hole and the side labelled "A" was identified as the Exit hole. The Entrance hole was located approximately one (1) inch from the top of the box and approximately two and a quarter (2 ¼) inches from the left side of the box. The exit hole was located approximately four (4) inches from the top of the box and approximately three (3) inches from the left side of the box. The bullet travelled downward (below the horizontal) at a vertical angle of 45.13° ±5° and a horizontal (azimuth) angle of 81.1° ±5° from left to right (viewing from the side labelled "1") through the box.
EZV6WE	Projectile motion is from face 1 to face A, from left to right, and downward.
F7TF6F	1). The entrance hole is labeled on side "1" and the exit hole is labeled on side "A" of the box. 2. The direction of travel of the bullet through the box was Left to Right (Horizontal angle 10 degrees with uncertainty angle 4 degrees) and downward (vertical angle 48 degrees with uncertainty angle 4 degrees).
FEKWRY	Item 1 consisted of a section from a partition wall. There was an entrance bullet hole in the side of the wall marked "1" and an associated exit in the opposing wall marked "A". From the position of the shooter, the direction of the shot was from the left to the right at an angle of approximately 9 degrees and downward at an angle of approximately 47 degrees from the vertical.
FME4B6	A bullet entered through the surface marked "1", travelled at 45 degree (+/- 5 degree) downwards and 79 degree (+/- 5 degree) from the left to the right with respect to the entrance hole, and exited through the surface marked "A".
FMYKQ8	The trajectory is described regarding 3 references planes : horizontal plane (parallel to top and bottom faces), longitudinal plane (parallel to 1 and A faces), transversal plane (perpendicular to both other planes). The bullet progressed through the box from face 1 (entrance hole) to A (exit hole) on an axis oriented downward with an angle of 45°, from horizontal plane, and from left to right when following the bullet path with the angle of 10° from the transversal plane.
FU2R8V	An object perforated a wooden box. The object entered the side labeled "1..." with a left to right and downward direction. The object exited the wooden box with the side labeled "A..."
FWP7W6	The trajectory of the bullet appeared to be at a downward angle and traveled from left to right.
G8G9D4	NOTIFICATION: On August 16, 2021, I was notified by [Agent in Charge] that a Trajectory Analysis proficiency test (21-5620) had been assigned to me. The test was administered by Collaborative Testing Services (CTS), Inc. Test results were to be submitted to the CTS online upon completion. TEST MATERIALS: The test materials consisted of a sealed white box that contained the test material. Inside the box was a roughly 6 in. x 6 in. x 3 in. wood box. The top of the box was marked "Top". One of the broad sides of the box was marked "A" the other broad side was marked "1". ANALYSIS: An apparent bullet trajectory perforated through the broad sides of the box. The entry was on side "1", the exit was on side "A". The trajectory was 45 degrees downward and slightly left to right (approximately 84 degrees +/- 3 degrees). Photographs were taken of the box with and without a trajectory rod in place.
GKQPLU	The holes in Item 1 were created by the passage of a single projectile. The projectile entered Item 1 through the side marked "1" and exited through the side marked "A". The projectile was traveling at a downward angle of 42° and an angle of 8° from left to right when it perforated Item 1.
GMUK4C	Defect A entrance (side 1), (3/8 inch length x 1/4 inch width) located 3/4 inch below the top edge of the wooden box and 3 1/2 inches left of the right edge of the wooden box. Bullet wipe was observed visually. The presence of bullet wipe indicates an entrance bullet defect. Defect A exit (side A), (1/4 inch diameter) located 3 3/4 inches below the top edge of the wooden box and 2 3/4 inches left of the right edge of the wooden box. The bullet traveled through the wooden box, entering side 1 and exiting side A. The direction of travel of the bullet was 10 degrees left to right and 45 degrees downward.

