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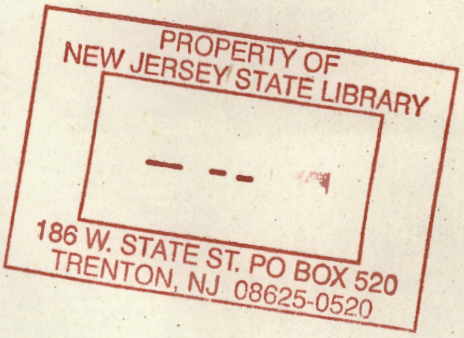


STATE POLICE AMMUNITION

November 13, 1974

DEPARTMENT OF LAW AND PUBLIC SAFETY
Division of State Police

Captain Thomas Tyrell, Commandant
State Police Academy at Sea Girt

STATE POLICE AMMUNITION

The Problem

During the 1960's, increasing concern over the effectiveness of .38 cal. police special ammunition (.158 grain lead bullet) was evident among police officers. Use of this ammunition was questioned principally because of:

- The great increase in violent crime - up 73% from 1960 through 1967. (Annex #1)
- Rapid rise in the number of police officers killed - up from 55 in 1963 to 86 in 1969.
- Cases where police officers shot their assailants and yet were unable to prevent the wounded gunmen from killing them.

These concerns were supported by studies of Allen P. Bristow writing in the Journal on Criminal Law, Criminology, and Police Science in 1962. This work documents repeated instances where criminals and officers were both shot with the .38 special and were able to continue the gunfight or flee.

Bristow, Professor of Police Science at the California State College in Los Angeles, evaluated data detailing the shooting of more than 150 officers.

In one case, two suspects entered a bar armed with a sawed-off shotgun and pistol. An officer, in plainclothes, was able to draw his .38 S & W Special revolver and fire. One suspect was struck in the chest and stomach, the other in the left side and left wrist. The suspect who was hit in the chest and stomach fired his shotgun, killing the officer and wounding several innocent by-standers. Both suspects then fled. Although the suspect with the shotgun died three days later from the wounds to the chest and stomach, he had been able to kill the officer, wound others, run from the bar and exist for three days.

In another instance, an assailant fired several shots at an officer after fleeing from a stolen vehicle. The officer returned fire with his .38 S & W Special revolver and struck the suspect in the left arm, right arm, through the right side and through the flesh at the base of the rib cage. The subject shot the officer in the arm, fled, and was able to engage in three hours and five minutes of strenuous and exhausting activity. The assailant was later killed by another officer. An autopsy showed that three of the .38 S & W Special bullets had attained complete penetration. Had this subject been shot just once in the arm, with an effective round, there is a strong possibility he would have been incapacitated and captured without the loss of his life or injury to the officer. Annex #2 cites other cases in which the .38 S & W Special was ineffective.

Deadly Force

In approaching the problem, preservation of the lives of the law-abiding public, state police, and criminal suspects continued as the central considerations in the use of deadly force of firearms. This conforms with stringent State Police doctrine limiting the use of deadly force to extreme circumstances and then only after all other reasonable means have failed.

The awesome responsibility for the decision to use deadly force is continually stressed in the Division. Equally, conditions under which State Police must refrain from firing are emphasized. Throughout, this doctrine is well within the bounds of current law.

Police Arms

Another important factor in assessing the problem was the evolution of police weapons and ammunition. From the 1930's through the 1960's, the majority of police departments in the country have used the .38 cal. police special, frequently referred to as the ".38 S & W Special." The .38 S & W Special cartridge was developed from the .38 Long Colt, the official United States Service cartridge between 1894 and 1911. The ballistics of these two rounds were similar. The military found, during the Phillippine operation (1899-1900), that the .38 Long Colt was unable to stop Moro warriors. Tests discredited

this round and established that any service cartridge submitted for adoption by the government be of .45 caliber.

Although similar to the ineffective .38 Long Colt, the .38 S & W Special was adopted by police organizations because of its mild recoil, accuracy in target shooting, economy in reloading and availability. There is no evidence the effectiveness of the round was considered.

