Exhibit 10

to

Plaintiffs' Cross-Motion for Summary Judgment

and

Opposition to Defendants' Motion for Summary Judgment

DECLARATION OF GARY K. ROBERTS, DDS

I, Gary K. Roberts, DDS, under penalty of perjury, declare and state as follows:

1. I am over the age of 18, have personal knowledge of the facts and events referred to in this declaration, and am competent to testify to the matters stated below.

2. I am enclosing a copy of my expert report in this matter, dated December 13, 2013, the contents of which are, to the best of my knowledge and belief, true and accurate.

3. In addition to the expert opinions proffered in my expert report, there are additional facts and opinions I hereby offer to rebut incorrect statements of fact and/or conclusions advanced by the Defendants in this case.

4. A pistol grip on a long gun allows for more accurate and consistent (and, therefore, safer), firing from a shoulder mounted position. Simply take a look at the way the hand works and it is obvious that it is quite hard to hold a rifle with a pistol grip at hip level. Pistol grips are not designed to allow for so-called "spray firing" from the hip. In fact, a pistol grip actually impedes firing a rifle from the hip. Nearly a century ago around WWI, U.S. military personnel were instructed on how to hip fire the M1897 Trench Gun and the M1918 BAR--neither had a pistol grip. Military riflemen generally found the hip fire technique to be inaccurate and ineffective, so they are no longer taught to use it. The Army Field Manual FM 3-22.9 "Rifle Marksmanship M16/M4 – Series Weapons" does not list or recommend firing rifles from the hip, even though both the M16 & M4 have pistol grips.

5. There is nothing ballistically special or different about a .223/5.56mm bullet whether fired from an AR-15 or some other rifle of the same caliber. The round is the round. As I explain in my report, .223/5.56mm can actually be considerably less dangerous to law enforcement officers than many other readily available centerfire rifle rounds. The soft body

armor commonly worn by law enforcement officers will not stop the vast majority of centerfire rifle rounds, and is really only designed to stop handgun rounds from penetrating.

6. Despite ignorant comments to the contrary by some misinformed individuals, .223/5.56mm bullets typically demonstrate less, not more, penetration after passing through building structural materials than common handguns, shotguns, and rifles chambered in other law enforcement service calibers and civilian hunting calibers. This has been demonstrated numerous times by law enforcement agencies such as the SDSD, LAPD, CHP, DEA, FBI, BATFE.

7. Just like with soft body armor, bullet resistant glass can be defeated by common hunting munitions as well or better than those firearms classified as "assault weapons" in Maryland.

8. Compared with other common handgun bullets, rifle ammunition, and defensive shotgun projectiles (buckshot and slugs) used for duty and hunting, almost all .223/5.56mm bullets fired from AR15's offer reduced downrange penetration hazards, resulting in less potential risk of injuring innocent citizens and reduced risk of civil litigation in situations where bullets miss their intended target and enter or exit structures.

9. When comparing issued handgun, shotgun, and rifle ammunition, the FBI has explicitly stated that the duty .223/5.56mm load used in their AR15's was the only ammunition that offered ideal penetration of 12-18 inches in all test events, that the issued .223/5.56mm had no over-penetration issues compared with the other service caliber handgun, shotgun, and rifle ammunition tested, and that .223/5.56mm was more consistent in performance than all the other calibers. This is in sharp contrast to, and completely refutes, the false claims that the .223/5.56mm ammunition used in AR15's increases the threat of stray bullets harming innocent

family members, neighbors, and passersby. In actuality, the facts clearly demonstrate that the .223/5.56mm AR15 is likely the safest and most effective defensive weapon for both civilians and LE officers to use in urban or suburban environments.

10. The recent FBI bulletin on Active Shooter Events (ASE) identified 110 such ASE from 2000-2012. 40% of the ASE's included in the study occurred at businesses and 29% occurred at schools - both areas where firearm possession is typically banned. In 59% of the cases, the most powerful weapon possessed by the shooter was a handgun, while in 25% of ASE it was a rifle of some type. The median number of people shot in all these ASE was five. The median LE response time was a rapid 3 minutes, yet despite the quick arrival of LE, in 49% of the cases, the attacker had stopped by the time LE arrived at the scene. One of the main recommendations in the FBI report is for victims of ASE to fight back if they cannot egress from the situation, which is much harder to do if the potential victims have been essentially disarmed.

11. 60% of pistols sold in the United States over the past several years have a magazine capacity in excess of ten rounds. The most popular and widely sold rifle in America is the AR15, accounting for 20% of rifles sold. According to the most recently release BATFE statistics from 2012, over 1 million AR15's were sold that year. Sales increased in 2013. "Assault weapons" are quite common and popular. Certainly the AR15 is the most popular rifle currently sold in the United States and some 25 million Americans have been trained to safely use one in the course of their military service to our Nation.

12. The military .223/5.56mm cartridge was derived from the civilian varmint hunting .222 Remington cartridge. Some military 5.56mm ammunition does fragment, but this mechanism of action was not fully understood until the mid 1980's, nearly 30 years after the

cartridge was designed. Typical .223/5.56mm loads generally do much LESS damage to the body than almost all common civilian hunting ammunition.

13. Commissioner Batts is incorrect in stating that the Baltimore Police Department issues the 10mm Glock 20; in fact their issued handgun is the .40 S&W Glock 22.

14. It is important not to overestimate, or overstate, the actual amount of firearm training a law enforcement officer may receive. In my experience, most LE agencies receive minimal firearms training and ongoing practice. It is not uncommon for LE officers to fire fewer than 500 rounds per year. For example, LAPD officers issued AR15's only fire 200 rounds per year through their rifle in training and qualifications. Even SWAT officers may shoot only 5000-10,000 rounds per year. By contrast, Force Recon and Special Operations Capable Marines trained at Special Operations Training Group (SOTG) Range 130, Camp Pendleton, CA often shot in excess of 25,000 rounds each during a year's training. Personnel at other U.S. SOF units have shot up to 100,000 rounds per person in a year of training. Even civilian competitive target shooters often shoot over 30,000 rounds per year while practicing for matches.