TABLE 4

WebCode	Conclusions
HQNX48	Pathway A (including impact A, A1) is consistent with a bullet traveling from side 1 to side A, left to right, and in a downward direction.
HR8KZ4	A trajectory rod was inserted in the bullet path labeled A. The bullet entered the partition wall at a downward angle and traveled from left to right.
HY6EX2	There was an elliptical shaped perforating entrance bullet defect, designated Defect A, on side 1 of the box with a corresponding exit defect (Defect A exit) on side A of the box. The general direction of travel of the bullet was from side 1 to side A, left to right, and downward.
HZFGKZ	A bullet entrance hole (Marker 1) was observed near the top, and slightly left of center on one side of the section of partition wall. A corresponding bullet exit hole (Marker A) was observed on the bottom near the middle of the opposite side. The bullet perforated this section of wooden partition wall with a path of travel that was determined to be from left to right at 82° from the horizontal plane, and at a -44° downward angle.
J9MBGE	Item AD has perforating bullet damage with an entrance hole on side 1 and an exit hole on side A. The trajectory was approximately 41 degrees downward and approximately 80 degrees relative to the wall surface from left to right. The measurements included in this report are for descriptive purposes only and are not quantitative forensic test results.
JEFBVA	The bullet travelled from left to right and entered the partition wall on the side labelled '1' and exited from the side labelled 'A'. The trajectory of this bullet has a downward vertical angle of approximately -44 ± 5 degrees or 44 ± 5 degrees below the horizontal plane at point of entry and an azimuth angle of approximately 81 ± 5 degrees from left to right (viewed facing side '1') or anticlockwise along the horizontal plane of side '1'.
JU6JT8	The projectile traveled at an azimuth of approximately 87 degrees left to right and approximately 45 degrees downward through the wall.
KZRTFB	The bullet entered side labeled (1) of the box and exited the side labeled (A). The bullet path was downward and slightly from left to right as one faces the box side labeled (1). The horizontal angle measurement is (79 ± 5) degree and the vertical angle measurement is (47 ± 5) degree.
L47PKC	RESULTS: 1). Damage was located on one side (labelled "1") of the wall, Exhibit 1, that is consistent with being an entrance hole caused by a projectile. Damage was located on the opposite side (labelled "A") of the wall, Exhibit 1, that is consistent with being an exit hole caused by a projectile. 2). A projectile path was determined between the entrance and exit holes of the wall, Exhibit 1, having a vertical angle of 43-degrees downward from horizontal and a lateral angle of 10-degrees from perpendicular, travelling left-to-right. CONCLUSIONS: Projectile impact damage consistent with being caused by one gunshot was located in both sides of the wall, Exhibit 1. The direction of the projectile path is "side 1"-to-"side A", downward and slightly left-to-right.
LB6C97	Item 1 was a section of partition wall, with a bullet hole through the front and rear surfaces, the bullet passing at a downward angle and from left to right through the wall. The trajectory of the bullet that caused the damage was measured as being 42 degrees downwards (off the horizontal) and 9 degrees from the plane perpendicular to the target surface (equivalent to 81 degrees out from the target surface) from left to right, as viewed by the firer. N.B., it should be noted that the trajectory measured represents the trajectory of the bullet through the section of partition wall. However, this does not necessarily represent the angle at which the bullet first struck the wall, as the bullet may have been deflected by its passage through the outermost layer.
LE22QY	A perforating, entrance bullet defect was in side 1 of the wall section with a corresponding exit defect in side A. The direction of travel associated with these defects was side 1 to side A, left to right, and downward.
LZ3WM8	[No Conclusions Reported.]