Subsequently, the firearms industry developed three weapons which possess stopping qualities lacking in the .38 S & W Special, the .357 magnum, .41 magnum and .44 magnum. The .357 magnum was introduced in 1935 by Smith and Wesson, producing 845 foot pounds of energy at the muzzle compared to the 415 of a .38 cal. round. In the mid 1950's, a 44 magnum was developed. This weapon produced 1150 foot pounds of energy at the muzzle, but was considered by many to have excessive recoil. The .41 magnum appeared in 1964. This compromise between the .357 and .44 magnums had less recoil than the larger .44 magnum. A 210 grain bullet produced 1193 foot pounds of energy at the muzzle. All of the magnums possessed considerably more muzzle energy, a criteria for stopping power, than the .38 cal. S & W Special.

In 1963, Super-Vel Corp. developed and marketed the first hollow-point ammunition (110 grains) which came into wide use in the United States. With acceptance of this ammunition, other manufacturers began production later in the decade.

In 1970, the Division reviewed the situation and made preliminary tests. Results were inconclusive and ammunition was not changed.

State Police Study

The continuing increase in police officers killed, up from 86 in 1969 to 114 in 1972, plus the wounding of two troopers in 1971, required the Division to again study the problem in 1973. Meanwhile during the study year, the toll in officers killed rose to 131, including the death of Trooper Werner Foerster. Trooper Foerster was incapacitated by a shot through the arm and chest with Super-Vel hollow-point ammunition and then killed by a bullet to the head with his service revolver. Trooper Harper was wounded during the same attack, by three assailants using more effective ammunition than the troopers.

Study Highlights

In assessing the problem, accuracy was a prime selection factor. Changing to a higher caliber weapon would have reduced accuracy because of greater recoil, even though relative stopping power would have been increased. Table #1 summarizes recoil and

and relative stopping power of various caliber ammunition in relation to muzzle velocity. Table data was developed by Bob Wallack, using manufacturers data, and appeared in "The Gun Digest", published in 1965 by Digest Books, Inc., Northfield, Illinois.

TABLE I

STOPPING POWER AND RECOIL

Cartridge	Bullet (grains)	Muzzle Vel. (ft./sec.)	I.R.S.P.*[1] 38 Spec. = 100	Recoil (ft. - lbs.)
.38 Special	158	855	100	3.3
.357 Magnum	158	1430	193	6.3
.44 Special	246	755	193	4.0
.45 Auto.	230	850	207	4.3
.44 Magnum	240	1470	457	16.3
.41 Magnum	210 SP	1500	371	12.5
.41 Magnum	210	1000	250	5.3

Another critical factor is the danger of ricochet accidents to the public. This is a product of velocity and the type of bullet used. Conventional bullets generally ricochet more than those designed with greater breakup and blunter configuration. This unique characteristic adds greatly to the desirability of this ammunition in that it significantly decreases the possibility of inflicting injury to innocent citizens.

1. Index Relative Stopping Power, Smith & Wesson, Springfield, Mass.

Additional considerations on changing revolvers included increased costs, $120.00 for a .357 magnum vs. $95.00 for the .38 now used (estimated cost for re-equipping the Division is approximately $186,000), delay in acquisition and the need to retrain all members of the Division.

These considerations, together with the fact that a single weapon has not been accepted as best for police service, combined to eliminate changing the caliber of the service revolver in response to the problem. As a result, the study was directed towards selecting more effective ammunition. Initial screening was based on police test ratings of the ten most widely used. .38 Special handgun loads, sponsored by Remington Arms Co., Inc., which is summarized in Table II.

