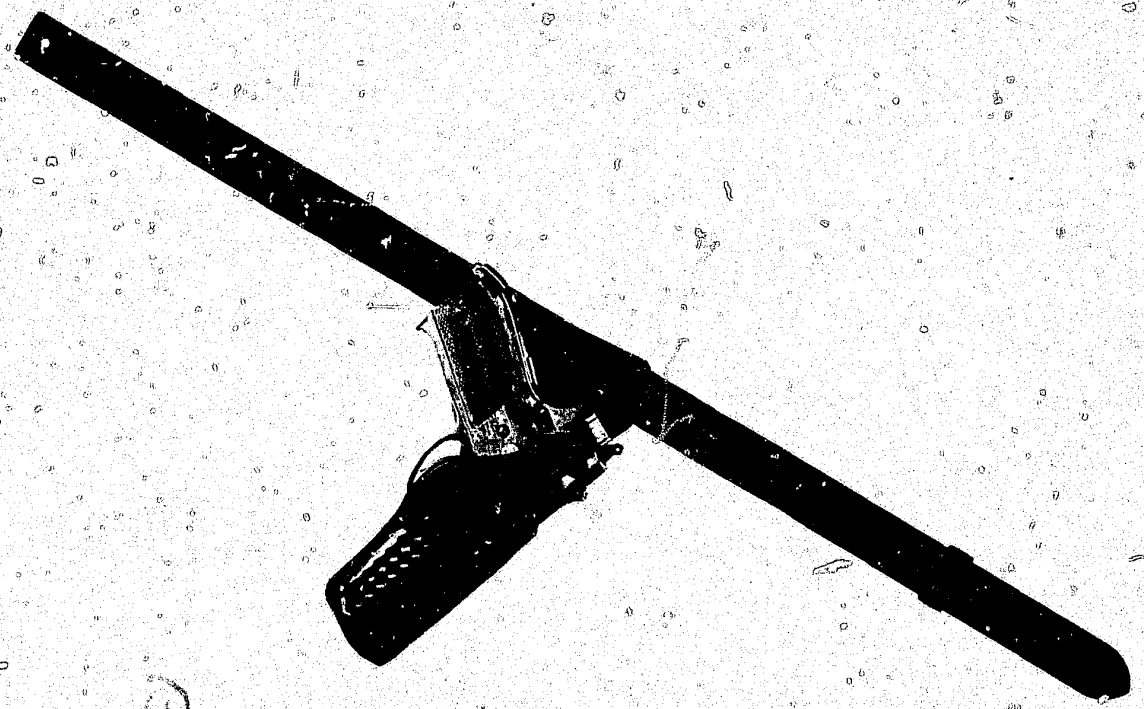
WEAPONS
&
AMMUNITION STUDY



LEXINGTON/FAYETTE URBAN COUNTY
DIVISION OF POLICE

RBES ROAD LEXINGTON, KENTUCKY 40505

For Police Use Only

PART I

TESTING OF POLICE HANDGUN

INTRODUCTION

PURPOSE OF POLICE SIDEARMS

A police officer is routinely exposed to situations of potential deadly attack. Operating in public as the most visible representative of the Criminal Justice System and, by inference, of the society as a whole, the police officer bears the brunt of the resentment felt toward the society in general and the Criminal Justice System specifically by certain elements. To be able to defend one's self against deadly assault, therefore, becomes a critical concern of the police officer and the proper training and equipment is necessarily a critical concern of the police agency.

In addition to self defensive utilization, the police sidearm is also authorized to be used to protect a third party from deadly assault.

The police handgun, either revolver or auto-loader, is by nature relatively inefficient. Any instance requiring the use of a weapon (as above) could more effectively be resolved with either a shotgun or high-powered rifle depending upon the range and degree of precision required. It will be readily apparent that these are specialized weapons and cannot feasibly be carried in a state of readiness by the police officer at all times.

The police officer must be armed with an effective weapon which is capable of being maintained on his person in a state of readiness. This weapon must be capable of defending the officer or another person from deadly assault.

With these stipulations, it becomes obvious that the handgun is the only practical police sidearm. The appropriate handgun, carried in a properly designed and maintained holster, is instantly available for use.

The immediate need, therefore, is to determine the most efficient handgun for police service.

POLICE HANDGUN

There are two criteria to the determination of a suitable police handgun. For the purposes of this study, the effectiveness of a police handgun is a reflection of the over-all ballistics of the individual weapon and of each separate type of ammunition. This ballistics data includes flight ballistics which measures the inherent accuracy of the weapon, and more importantly, terminal ballistics which measures the behavior of the projectile at or in the target. This aspect of ballistic study is often termed "Stopping Power." Stopping power is a function of caliber, velocity and projectile type.

It must be practical. Practicality is a function of weapon size and weight; concealability, if necessary; suitability of action; and degree of expertise attainable by the individual officer within the limits of the agency's training program.

The twin criteria of effectiveness and suitability will be established throughout this study with regard to present and proposed handguns.

.38 Special

(Note: Any weapon less powerful than the .38 Special must be rejected as inadequate, see attached Tables A & B.)

The .38 Special is the traditional police handgun. It is of marginal power and effectiveness in stopping armed aggressors as numerous case studies have shown. Many attempts have been made to update this weapon through high-speed low mass cartridges and special projectiles and while some are effective (see Tables A & B); they are, at best, merely stop-gap remedies. The typical .38 Special revolver is light-weight (20-36 oz.), durable, relatively easy to train with; and in the 2" configuration, it is easily concealed. Various models

are available from the two major manufacturers and others in varying degrees of sophistication and finishes ranging from blue-steel to solid stainless steel. The .38 Special therefore possesses a high level of practicality, but unless specific cartridges are utilized, a low level of effectiveness.

.357 Magnum

The .357 Magnum is a stretched .38 Special loaded to approximately 50% higher chamber pressure for equivalent projectiles. This weapon was created in the 1930's partly as a response to requests for a more powerful .38 Special from police departments. The .357 Magnum shares some of the faults of the .38 Special in that certain cartridges are only marginally effective. However, newer loadings have proved highly efficient for police use and the .357 Magnum, thus equipped, is the best of the medium caliber police revolvers.

Many of the practical attributes of the .38 Special are shared by the .357. The .38 Special target cartridge may be utilized for training as all .357 revolvers will also chamber .38 Special ammunition. The .357 is offered in many styles by the two major manufacturers and others and in the same selection of materials and finishes as the .38 Special.

The .357 Magnum, therefore, has a moderate to high level of effectiveness and shares the high level of practicality of the .38 Special.

.41 Magnum and .44 Magnum

Both of these weapons are highly effective but marginally practical due to the weight of the handguns and the degree of training required for proficiency.

9mm Parabellum

This cartridge is commonly used by every military force in the world except the United States and the Soviet and Chinese blocs. Most foreign police

departments and several in the United States use the 9mm in auto-loading pistols.

The standard loading for this cartridge is only marginal for police service. However, there are cartridges available which provide a level of performance matching that of the .357 Magnum.

There are many pistols chambered for the 9mm Parabellum. Only two of American manufacture are presently deemed acceptable for police service. The Smith & Wesson Model 39 and Model 59 are both double-action and thus possess an inherent degree of safety. Both weapons are relatively light in weight (26 oz. +), durable, and relatively uncomplicated to train with. The greatest advantage of the auto-loaders is their ease of reloading, and the convenient manner in which extra ammunition is carried in a separate magazine. They are flat-sided in contrast to a revolver and are more readily concealed.

The defensive use of the police handgun is, by the nature of police service, to stop an aggressor--to render him uncapable of completing his deadly course of action. In order to be effective, therefore, a handgun must have the capability to stop an adversary immediately. In addition to this incapacitating ability, the weapon should minimize the danger to bystanders from ricochet and excessive penetration.

Many methods of measurement of effectiveness have been devised. The best known is the Hatcher Scale of Relative Stopping Power originated by Major General Julian S. Hatcher. Without going into a detailed discussion of ballistic rating, we must stipulate that any rating will be, at best, only an approximation of projectile performance--a base standard upon which comparisons may be drawn between typical projectile performance and equal test media. Actual performance thus estimated is valued numerically. (See Tables A & B)

Ricochet is a hazard with any projectile, but diminishes in importance with increased velocity and a frangible projectile. A solid projectile striking a flat surface at a shallow angle will impart a small portion of its energy to the surface, but the ricocheting mass will retain much of the original energy and thus is dangerous. The worst offenders are heavy, low velocity loadings. High velocity, low mass loadings have shown a marked tendency to disintegrate on impact; the resulting fragments having low mass, dissipate their energy quickly and present minmal ricochet hazard.

Penetration is desirable to a certain extent. However, the ideal projectile is that which expends 100% of its energy within the target. If the projectile passes through the body of the target, it will possess residual energy which is wasted. Additionally, the projectile represents a hazard to bystanders.

Keeping in mind the necessary concessions made in effectiveness to insure practicality, concessions which tend to reduce the over-all power of the weapon, it is obvious that little or no energy should be wasted due to over-penetration. If, as testing has indicated, a projectile exists which will typically impart all or most of its energy within the target, it should be the loading of choice.

Studies of weapon performance have indicated that three weapons are suitable for police service as indicated previously. The .38 Special is suitable only if certain ammunition is used and then only marginally as proper shot placement (accuracy) is critical.

The .357 Magnum is more flexible as regards loadings with more inherent power. However, certain projectle types must be used to minimize over-penetration.

The 9mm auto-loader falls between the .38 Special and the .357 Magnum in power. It, too, requires certain projectile types to minimize over-penetration.

RECOMMENDATIONS

The Division of Police recognizes that any handgun used in police service must be used with a high degree of proficiency. The standard course of training with the .38 Special provides a level of expertise. This expertise is limited to the use of low-power target ammunition. As a basic training device, this has proven effective.

Recognizing the limitations of the .38 Special, we recommend that the .357 Magnum be made an optional police sidearm. The 4" barrel .38 Special revolver will remain the basic sidearm. The 2" barrel .38 Special may be carried only in those instances where concealability is essential to the furtherance of the police mission. Plainclothes officers will have the option of carrying the double-action 9mm auto-loader if desired and if proficiency is demonstrated to the Range Officer who will certify such proficiency to the Chief of Police.

These weapons are regarded as satisfactory only when specific types of ammunition are used. The specified ammunition will be determined by the Chief of Police based upon tests to be conducted by the Range Officer and the Planning Unit.

Appendix II gives several accounts showing the inadequacy of the .38 Special in actual use. These accounts were recorded in "The Heene Report" by Mason Williams in Law & Order, December 1970.