15. Chief Batts asserts that "one lesson learned from the Navy Yard shooting was how difficult it was for law enforcement to maneuver assault weapons down the narrow hallways and the corridors between partitions in that office building." Yet, Chief Batts has described how his SWAT team used AR15's for "assaulting small structures in which suspects were located". In fact, almost all American law enforcement SWAT teams and military Special Operations units use AR15's for entries, Hostage Rescue (HR), and Close Quarter Battle (CQB) indoors without major difficulties.

16. It is not true that "assault weapons" are disproportionately used to kill police officers as alleged by some sources. The most recent FBI Uniform Crime Report (UCR) from

2011 clearly illustrates that most police officers killed by firearms succumb to wounds from common handguns, while rifles of all types, let alone those classified as "assault weapons", accounted for less than 10% of LE officers killed. In fact, the recently released report "Law Enforcement Officer Deaths: Preliminary 2013" clearly states that more officers (46) were killed in traffic incidents than by gunfire. Furthermore, of the 33 law enforcement officers killed by gunfire in 2013, only 6 were shot by rifles of any type, let alone "assault weapons".

17. A simple, inexpensive, fully legal pump action twelve gauge shotgun with five round capacity using standard 2¾ inch, #4 buckshot can fire thirty-four .24 caliber projectiles with each pull of the trigger. In contrast, an AR15 with a thirty round magazine can only fire one .22 caliber projectile with each pull of the trigger. A shooter would have to fire six thirty round AR15 magazines to exceed the number of projectiles unleashed by the standard five round capacity twelve gauge shotgun. Additionally, ballistic testing has demonstrated that shotgun projectiles that offer adequate penetration in tissue typically will result in over-penetration hazards when fired through interior walls.

18. AR15 rifles are clearly appropriate for both home defense and sporting use, such as competitive shooting and hunting. For the past quarter of a century AR15's have consistently been used by winning competitors at the U.S. Civilian Marksmanship National Match target shooting championships held each year at Camp Perry, Ohio. Likewise, AR15's have become one of the most popular hunting rifles in America for harvesting a wide variety of game, including varmints, feral hog, deer and even elk. Many, if not most, major manufacturers produce AR15s which are specifically configured for hunting. In addition, AR15's are the most commonly used and recommended rifles for defensive use by LE personnel, including municipal agencies like the LAPD, state agencies like the CHP, as well as Federal agencies like the FBI

and BATFE. Numerous LE agencies in Maryland allow their officers to use issued or personally owned AR15's.

19. During defensive shooting encounters, the "two rounds and assess" approach has not been standard practice since the mid-1990s, as easily verified by assessing the curriculum taught by leading progressive professional firearms trainers. Now, the Non-Standard Response (NSR) is widely considered the correct tactic in a lethal force shooting incident: shoot until the attacker is no longer threat, be that 1, 2, 10 or more shots.

20. There is no better firearm for self-defense than an ergonomic, shoulder-fired weapon like the AR15, that has been proven to have greater accuracy, less recoil, and decreased risk of over-penetration when used defensively to stop a lethal attack.

I declare under penalty of perjury that the foregoing is true and correct.

Gary K. Roberts, DDS

16 March 2014

Gary K. Roberts — Date

Attachment A

EXPERT REPORT OF GARY ROBERTS

Gary K. Roberts, DDS

750 Welch Road

Suite 118

Palo Alto, CA 94304

(650) 328-6684

December 13, 2013

I studied wound and terminal ballistics at the Army Wound Ballistics Research Laboratory at the Letterman Army Institute of Research while on active military duty. I thereafter became one of the first members of the International Wound Ballistics Association. Since that time, I have performed military, law enforcement and privately funded wound ballistic testing and analysis. As a U.S. Navy Reserve Officer from 1986 to 2008, I served on the Joint Service Wound Ballistic IPT and served as a consultant to the Joint FBI-USMC munitions testing program. Over the years, I have been a technical advisor to the Association of Firearms and Toolmark Examiners and to a variety of Federal, State and municipal law enforcement agencies. I also served as a Reserve Police Officer in the San Francisco Bay area and I currently serve in a law enforcement training role. I am currently on staff at Stanford University Medical Center, a large teaching hospital and Level I Trauma Center, where I perform hospital dentistry and surgery.

OPINIONS AND BASES FOR THOSE OPINIONS

DEFENSIVE MUNITION REQUIREMENTS

Civilian citizens should use the same munitions chosen by police in their community, as the lethal force requirements are identical and the anatomy, physiology, and incapacitation potential of a violent felon does not suddenly change whether confronted by law enforcement officers or private citizens.

All projectiles discharged by firearms have the capacity to kill. None are more "lethal" than others. If person is shot with a projectile that can penetrate into the body, it has the capacity to kill and deadly force has been applied. The hype created by the entertainment industry and media has led the general public to be ignorant of the true mechanics of wound ballistics.[1] When law enforcement agencies select munitions intended for

[1] To assist the reader, I have included an Introduction to Terminal Ballistics and Basic Wound Ballistic Facts as Appendix A to this report. Reference to this short primer on the science of terminal ballistics will be invaluable in helping the reader develop a fuller understanding of terminal ballistics (the study of projectile behavior from the time the first target is hit until the projectile stops moving) while simultaneously divorcing the actual scientific and medical realities of gunshot wounds and bullet

potential lethal force use, the primary requirement is to choose ammunition that can reliably rapidly incapacitate and stop hostile individuals who pose an immediate life threatening danger to public safety and prevent them from continuing their violent actions.

In addition, the munitions are carefully selected to try and minimize danger to innocent bystanders, as well as officers. By design, hunting bullets are designed to kill efficiently and humanely. In contrast, LE munitions are engineered to incapacitate and stop violent action as quickly as possible—an important distinction. This differentiation between death and incapacitation is not just one of semantics. If a hunter shoots and incapacitates a deer and the animal is still alive when the hunter reaches it, the hunter quickly kills the deer. The hunter is shooting to kill. If a LE officer uses a firearm to incapacitate a suspect and the suspect is still alive as the officer approaches, the officer captures the suspect and initiates medical care. This is shooting to stop a threat. There is a major difference in intent and action.