TABLE 4

WebCode	Conclusions
M7NA2Z	Pathway P (including impacts P, P1) is consistent with a bullet traveling from side 1 to side A, left to right, and in a downward direction.
MY67UX	A trajectory rod was inserted through bullet path A. Bullet path A entered the wooden box at a downward angle and traveled from left to right.
NYNA2Y	The direction of travel of the bullet is left to right and downward. The vertical angle would be reported as 42 degrees below the horizontal plane. The horizontal angle would be reported as 84 degrees out of the struck plane with a left to right track.
P3279L	The section of partition wall measured approximately 5-3/4 inches by 5-7/8 inches by 3-1/8 inches. Three adhesive labels were adhering to different surfaces of the partition wall. The labels read as follows: Test No. 21-5620 1. Test No. 21-5620 A. Test No. 21-5620 TOP. An arrow had been drawn on one side of the partition wall and pointed to the side of the box with the label that read in part, "TOP." The side of the box with the label that read, "Test No. 21-5620 1" had an oval hole that had gray material around the top margins of the defect and was located near the upper portion of the wall. This hole was tested for the presence of lead using sodium rhodizonate; the result of this test was positive. This hole was determined to be the entrance hole of the projectile. The opposite side of the partition wall that had the label that read, "Test No. 21-5620 A" had an irregular hole with jagged margins and was located near the bottom portion of the wall. This hole was tested for the presence of lead using sodium rhodizonate; the result of this test was negative. This hole was determined to be the exit hole of the projectile. A probe was placed through these two holes to illustrate the path of this projectile; azimuth (horizontal) and vertical angles were measured. The path of this projectile was determined to be downward and from left to right.
PA3LUM	Perforated the wooden partition wall. Relative directionality:Top to bottom.
PDZ6X7	Examination of Item 1 revealed a wooden box/wall section. Further examination revealed the presence to two (2) holes. The hole on side "1" is consistent in appearance and morphology with a bullet entrance hole. The hole on side "A" is consistent in appearance and morphology with a bullet exit hole. These two holes are consistent with one bullet trajectory. The trajectory associated with these two holes is approximately 43.6° downward and 6.1° left to right (with the "Top" label facing up and facing entry side, labeled "1").
PGLRQU	On examination of the wall, an apparent perforating bullet hole (Placard A) was observed. Based on the visual characteristics, an entry (Side 1) and an exit (Side A) were established. The trajectory was determined to be left to right at 83 degrees from the vertical plane and at a (-) 43 degrees downward angle. Footnotes: A perforating hole is one in which the projectile passes completely through the object. All trajectories measured in this report reflect a ±5° measurement of uncertainty with a confidence interval of 95%.
PKJBTR	Pathway A (including impacts A, A1) is consistent with a bullet traveling from side "1" to side "A", left to right, and in a downward direction.
PQQY7U	The submitted portion of wall has a hole consistent with a bullet impact. The projectile perforates the target from the side labeled "1" toward the side labeled "A". The trajectory of the projecitle would be from 1 to A in a downward direction slightly left to right when facing side 1.
PRKMPP	The projectile entered the surface "1" in a downward trajectory (42,5°, +/- 2°) and from left to right (80°, +/- 2°).