TABLE A

	---------WEAPON---------			--BULLET--			
Caliber	Make	Barrel Length	Weight in ozs.	Weight	Muzzle Velocity	Relative Stopping Power (RSP)	Recoil Energy
.38 Special	SW #36	3"	21	90 gr.	1052	22.4	2.1
.38 Special	#36	3"	21	110 gr.	1102	28.7	3.5
.38 Special	#36	3"	21	158 gr.	818	30.5	4.0
.38 Special	#60	2"	19	158 gr.	763	28.5	3.4
.38 Special	#10	4"	34	110 gr.	1195	31.1	2.6
.38 Special	#10	4"	34	125 gr.	980	28.9	2.2
.38 Special	#10	4"	34	158 gr.	850	31.8	2.7
.38 Special	#19	4"	35	158 gr.	799	29.8	2.4
.38 Special	#10	4"	34	158 gr.	855	31.9	2.9
.38 Hi-Velocity	#10	4"	34	158 gr.	1090	48.5	4.7
.38 Special	#10	4"	34	200 gr.	730	32.9	3.0
.357 Magnum	#19	4"	35	110 gr.	1375	35.8	3.4
.357 Magnum	#66	4"	35	158 gr.	1146	51.0	4.9
.41 Police	#58	4"	41	210 gr.	947	72.5	5.0
.41 Magnum	#58	4"	41	210 gr.	1247	84.0	8.6
.44 Special	#29	4"	43	246 gr.	657	51.4	3.3
.44 Special	Bulldog	3"	19	246 gr.	658	51.5	7.5
.44 Magnum	#29	4"	43	240 gr.	1267	120.9	11.7

SW - Smith & Wesson
Bulldog - Charter Arms Bulldog

TABLE B

PERFORMANCE OF COMMERCIALLY AVAILABLE HANDGUN AMMUNITION

Bullet ID No.	Caliber	Weight (grains)	Manufacturer	Barrel Length (in)	Nominal (fps)	Measured (fps)	Measured (mps)	RI Index
1	.44 Magnum	200	Speer	4.00	1675	1277	389	54.9
2	9mm	96	Deadeye Assoc.	4.00	1365	1839	560	54.5
3	.41 Magnum	210	Remington	4.00	1500	1260	384	51.9
4	.357 Magnum	96	Deadeye Assoc.	4.00	1120	1725	525	50.0
5	.44 Magnum	240	Winch-Western	4.00	1470	1330	405	50.0
6	.44 Magnum	240	Browning	4.00	1470	1311	399	49.8
7	.44 Magnum	240	Remington	4.00	1470	1286	391	48.9
8	.44 Magnum	240	Browning	4.00	1330	1257	383	47.9
9	.44 Magnum	240	Remington	4.00	1470	1229	374	46.7
10	.357 Magnum	96	Deadeye Assoc.	2.75	1120	1615	492	46.0
11	.44 Magnum	240	Speer	4.00	1650	1203	366	45.7
12	.357 Magnum	125	Speer	4.00	1900	1301	396	44.4
13	.357 Magnum	140	Speer	4.00	1780	1221	372	44.4
14	.357 Magnum	125	Remington	4.00	1675	1366	416	42.5
15	.38 Special	96	Deadeye Assoc.	4.00	1800	1585	483	41.8
16	.44 Magnum	180	Super Vel	4.00	1995	1495	455	41.6
17	9mm	115	Remington	4.00	1160	1192	363	38.0
18	.38 Special	96	Deadeye Assoc.	2.00	1800	1496	455	37.5
19	.357 Magnum	125	Remington	2.75	1675	1173	357	37.1
20	.357 Magnum	140	Speer	2.75	1780	1125	342	34.4
21	.357 Magnum	110	Speear	4.00	1700	1246	379	33.4
22	.357 Magnum	125	Speer	2.75	1900	1161	353	30.6
23	.357 Magnum	158	Speer	4.00	1625	1156	352	28.0
24	.38 Special	95	Remington	4.00	985	1187	361	28.0
25	9mm	100	Speer	4.00	1315	1188	362	27.9
26	.38 Special	125	Remington	4.00	1160	1108	337	25.5
27	.38 Special	110	Super Vel	4.00	1370	1159	353	25.1
28	.38 Special	110	Super Vel	2.00	1370	1148	349	24.8
29	.357 Magnum	110	Smith & Wesson	4.00	1800	1226	373	24.0
30	.357 Magnum	110	Speer	2.75	1700	1178	359	23.3
31	.38 Special	125	Speer	4.00	1425	1047	319	22.5
32	.357 Magnum	125	Smith & Wesson	4.00	1775	1227	373	22.1
33	.357 Magnum	158	Federal	4.00	1550	1255	382	21.1
34	.45 Auto	185	Remington	5.00	950	895	272	21.1
35	.357 Magnum	110	Western Sup-X	4.00	1500	1309	398	21.0
36	.357 Magnum	110	Western Sup-X	2.75	1500	1258	383	20.2
37	.38 Special	125	Speer	4.00	1425	1006	306	19.9
38	.38 Special	90	KTW	4.00	1030	922	281	19.6
39	.38 Special	110	Super Vel	4.00	1370	1202	366	19.4
40	.38 Special	110	Winch-Western	4.00	-	1106	337	19.3
41	.357 Magnum	158	Federal	2.75	1550	1195	364	18.7
42	.38 Special	140	Speer	4.00	1200	978	298	18.6
43	.38 Special	140	Speer	2.00	1200	897	273	18.5
44	.38 Special	158	Winch-Western	4.00	855	915	278	18.4

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Bullet ID No.	Caliber	Weight (grains)	Manufacturer	Barrel Length (in)	Nominal (fps)	Measured (fps)	Measured (mps)	RI Index
45	.357 Magnum	125	Smith & Wesson	2.75	1775	1188	362	17.7
46	.357 Magnum	158	Speer	2.75	1625	1030	313	17.5
47	.357 Magnum	158	Smith & Wesson	4.00	1500	1168	356	17.2
48	.357 Magnum	158	Smith & Wesson	2.75	1500	1091	332	17.0
49	9mm	115	Smith & Wesson	4.00	1145	1193	363	16.6
50	.357 Magnum	158	Western Sup-X	4.00	1410	1230	374	16.6
51	.38 Special	125	3-D	4.00	1085	1091	332	16.5
52	.38 Special	90	KTW	2.00	1030	734	223	15.6
53	.38 Special	125	Speer	2.00	1425	931	283	15.5
54	9mm	100	Smith & Wesson	4.00	1250	1341	408	15.2
55	.45 Automatic	185	Remington	5.00	775	821	250	14.7
56	.38 Special	125	Smith & Wesson	4.00	1350	1064	324	14.5
57	.357 Magnum	158	Smith & Wesson	4.00	1050	1116	340	14.4
58	.357 Magnum	158	Western Sup-X	2.75	1410	1169	356	14.4
59	.38 Special	158	Winchester	4.00	855	924	281	14.3
60	.38 Special	95	Remington	2.00	985	1019	310	14.0
61	.38 Special	110	Winch-Western	2.00	-	956	291	14.0
62	.38 Special	110	Super Vel	2.00	1370	1076	327	14.0
63	.357 Magnum	110	Smith & Wesson	2.75	1800	1044	318	13.9
64	9mm	124	Remington	4.00	1120	1084	330	13.8
65	.41 Magnum	210	Remington	4.00	1050	944	287	13.7
66	.38 Special	125	Speer	2.00	1425	983	299	13.2
67	.38 Special	158	Smith & Wesson	4.00	1050	1047	319	13.0
68	.38 Special	90	Smith & Wesson	4.00	1350	1158	352	12.4
69	.38 Special	110	Smith & Wesson	4.00	1380	1014	309	12.4
70	.38 Special	148	Remington	4.00	770	741	225	12.4
71	.38 Special	148	Browning	4.00	770	731	222	12.3
72	.38 Special	148	Federal	4.00	770	737	224	12.3
73	.38 Special	148	Smith & Wesson	4.00	800	726	221	12.3
74	.38 Special	148	Remington	2.00	770	700	213	12.2
75	.38 Special	148	Federal	2.00	770	674	205	12.1
76	.38 Special	148	Smith & Wesson	2.00	800	662	201	12.1
77	.38 Special	148	Speer	4.00	825	679	206	12.1
78	.38 Special	148	Western	4.00	770	696	212	12.1
79	9mm	115	Western Sup-X	4.00	1160	1272	387	12.0
80	.38 Special	148	Speer	2.00	825	652	198	12.0
81	.38 Special	148	Browning	2.00	770	618	188	11.9
82	.38 Special	148	Western	2.00	770	618	188	11.9
83	.38 Special	90	Smith & Wesson	4.00	1350	1118	340	11.8
84	.357 Magnum	158	Smith & Wesson	2.75	1050	982	299	11.1
85	.38 Special	158	Winch-Western	2.00	855	805	245	11.0
86	.38 Special	158	Federal	4.00	855	823	250	10.9
87	.38 Special	158	Smith & Wesson	4.00	850	1006	306	10.8
88	.38 Special	158	Smith & Wesson	2.00	1050	950	289	10.6
89	.38 Special	110	Speer	4.00	1245	857	261	10.5

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Bullet ID No.	Caliber	Weight (grains)	Manufacturer	Barrel Length (in)	Nominal (fps)	Measured (fps)	Measured (mps)	RI Index
90	9mm	115	Smith & Wesson	4.00	1145	1192	363	10.3
91	.357 Magnum	158	Remington	4.00	1410	1088	331	10.2
92	.38 Special	125	3-D	2.00	1085	957	291	10.1
93	9mm	125	Speer	4.00	1120	1058	322	9.1
94	9mm	115	Winchester	4.00	1140	1126	343	9.7
95	.45 Automatic	185	Federal	5.00	775	751	228	9.7
96	.38 Special	125	Smith & Wesson	4.00	1350	1002	305	9.6
97	.357 Magnum	158	Remington	2.75	1410	958	291	9.3
98	9mm	115	Browning	4.00	1140	1067	325	9.2
99	.38 Special	158	Federal	4.00	1090	999	304	9.0
100	.38 Special	125	Smith & Wesson	2.00	1350	899	274	8.9
101	.38 Special	158	Federal	2.00	855	796	242	8.5
102	.38 Special	158	Speer	4.00	975	803	244	8.5
103	.38 Special	158	Federal	2.00	1090	947	288	8.2
104	.38 Special	158	Winchester	2.00	855	779	237	8.2
105	.38 Special	158	Winchester	4.00	855	919	280	8.0
106	.38 Special	110	Speer	2.00	1245	789	240	7.7
107	.38 Special	90	Smith & Wesson	2.00	1350	1053	320	7.2
108	.38 Special	125	Remington	2.00	1160	911	277	7.0
109	.38 Special	110	Smith & Wesson	2.00	1380	888	270	6.8
110	.45 Automatic	230	Remington	5.00	855	839	255	6.7
111	.45 LC	255	Winch-Western	7.50	860	821	250	6.6
112	.38 Special	90	Smith & Wesson	2.00	1350	975	297	6.5
113	.45 Automatic	230	Winch-Western	5.00	850	740	225	6.5
114	.44 Special	246	Remington	3.00	755	640	195	6.3
115	.38 Special	125	Smith & Wesson	4.00	1350	900	274	5.9
116	.38 Special	158	Speer	2.00	975	640	195	5.7
117	.38 Special	125	Smith & Wesson	2.00	1350	896	273	5.6
118	.38 Special	158	Federal	4.00	855	795	242	5.0
119	.38 Special	158	Winchester	2.00	855	780	237	4.6
120	.38 Special	158	Remington	4.00	855	749	228	4.5
121	.38 Special	158	Speer	4.00	975	749	228	4.5
122	.38 Special	200	Remington	4.00	730	647	197	4.5
123	.38 Special	200	Speer	4.00	850	710	216	4.5
124	.38 Special	158	Remington	2.00	855	694	211	4.4
125	.38 Special	158	Speer	2.00	975	635	193	4.4
126	.38 Special	158	Smith & Wesson	4.00	910	708	215	4.4
127	.38 Special	158	Federal	2.00	855	632	192	4.2
128	.38 Special	200	Western Sup-X	4.00	730	626	190	4.2
129	.38 Special	200	Speer	2.00	850	598	182	4.1
130	.38 Special	200	Western Sup-X	2.00	730	592	180	4.1
131	.38 Special	158	Smith & Wesson	4.00	1060	875	266	4.0
132	.38 Special	158	Smith & Wesson	2.00	850	870	265	4.0