In many respects, the use of the most capable defensive ammunition available is more humane, as accurate and effective munitions can reduce the need for multiple shots--decreasing the chance of shots missing the intended hostile opponent and striking innocent bystanders. The use of properly designed and manufactured defensive ammunition also reduces the potential of innocent bystanders getting hit by projectiles that first perforate the violent attacker. Often times it is more difficult, time consuming, and complex for healthcare providers to repair multiple gunshot wounds; thus the use of consistent, reliable, and effective defensive ammunition may reduce the number of times a dangerous opponent must be shot in order to rapidly stop their assault, thereby potentially limiting the amount of surgical intervention needed to control hemorrhage and repair injuries.

There is in fact a significant difference between many of the most common civilian hunting munitions and those used by law enforcement—the civilian ammunition is generally substantially more powerful and destructive than almost all small arms munitions in common police use. The most commonly used LE handguns in service calibers like 9 mm, .40 S&W, and .45 Auto are far less powerful than typical hunting handguns firing deep penetrating magnum calibers like the .357 Mag, .41 Mag, .44 Mag, .460 S&W Mag, and .500 S&W Mag. Likewise, police AR15's firing relatively weak .223/5.56 mm ammunition are quite anemic in penetration capability and pale in destructive capacity when compared to common civilian hunting rifles firing calibers like .260 Rem, .270 Win, 7 mm Mag, .30-06, .300 Mag, .338 Mag, .375 H&H, 416 Rigby, .458 Lott, and .500 Nitro. Even hunting rifles in older calibers from the 1800's, like .30-30 and .45-70, penetrate much deeper and are far more damaging than the .223/5.56 mm ammunition fired by the AR15 carbines generally used by police. The only common LE weapon that approaches the destructive capability of civilian hunting firearms are 12 gauge shotguns, however police shotgun ammunition almost always uses the weaker 2

---

mechanics from the ignorant and simply inaccurate depictions found in entertainment media and modern politics.

¾" shells, while many civilian hunting shotguns use the more powerful 3" and 3 ½" magnum shotgun loads. Any of the civilian handgun, rifle, or shotgun calibers that are commonly used to hunt feral hogs, deer, elk, moose, bear, etc… will prove far more penetrative and destructive than most of the typical police handgun or carbine loads.

Almost all modern law enforcement ammunition is engineered to meet FBI guidelines of penetrating no less than 12" and no more than 18". In addition, LE ammunition is designed to be blind to barriers--in other words to consistently perform the same, whether a shot is unobstructed or first has to go through an intermediate barrier like an automobile windshield, vehicle door, or structural materials (*ex. a wall or door in a building, as well as window glass*). If a member of the public is sadly forced to use lethal force to defend themselves, their family, or other innocent citizens, the requirements for lethal force munitions are EXACTLY the same as needed by the police in such a horrible eventuality--to quickly stop the violent criminal without endangering other innocent people. In fact, it would likely be prudent and wise for a legally armed citizen to seek out the same tested and proven arms and munitions that are used by police in order to have the greatest chance of safely and successfully surviving a lethal force encounter. As the progenitor of modern law enforcement, Sir Robert Peel, so cogently noted:

"*The police are the public and the public are the police; the police being only members of the public who are paid to give full time attention to duties which are incumbent on every citizen in the interests of community welfare and existence.*"

MAGAZINE CAPACITY

The public should NEVER be limited to magazines of less capacity than that authorized for police in their community. Any artificial limitations on magazine capacity imposed by the government represents an unjust and illogical interference on a civilian's ability to defend himself or herself from assailants.

A standard capacity magazine is one containing the number of cartridges the firearm was designed to operate with: typically 15-17 rounds in 9 mm, 15 rounds in .40 S&W, 7-13 rounds in .45 ACP, 20-30 rounds in 5.56 mm, and 20 rounds in .308. High capacity magazines and feeding devices are those holding more cartridges than the weapon was originally designed to use; low capacity magazines are those whose capacity is artificially reduced from that which the firearm was originally designed to use. Numerous tests by LE and military entities have documented that the most reliable magazines are those the weapon was originally designed to use; both high capacity and reduced capacity magazines have frequently demonstrated more malfunctions in various types of firearms.

According to data from the BATF, the majority (approx. 62%) of pistols currently manufactured each year in the U.S. are designed to use magazines with a standard capacity greater than 10 rounds. The U.S. military has not adopted a handgun with a standard magazine capacity less than 10 rounds since 1911. Likewise, all U.S. military rifles that have been adopted since 1937 have a magazine capacity of 15 or more rounds.

By capriciously limiting magazine capacity to 10 rounds or less, the government would deny citizens the benefits of modern technology and force them to use defensive tools from a bygone era. It is like forcing citizens to go back to driving the Model-T Ford because current automobiles are too fast and result in too many traffic deaths each year.

The most recently released NYPD SOP-9 "Annual Firearms Discharge Report" data show from 2011 document that 7 rounds or less were fired in 65% of NYPD OIS incidents, while in 35% of cases officers needed to fire more than 7 shots to stop the threat. Interestingly in 29% of the incidents, more than 10 shots were required to end the violent encounter. Of the higher round count incidents, one case required 45 shots to stop the threat and one required 73 shots. Thus in 2011, NYPD officers needed between 1 and 73 shots to end violent threats. For 2010, in 67% of the NYPD OIS incidents 7 rounds or less were fired; however in 33% of the incidents more than 7 shots were required to subdue the threat. In 21% of lethal force encounters more than 10 shots were required.

