



WOUND BALLISTIC WORKSHOP

Host Agency: Aurora PD

Date: June 24<sup>th</sup>, 2008



**FEDERAL  
PREMIUM<sup>®</sup>**  
LAW ENFORCEMENT  
AMMUNITION



Hosted By:

**AURORA POLICE  
DEPARTMENT**



Attending Agencies:

Aurora Police Department  
Parker Police Department  
Colorado Dept. of Corrections  
Steamboat Springs Police Department  
Silverthorne Police Department  
Arvada Police Department  
Jeffco SWAT  
Louisville Police Department

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## Wound Ballistic Workshop Report

On June 24<sup>th</sup>, 2008 Aurora Police Department hosted a Wound Ballistic Workshop at their training facility to evaluate performance duty ammunition. Invitations went out and the following agencies were present:

Aurora Police Department  
Parker Police Department  
Colorado Dept. of Corrections  
Steamboat Springs Police  
Department  
Silverthorne Police Department  
Arvada Police Department  
Jeffco SWAT  
Louisville Police Department



In some workshops we begin in the classroom with a discussion of wound ballistic theory and history of ammunition selection. These discussions are usually centered around the science that agencies should be basing their ammunition selection on and why. After an approximate hour and a half classroom presentation on ballistics the class will then move to the range for hands on ballistic testing. Due to time restraints on the range the participants opted out of the classroom presentation to focus more on the hands on ballistic testing. However, out on the range we did discuss wound ballistics. When conducting a workshop often times firearms instructors, SWAT personnel, criminalists, rangemasters, lab technicians, and snipers are present which brings a vast array of application and knowledge to the table when evaluating ballistic performance.

The workshop follows the FBI Wound Ballistic Testing Protocol. This test is specific to penetration, retained weight and expansion through multiple test events. These events are listed below by corresponding number:

- |                             |                             |
|-----------------------------|-----------------------------|
| #1 – Bare Gelatin @ 10 ft   | #5 – Plywood @ 10 ft        |
| #2 – Heavy Clothing @ 10 ft | #6 – Auto Glass @ 10 ft     |
| #3 – Steel @ 10 ft          | #7 – Heavy Clothing @ 20 yd |
| #4 – Wallboard @ 10 ft      | #8 – Auto Glass @ 20 yd     |

The agencies then chose which rounds that they were going to shoot through which protocol. The agencies keyed on events #1 – Bare Gelatin, #2 – Heavy Clothing, #6 – Auto Glass. Demonstrated Calibers - 9MM, 45 Auto, and some 223.

*\*\*\*NOTE: ALL COMPETITORS AMMUNITION WAS SUPPLIED BY AGENCY NOT ATK PERSONNEL \*\*\*  
\*\*\* THE PURPOSE OF THIS IS TO ENSURE THE INTEGRITY OF THE TEST \*\*\**

*Please note that the shooting, measuring, weighing, and data entry is all done by the participants and not by ATK personnel. This is to allow participants a “hands on” and “unbiased” approach to ballistic testing.*

**Test Event #1 – Bare Gelatin @ 10 Feet**

The gelatin used for this test is 10% gelatin as called out in the FBI Protocol and was calibrated by temperature as well as BB penetration at a specified velocity.

<b>Bullet</b>	<b>Caliber/Weight</b>	<b>Penetration</b>	<b>Expansion (in.)</b>	<b>Retained Weight</b>
Federal HST	9MM 147 gr.	<b>12.25”</b>	<b>0.830”</b>	<b>102.52%</b>
Speer GDHP	9MM +P 124 gr.	<b>13.25”</b>	<b>0.665”</b>	<b>100.56%</b>
Winchester SXT	9MM +P 124 gr.	11.00”	0.610”	98.47%

*\*Retained weight may exceed 100% due to test media being trapped in the bullet.*

As noted in the table above both the Federal HST and Speer GD out penetrated, had larger expansion, and retained more weight than Winchester SXT. The expanded diameter of the HST was 36% larger than the SXT and it penetrated to the FBI test protocol standards.