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Bullet ID No.	Caliber	Weight (grains)	Manufacturer	Barrel Length (in)	Nominal (fps)	Measured (fps)	(mps)	RI Index
133	.38 Special	200	Remington	2.00	730	593	180	4.0
134	380 Automatic	95	Western Sup-X	3.86	955	948	288	4.0
135	.38 Special	158	Smith & Wesson	2.00	910	626	190	3.5
136	.38 Special	125	Smith & Wesson	2.00	1350	716	218	3.0
137	.38 Special	158	Smith & Wesson	4.00	1050	828	252	2.9
138	.38 Special	158	Smith & Wesson	2.00	1060	678	206	2.5
139	.22 Cal.	37	Winch-Western	2.00	1365	872	265	2.3
140	.38 Special	158	Smith & Wesson	2.00	1050	730	222	2.0
141	.38 Special	64	MBA	4.00	-	738	224	0.9
142	.38 Special	64	MBA	2.00	-	671	204	0.4

TABLE C

VENTED BARREL BALLISTICS

Caliber	-----BULLET----- Weight (grains)	Type	------SYMBOL-------- Winchester	Western	Primer	--------VELOCITY-FPS------- Muzzle	50 Yds.	100 Yds.	----ENERGY FT./LBS.----- Muzzle	50 Yds.	100 Yds.	MID RANGE TRAJECTORY INCHES 50 Yds.	100 Yds.	BARREL LENGTH INCHES
.357 Magnum Jacketed Hollow Point Super-X	110	JHP	--	3573P	1½-108	1295	1094	975	410	292	232	0.8	3.5	4V
.357 Magnum Jacketed Hollow Point Super-X	125	JHP	--	3576P	1½-108	1450	1240	1090	583	427	330	0.6	2.8	4V
.357 Magnum Super-X (inside lubricated)	158	Lead	--	3571P	1½-108	1235	1104	1015	535	428	361	0.8	3.5	4V
.357 Magnum Jacketed Hollow Point Super-X	158	JHP	--	3574P	1½-108	1235	1104	1015	535	428	361	0.8	3.5	4V
.357 Magnum Jacketed Soft Point Super-X	158	JSP	--	3575P	1½-108	1235	1104	1015	535	428	361	0.8	3.5	4V
.357 Magnum Metal Piercing Super-X (inside lubricated, lead bearing)	158	Met.Pierc.	--	3572P	1½-108	1235	1104	1015	535	428	361	0.8	3.5	4V
.38 Special (inside lubricated)	158	Lead	W38S1P	38S1P	1½-108	755	723	693	200	183	168	2.0	8.3	4V
.38 Special Metal Point (inside lubricated, lead bearing)	158	Met.Pt.	W38S2P	38S3P	1½-108	755	723	693	200	183	168	2.0	8.3	4V
.38 Special Super Police (inside lubricated)	200	Lead	W38S3P	38S6PH	1½-108	635	614	594	179	168	157	2.8	11.5	4V
.38 Special Super-X Jacketed Hollow Point +P	110	JHP	--		1½-108	1020	945	887	254	218	192	1.1	4.8	4V
.38 Special Super-X Jacketed Hollow Point +P	125	JHP	W38S7PH	--	1½-108	945	898	858	248	224	204	1.3	5.4	4V
.38 Special Super-X +P	130	FMC	--	38S8P	1½-108	950	910	880	260	240	225	1.3	5.2	4V
.38 Special Super-X (inside lubricated) +P	150	Lead	--	38S4P	1½-108	910	870	835	276	252	232	1.4	5.7	4V
.38 Special Metal Piercing Super-X (inside lubricated, lead bearing) +P	150	Met.Pierc.	--	38S5P	1½-108	910	870	835	276	252	232	1.4	5.7	4V
.38 Special Super-X (inside lubricated) +P	158	Lead-HP	W38SPD	--	1½-108	915	878	844	294	270	250	1.4	5.6	4V
.38 Special Super-X Semi-Wad Cutter (inside lubricated) +P	158	Lead-SWC	W38WCP	--	1½-108	915	878	844	294	270	250	1.4	5.6	4V
.38 Special Super-Match and Match Mid-Range Clean Cutting (inside lubricated)	148	Lead-WC	W38SMRP	38SMRP	1½-108	710	634	566	166	132	105	2.4	10.8	4V
.38 Special Super Match (inside lubricated)	158	Lead	--	38SMP	1½-108	755	723	693	200	183	168	2.0	8.3	4V

TABLE D

VENTED BARREL BALLISTICS

Caliber	Remington Order No.	Weight (grains)	Style	Velocity -FT. PER SEC.- Muzzle	Velocity -FT. PER SEC.- 50 Yds.	Energy ---FT. LBS.--- Muzzle	Energy ---FT. LBS.--- 50 Yds.	Mid-Range -TRAJ.- 50 Yds.	Barrel
.38 Special	R38S1	95	SJHP+P	1060	970	237	198	1.1"	2"
	R38S1*	95	SJHP+P	1175	1044	291	230	0.9"	4"*
	R38S2	125	SJHP+P	945	898	248	224	1.3"	4"
	R38S3	148	WC	710	634	166	132	2.4"	4"
	R38S4	158	TGTM	755	723	200	183	2.0"	4"
	R38S5	158	LEAD	755	723	200	183	2.0"	4"
	R38S6	158	SWC	755	723	200	183	2.0"	4"
	R38S7	158	MP	755	200	200	183	2.0"	4"
	R38S8	158	LEAD+P	915	878	294	270	1.4"	4"
	R38S9	200	LEAD	635	614	179	168	2.8"	4"
.357 Magnum	R357M1	125	SJHP	1450	1240	583	427	0.6"	4"
	R357M2	158	SP	1235	1104	535	428	0.8"	4"
	R357M3	158	MP	1235	1104	535	428	0.8"	4"
	R357M4	158	SJHP	1235	1104	535	428	0.8"	4"
	R357M5	158	LEAD	1235	1104	535	428	0.8"	4"
.41 Magnum	R41MG1	210	SP	1300	1162	778	630	0.7"	4"
	R41MG2	210	LEAD	965	898	434	376	1.3"	4"
.44 Rem.Mag.	R44MG1	240	LEAD	1350	1186	971	749	0.7"	4"
	R44MG2	240	SP	1180	1081	741	623	0.9"	4"
	R44MG3	240	SJHP	1180	1081	741	623	0.9"	4"

* The 95 grain load, tested in 4" barrels for consistency, is designed specifically for use in shorter barrels.

Ammunition with (+P) on the case headstamp is loaded to higher pressure. Use only in firearms designated for this cartridge and so recommended by the gun manufacturer.

CONVENTIONAL REVOLVER BALLISTICS

Caliber	Muzzle Velocity	Muzzle Energy	Barrel
.38 Special	985	205	2"
	-	-	-
	1028	300	6"
	770	195	6"
	885	255	6"
	885	255	6"
	885	255	6"
	885	255	6"
	1090	415	6"
	730	235	6"
.357 Magnum	1675	780	8-3/8"
	1550	845	8-3/8"
	1550	845	8-3/8"
	1410	695	8-3/8"
	1410	695	8-3/8"
.41 Magnum	1500	1050	8-3/8"
	1050	515	8-3/8"
.44 Rem.Mag.	1470	1150	6-1/2"
	1470	1150	6-1/2"
	1470	1150	6-1/2"

PART II

TESTING OF COMMERCIALLY LOADED AMMUNITION

TESTING OF COMMERCIALLY LOADED AMMUNITION

The available literature on handgun ballistics is replete with examples of the inadequacy of the .38 Special. Many police agencies have sought to improve the defensive capabilities of their officers by increasing the power of the issue sidearm. These remedies run the gamut of available weaponry from high velocity .38 Special loadings of the type popularized by the Lee Jurras' now defunct Super Vel to the awesome .44 Remington Magnum, which is a hunting weapon much too heavy and powerful for the typical police officer.

If one is confined to the realm of practicality, the latest word on handgun ballistics is contained in the Law Enforcement Standards Program Summary Report: An Evaluation of Police Handgun Ammunition, U.S. Department of Justice, LEAA, October, 1975. This Summary Report was prepared by R. C. Dobbyn of the Law Enforcement Standards Laboratory, National Bureau of Standards; W. V. Bruchey, Jr., U.S. Army Ballistic Research Laboratory, Aberdeen Proving Ground; and L. D. Shubin, National Institute of Law Enforcement and Criminal Justice, LEAA. It is the most thorough evaluation of handgun capabilities presently available. With certain exceptions, which will be noted, this report will use the conclusions of the Summary Report.

We recognize the limitations of the methodology of the LEAA study. Simply stated, the authors were guilty of faulty conceptualization. Their use of computer simulation to generalize about projectile performance is a flaw which must be recognized.

The basic study of handgun performance was the Thompson-LaGarde Board Report of 1904. This Board, convinced at the behest of the War Department, included Colonel John T. Thompson, inventor of the Thompson Submachine Gun, and Colonel Louis A. LaGarde. Their testing, done on cadavers and live animals,

resulted in the adoption of the .45 ACP cartridge as the standard American Military service round. Thompson-LaGarde found that the effectiveness of a cartridge in providing a high degree of stopping power was a direct function of projectile diameter.

Major General Julian S. Hatcher analyzed in detail the results of the Thompson-LaGarde Report in 1927 and again in 1935. General Hatcher expressed the results of his analyses in a table, termed Relative Stopping Power (RSP). The Hatcher Scale of Relative Stopping Power, as it became commonly known, was the standard by which all cartridges were measured for forty years.

Hatcher established his base line at the performance level of the RMJ .45 ACP, with a RSP rating of 60. For example, the RNL .38 Special, the traditional police cartridge, has a RSP of 30.8.

The Southwestern Institute of Forensic Sciences, Dallas, Texas, prepared an evaluation of .38 Special ammunition in 1973 in which the kinetic energy loss of various projectiles and loadings were compared. Their testing procedure utilized blocks of ordnance gelatin 15 cm in thickness. The velocity of each projectile was measured at 12 feet from the muzzle. Then the velocity of ten projectiles was determined after penetration of the gelatin and the results averaged. The difference in kinetic energy as determined was stated as kinetic energy loss. The evaluation conceptualized that projectiles and loadings exhibiting higher kinetic energy loss would be more efficient, expend more energy within the target. Conversely, those showing low kinetic energy loss would be less efficient and would be subject to over penetration.

Therefore, we have three methods of evaluation available in current literature: The Hatcher Scale of Relative Stopping Power, The Southwestern Institute of Forensic Sciences Table of Kinetic Energy Loss (.38 Special only),

and The LEAA Table of Relative Incapacitation. Each of these methods has certain deficiencies; some already cited.

This study utilizes elements of each, particularly in those areas of technical data for which corroborative equipment is locally unavailable. It will be noted within the text of this study when published data is cited.

The field testing performed by the Planning Unit of the Division of Police consisted principally of firing selected rounds of test ammunition through the eight foot water column of the Kentucky State Police Lab. This testing was done with the assistance of David Williams, civilian technician of the Kentucky State Police. Each projectile was recovered, weighed, and measured. In those instances where the projectiles broke up on impact, the largest remaining portion was weighed and measured. Testing was done with barrels of various lengths, which are noted with each experimental round.

Velocities for these tests were taken from currently published tables as a suitable chronograph was unavailable. Velocities for all loads except Remington and Winchester/Western were estimated. Remington and Winchester/Western have devised a "Vented Test Barrel" which closely approximates the performance of ammunition in service revolvers (See Tables C and D). Other published velocity data was derived from solid barrels ranging in length from 6" for .38 Special to 8-3/8" for .357 Magnum. According to the Remington table, actual muzzle velocities differ from conventionally derived velocities, ranging from 79.68% to 92.21% of the published conventional velocities. The great majority falls between 83-85% so an average of 85% will be used for estimation. It should be noted here that this will apply only to revolvers with 4" barrels. Remington states that the vented barrel data may be extrapolated to apply to 3-1/2", 2-1/2", and 2" revolvers as velocity will drop approximately 50 fps for each 1" reduction in barrel length.