When OIS incidents are looked at in aggregate, approximately 1/3 of the time only 1 shot will be needed to stop the threat, in another 1/3 of cases 2-9 shots will be needed, ***unfortunately 10+ shots may be necessary to end 1/3 of violent encounters.***

So if police officers need more than 10 shots to stop violent attackers approximately 1/3 of the time, why would innocent civilians who likely have no body armor, no radio, no partner, no cover units, no less lethal options, no duty belt with extra magazines, yet who are being confronted by the same violent felons as the police, need less ammunition than police officers? What about citizens with disabilities that may prevent their escape or avoidance of a threat and severely limit their ability to rapidly and effectively reload a firearm? I am unaware of any person who has had to use lethal force to defend their life in a gunfight who wishes they had less ammunition during the encounter. By arbitrarily restricting magazine capacity for civilians to 10 rounds, the most current NYPD SOP-9 data, as well as other OIS data strongly suggests that, in a full one third of incidents, that civilians will likely run out of ammunition before the violent attacker has been stopped.

Given that all LE agency shooting incidents are defensive in nature and that virtually all LE agencies issue handgun magazines of greater capacity than 10 rounds and rifle magazines of 20-30 rounds, it seems obvious that LE experts have concluded that magazines with capacities greater than 10 rounds are the best choice for defensive shooting incidents.

FIREARMS FOR SELF-DEFENSE

The semi-automatic AR15 carbine is likely the most ergonomic, safe, readily available and effective firearm for civilian self-defense and law enforcement general purpose use.

There are multiple factors that will play a role in determining which weapon might be the best choice for self-defense. Handguns are compact and easily carried, but generally offer poor incapacitation potential and are harder to shoot accurately compared to

shoulder fired weapons. In contrast to handgun caliber weapons, virtually any shoulder fired firearm chambered in a center fire rifle caliber or using 12 ga. shotgun ammunition will prove superior from a both a wound ballistic and practical accuracy standpoint. SA Urey Patrick of the FBI Firearms Training Unit wrote the following to emphasize this point:

"...no law enforcement officer should ever plan to meet an expected attack armed only with a handgun. Experienced officers implicitly recognize...when potential violence is reasonably anticipated their preparations are characterized by obtaining as many shoulder (fired) weapons as possible."

If at all possible, civilians forced to defend themselves with a firearm should heed this advice and select a shoulder-fired weapon in an effective caliber whenever circumstances allow this option.

The question then becomes which shoulder fired weapon is optimum for self-defense. In America's past, common shoulder fired weapons for home defense included muskets like the ubiquitous "Brown Bess" from the time of our Nation's founding, the Winchester lever action repeating rifle from the days of the Western Frontier, and a variety of shotguns. Until recently, the 12 gauge shotgun has remained the universally accepted shoulder fired weapon for United States law enforcement use. A close range hit from a 12 ga. shotgun using buckshot will create more tissue damage than most other commonly used LE firearms. Unfortunately, shotguns are not an ideal weapon due to their short effective range, imprecise accuracy, potential downrange hazard to innocent bystanders from stray pellets, possible excessive penetration, small ammunition capacity, slow reloading, difficult manual of arms, poor ergonomics, and harsh recoil. Recognition of the shotgun's significant limitations have prompted many American law enforcement agencies to adopt the more versatile semi-automatic magazine fed carbine. Semi-automatic carbines offer superior accuracy, less recoil, greater effective range, faster reloading, potentially reduced downrange hazard, better ergonomics, and a larger ammunition capacity than the traditional shotgun. In addition, semi-automatic carbines are generally easier to operate one handed in case of injury, when holding a child, or when using a communication device to dial 911 on a telephone or talk with a dispatcher via radio. Currently, the most common carbine in LE use is the .223/5.56 mm AR15.

Recently many in the media and politics have focused their ire on the AR15 and vilified it as an "assault weapon" only good for killing people. This is both inaccurate and unfortunate. The AR15 is the semi-automatic civilian sporting version of the select-fire M16 rifle and M4 carbine used by the U.S. military and many LE agencies. If the civilian legal, semi-automatic AR15 is only a dangerous and unusual offensive weapon of war, with no legitimate hunting, sporting, or self-defense purpose, good only for producing mass mayhem, and not in common use by law abiding citizens for lawful purposes as some uninformed individuals have claimed, why is it that AR15 rifles have consistently been used by winning competitors for the past quarter of a century at the U.S. Civilian Marksmanship National Match target shooting championships held each year at Camp Perry, Ohio? Why have AR15's become one of the most popular hunting

rifles for harvesting a wide variety of game, including varmints, feral hog, deer, and even elk? Why are AR15's the most commonly used and recommended rifles for defensive use by LE personnel? Aren't target shooters, hunters, and police officers law abiding citizens engaged in lawful pursuits?

According to experts such as the U.S. military, the Association of Firearms and Toolmark Examiners (AFTE), and the Smithsonian Museum, for a weapon to be labeled an "Assault Rifle", it must have the following specific physical and performance characteristics:

- Shoulder Fired Carbine
- Uses an Intermediate Cartridge
- Fires from a Closed Bolt
- Magazine with Capacity of at least 20 rounds
- Offers Select Fire Capability (*ie. can fire multiple shots per each trigger pull*)

The civilian legal, semi-automatic AR15 does NOT meet these criteria, as it is NOT select-fire and, despite misleading statements to the contrary, it cannot easily be modified to be so. As a result of their select fire capability, true assault rifles like the M16 and M4 are severely restricted and effectively banned for routine civilian ownership by the NFA of 1934, the GCA of 1968, and the FOPA of 1986. Some glib persons have stated that semi-automatic weapons like the AR15 can be shot at rates of fire making them virtually indistinguishable from machine guns; clearly this is ludicrous, as the U.S. military has documented that the average rate of accurate semi-automatic fire from an AR15 type rifle is approximately 45-90 RPM, while select-fire M16 rifles or M4 carbines shoot at 700-970 RPM—a quite profound and obvious difference.

Likewise many individuals have decried the standard capacity 30 round magazine used in the AR15 (*which typically fires .22"/5.56 mm projectiles*), while absurdly championing the idea that the 12 ga. pump action shotgun with a 5 round capacity is more suitable for civilian self-defense purposes—this is illogical on many levels. Keep in mind that EACH typical 2 3/4" 12 ga #4 buckshot shell contains up to thirty-four .24"/6.1 mm diameter pellets. Thus each pull of the pump-action shotgun trigger launches as many projectiles as firing an entire 30 round AR15 magazine; emptying the 5 round shotgun magazine launches as many projectiles as completely firing FIVE 30 round AR15 magazines!