TABLE II

POLICE TEST-RATINGS OF THE 10 MOST WIDELY USED
.38 SPECIAL HANDGUN LOADS

AMMUNITION BRAND BULLET WEIGHT AND TYPE	HYDRO-STATIC SHOCK	PENE-TRATION IN WOOD	LEAST RICO-CHET FROM HARD SURFACE	LEAST RICO-CHET FROM SOFT SURFACE	BULLET BREAKUP FROM STRIKING HARD SURFACE	BULLET BREAKUP FROM STRIKING SOFT SURFACE	VELOCITY FEET-PER-SECOND	SCORING TOTAL 0-1 POINTS PER TEST. POSSIBLE OF 80
Brand "A" 110-Grain Jacketed Hollow-Point	8	6	8	6	8	6.5	1370 7.5	50.0
Remington 125-Grain Semijacketed Hollow-Point	8	6.5	7	5.5	7.5	6	1350 7.5	48.0
Brand "A" 125-Grain Jacketed Hollow-Point	8.5	6.5	7.5	7.5	8	6.5	1370 7.5	52.0
Brand "C" 125-Grain Round Soft-Point Jacketed	6	5.5	5	4.5	5.5	4	1060	30.5
Remington 158-Grain Semijacketed Hollow-Point	7	6	5	4	6	5	1140 5.5	38.5
Brand "B" 158-Grain Hollow-Point Lead	6	5	5	4	5.5	4	1060 5	34.5
Brand "B" (and Remington) 158-Grain Lead	2	4	3	4	3	1	855 3	20.0
Brand "B" (and Remington) 200-Grain Lead	2	3.5	2	4.5	2	0.5	730 2	16.5

Information supplied by other sources, which have not given express permission to release the data, substantiated the superiority of the 125 grain semijacketed hollow-point bullet. For further confirmation, tests on this ammunition were conducted by the State Police Training Bureau, to the extent possible. These concentrated on demonstrations of accuracy, bullet breakup and ricochet. Also tested was 158 grain high speed ammunition. This was added to the evaluation to compare ricochet characteristics of a bullet with greater stopping power but without the hollow-point semijacketed configuration. The 125 grain hollow-point semijacketed ammunition was found to have less ricochet than either the 158 grain bullet or the ammunition issued to the State Police at the time. Annex #3 gives test details. Table III summarizes other characteristics.

TABLE III

PRIMER NUMBER	WEIGHT GRAINS	BULLET STYLE	MUZZLE VELOCITY FEET PER SECOND	ENERGY IN FOOT POUNDS (muzzle)
1½	158	T' Master lead, ball (State Police issue)	855	255
1½	125	Semijacket hollow point	1160	375
1½	158	Lead, Ball High Speed	1090	415

NOTE: Variation between muzzle velocities here and in Table II, page 7, result from variations in test conditions for data as supplied by the manufacturer.

The net effect of the new ammunition when used against a person was an important consideration.

It should be noted the present ammunition utilized by the United States Military and other Allied Nations, although fully jacketed and non-hollow pointed has a more destructive effect on the human body due to the higher velocity than does the present semi-jacketed hollow pointed low velocity ammunition.

It is fair to say that the increased stopping power of hollow-pointed semijacketed ammunition may cause death if vital areas are penetrated. However, conventional bullets will produce the same extreme result if the wound path traverses through vital areas. Obviously, all bullets will have a fatal effect if they penetrate a vital area.

The critical point in this connection, is the fact that 125 grain hollow-pointed semijacketed ammunition will generally incapacitate a person if struck in a non-vital area, thereby, limiting the potential number of rounds that would be exchanged by both the police officer and the felon. Consequently, lowering the chance of innocent persons being wounded or killed because of a protracted exchange of rounds. Although case studies indicate that individuals shot with conventional unjacketed lead .38 special ammunition could sustain several hits

in non-vital areas and continue to endanger life be it police officer or innocent citizen. It is further noted that in many of these case histories, the felon eventually expired as a result of multiple hits. However, it is reasonable to assume if the felon would have been incapacitated or stopped by a single non-vital hit, the necessity for additional hits would be negated and the possibility of death to the assailant and others, (police and innocent citizens) reduced.