The eight foot water column was chosen as the test medium for several reasons. Water being homogenous in nature will give consistent results which can be replicated at will. Water, while not as similar to tissue consistency as ordnance gelatin or plastiscene, will as a function of its homogeniety give results allowing comparison of only two variables, velocity and projectile type. Water is suitable for easy recovery of all projectile fragments, and the water column is readily available where the use of another medium would necessitate the construction of a complete test facility.

We realize the limitation inherent in the use of test media, specifically that any conclusions derived from a test sequence using a test medium other than living tissue will be, at best, presumptive and more probably an educated guess as to the results to be obtained on living tissue. For obvious reasons, objective testing (human tissue) is impossible. It is equally impossible to duplicate the methodology of the Thompson-LaGarde study. Public opinion, taking a dim view of vivisection even under controlled medical conditions, would be outraged at this type of experimentation. The macabre practice of shooting into cadavers has no justification in today's society and could never be tolerated.

The water tests showed results as, to a substantial degree, had been expected. The results will be noted by caliber with the most efficient and practical cartridges described.

.38 SPECIAL

Two separate cartridges showed efficiency depending upon barrel lengths. The common weakness in .38 Special ammunition is inadequate transmittal of energy to the target due to the failure of the projectile to expand. Expansion or mushrooming is essential to efficient transfer of energy as the deformation

of the projectile causes rapid dissipation of this energy as well as creating a larger wound channel.

2" Barrel Weapons

These so called snub-nose revolvers are light in weight and relatively easy to conceal. They have the reputation for poor stopping power and truly are a miserable choice for police use unless specific cartridges are used. Compare Illustration 1 through 7 showing the performance of selected cartridges in the water column.

1. 158 gr. RNL Smith & Wesson: This cartridge is typical of the standard .38 Special loading. Its listed muzzle velocity is 885 fps with a muzzle energy of 255 ft. lb. This is with a 6" test barrel. Actual velocity with a 2" revolver is estimated to be 650 fps with muzzle energy in the area of 140 ft. lb. The recovered projectile shows no distortion. Published data (Southwestern Forensic) indicates that this is the least efficient cartridge.

2. 90 gr. JSP Smith & Wesson: This cartridge is considerably higher in velocity and lower in weight than #1. However, it too shows little or no projectile deformation.

3. 158 gr. SWCHP Smith & Wesson: This cartridge was the issue ammunition of the Division of Police. Conversations with Smith & Wesson's staff indicated that this cartridge lost 50% of its velocity and 70% of its energy when fired in a 2" barrel revolver. The test projectile shows minimal expansion in the nose area, none of which exceeds bullet diameter.

4. 125 gr. SJHP Remington: This highly effective cartridge (see data on 4" barrel) is so reduced in velocity in a 2" barrel that no expansion occurs.

5. 125 gr. SJHP Federal: This cartridge shows a degree of expansion which places it in the category of minimal effectiveness.

6. 125 gr. SJHP Winchester-Western: This cartridge is somewhat more effective than the Federal (#5). Expansion is slightly over 20% (.42 inches).

7. 95 gr. SJHP Remington: This is the most effective .38 Special ammunition to be used in the 2" barrel revolver. Expansion is in excess of 50%, and the transmittal of kinetic energy is higher than any comparable loading.

4" Barrel Weapons

The 4" barrel revolver is the standard police sidearm. In caliber .38 Special, the rounds tested are shown in Illustrations 8 through 14.

8. 158 gr. RNL Remington: As with #1, this is the standard .38 Special load. It performs no more impressively in the longer barrel.

9. 90 gr. JSP Smith & Wesson: As with #2, this round is ineffective in the longer barrel.

10. 158 gr. SWCHP Smith & Wesson: The former issue ammunition shows minimal expansion even in the 4" barrel. This projectile is composed of a very hard alloy of antimony and lead hindering its performance.

11. 125 gr. SJHP Federal

12. 125 gr. SJHP Winchester-Western

13. 95 gr. SJHP Remington

    Each of these cartridges demonstrated adequate expansion and energy transfer; however, they were inferior to #14.

14. 125 gr. SJHP Remington: This cartridge demonstrated the greatest degree of expansion and energy transfer of all .38 Special ammunition tested.

.357 MAGNUM

One cartridge showed a high level of efficiency in barrel lengths of 2-1/2" to 4". The others were quite dependent upon barrel length for performance.

15. 90 gr. JSP Smith & Wesson: This round showed adequate expansion and fragmentation but is unstable due to its light weight.

16 and 16-A. 125 gr. SJHP Smith & Wesson

17 and 17-A. 125 gr. SJHP Speer

These two cartridges are very dependent upon barrel length. Note the marked difference in both cases between projectile deformation from 2-1/2" and 4" barrels.

18 and 18-A. 125 gr. SJHP Remington: This cartridge is markedly superior to all others in terms of over-all performance. Note the heavy deformation and fragmentation from both barrel lengths. This cartridge is currently the standard issue of the Kentucky State Police.

19 and 19-A. 110 gr. SJHP Winchester-Western: This cartridge shows substantial deformation, but in consideration of the light projectile, weight is regarded as inferior to #18 and 18-A.

9MM PARABELLUM

One cartridge in the 9mm is so superior to all others that no comparison is necessary. Illustration #20 shows two recovered projectiles. Expansion is excellent. One concern with auto-loading pistols is the reliability of specific cartridges in feeding from the magazine to the chamber. This cartridge, 115 gr. JHP Remington, feeds reliably.

RECOMMENDATIONS

Based upon the tests performed by the Division of Police and upon published reports which have been freely quoted, the following cartridges are recommended for service use:

.38 Special:	2" barrel revolver - Remington 95 gr. SJHP (R38S1) 4" barrel revolver - Remington 125 gr. SJHP (R38S2)
.357 Magnum:	All barrel lengths - Remington 125 gr. SJHP (R357M1)
9mm Parabellum:	4" barrel auto-loader - Remington 115 gr. JHP (R9MM1)

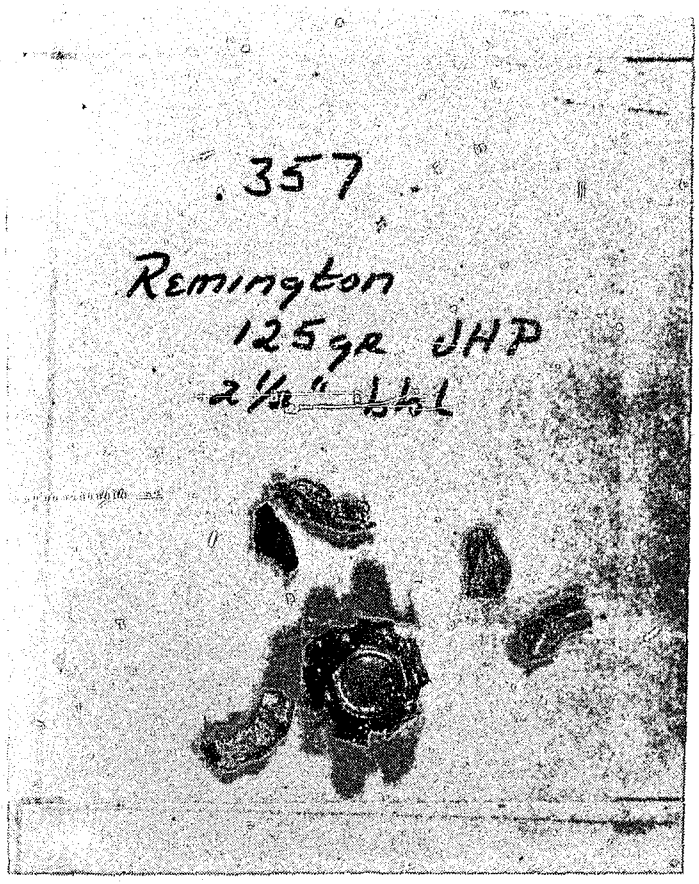
All of the recommended cartridges possess the capability of stopping a determined assailant with a high frequency of success. Energy transmittal is excellent in all cases. Only one, the 95 gr. SJHP, may in extreme instances be termed marginal. This is due to the light bullet weight necessary to achieve velocities insuring positive projectile deformation. Nonetheless, this cartridge is to be used only in 2" barrel revolvers which by nature are short-range defensive weapons. All of the

recommended cartridges have projectiles which deform and fragment readily thereby minimizing ricochet hazard.

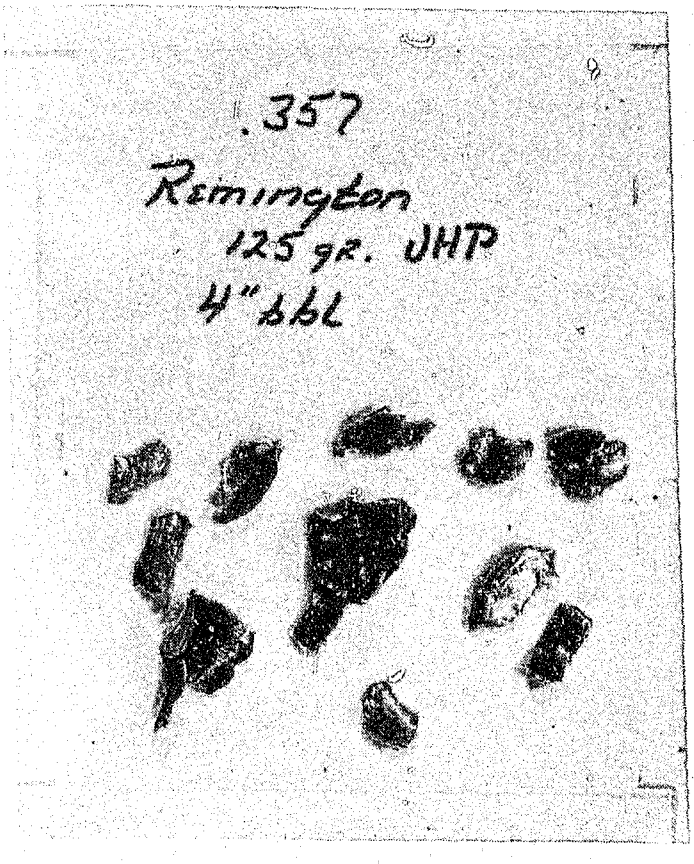
One cartridge was not tested. The Glaser Safety Slug is receiving a great deal of publicity in law enforcement circles. It scored consistently high ratings in the LEAA study. The Glaser Safety Slug is radically different from conventional ammunition. The projectile consists of a thin copper jacket filled with #12 shot suspended in a liquid teflon solution. It is capped with a mixture of glass and teflon. With a total weight of 96 gr. in .357/.38 caliber, the loaded cartridge achieves high velocity assuring disruption of the projectile and dispersal of the shot contents in the target. The cited advantages of this round are the total transmittal of energy to the target, the minimal penetration, and the lack of ricochet. In fact, the performance of the Glaser Safety Slug leaves much to be desired. The highly unstable projectile has a tendency to disrupt on impact with heavy clothing, belt buckles, etc. This lack of reliable penetration renders the Safety Slug unreliable for law enforcement use.