<b>Bullet</b>	<b>Caliber/Weight</b>	<b>Penetration</b>	<b>Expansion (in.)</b>	<b>Retained Weight</b>
Federal HST	40 S&W 180 gr.	<b>10.75”</b>	<b>0.982”</b>	<b>101.89%</b>
Winchester SXT	40 S&W 180 gr.	9.75”	0.768”	93.06%

*\*Retained weight may exceed 100% due to test media being trapped in the bullet.*

In the 40 S&W 180 grain the HST outperformed the SXT in penetration, expansion, and weight retention. The HST expanded to .982” which is almost 27% larger than the SXT. While this is an extreme expansion, a typical expansion for this HST round is 0.95 inches, which is still significantly larger than Winchester’s SXT.

**Test Event #2 – Heavy Clothing @ 10 Feet**

The gelatin block is covered with four layers of clothing: One layer of cotton T-shirt (48 threads per inch); one layer of cotton shirt material (80 threads per inch); a 10 ounce down comforter in cambric shell cover (232 threads per inch); and one layer of 13 ounce cotton denim (50 threads per inch). This simulates typical cold weather wear. The block is shot at ten feet, measured from the muzzle to the front of the block.

<b>Bullet</b>	<b>Caliber/Weight</b>	<b>Penetration</b>	<b>Expansion (in.)</b>	<b>Retained Weight</b>
Federal HST	45 Auto 230 gr.	<b>14.25"</b>	<b>0.965"</b>	100.00%
Winchester SXT	45 Auto 230 gr.	11.25"	0.890"	101.48

*\*Retained weight may exceed 100% due to test media being trapped in the bullet.*

As evident in the table above, HST penetrated 3.0" further than the SXT and had a 9% larger expansion than the SXT. With increasing expansion there is an inherent increased drag on a bullet, thus reducing penetration. The HST still out penetrated the SXT even though it had a larger expansion.

### **Test Event #6 – Auto Glass @ 10 Feet**

One piece of A.S.I. ¼" laminated automobile safety glass measuring 15" X 18" is set at an angle of 45 degrees to the horizontal. The line of bore of the weapon is offset 15 degrees to the side, resulting in a compound angle of impact for the bullet upon the glass. The shot is made at ten feet, measured from the muzzle to the center of the glass pane. This test event with its two angles simulates a shot taken at the driver of a car from the left front quarter of the vehicle, and not directly in front of it.

<b>Bullet</b>	<b>Caliber/Weight</b>	<b>Penetration</b>	<b>Expansion (in.)</b>	<b>Retained Weight</b>
Federal HST	9MM 147 gr.	<b>14.25"</b>	<b>.558"</b>	<b>87.76%</b>
Speer GDHP	9MM +P 124 gr.	<b>15.25"</b>	<b>.577"</b>	80.24%
Winchester SXT	9MM +P 124 gr.	9.0"	.508"	84.84%

*\*\*Core Jacket Separation \*\**



Core jacket separation is common when firing through auto glass, however both the Federal HST and Speer GDHP round did not shed its jacket and penetrated almost 5.25-6.25" further than the SXT load. With further penetration the HST and Gold Dot are creating a larger permanent wound cavity than the SXT.

<b>Bullet</b>	<b>Caliber/Weight</b>	<b>Penetration</b>	<b>Expansion (in.)</b>	<b>Retained Weight</b>
Federal HST	40 S&W 180 gr.	<b>13.25"</b>	<b>0.589"</b>	<b>92.56%</b>
Winchester SXT	40 S&W 180 gr.	13.00"	0.529"	71.67%**

*\*\*Core Jacket Separation\*\**

In the 40 S&W the Winchester SXT had core jacket separation and penetrated .25" less than the HST. The HST expanded almost 11% larger in diameter than the SXT and retained 20% more of its weight than the SXT.

Overall, Federal's HST had greater weight retention, larger expansion, and retained its jacket when being shot through auto glass. In almost all of the test events the HST had the largest expansion and retained weight.