Public Criticism

The present 125 grain, semijacketed hollow-pointed round has been commonly referred to as a "dumdum" bullet. This is a misnomer. This round cannot be compared with the crude "dumdum" bullet which first appeared in the 1850's. A "dumdum" round, manufactured at a British Arsenal in Calcutta, India, was an unjacketed lead projectile with the point filed flat, which produced an uncontrolled mushrooming effect on impact. This "dumdum" projectile, which inflicted severe wounds cannot properly be compared to the present ammunition inasmuch as the design of the present round controls expansion and is semijacketed.

The often referred to International Agreement cited as a source of prohibition on certain ammunition is not the Geneva Convention but rather the Hague Declaration of 1907, signed by President Theodore Roosevelt in 1909. In article 23, it is specifically forbidden, forbidden, "To employ arms, projectiles, or material calculated to

cause unnecessary suffering." However, flame throwers, land mines, fully automatic weapons, time exploding grenades and ammunition, which have devastating effect on human life are not specifically covered.

Critics also raise the possibility of accidental discharge or bad aim by the police. These possibilities are reduced by the great accuracy of the weapons and ammunition used and the quality of training, both pre-service and on-going in-service, received in State Police. This concern is further diminished by the fact that most police shoot-outs (75%) occur at distances ranging from one to ten feet, as shown in Annex 4.

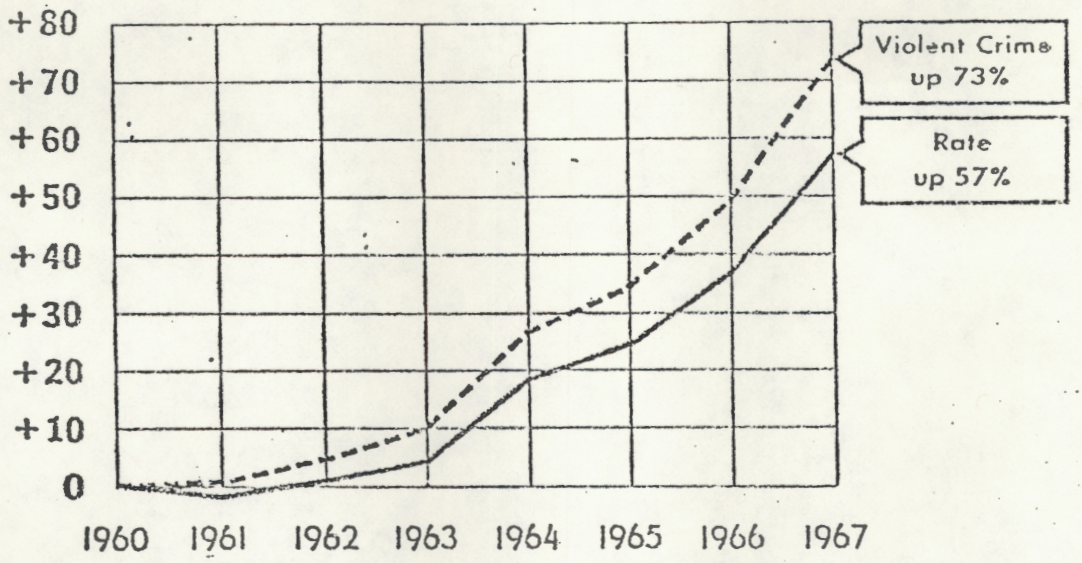
Conclusion:

Based on all considerations summarized in this document, 125 grain hollow-point semijacketed ammunition was adopted for use on an interim basis, effective June 1, 1973. The Division will continue studying the problem and evaluating new police weapons and ammunition. In doing so, all factors bearing on the problem will be considered. In the event weapons or ammunition are developed which prove more suitable for police service than those now used by the Division, changes will be made as soon as possible.