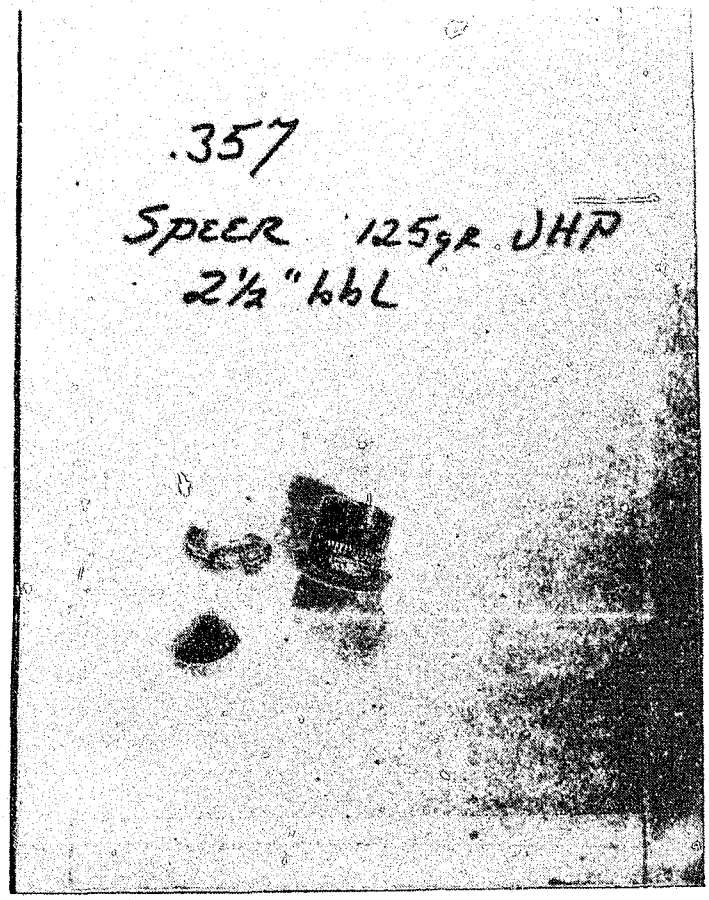
Current information is that the Safety Slug cartridge is handloaded from various components. While handloading under carefully controlled conditions, it will produce a safe and effective cartridge. The Division of Police cannot assume that an acceptable level of quality control exists unless the handloading operation is maintained under its direct control.

APPENDIX I

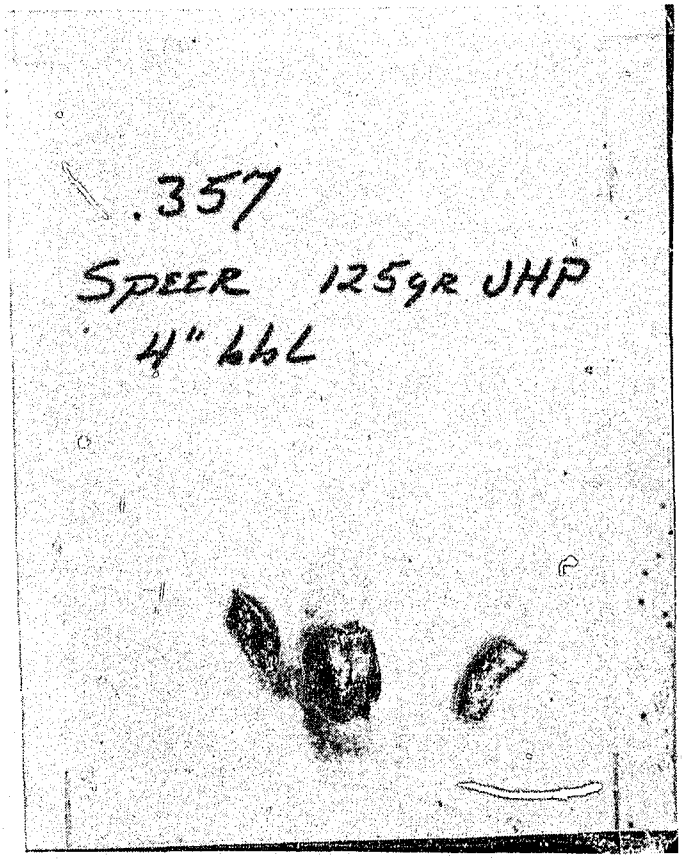


This is the current issue cartridge.
Note the degree of fragmentation through
both barrel lengths.



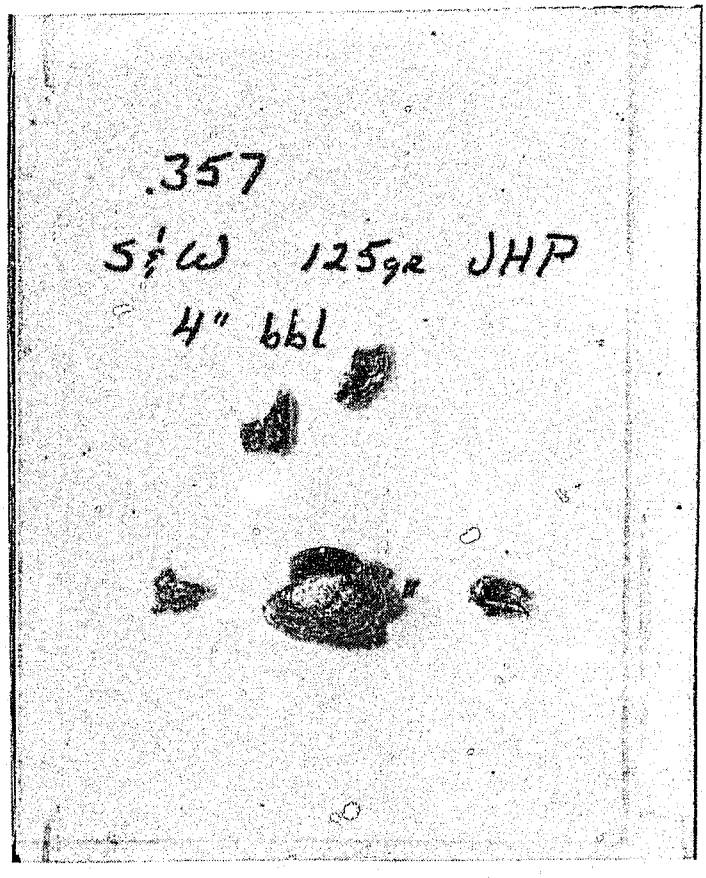


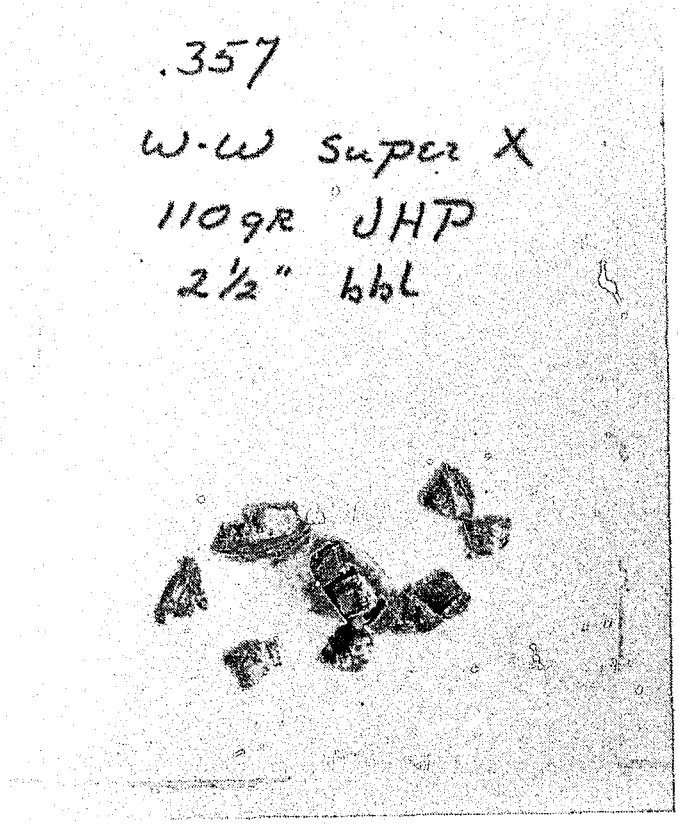
K.S.P. reports that this round has shown a pressure level in excess of absolute safe parameters.



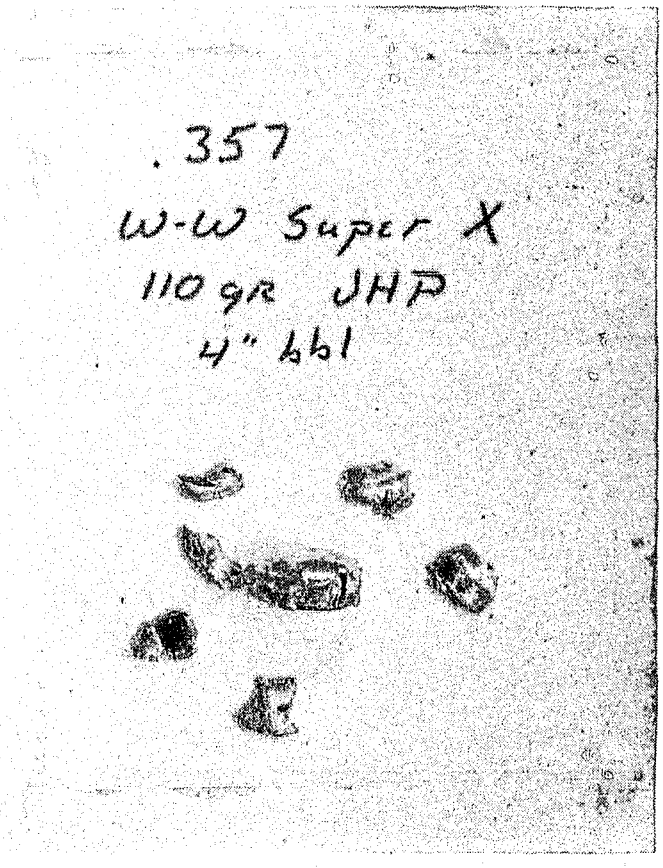
.357
S&W 125 gr JHP
2½" bbl

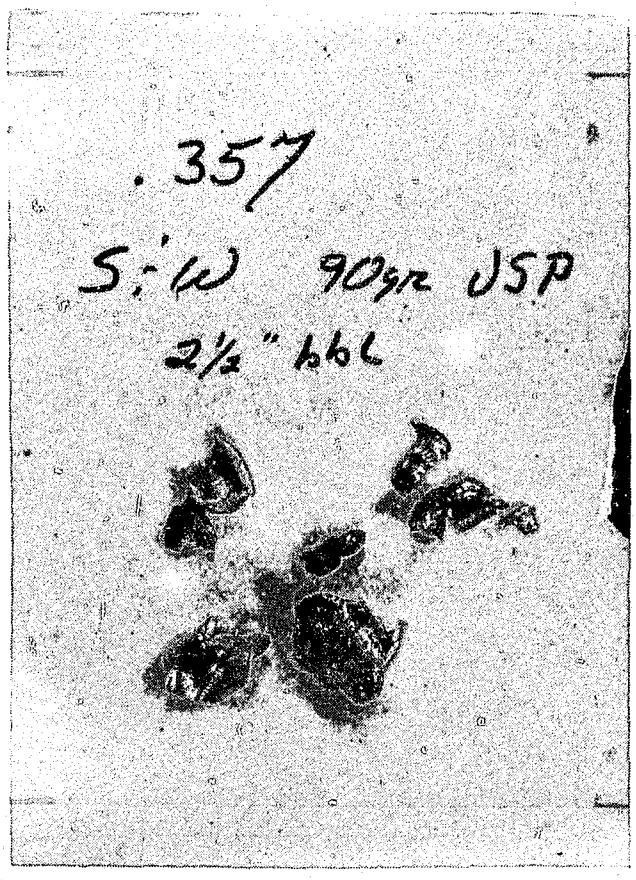
This round showed the least amount of deformation/fragmentation.