In the past two decades, a new term has joined the popular lexicon: "Assault Weapon". The term "assault weapon" is a vague, inaccurate misnomer, and is not synonymous with "assault rifle". The term "assault weapon" appears to arbitrarily be based on the appearance of a firearm and not specific functional or performance parameters. Any civilian firearm which has the appearance of a military weapon, such as a detachable magazine, magazine with a standard capacity of 20+ rounds, flash hider, bayonet lug, pistol grip, adjustable stock, or black synthetic furniture is often arbitrarily referred to as an "assault weapon" by ignorant individuals, as well as by politicians and media personalities attempting to sway public opinion. Many mendacious commentators have decried these "military features" as only being useful for combat and criminal

applications, but unnecessary for self-defense or sporting purposes. Obviously this is utterly inaccurate, as features like adjustable stocks, muzzle devices, and free float rails are commonly in use on precision target firearms used for competition, as well as on LE rifles intended for self-defense use, as they increase accuracy and improve ergonomics. Some areas also have laws codifying various firearms as so-called "assault weapons". This is illogical, confusing, and bizarre, as two firearms can exhibit identical performance parameters: the same caliber, same magazine capacity, and same rate of fire, but one is classified as an "assault weapon" and the other is not.

If assault weapons are, "*the weapons of choice among drug dealers, criminal gangs, hate groups, and mentally deranged persons bent on mass murder*" as stated by some individuals, why do almost all major U.S. law enforcement agencies, including the FBI, recommend "assault weapons" like the AR15 for lawful defensive purposes? If "assault weapons" are so profligate and dangerous as alleged by some commentators, why do the FBI Uniform Crime Reports (UCR) document that, per year, more people are feloniously killed by blunt objects such as hammers than by rifles of ALL types, let alone rifles spuriously classified as "assault weapons"? If "assault weapons" are disproportionately used to kill police officers as alleged by some sources, why does the most recent FBI UCR from 2011 yet again clearly illustrate that most police officers killed by firearms succumb to wounds from common handguns, while rifles of all types, let alone those classified "assault weapons", accounted for less than 10% of LE officers killed?

True military assault rifles, as well as civilian firearms disingenuously labeled as "assault weapons" based on physical appearance rather than functional characteristics, do not inflict wounds of any greater severity than those produced by traditional military rifles. In addition, wounds caused by common civilian hunting rifles and shotguns like those in use for the past 150 years or so are typically far more severe and destructive to tissue than many so-called "assault weapons".

The roots of the .223/5.56 mm cartridge commonly used in the AR15 come from a caliber designed for small game varmint hunting and used to eliminate small rodents and animals up to coyote size. Many hunters avoid it for medium size, 100 + pound game; in fact in numerous states it is prohibited to hunt deer size game with the .223/5.56 mm. 5.56 mm 55 gr M193 FMJ fired from 20" barrel M16A1 rifles was the standard U.S. military 5.56 mm ammunition in the 1960's and 1970's. Dr. Martin Fackler, the man who has done more research on the 5.56 mm 55 gr M193 FMJ than anyone else on this planet, has written the following (Fackler, ML: *"Literature Review"*. **Wound Ballistics Review**; 5(2):40, Fall 2001) about 55 gr FMJ:

"In 1980, I treated a soldier shot accidentally with an M16 M193 bullet from a distance of about ten feet. The bullet entered his left thigh and traveled obliquely upward. It exited after passing through about 11 inches of muscle. The man walked in to my clinic with no limp whatsoever: the entrance and exit holes were about 4 mm across, and punctate. X-ray films showed intact bones, no bullet fragments, and no evidence of significant tissue disruption caused by the bullet's temporary cavity. The bullet path passed well lateral to the femoral vessels. He was back on duty in a few days. Devastating? Hardly. The wound

profile of the M193 bullet (page 29 of the Emergency War Surgery—NATO Handbook, GPO, Washington, D.C., 1988) shows that most often the bullet travels about five inches through flesh before beginning significant yaw. But about 15% of the time, it travels much farther than that before yawing—in which case it causes even milder wounds, if it missed bones, guts, lung, and major blood vessels. In my experience and research, at least as many M16 users in Vietnam concluded that it produced unacceptably minimal, rather than "massive", wounds. After viewing the wound profile, recall that the Vietnamese were small people, and generally very slim. Many M16 bullets passed through their torsos traveling mostly point forward, and caused minimal damage. Most shots piercing an extremity, even in the heavier-built Americans, unless they hit bone, caused no more damage than a 22 caliber rimfire bullet."

During defensive shooting encounters, shots that inadvertently miss the intended target in CQB and urban environments can place innocent citizens in danger. In general, .223/5.56 mm bullets demonstrate LESS penetration after passing through building structural materials than other common LE and civilian calibers. All of the .223/5.56mm bullets recommended for law enforcement use offer reduced downrange penetration hazards, resulting in less potential risk of injuring innocent citizens and reduced risk of civil litigation in situations where bullets miss their intended target and enter or exit structures compared with common handgun bullets, traditional hunting rifle ammunition, and defensive shotgun projectiles (*buckshot and slugs*). When comparing issued handgun, shotgun, and rifle ammunition, the FBI has explicitly stated that the .223/5.56 mm ammunition used in the AR15 was the only caliber that offered ideal penetration of 12-18" in all test events, that the issued .223/5.56 mm loading had no over-penetration issues compared with the other service caliber handgun, shotgun, and rifle ammunition tested, and that .223/5.56 mm was more consistent in performance than all the other calibers. This is in sharp contrast to, and completely refutes, the false claims that the .223/5.56 mm ammunition used in AR15's increases the threat of stray bullets harming innocent family members, neighbors, and passersby.