CRIMES OF VIOLENCE

1960 - 1967

PERCENT CHANGE OVER 1960



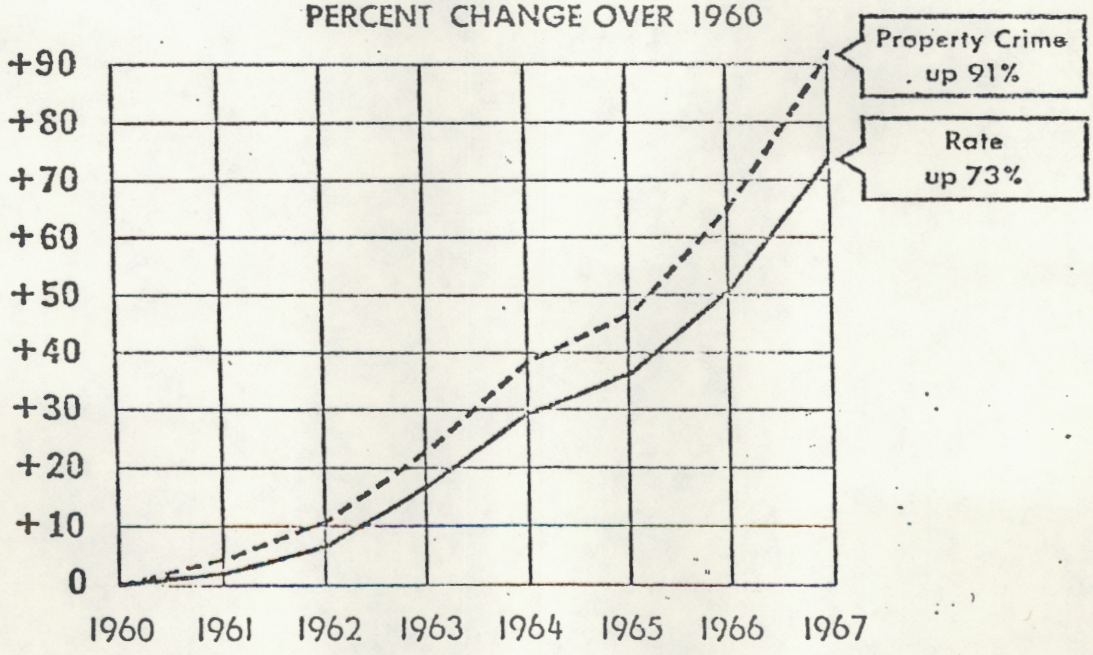
LIMITED TO MURDER, FORCIBLE RAPE, ROBBERY AND AGGRAVATED ASSAULT

FBI CHART

CRIMES AGAINST PROPERTY

1960 - 1967

PERCENT CHANGE OVER 1960



LIMITED TO BURGLARY, LARCENY $50 AND OVER, AND AUTO THEFT

FBI CHART

WHICH CARTRIDGE FOR POLICE*

Allen P. Bristow

During 1959, Police Science students at Los Angeles State College began collecting case studies of peace officers shot in the line of duty. To date over 110 cases have been collected which describe in detail the shooting of more than 150 officers. These cases are being evaluated in an attempt to develop training material on police tactics.

During the preliminary evaluation of these case studies an interesting and unexpected by-product became apparent. In repeated instances, both criminals and officers who were shot with the .38 S & W Special were able to continue the gunfight or flee. In a number of cases the shooting of the officer was accomplished by a criminal who had been shot several times by the officer. At this time the researchers have identified police use of the .38 S & W Special cartridge as one of a number of elements which contribute to the shooting of officers in the study. While statistical data is still pending on the pilot study, several cases are so outstanding that they will be of interest to police and civilian shooters alike. These cases have been edited to obscure the identity of the participants and include only information on the actual gunfight.

Case #5. Suspect "A" and suspect "B" entered a bar, exhibited a sawed-off shotgun and pistol, and ordered the occupants to line up facing the wall. One of the occupants was an officer in plain clothes, and as he faced the wall he was able to draw his .38 S & W Special revolver unnoticed by the suspects. The officer turned and emptied his revolver at the suspects. His shots

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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. Both suspects then fled from the bar on foot. These suspects were arrested the next day while seeking medical aid for their wounds. Suspect "A" died within three days of wounds in the stomach and lung. Suspect "B" recovered and was sentenced to death for his part in the crime. Note that suspect "A," although shot in the stomach and lung, was able to get back up, shoot the officer and others, run from the bar, exist one day while seeking medical aid, and then live for two additional days under medical care.