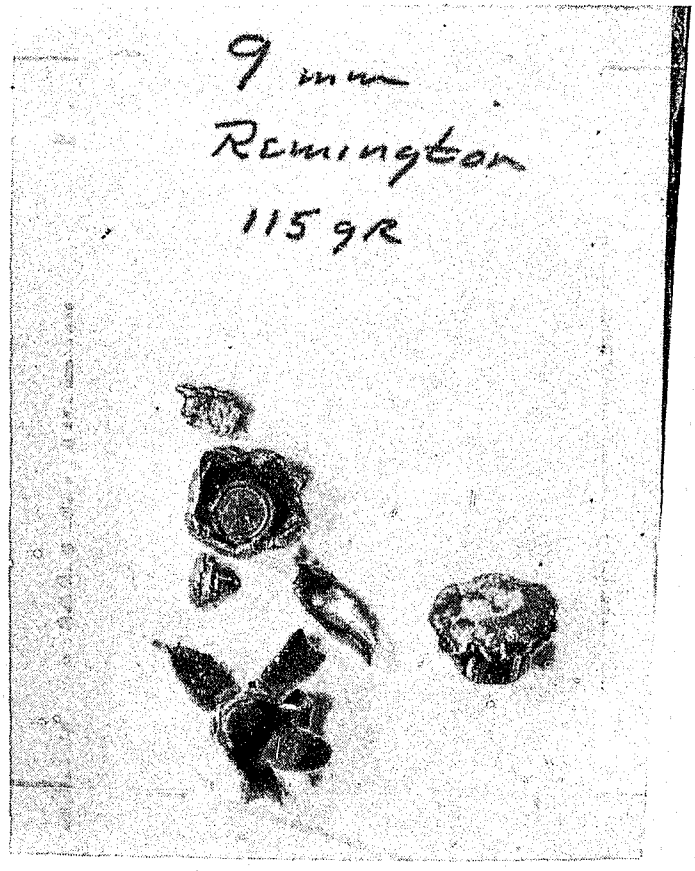
While the deformation/fragmentation of this round is excellent, the relatively light weight tends toward instability.

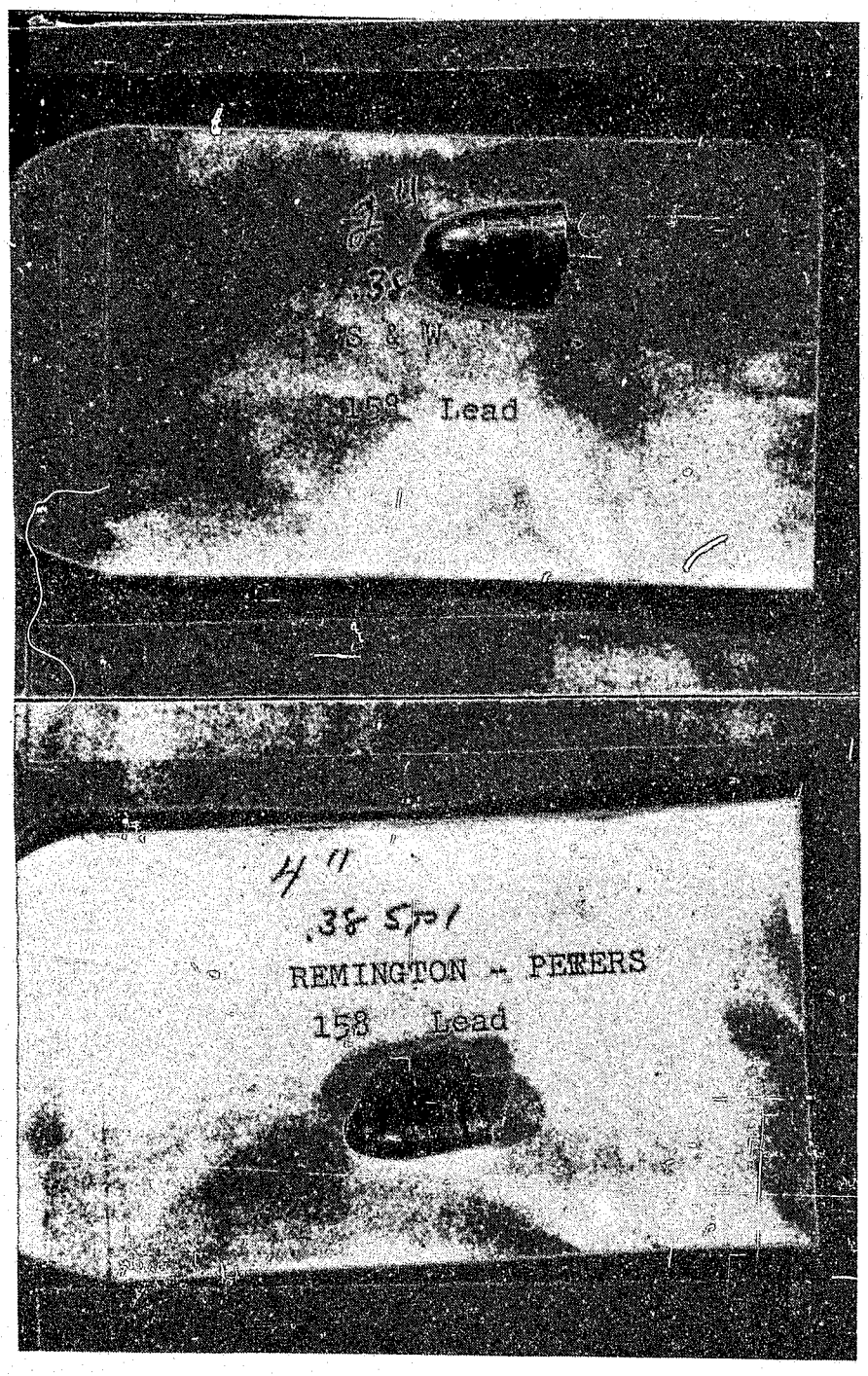




This round was only tested in 2 1/2" barrel. As with the WW-110 gr. JHP, this is too light for reliable performance.

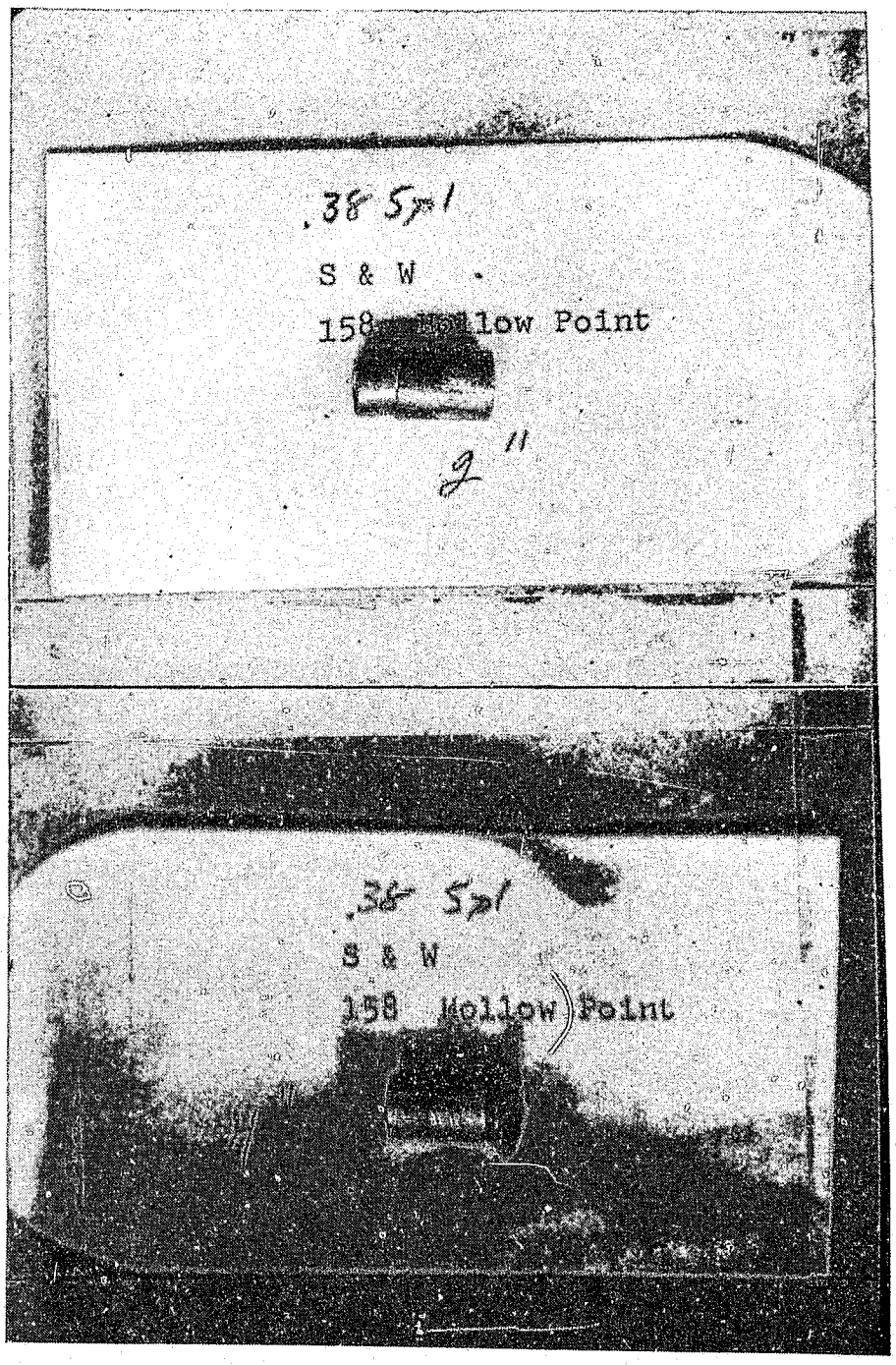
This round was the only 9 mm JHP which chambered reliably. Note that this is two bullets; the other mushroomed.