Wound Ballistic Workshop

Rep Initials: TW  
 Date of Workshop: 6/24/2008  
 Host Agency: Aurora PD  
 Agency Contact: Sgt. Dunne  
 Agency Telephone: 303-739-6876  
 Range Contact: Graham Dunne

Recorder: Ty Windhorst  
 Statistician: Kent Crossman  
 Shooter: Graham Dunne  
 Judge: David Siderfin  
 Agencies Attending: Aur.PD, Park. PD, Lous. PD, CDOC, Steam, Silv.,Ar  
 Agency Personnel: 13

Type of Range: Outdoor  
 Chronograph: CED Millenium  
 Temperature: 86  
 Weather: Sunny  
 ATK Rep: Ty Windhorst  
 5 Shot BB Avg: 3.25

Shot #	Firearm	Test Event	Part Number	Lot Number	Ammo Mfg	Ammo Type	Bullet Weight (Grains)	Velocity (Ft./Sec.)	Penetration (Inches)	Expand (Low)	Expand (High)	Expand (Avg)	Retained Weight (Grains)	Retained Weight (Percent)	Comments	
1	Glock 17 4.49" barrel	1	WIN-RA9124TP		Winchester	T-Series	9MM +P	124	1149	11	0.574	0.646	0.610	122.1	98.47%	40.2 degree Gel
2	Glock 17 4.49" barrel	1	FED-P9HST2		Federal	HST	9MM	147	998	12.25	0.813	0.847	0.830	150.7	102.52%	
3	Glock 17 4.49" barrel	1	SPE-53617		Speer	Gold Dot HP	9MM +P	124	1197	13.25	0.663	0.668	0.665	124.7	100.56%	
4	Glock 22 4.49" barrel	1	WIN-RA40T		Winchester	SXT	40 S&W	180	962	9.75	0.693	0.842	0.768	167.5	93.06%	
5	Glock 22 4.49" barrel	1	FED-P40HS3G		Federal	HS HP	40 S&W	165	1011	12	0.686	0.707	0.697	165.7	100.42%	
6	Glock 22 4.49" barrel	1	FED-P40HST1		Federal	HST	40 S&W	180	1028	10.75	0.977	0.986	0.982	183.4	101.89%	
7	Kimber 1911 4.5"	1	WIN-RA45T		Winchester	SXT	45 AUTO	230	891	11.75	0.844	0.866	0.855	230.4	100.17%	
8	Kimber 1911 4.5"	1	FED-P45HST1		Federal	HST	5 AUTO +	230	922	12	0.985	1.02	1.003	230.4	100.17%	40.5 degree gel
9	Glock 17 4.49" barrel	2	WIN-RA9124TP		Winchester	T-Series	9MM +P	124	1149	12	0.753	0.767	0.760	121.6	98.06%	
10	Glock 17 4.49" barrel	2	FED-P9HST2		Federal	HST	9MM	147	998	14	0.607	0.659	0.633	149.5	101.70%	
11	Glock 17 4.49" barrel	2	SPE-53617		Speer	Gold Dot HP	9MM +P	124	1197	14	0.558	0.605	0.582	125	100.81%	
12	Glock 22 4.49" barrel	2	WIN-RA40T		Winchester	SXT	40 S&W	180	962	13	0.71	0.74	0.725	177.2	98.44%	
13	Glock 22 4.49" barrel	2	FED-P40HS3G		Federal	HS HP	40 S&W	165	1011	13.75	0.653	0.665	0.659	163.5	99.09%	
14	Glock 22 4.49" barrel	2	FED-P40HST1		Federal	HST	40 S&W	180	1028	14	0.743	0.759	0.751	180	100.00%	
15	Kimber 1911 4.5"	2	WIN-RA45T		Winchester	SXT	45 AUTO	230	891	11.25	0.827	0.955	0.891	233.4	101.48%	
16	Kimber 1911 4.5"	2	FED-P45HST1		Federal	HST	5 AUTO +	230	922	14.25	0.92	1.01	0.965	230	100.00%	
17	Glock 17 4.49" barrel	6	WIN-RA9124TP		Winchester	T-Series	9MM +P	124	1149	9	0.371	0.645	0.508	105.2	84.84%	