TABLE 4

WebCode	Conclusions
Q3X2A3	Test Report: This laboratory test report contains the conclusions, opinions and interpretations of the member whose initials/signature appears on the report. Results relate only to the items tested. Unless otherwise noted, all activities performed at [Laboratory]. This is a supplement to the original report. On 08-09-20, [Individual] provided me with a box (Item #1) for trajectory analysis. Item #1: A sealed cardboard box containing one square plywood box marked on three sides as follows: "Test No. 21-5620 Top" on what will now be referred to at the top. "Test No. 21-5620 1" on one side. "Test no. 21-5621 A" on the opposite side from 1. The box measures approximately 5 ¾ inches wide, 5 7/8 inches high and 3 inches deep. The box has two holes (possible bullet defects), one on side 1 and the other on side A. The hole on side 1 is mostly circular with portions of the plywood around the edges of the hole pointing inwards towards the interior of the box. The center of the hole is approximately 2 ½ inches from the left side of the box and 1 ¼ inches from the top. The hole is approximately 7 1/16ths wide and 9 1/16ths high. The hole on side A is a slightly more ragged hole with some plywood appearing to be pushed slightly out from the interior. The hole is approximately 3 inches from the left side of the box and 4 ¼ inches from the top. There is some wood splintering on the outer most layer of plywood around the whole. The area encompassing the hole and splintered area is approximately 13 1/16ths wide and 17 1/16ths high. By the appearance of the holes and the condition of the wood, the hole on side 1 is likely the entry the one on side A is the exit. To find the angle of the bullet path, a dow rod was inserted into the hole on side 1 and through the hole on side A. The angles were determined to be 43 degrees down and 9 degrees left to right. No further at this time.
Q8PD6Y	The surface contains a single perforating bullet hole which travels left to right and downward. Apparent bullet wipe is present on the entry surface. The approximately azimuth angle was 84 degrees and the vertical was -42 degrees.
QC3BD8	There has been a bullet impact with a downward trajectory, from left to right from te shooter's point of view, at the following angles: Downward incline 41%, Drift 84 degrees.
QHP4NL	Side 1 appears to contain the bullet hole entrance based on the deformation of the wood and possible bullet wipe around the top of the hole. Side A appears to contain the bullet hole exit based on the deformation of the wood. A trajectory rod was placed through both bullet holes to estimate the bullet trajectory measurements. The vertical angle measured approximately 43 degrees in a downward trajectory. The horizontal (azimuth) angle measured approximately 79 degrees from left to right facing side 1 (entrance hole). I printed the photographs to estimate the same trajectory measurements and used them to measure both angles. The vertical angle measured 44 degrees in a downward trajectory. The horizontal angle measured 80 degrees from left to right facing side 1 (entrance hole). I took the average of both horizontal (azimuth) angle measurements (79 + 80)/2 = 79.5 degrees left to right. I took the average of both vertical angle measurements (44 + 43)/2 = 43.5 degrees down. The trajectory will be reported as: 1). Side 1 contains the bullet entrance hole. 2). The bullet traveled in a left to right, and downward trajectory through the wall. 3). The horizontal (azimuth) angle is approximately 80 degrees from left to right. The vertical angle is approximately 44 degrees down.
QWZ63	BS 1: one hole measuring ~ 1/2 inch by 5/16 inch with a smooth perimeter on the top half of the hole. The wood is pushed into the hole. The horizontal angle is ~9 degrees left to right. The vertical angle is ~43 degrees downward. BS 2: one hole measuring ~5/8 inch by 3/8 inch with jagged edges. The is outward around the hole. Hole 1 is the entrance hole due the wood fibers being pushed inward and a smooth perimeter on the top edge. Hole 2 is the exit hole due to the wood fibers being pushed outward and the jagged edge characteristics.
RLHKDK	Results: There were two (2) areas of damage on the section of partition wall, Exhibit ITEM 1, consistent with having been caused by the passage of a single projectile. Conclusion: Damage to side 1 of the partition wall, ITEM 1, is consistent with a primary projectile impact originating to the left of the partition wall on a downward direction. Damage to side A of the of the partition wall, ITEM 1, is consistent an exit associated to the damage on side 1 of the partition wall.
TAA46U	Pathway 1 (including impact 1, A) is consistent with a bullet traveling from side "1" to side "A", left to right, and in a downward direction.