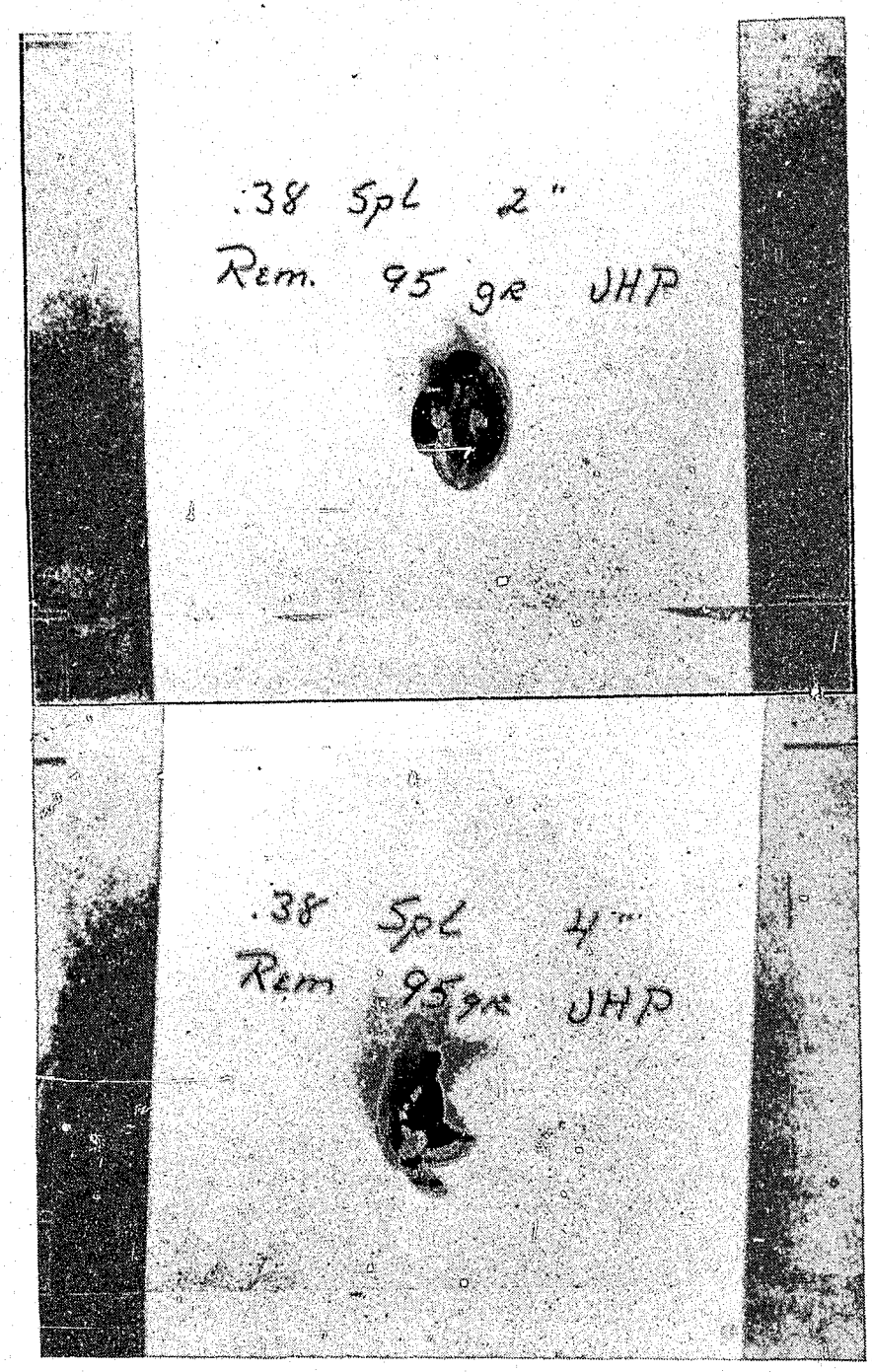




The 158 gr. RNL round is the traditional .38 Spl. loading. It is lightly powered to provide a margin of safety in old and obsolete weapons. These test samples show absolutely no deformation. The ricochet value of this cartridge is high. It is the least effective round tested.

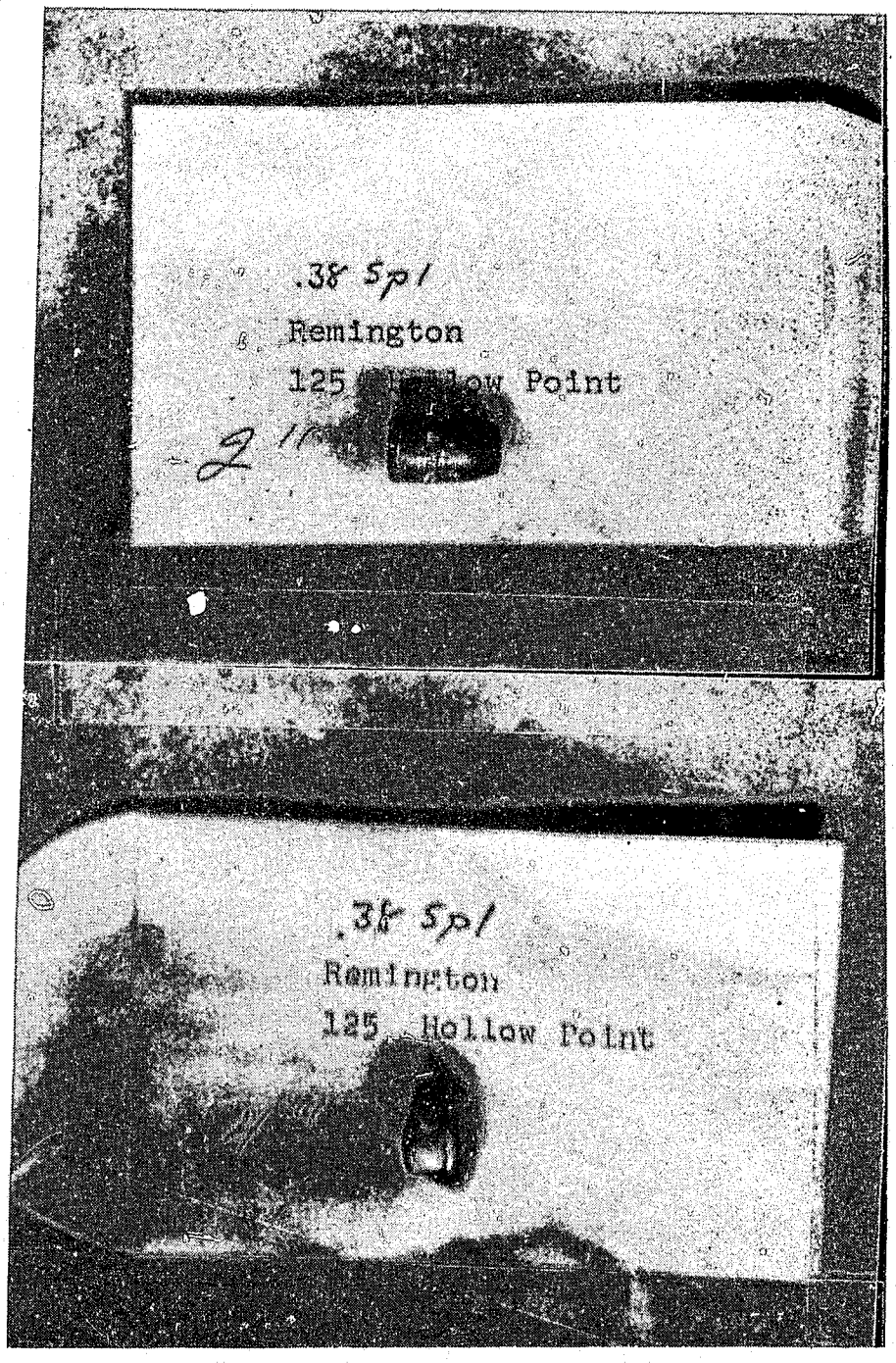
The 158 gr. SWCHP S&W cartridge was the former issue round. Its lack of effectiveness was the precipitating factor in these tests. S&W factory ballisticians admit that it loses 40 % of its velocity in a 2" barrel. It is composed of an alloy with a high level of antimony resulting in excessive hardness.

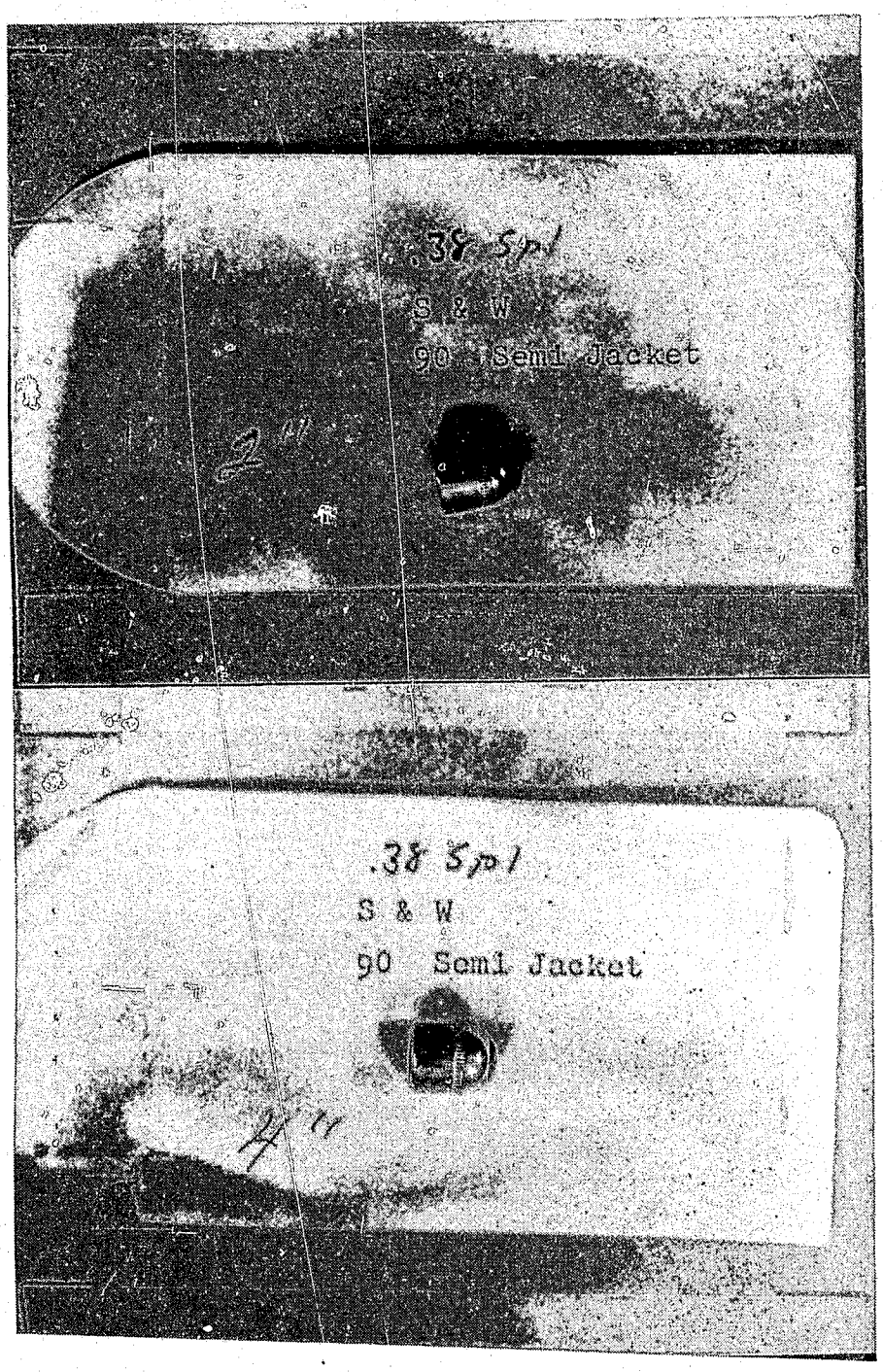




The 95 gr. JHP Remington round demonstrated the highest level of performance in a 2" bbl. It must be noted that the projectile is unstable due to light weight, low sectional density and high speed. However, it is the only round tested which gives adequate performance in a 2" bbl.