The AR15 is extremely common in America. According to data from the BATF, FBI, and NSSF (National Shooting Sports Foundation), approximately 4.5 million AR15's have been sold in the U.S. since 1986; historical data indicates that an additional 350,000 AR15's were produced from 1963-1986. AR15 commercial sales continue to increase, currently accounting for approximately 20% of all rifles sold in the U.S. Within the next year, the total number of AR15's sold in American will likely have reached 5 million rifles. In addition, approximately 6 million Ruger Mini-14 rifles have been sold in the U.S.; these fire the same .223 cartridge as the AR15, have the same rate of fire, an identical magazine capacity, and have also been used by some LE agencies, including NYPD and CHP. However, the Mini-14 has not proven as accurate, durable, ergonomic, reliable, or as easy to maintain in LE service as the AR15 and has generally fallen out of LE use. In addition, quite a few of the 3 million or so AK type rifles imported to the U.S. use the .223 cartridge, as do many rifles that have been sold in the U.S. by foreign companies such as Beretta, Daewoo, FN, HK, IMI, Sig, Steyr, Valmet, and other vendors.

As a result of the M16 FOW (Family of Weapons) being used by the U.S. military for nearly 50 years, perhaps more Americans have been trained to safely operate the AR15 than any other firearm. There are approximately 25 million American veterans who have been taught how to properly use an AR15 type rifle through their military training, not to mention in excess of 1 million American LE officers who have qualified on the AR15 over the last several decades. In addition, there are numerous civilian target shooters and hunters who routinely use AR15's. Since so few military service members, particularly those not on active duty, get enough training and practice with their M16 or M4 service rifle, many military Reservists and National Guard personnel, as well as some active duty service members, have purchased civilian AR15's in order to train and practice on their own time with a rifle offering similar ergonomics and operating controls as the service weapon they are issued in the military. In many ways, the AR15 is the ubiquitous "Brown Bess" musket or Winchester repeating rifle of the modern era—a true firearm for the people. The AR15 is a highly versatile design that can be adapted for military, law enforcement, civilian self-defense, hunting, target shooting, and other sporting purposes.

I am charging $700 per hour for my services.

Gary K. Roberts, DDS

Gary K. Roberts, D.D.S.

APPENDIX A

INTRODUCTION to TERMINAL BALLISTICS

Gunshot wounds are an unfortunate fact in our world. Due to the large number of gunshot wounds which occur during military conflicts and the frequency of civilian gunshot wounds in large urban areas, the common assumption is that firearms injuries are well understood and that health care providers have gained the necessary knowledge and skill to appropriately treat gunshot wounds. Unfortunately, this assumption is incorrect. Probably no scientific or medical field contains more misinformation than wound ballistics.

Numerous "war stories" and a great deal of folklore exist about gunshot wounds, but the actual effects of bullets on the human body remain shrouded in mystery to the average person. An overwhelming volume of conflicting and contradictory articles written about firearms wounds have been published in medical journals, law enforcement publications, military briefings, and civilian articles. Sadly, while many of these texts propose theories which purport to explain the effects of penetrating projectiles on the body, the majority are replete with erroneous assumptions and pseudoscientific speculation which result in further misunderstanding. In addition, many of the myths and misconceptions about bullet wounds are perpetuated by inaccurate entertainment industry portrayals on television shows and at the cinema, and by distorted exaggerations of weapons effects in news media accounts of shootings.

Internal ballistics is the study of projectile behavior from the time the cartridge is fired and propellant ignited, until the bullet exits the barrel of the firearm. External ballistics is the study of projectile flight through air after exiting the barrel of the firearm, until a target or object is hit. Terminal ballistics is the study of projectile behavior from the time the first target, intermediate barrier, or object is hit, until the projectile stops moving. Wound ballistics is the branch of terminal ballistics that studies the interaction between penetrating projectiles and tissue; essentially the pathophysiology of gunshot wounds. This is of crucial importance to the healthcare provider who must treat gunshot wounds, as a poor understanding of the types of injuries produced by penetrating projectiles may result in improper or inadequate clinical treatment being provided to a shooting victim. Terminal ballistics and wound ballistics are also of interest to military and law enforcement personnel as well as private citizens who depend on firearms to protect themselves since misconceptions regarding bullet effectiveness and body armor can jeopardize their lives and those of innocent individuals they are protecting.

BASIC WOUND BALLISTIC FACTS

The last 25 years of modern wound ballistic research has demonstrated yet again what historical reports have always indicated--that there are only two valid methods of incapacitation: one based on psychological factors and the other physiological damage.

People are often rapidly psychologically incapacitated by minor wounds that are not immediately physiologically incapacitating. Preconceived notions of how people should react when shot; intimidation from the weapon or act of being shot; fear of pain, injury, or death; anxiety about the appearance of their wound and the sight of their own blood; or a lack of will to continue and a desire to quit can all influence an individual's response to being shot. Up to fifty percent of those individuals rapidly incapacitated by bullet wounds are probably incapacitated for psychological rather than physiological reasons. Psychological factors are also the reason people can receive severe, even non-survivable wounds and continue functioning for short periods of time. Since pain is often initially absent following injury, an individual may not be aware of their wound and therefore will not react to it. Strong emotions such as anger, rage, hate, and basic survival instincts that release adrenalin, can stimulate the body. Chemicals can strongly influence an individual's psychological state. People under the influence of analgesics, stimulants, tranquilizers, or dissociative agents may not be aware of their injury, may have decreased pain perception, or may show no concern about their wound. Psychological incapacitation is an extremely erratic, highly variable, and completely unpredictable human response, independent of any inherent characteristics of a particular projectile.