TABLE 4

WebCode	Conclusions
U8WURM	A perforating defect, presenting as a jagged hole through side 1 was located 1 inch from the top of the box and 2.25 inches from the left side of the box. The trajectory of this bullet at the time of impact was from side 1 to side A at a 44 degree downward angle and was moving from left to right (if looking at side 1) at a 85 degree angle.
U9R8G2	The box is damaged by one bullet, approx. diameter 9 millimeters. The direction of the bullet is from "1" to "A". The lesion is directed from top to bottom with 45 degrees and from left to right with 9 degrees.
UTD8HP	The trajectory of the bullet passing through the partition was from side 1 (entrance) to side A (exit), with downward and slightly left to right directionality.
UTFWLM	Pathway A (including impacts A and A1) is consistent with a bullet traveling from side "1" to side "A", left to right, and in a downward direction.
UXBNW6	The holes in sides 1 and A are consistent with the passage of a single bullet. The bullet first struck/entered the wooden box/garage partition on side 1 and exited through side A. When the bullet struck side 1 it was traveling downward (up to down) and from left to right (as facing side 1). I measured the horizontal angle to be approximately 78 degrees (from the left side as facing side 1) and the downward/vertical angle to be approximately 41 degrees. Any reported measurements are approximate and for descriptive purposes only. They are not quantitative forensic test results.
V3HGMU	Trajectory rods were placed through the defects utilizing centering cones. The trajectory of defects “1” and “A” were noted to be approximately 39 degrees downward and approximately 85 degrees left to right. 90 degrees on the protractor was used as the 0 degree point for the horizontal measurement. It should be noted that these measurements are +/- 5 degrees in accuracy.
V8RU4T	Pathway A (including impacts A, A1) is consistent with a bullet traveling from side 1 to side A, left to right, and in a downward direction.
VJ7PNX	The trajectory is downward and left to right path. The bullet entered at an approximately 40 degree downward angle, as measured from perpendicular to the surface; and 5 degree angle left to right, as measured from perpendicular to the surface. The trajectory is downward and left to right path. The bullet entered at an approximately 40 degree downward angle, as measured from perpendicular to the surface; and 5 degree angle left to right, as measured from perpendicular to the surface.
VLC8MU	THE BLOCK HAD BEEN PERFORATED BY A PROJECTILE THAT WAS TRAVELLING DOWNWARDS FROM LEFT TO RIGHT FROM SIDE 1 TO SIDE A. THE DOWNWARD COMPONENT OF THE TRAJECTORY WAS APPROXIMATELY 43 DEGREES FROM THE HORIZONTAL. THE LEFT-TO-RIGHT COMPONENT OF THE TRAJECTORY WAS APPROXIMATELY 82 DEGREES FROM THE SURFACE OF THE BLOCK.
VTA2FL	Approximate trajectory measurements were recorded with directionality from left to right, downward.
W3UU6N	A trajectory rod was inserted through the bullet path labeled A. The bullet path entered the wooden box at a downward angle and traveled from left to right.
W8BVQV	1). A Projectile Trajectory: projectile entered the surface marked "1" downward at 40 degrees (+/- 5 degrees) and from left to right at 80 degrees (+/- 5 degrees).
WVERKF	Defect 1: Wooden box. This bullet initially perforated the wooden box at defect 1 (primary impact) and traveled downward perforating the wooden box at defect A (secondary impact). The bullet path had a vertical angle of -43 degrees and a horizontal angle of 83 degrees.
WYGRJR	Pathway A (including impacts A, A1) is consistent with a bullet traveling from side "1" to side "A", left to right, and in a downward direction.
X6E27V	The box has sustained perforating damage cause by a bullet entering side 1 and exiting side A. The track is slightly left to right and downwards.

TABLE 4

WebCode	Conclusions
XCY2KM	A firearm bullet passed through the item 1. The entrance hole is located on the side "1" and the exit hole is located in the side "A". This shot had a downward trajectory of approximately 44,5°, and an azimut angle of approximately 82°, from left to right. The uncertainty of mesurement is +/- 5°.
XMK7RM	A perforating bullet defect was in the wooden box, on the side labeled "1". The general direction of travel of the bullet associated with the defect was Side 1 to Side A, downward, and slightly left to right.
XZ7FGD	The bullet was descending at a 44 degree angle (UM: +/- 5 degrees). The bullet entered side 1, traveling from left to right, at a 85 degree angle (UM: +/- 5 degrees).
YL3EGG	The projectile producing the two defects exhibited in the (5 1/2" x 6" x 3") wooden box entered side labeled #1, traveled from left to right (at an 81 degree angle) in a downward (45 degree) trajectory exiting side labeled A.
ZQVZKP	Item 1 section of partition wall contains a perforating bullet hole defect consistent with the passage of a bullet. The entrance hole defect is on the side marked as "1" (bullet wipe) and the exit hole defect on the side marked as "A". The bullet pathway through the section of partition wall follows a downward path from left to right with the vertical angle measured as approximately -40 degrees (+/- 3 degrees) and the horizontal or azimuth angle as approximately 80 degrees left to right.
ZR3D3Q	[No Conclusions Reported.]