Case #36. Officers "A" and "B" forced a stolen vehicle to the curb at 1:25 A.M. which contained three suspects. One suspect fled into an alley and was pursued by Officer "A." This suspect drew a .32 caliber automatic pistol, turned and began firing at Officer "A." Officer "A" drew his .38 S & W Special caliber service revolver and fired four shots at the suspect before being struck in the arm, which caused him to drop his weapon. In this exchange the suspect was shot in the left arm, in the right arm, through the right side, and through the flesh at the base of the rib cage. The suspect then fled the scene leaving Officer "A" incapacitated. An immediate search of the area was begun by additional officers. At 2:10 A.M. the fleeing suspect forced a motorist from his vehicle, robbed him, and unsuccessfully attempted to drive off in the car. At 2:30 A.M. a patrol car crew observed the suspect in a field two miles from the location of the shooting and chased him on foot until he was lost in the darkness. At 3:00 A.M. the suspect stole a car and was able to escape from the search area. A state patrolman observed the suspect in the stolen auto at 4:00 A.M. and began pursuit. This high-speed chase lasted until 4:30 A.M. (thirty minutes) when the suspect skidded the stolen car into a ditch. The suspect fled into a field, and the state patrolman continued pursuit on foot. Apparently exhausted and weak, the suspect turned and aimed his .32 automatic at the officer. The officer drew his

.357 Magnum and shot the suspect through the head, killing him instantly. Autopsy showed that the .38 S & W 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 S & W Special.

Case #47. Officer "A" and Officer "B" approached two suspects in a parked car. The suspects were removed from the car for investigation. One suspect drew a 9 mm automatic from a hidden holster and commanded the officers to throw up their hands, which they did. Both officers attempted to reason with the suspect, and failing at this, they leaped at the suspect in an attempt to disarm him. The suspect fired once, fatally wounding Officer "B" through the chest. 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 S & W Special rounds at contact distance into the chest area of the struggling suspect. The suspect fell to the ground still clutching the 9 mm 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 service 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 S & W 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.

Case #69. Officer "A" and Officer "B" observed a vehicle being driven in a suspicious manner and approached the driver. The driver began firing at the officers while he was sitting in the car, and the officers returned his fire through the doors and windshield at a distance of approximately 15 yards. Both

the officers and the suspect were using .38 S & W Special revolvers. Officer "A" fired six rounds through the windshield and reloaded behind another car. Officer "B" fired two shots through the rear window and several into the body of the car. The suspect then ran from the car, firing at Officer "B," who returned his fire. Officer "A" then fired four rounds into the suspect's back and side. At this point the suspect fell to the ground, fatally wounded. Officer "A" then observed that Officer "B" was wounded, and went to his assistance. Officer "B" was struck in the forehead by a .38 S & W Special, which was deflected by the uniform cap brim to the extent that it resulted in only severe flesh laceration. A total of fifteen separate bullet wounds were found in the suspect's body, eleven of which were inflicted while he was concealed in the car. Note that if any one of these eleven rounds had been effective, Officer "B" would not have been later shot in the head.

Case #29. The suspect was surprised by a patrolman while committing robbery in a liquor store. He shot the policeman five times and fled the store. The suspect ran through an alley and in emerging, was cornered by two other officers. In effecting the arrest, the patrolmen shot the suspect through the right leg. The suspect was placed in an ambulance and, while en route to the hospital, disarmed and shot one transportation officer and fled from the vehicle. In this struggle the suspect was shot three times by another officer with a .38 S & W Special in the right hip, in the right leg, and in the neck. The suspect then entered a taxicab which was soon surrounded by officers. In the gunfight which followed the suspect was shot in the left leg, the chest, and in the right arm. The suspect, then unable to fire his weapon, was subdued after a struggle with the officers. The hospital report showed seven separate .38 S & W Special bullet wounds. The suspect lived, and was sentenced to life imprisonment for homicide of a police officer.