On the other hand, the degree and rapidity of any physiological incapacitation is determined by the anatomic structures the projectile disrupts and the severity of the tissue damage caused by the bullet. Physiologically, immediate incapacitation or death can only occur when the brain or upper spinal cord is damaged or destroyed. The tactical reality is that in OIS (*officer involved shooting*) incidents, opportunities for LE (*law enforcement*) personnel to take precisely aimed shots at the CNS (*central nervous system*) of threatening opponents is rare due to high stress unexpected contact marked by rapid fleeting movements, along with frequent poor visibility of the target caused by darkness, innocent bystanders, and the use of cover and concealment. Battlefield conditions for military personnel can be even more chaotic. Likewise, civilian self-defense encounters can be highly stressful and confusing. Thus there is a reduced likelihood of routine CNS targeting in defensive encounters requiring lethal force. Absent CNS damage, circulatory system collapse from severe disruption of the vital organs and blood vessels in the torso is the only other reliable method of physiological incapacitation from small arms. If the CNS is uninjured, physiological incapacitation is delayed until blood loss is sufficient to deprive the brain of oxygen. Multiple hits may be needed before an individual is physiologically incapacitated. An individual wounded in any area of the body other than the CNS may physiologically be able to continue their actions for a short period of time, even with non-survivable injuries. In a 1992 IWBA Journal paper, Dr. Ken Newgard wrote the following about how blood loss effects incapacitation:

"A 70 kg male has a cardiac output of around 5.5 liters per minute. His blood volume is about 4200 cc. Assuming that his cardiac output can double under stress, his aortic blood flow can reach 11 Liters per minute. If this male had his thoracic aorta totally severed, it would take him 4.6 seconds to lose 20% of his total blood volume. This is the minimum amount of time in which a person could lose 20% of his blood volume from one point of injury. A marginally trained person can fire at a rate of two shots per second. In 4.6

seconds there could easily be 9 shots of return fire before the assailant's activity is neutralized. Note this analysis does not account for oxygen contained in the blood already perusing the brain that will keep the brain functioning for an even longer period of time."

LE personnel are generally trained to shoot at the center of mass, usually the torso, of an aggressive opponent who must be stopped through the use of lethal force. While the human body can appear incredibly complex and frail, it is also remarkably robust and durable, with the capacity to withstand severe stress and damage before being incapacitated. Physiological incapacitation with wounds to the torso is usually the result of circulatory system collapse. More rapid incapacitation may occur with greater tissue disruption. Tissue is damaged through two wounding mechanisms: the tissue in the projectile's path is permanently crushed and the tissue surrounding the projectile's path is temporarily stretched. A penetrating projectile physically crushes and destroys tissue as it cuts its path through the body. The space occupied by this pulped and disintegrated tissue is referred to as the permanent cavity. The permanent cavity, or wound track, can quite simply be considered as the hole bored by the projectile's passage. Obviously, bullets of greater diameter crush more tissue, forming a larger permanent cavity. The formation of this permanent cavity is consistent and reliable.

The tissue surrounding the permanent cavity is briefly pushed laterally aside as it is centrifugally driven radially outward by the projectile's passage. The empty space normally occupied by the momentarily displaced tissue surrounding the wound track is called the temporary cavity. The temporary cavity quickly subsides as the elastic recoil of the stretched tissue returns it towards the wound track. The tissue that was stretched by the temporary cavity may be injured and is analogous to an area of blunt trauma surrounding the permanent crush cavity. The degree of injury produced by temporary cavitation is quite variable, erratic, and highly dependent on anatomic and physiologic considerations. Many flexible, elastic soft tissues such as muscle, bowel wall, skin, blood vessels, and empty hollow organs (*stomach, intestines, bladder, etc*...) are good energy absorbers and are highly resistant to the blunt trauma and contusion caused by the stretch of temporary cavitation. Inelastic tissues such as the liver, kidney, spleen, pancreas, brain, and completely full fluid or gas filled hollow organs are highly susceptible to severe permanent splitting, tearing, and rupture due to temporary cavitation insults. Projectiles are traveling at their maximum velocity when they initially strike and then slow as they travel through tissue. In spite of this, the maximum temporary cavity is not always found at the surface where the projectile is at its highest velocity, but often deeper in the tissue after it has slowed considerably. The maximum temporary cavitation is usually coincidental with that of maximum bullet yaw, deformation, or hyper-expansion and fragmentation, but not necessarily maximum projectile velocity.

All projectiles that penetrate the body can only disrupt tissue by these two wounding mechanisms: the localized crushing of tissue in the bullet's path and the transient stretching of tissue adjacent to the wound track. Projectile wounds differ in the amount and location of crushed and stretched tissue. The relative contribution by each of these mechanisms to any wound depends on the physical characteristics of the projectile, its

size, weight, shape, construction, and velocity, penetration depth and the type of tissue with which the projectile interacts. Unlike rifle bullets, handgun bullets, regardless of whether they are fired from pistols or SMG's (*sub-machine gun)*, generally only disrupt tissue by the crush mechanism. In addition, temporary cavitation from most handgun bullets does not reliably damage tissue and is not usually a significant mechanism of wounding.

Vital anatomic structures are located deep within the body, protected by various layers of tissue. The average thickness of an adult human torso is 9.4" and the major blood vessels in the torso of even a slender adult are located approximately 6" from the ventral skin surface. Bullets that may be required to incapacitate aggressors must reliably penetrate a minimum of approximately 10 to 12 inches of tissue in order to ensure disruption of the major organs and blood vessels in the torso from any angle and through excessive adipose tissue, hypertrophied muscle, or intervening anatomic structures, such as a raised arm. The FBI has defined the ideal penetration range for projectiles intended for LE use to be 12-18", thus ensuring adequate penetration, while limiting the chance of projectiles exiting a violent aggressor and going downrange to hit an innocent bystander. Bullet penetration depth varies depending on the density and resistance of the tissue encountered. Bullets striking dense structures such as bone have reduced penetration while those traveling through less resistant tissue, such as lung, exhibit increased penetration. The tough, resilient, flexible skin on the exit side of the body can have the same resistance to bullet passage as four inches of muscle and often causes bullets to end their path just under the skin at the anticipated exit point.