Additional Comments

TABLE 5

WebCode	Additional Comments
2RWFBR	I like this testing, i want in another testing different surface, like glass or metal. Thanks.
7RJFFT	a). The decimal separator used is represented by a point (.). b). The length measurements in this report have an uncertainty of ±0.02 mm. c). The following positions: left, right, upward and downward have been established accordingly to the reference system of the observer located front straight from the box surface identified with No. 1. d). For the description of the perforation positions, it has been established from an approximate midpoint of the described perforations and measurements are expressed in millimeters due to the dimensions of described object, and in other cases they may be expressed in centimeters or meters. e). The vertical angle was measured regarding to the horizontal. f). The horizontal angle (Azimuth) was measured regarding to the normal of box surface where the entrance perforation is located, only its module is reported.
83KZHK	This tests are excellent for our continue education in forensic science. In the future we appreciate any other test with different surface to put our analysis skills in bullet perforations, like metal, plastic, glass, etc.
8RGAEP	The digital angle finder was set to zero by placing it first, on a flat surface. Evidence was placed at the same flat surface while measuring horizontal and vertical angles. Penetration rod was passed through the holes and anchored in position. The horizontal angle was measured using protractor, plumb line and digital leveller. The vertical angle was measured by digital angle measurer. Direction of travel is specified as Left to Right and downwards from shooter's perspective.
9C34YJ	In addition to the tools used, my notes would contain all the information listed in all answers. Please note that our laboratory does not report degree of uncertainty, therefore it was not provided on this examination.
9H9XXL	Bullet wipe is apparent on entrance defect in Side 1.
AZL2RC	Horizontal angle measured between the rod and the 90 degree perpendicular.
E3WA9Y	The negative value for the vertical angle refers to a downward trajectory.
EZV6WE	I think that testing is great, but i think if possible the next in a diferent surface. Thanks.
FWP7W6	Trajectory Kit #5: Per our current S.O.P., angles are not reported as we do not calculate measurements of uncertainty for angle determination.
HR8KZ4	Due to our laboratory's current SOP, angles and measurements are not reported in distributed reports. Our section does not calculate uncertainty of measurements for angle determinization. Therefore the uncertainty of measurement field is left blank.
HZFGKZ	A footnote associated with the measured angles reads as follows: Unless otherwise noted, all trajectories measured in this report reflect a ±5° measurement of uncertainty with a confidence interval of 95%.
MY67UX	Angles are not reported (per SOPs) and we do not calculate uncertainty of measurement for angle determination.