#1	Bare Gelatin @ 10 Feet	#3	Steel @ 10 Feet	#5	Plywood @ 10 Feet	#7	Heavy Clothing @ 20 Yards	#9	IWBA 4 Layers of Denim
#2	Heavy Clothing @ 10 Feet	#4	Wallboard @ 10 Feet	#6	Auto Glass @ 10 Feet	#8	Auto Glass @ 20 Yards		



Wound Ballistic Workshop

Shot #	Firearm	Test Event	Part Number	Lot Number	Ammo Mfg	Ammo Type	Bullet Weight (Grains)	Velocity (Ft./Sec.)	Penetration (Inches)	Expand (Low)	Expand (High)	Expand (Avg)	Retained Weight (Grains)	Retained Weight (Percent)	Comments	
18	Glock 17 4.49" barrel	6	FED-P9HST2		Federal	HST	9MM	147	998	14.25	0.423	0.694	0.558	129	87.76%	
19	Glock 17 4.49" barrel	6	SPE-53617		Speer	Gold Dot HP	9MM +P	124	1197	15.25	0.441	0.714	0.577	99.5	80.24%	
20	Glock 22 4.49" barrel	6	WIN-RA40T		Winchester	SXT	40 S&W	180	962	13	0.443	0.615	0.529	129	71.67%	Core Jacket Separation
21	Glock 22 4.49" barrel	6	FED-P40HS3G		Federal	HS HP	40 S&W	165	1011	12.5	0.472	0.608	0.540	116	70.30%	Core Jacket Separation
22	Glock 22 4.49" barrel	6	FED-P40HST1		Federal	HST	40 S&W	180	1028	13.25	0.502	0.676	0.589	166.6	92.56%	
23	Kimber 1911 4.5"	6	WIN-RA45T		Winchester	SXT	45 AUTO	230	891	12	0.575	0.728	0.651	231	100.43%	
24	Kimber 1911 4.5"	6	FED-P45HST1		Federal	HST	5 AUTO +	230	922	15.75	0.536	0.759	0.648	221	96.09%	
25	Commando 11" 1:7	6	SPE-24448		Speer	SD Soft Poin	.223 cal	64	2575	8.5	0.298	0.587	0.442	36.9	57.66%	
26	Commando 11" 1:7	6	WIN-RA223BST		Winchester	Ballistic ST	223	55	2750	6	0.248	0.287	0.267	10.3	18.73%	Fragmented non-recoverable
27	Commando 11" 1:7	6	FED-LE223T1		Federal	Bonded SP	223	55	2741	13.75	0.335	0.379	0.357	33.4	60.73%	
28	Commando 11" 1:7	6	SPE-24448		Speer	SD Soft Poin	.223 cal	64	2575	10	0.424	0.548	0.486	33	51.56%	
29	Commando 11" 1:7	1	SPE-24448		Speer	SD Soft Poin	.223 cal	64	2575	18.5	0.424	0.713	0.568	59.6	93.12%	
30	Commando 11" 1:7	1	WIN-RA223BST		Winchester	Ballistic ST	223	55	2750	13	0.233	0.233	0.233	12.3	22.36%	Fragmented base recovered
31	Commando 11" 1:7	1	FED-LE223T1		Federal	Bonded SP	223	55	2741	14.75	0.433	0.446	0.440	54.3	98.73%	

#1	Bare Gelatin @ 10 Feet	#3	Steel @ 10 Feet	#5	Plywood @ 10 Feet	#7	Heavy Clothing @ 20 Yards	#9	IWBA 4 Layers of Denim
#2	Heavy Clothing @ 10 Feet	#4	Wallboard @ 10 Feet	#6	Auto Glass @ 10 Feet	#8	Auto Glass @ 20 Yards		