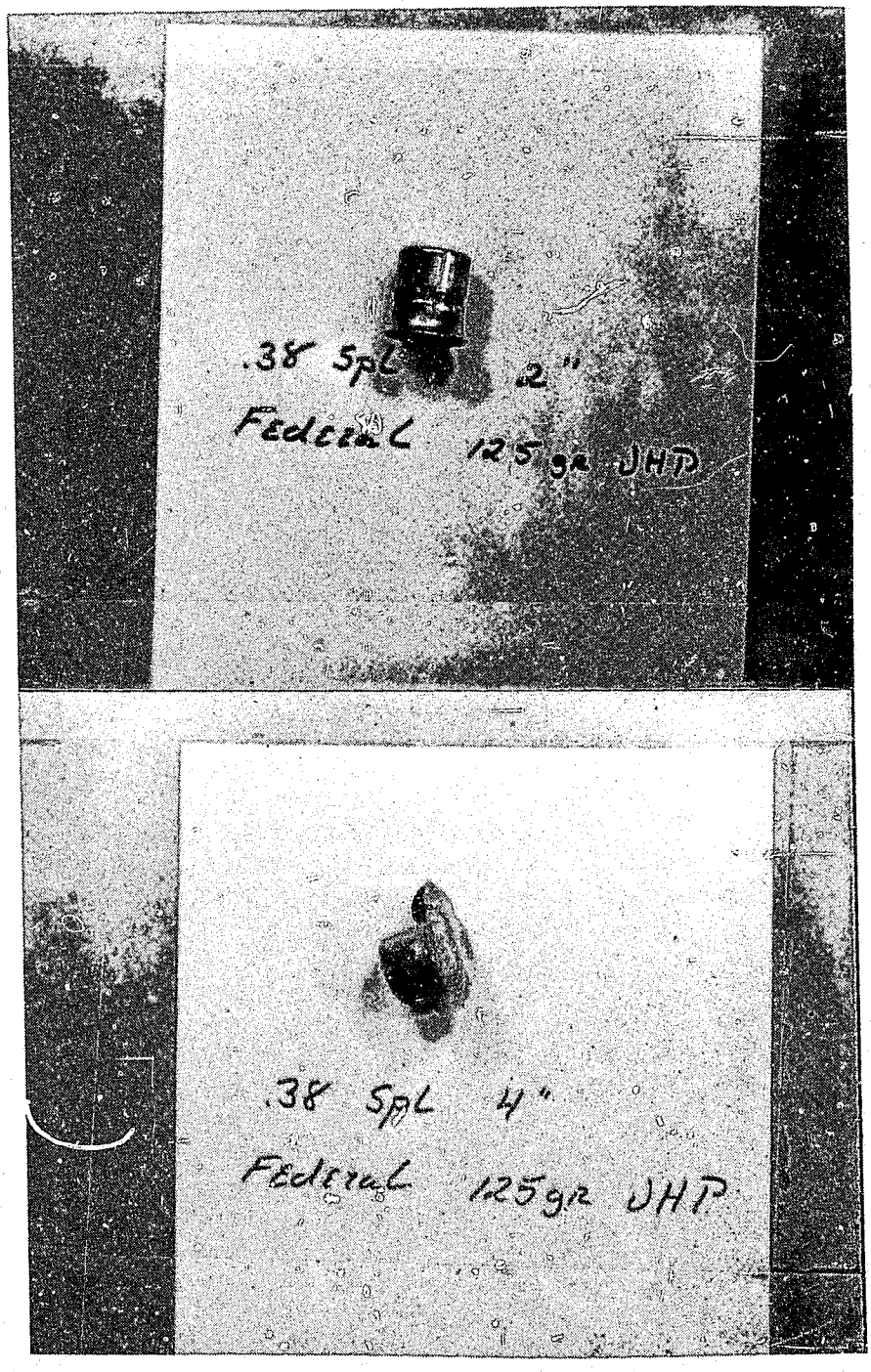
The 125 gr. JHP Remington round demonstrated the highest level of performance in a 4" bbl. Note that it shows no deformation from a 2" bbl. For this reason it should not be carried in any weapon less than a 4" bbl.

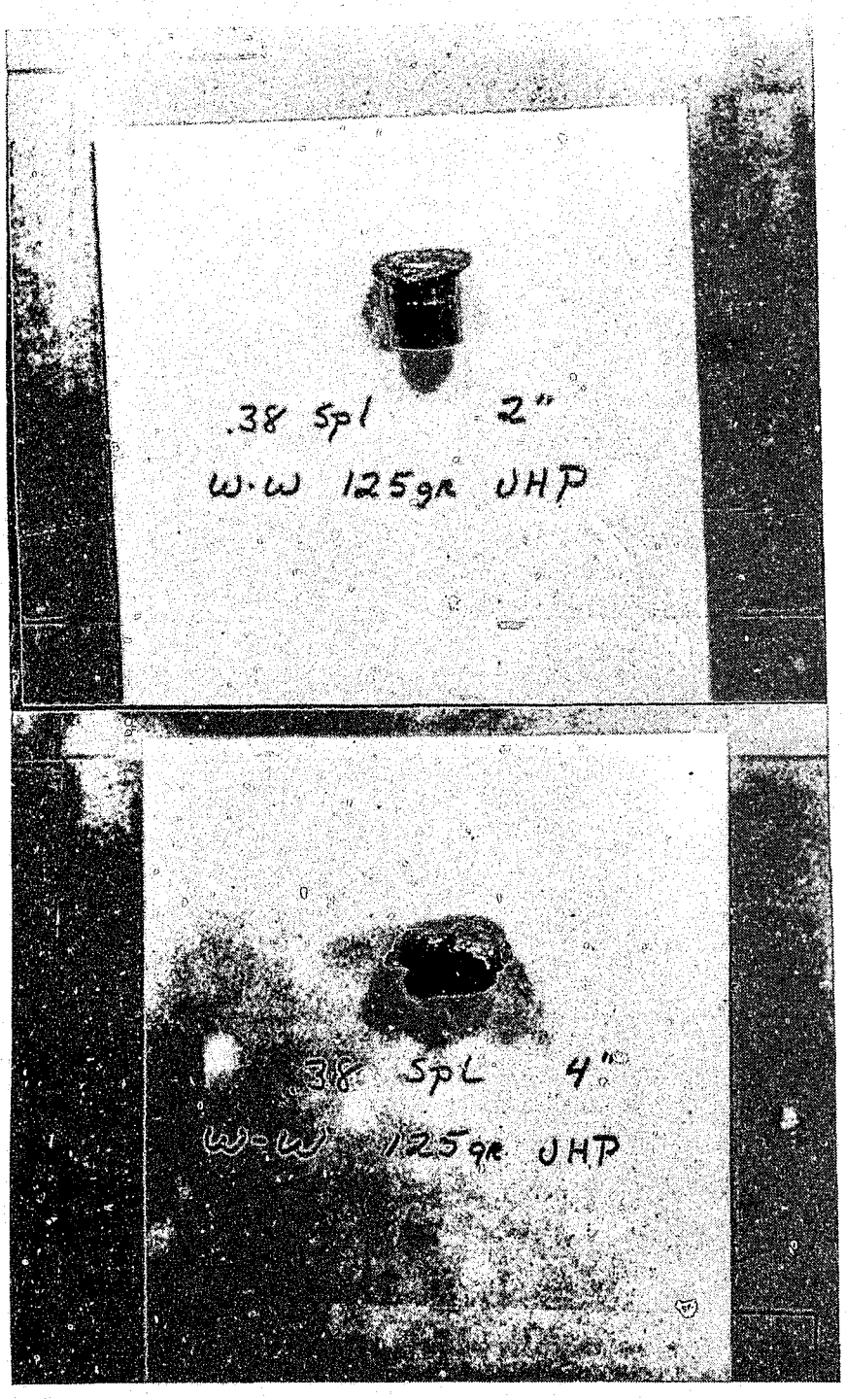




This round is billed as S&W's answer to the 2" bbl. problem.
IT ISN'T!
The bullet fired through the 4" bbl. was later reloaded and fired again. It didn't do any better the second time.

Both the Federal and the Winchester-Western 125 JHP rounds show satisfactory levels of performance through a 4" bbl. However they are both slightly inferior to the Remington 125 gr. JHP.





Both the Federal and the Winchester-Western 125 gr. JHP rounds show satisfactory levels of performance through a 4" bbl. However they are both slightly inferior to the Remington 125 gr. JHP.

APPENDIX II

1. The officer fired one shot from his revolver, striking the suspect in the left shoulder area. The suspect stated that he heard the gun fire and did not realize he was shot until shortly thereafter he observed blood running down the front of his shirt. The doctor stated that it was a through and through wound in the left shoulder, front and back. The cartridge fired was a .38 Special Super Vel. Weapon was a S & W .38, 6" barrel revolver. The travel of the bullet was from the officer's revolver, passing through the suspect's left shoulder, then travelling some distance striking a trailer house, passing through the trailer house wall, into the kitchen area, then striking a cabinet door, passing through same and coming to rest in a blanket. The bullet never expanded and the distortion to the nose was not larger than the diameter of the bullet.

2. The Sergeant gave foot pursuit, ordering the suspect to stop. The suspect stopped, pulled a pistol from his waistband, firing one shot, striking the Sergeant in the waist area. The bullet did not penetrate the cartridge case and the Sam Brown belt. The Sergeant drew his revolver, a S & W Special, 4", and fired six shots from a distance of about eight feet. The suspect, fatally wounded with two shots in the abdomen and two in the upper left arm, remained standing, firing further shots at the Sergeant as he ran for cover. The suspect fell to the ground, came to his feet, pointing the pistol at the Sergeant, and then finally collapsed. Both the Sergeant and the suspect fired .38 Special ammunition.

3. Officer A, being held at gun point, was able to get this information to his partner. Officer B drew his service revolver and moved into a position from which he fired three shots from his .38 Special. The suspect remained standing and fired his .45 pistol. Officer A was struck one time in the abdomen by the suspect's fire and fell to the floor. While pulling Officer A to safety, Officer B fired two more shots into the groin area of the suspect. The suspect still returned shots. He continued to do so until three officers opened fire with shotguns and pistols. Note that Officer A, struck once in the abdomen by the .45 ACP bullet was instantly put out of action.

4. The officer gave foot pursuit. The suspect ran around the corner of a building, turned and was taking aim at the officer. The officer was able to go into a combat stance and fire one round. The round struck the suspect through the shoulder at a distance of about 30 yards. The suspect turned, and ran another 20 yards. The officer fired a second, missing the suspect. The officer fired a third round, which struck the suspect through the right wrist knocking the suspect's weapon 40 feet. Though shot twice with a .38 Special, the suspect again ran and was taken to the ground by the officer. The officer's revolver was a 6" S & W K-38.

5. The officer turned and emptied his revolver at the suspects. His shots struck Suspect A in the chest and stomach causing him to fall to the floor. Suspect B was shot in the left side and the left wrist. The officer's other two shots missed the suspects. Suspect A regained his feet and began firing the shotgun. His shots killed the officer who was trying to reload and wounded several patrons of the bar.

6. Autopsy showed that of the .38 Special bullets fired by Officer A, only one was a flesh wound, the other shots attained complete penetration. No bones were broken by these bullets, and there was little external bleeding. Note that the suspect was able to engage in three hours and five minutes of strenuous and exhausting activity after being shot four times with the .38 Special.

7. Officer A grasped the suspect's pistol in one hand and held it down while drawing his own service revolver with his free hand. Officer A then fired five .38 Special rounds at contact distance into the chest area of the struggling suspect. The suspect fell to the ground still clutching the 9 m/m pistol. Officer A turned to assist Officer B. The suspect then attempted to regain his feet and point his pistol at Officer A. Officer A dropped his empty revolver (this department required officers to leave the chamber under the hammer empty), and lunged for the revolver on the belt of Officer B. With this weapon, he shot the suspect through the head, killing him instantly. Autopsy revealed that none of the five .38 Special shots fired into the suspect's body exited. Several ribs were broken, both lungs penetrated and there was extensive internal bleeding. Note that although the wounds were serious, the shocking effect was not sufficient to prevent the suspect from regaining his feet and attempting to shoot the second officer.

8. Officer A then observed that Officer B was wounded and went to his assistance. Officer B was struck in the forehead by a .38 Special which was deflected by the uniform cap brim to the extent that it resulted in only severe flesh laceration. A total of 15 separate bullet wounds were found in the suspect's body, 11 of which were inflicted while he was concealed in the car. Note that if any one of these 11 rounds had been effective, Officer B would not have been later shot in the head.

END