TABLE 5

WebCode	Additional Comments
PA3LUM	Trajectory Determination Results: 1). All reported angles of incidence include a ±5° uncertainty of measurement. 2). Positive (+) vertical angles are associated with shots upward, towards the sky. 3). Negative (-) vertical angles are associated with shots downward, towards the ground. Report Limitations: Uncertainty of Measurement: As shown in this report, trajectory angles are within the ±5° uncertainty of measurement. The coverage probabilities for the reported angles are approximately 99%; meaning the reported range will include the true value 99% of the time. Opinions/Interpretations within this report are based on the information provided at the time of scene processing or as a result of further investigation and/or experimentation. Any additional information, statements, or evidence received after completion of this report may alter the results, opinions, and/or interpretations herein. The curvature of a stable projectile's trajectory is minimal within 50 yards of the firearm so as to not be outside the ±5° uncertainty of measurement. Projectile defects outlined in this report were assumed to be created during the shooting event under investigation and not as a result of a previous shooting event. Methodology: Trajectory Determination is the analysis of bullet impact characteristics to make opinions/interpretations in regard to direction of travel, shot sequencing, and/or angle of incidence. Glossary of Terms: Angle of Incidence: The angle formed between the path of the projectile prior to impact and the plane of the impacted surface. Ballistics: The science and study of projectiles in motion, usually divided into three parts: (1) Internal, which studies the projectile's movement inside the gun, (2) External, which studies the projectile's movement between muzzle and the target, and (3) Terminal, which studies the projectile's movement and behavior in the target. Bullet Wipe: The discolored area on the immediate periphery of a bullet hole, caused by the transference of residues from the bullet's bearing surface. Horizontal Angle: The angle measured along a horizontal plane with the horizon line being 0° and the angle increasing as it moves away from the horizon, up to 90° at perpendicular. Inclinometer: A measuring instrument used for indicating the incline of an object in reference to a vertical axis. Lead-In Mark: Partial elliptical mark created at the entry side of an impact site from the nose of the bullet first making contact with the surface material. Perforation: Indicative of a projectile impacting a surface and passing through the material, creating not only an entry defect, but an exit defect as well. Plumb Bob String/Line: A line or string with a weight attached to the end used to create a true vertical line. Protractor (Zero-Edge): A measuring instrument consisting of an edge that lacks any tabs or protrusions, thus allowing the 0° mark to be placed directly against a surface; an instrument consisting of a graduated arc for plotting or measuring angles and ultimately a projectile's flight path. Trajectory: The arched path of a bullet in flight depicting the relationship between the location of the firearm and the object struck. Vertical Angle: The angle measured relative to a vertical plane, with the vertical plane being 90° and the angle of incidence falling between 0° (perpendicular) and 90°.
PGLRQU	For consistency, we were told for downward vertical angles to record as a negative (-) angle and for horizontal/azimuth angles to record the angles as if the surface struck is 0 degrees. For example, a straight in shot would be 90 degrees.
UXBNW6	No uncertainty is required to be reported by our tech procedures, so I wrote in "n/a."
W3UU6N	Angles are not reported (per SOPs) and we do not calculate uncertainty of measurement for angle determination.
WVERKF	Note: Positive vertical angles represent an upward trajectory while negative vertical angles represent a downward trajectory. In addition, horizontal angles were measured from left to right (at defect 1).
X6E27V	When comparing results from different laboratories, some addition uncertainity could be expected due to tes sample differences.
XZ7FGD	Our UM is stated in our manual to be +/- 5 degrees as this is commonly used in literature.
YL3EGG	The angles used in this test utilized a 180 degree perspective, e.g a 0-90 degree angle on the horizontal plane would produce a left to right trajectory and a 0-90 degree angle on a vertical plane would produce a downward trajectory.
ZQVZKP	Negative angle value for the vertical angle measurement indicates a downward directionality.

-End of Report-
(Appendix may follow)

Collaborative Testing Services ~ Forensic Testing Program

Test No. 21-5620: Shooting Reconstruction - Angle Determination

DATA MUST BE SUBMITTED BY **Oct. 12, 2021, 11:59 p.m.** TO BE INCLUDED IN THE REPORT

Participant Code: U1234A WebCode: 3MKPPX

Scenario:
Investigators have submitted a section of a partition wall from a garage in which a shooting took place. They are asking you to conduct your analysis using your laboratory's procedures.

Please note:
-For this exercise, the sample contains a TOP label for orientation purposes.
-The sample has been labeled with two different characters (A and 1) in which participants can use as reference in reporting.
-Make sure to place the sample on a flat surface when measuring angles.

Items Submitted (Sample Pack AD):
Item 1: A section of the partition wall which contains one entrance hole and one exit hole.

1.) Which label on the box represents the entrance hole?

○ A ○ 1

2.) What is the direction of travel of the bullet through the box? (Select one from each column)

○ Left to Right	○ Upward
○ Right to Left	○ Downward

3.) Please record your angles below. (If the angle type below differs from your normal terminology, you may use your preferred terminology in the conclusions section of the data sheet.)

Angle Type (i.e. Azimuth, Vertical, Horizontal)	Angle Measurement (in degrees)		Uncertainty (in degrees)
Horizontal (Azimuth)		±	
Vertical		±	

Please note: *Any additional formatting applied in the free form space 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.*

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

5.) 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)