Case #X3. (Note that this case is from another collection in which the officer was not shot, but assaulted with a knife.) Officer "A" and Officer "B" were attempting to subdue a crazed suspect armed with a knife. Officer "A" finally decided that it was necessary to shoot the suspect as he advanced. The officer

began firing at the suspect with his .38 S & W Special at a distance of approximately 20 feet. The first round struck the suspect in the right chest, passing through the lung and lodging next to a rib near the spine. The suspect continued to advance and Officer "A" shot him in the left chest. This shot punctured the lung, and exited through the back. As the suspect continued to advance, Officer "A" shot him in the stomach; the bullet also penetrated the upper right pelvis. The suspect now was directly in front of the officer, continuing to advance, with the knife held high over his head. The officer fired at point-blank range, and this round went through the abdomen, lodged in the tailbone, knocking the suspect to the ground. Had this fourth round not had effect, the officer would most certainly have been assaulted. The suspect revived later and struggled with officers en route to the hospital, but died shortly thereafter.

These cases were admittedly selected from among many others because of their spectacular nature. However, if these cases of ineffective firepower occur with a frequency sufficient to make them significant in a study limited to situations where an officer was shot, what is the probability of their occurrence in the far more frequent gunfights where an officer is not injured?

The .38 S & W Special cartridge was developed from the .38 Long Colt, which was an official United States Service cartridge for some time (1894-1911).[1] Their ballistics are somewhat similar as indicated in Table I.

TABLE I

Cartridge	*Bullet Grains*	*Muzzle Velocity*	*Muzzle Energy (ft.-lbs.)*	*½" Pine Boards Penetration*
.38 Long Colt	150	785	205	6
.38 S & W Special	158	870	266	7

The United States Service cartridge (.38 Long Colt) became very unpopular during the Philippine operation (1899-1900) because of its inability to stop Moro warriors. An Ordnance Board undertook extensive testing in an attempt to select a more

[1]Smith, Walter H. B.: *Pistols and Revolvers, Volume I, The N.R.A. Book of Small Arms.* Harrisburg Military Service Publishing Co., 1948, pp. 347-49.

effective cartridge. These tests were conducted by Colonel Louis A. La Garde on soft wood, clay, animal carcasses, and human cadavers. The results of these tests, and others, discredited the .38 United States Service cartridge, and established the requirement that any service cartridge submitted for adoption by the government be of .45 caliber.[2]

The .38 S & W Special, however, became quite popular with civilian and police groups because of its accuracy and mild recoil. It continues to be popular although many authorities have come to feel that it is obsolete in some respects.[3]

The results of the pilot study, or for that matter, the previously described cases, indicate that police administrators may well wish to reevaluate the standardized service cartridge. If they choose to do so, what alternatives are available?

The firearms industry has developed two revolver cartridges designed specifically for man-stopping qualities and vehicle penetration: the .357 and .44 Magnum. The .357 Magnum has been available to law enforcement agencies since the mid-1930's, yet only a few agencies have adopted it or permit its use by officers. Police administrators fear the extensive range and penetration of Magnum cartridges with respect to civil liability.

Another alternative is the adoption of a larger caliber revolver, which would be a more effective man-stopper, but which has a short range and limited penetration. Several common commercial calibers are available which meet these requirements, the most obvious of which is the .45 ACP or Auto-Rim. It is also possible that our firearms manufacturers could develop a new cartridge, designed solely to fit police needs.

Both of the above alternatives involve a change in sidearms, and for this reason would be unpopular with individual officers and city treasurers. A third alternative might be to develop a man-stopping cartridge from the .38 S & W Special caliber.

Police thinking in this country seems to cling to the Geneva Convention limitations on military weapons. Actually, as far as

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[2]Bady, Donald B.: *Colt Automatic Pistols.* Beverly Hills, Fadco Publishing Co., 1956, p. 33.

[3]N.R.A. Staff: Loads for the .38 S & W Special. *The American Rifleman, 109*:27, March, 1961.

can be determined locally, no restrictions exist with respect to civilian police use of bullets which are (1) hollow-point, (2) soft-nose, or (3) explosive. This alternative would seem to be the most economical, but probably the least acceptable to the public.

This article was intended to stimulate thinking on the subject. Is there actually a problem? Is the .38 S & W Special an ineffective police cartridge? Should police agencies change the caliber of their sidearms? Which caliber should be selected? And these questions, of course, must be answered only after extensive research, conducted by an independent, unbiased institution.

ANNEX #3

The Practical Pistol Course was fired by several firearms instructors to determine the accuracy of each type cartridge. There was no appreciable difference in accuracy noted between any of the cartridges when fired in 2", 3", and 6" revolvers.

Test firings indicated slight increase in recoil when firing the .125 grain SJHP and .158 grain high speed round as compared to the standard .158 grain bullet. When firing a weapon loaded with three rounds of .125 grain SJHP and .158 grain high speed cartridges, it was impossible to distinguish between the recoil of the two.

The tests indicate the .125 grain semijacketed hollow-point round was superior to the other two rounds tested, particularly in the area of break-up characteristics and lack of ricochet.

Details appear on the following pages.

On March 13, 1973, tests comparing the .38 cal. 158 grain, ball, cartridge, used by the Division of State Police, with the .38 cal. 125 grain, semijacketed hollow-point, cartridge and the .38 cal. 158 grain, ball, high speed cartridge, were conducted at the New Jersey State Police Training Center, Sea Girt, New Jersey.

Tests were conducted to determine ricochet potential, break-up characteristics, accuracy and recoil of the three different cartridges.

The first test compared the ricochet potential of the three rounds after striking a 1/8" steel plate.

1. 3 rounds of standard 158 grain fired at 50 yards - The rounds scratched the plate but there were no dents.
2. 3 rounds of 125 grain S.J.H.P. fired at 50 yards - There were two large dents in the plate and one round split the plate.
3. 3 rounds of 158 grain, high speed, ball, fired at 50 yards - There were three large dents in the plate, but none of the rounds split the plate.

It was noted on the above test that the 158 grain, ball, cartridges, standard and high speed, ricocheted from the plate and could not be found. Small pieces of the 125 grain S.J.H.P. were found in front of the plate along with the copper jackets from each round.

ANNEX #3 (CONT'D.)

Tests were conducted by firing from a 15 and 45 degree angle on a 1/8" steel plate to attempt to show how the different cartridges react when striking an object where there is little chance of penetration. The results were as follows:

1. 3 rounds of standard 158 grain fired at 15 degrees from 7 yards -
   Small scratches on plate. No penetration. Bullets could not be found.

2. 3 rounds of 125 grain S. J. H. P. fired at 15 degrees from 7 yards -
   All three rounds dented the plate. There was no penetration. The cooper jackets and small pieces of lead were recovered directly in front of the plate.

3. 3 rounds of 158 grain high speed, ball, fired at 15 degrees from 7 yards -
   All three rounds dented the plate. There was no penetration. One of the three rounds was recovered approximately 15 feet from the plate.

4. 3 rounds of standard 158 grain fired at 45 degrees from 7 yards -
   Small scratches on plate. No penetration. Bullets could not be found.

5. 3 rounds of 158 grain, high speed, ball, fired at 45 degrees from 7 yards -
   All three rounds dented the plate. There was no penetration. Bullets could not be found.

6. 3 rounds of 125 grain S. J. H. P. fired at 45 degrees from 7 yards -
   All three rounds dented the plate. No penetration. Two of the three cooper jackets were found along with small pieces of lead, approximately 5 feet from the plate.

LAW ENFORCEMENT OFFICERS KILLED BY FIREARMS - 1973
DISTANCE BETWEEN VICTIM OFFICER AND OFFENDER

Feet	Number of Officers
1 - 5	66
6 - 10	27
11 - 20	13
21 - 50	8
Over 50	10

FBI UNIFORM CRIME REPORTS