All other factors being equal, heavier bullets penetrate to a deeper depth in tissue than lighter bullets and non-deforming bullets generally penetrate deeper than deforming bullets. Non-deforming projectiles exhibit greater penetration as velocity is increased. Higher velocity also increases the penetration depth of deforming bullets, but only until the bullet begins to upset. The higher velocity then increases the amount and rate of bullet deformation, with the enlarged frontal area of the expanded bullet causing increased resistance to further penetration and a decreased total penetration depth. Projectiles that become destabilized after leaving the muzzle have greater yaw angles in flight and therefore greater AOA (*angle-of-attack*) on impact. AOA at impact refers to the angle between the flight axis of the projectile and the geometric axis of the projectile at the moment of impact. This results in decreased tissue penetration compared to the same bullet when properly stabilized. Decreased projectile penetration can also result if the bullet is deformed or fragmented after passing through intermediate obstacles, for example automobile windshields or sheet metal, before striking tissue. Penetration depth can be increased if an expanding bullet fails to deform, either through poor bullet design or external influences. For example, if the hollow nose cavity of a JHP (*jacketed hollow point*) bullet collapses in on itself after passing through intermediate obstacles such as automobile steel or if the hollow point becomes clogged with material from intermediate obstacles like wood or heavy clothing, it may be prevented from expanding and will behave like a deeper penetrating, non-deforming bullet.

Aerodynamic projectiles, such as bullets, cause minimal tissue disturbance when passing point forward through tissue. Tissue is a denser medium than air; as the bullets strikes tissue, the increased drag on the projectile overcomes its rotational stabilization and the bullet can upset and yaw. If the bullet yaws, more surface area is in contact with tissue, so it crushes more tissue, creating a larger permanent cavity. When a bullet yaws, it also displaces more of the surrounding tissue, increasing the temporary cavity size. Both the largest permanent and temporary cavities are produced by a non-deforming projectile when it is traveling sideways at 90 degrees of yaw, allowing the maximum lateral cross sectional area of the bullet to strike tissue and displace the greatest amount of tissue. Longer and wider bullets have a greater lateral cross sectional area and thus create a larger permanent cavity when they yaw. The depth in tissue at which a given bullet upsets is independent of bullet mass and velocity, and is strongly influenced by the AOA at which the bullet strikes tissue, as well as the projectile shape, construction, and center of gravity. All non-deforming, pointed tip Spitzer type projectiles, such as the FMJ (*full metal jacketed*) rifle bullets commonly used by militaries, yaw past 90 degrees in tissue, finally ending their path pointed backwards, their bases facing the direction of travel, as this is the most stable position for these projectiles when traveling through tissue since this places the bullet's center of gravity forward.

Projectile deformation destroys the aerodynamic shape of the bullet, shortening its length and increasing its diameter by expanding and flattening the bullet tip in the classic "mushroom" pattern exhibited by deforming JHP and JSP (*jacketed soft point bullets*). The larger frontal area of deformed bullets can crush more tissue, thus increasing permanent cavity size; more tissue is also displaced by a bullet with increased frontal area, causing an enlarged temporary cavity. The larger permanent and temporary cavities occur at a shallower penetration depth than that caused by non-deforming projectiles. The increased frontal area of a deformed bullet provides greater resistance to the projectile's passage, resulting in decreased penetration depth.

Projectile hyper-expansion and fragmentation in tissue can also greatly increase the permanent cavity size. When a rifle bullet hyper-expands and fragments in tissue, each of the multiple fragments spreads out radially from the main wound track, cutting its own path through tissue. This fragmentation acts synergistically with the stretch of temporary cavitation. The multiply perforated tissue loses its elasticity and is unable to absorb stretching that would ordinarily be tolerated by intact tissue. The temporary cavitation displacement of tissue, which occurs following the passage of the projectile, stretches this weakened tissue and can grossly disrupt its integrity, tearing and detaching pieces of tissue. Note that handgun bullets, regardless of whether they are fired from pistols or SMG's, do not generally exhibit the hyper-expansion and fragmentation effects produced by some rifle bullets. If handgun bullets do fragment, the bullet fragments are usually found within 1 cm of the permanent cavity and wound severity is usually decreased by the fragmentation since the bullet mass is reduced, causing a smaller permanent crush cavity. Depending on bullet design, as the velocity of a projectile is increased, the potential for fragmentation is often magnified. Tissue disruption can also be increased if bullets strike bone, since fractured bone fragments can act as secondary missiles, cutting through tissue surrounding the wound track. Furthermore, bullet deformation and

fragmentation is more likely to occur if a projectile strikes bone. This same fragmentation effect can occur if a bullet strikes an intermediate object, such as a belt buckle, prior to penetrating tissue.

The approximately 40% to 60% of gunshot victims who fall down immediately upon wounding are not knocked over by the kinetic energy or momentum of the bullet impact, but rather are incapacitated by physiological and psychological effects. Bullets cannot physically knock down a person by the force of their impact. The U.S. M1911 .45 Auto 230 gr FMJ bullet has developed a legendary reputation for having "knock-down power", yet the impact or momentum of that bullet hitting the body is equivalent to being hit by a 10 pound weight dropped from a height of only 1.37 inches. Obviously, this impact could not knock a person over. Newton's Second Law of motion shows that every action has an equal and opposite reaction. If a bullet had the energy to knock a person down on impact, the recoil of the gun would also knock the shooter down as the bullet was fired. This basic law of physics is dramatically illustrated by a well known demonstration in which an adult male, protected by body armor, is shot from less than five feet by a 7.62 x 51mm NATO bullet fired from an FN FAL type rifle; the approximately 2667 ft/lbs of energy which the bullet "deposits" or "transfers" to the man does not knock him down or push him violently backwards. Kinetic energy or momentum transfer from a projectile to tissue is not a wounding mechanism. The amount of energy "deposited" in the body by a bullet is approximately equal to the amount transferred to the body when a person is hit by a baseball. The amount of kinetic energy "deposited" or momentum transferred to a body by a projectile is not directly proportional to the amount of tissue damaged and is not a measure of wounding power. Wounds of vastly differing severity can be inflicted by bullets of identical kinetic energy and momentum. What the bullet does in the body--whether it yaws, deforms, or fragments, how deeply it penetrates, and what tissue it passes through is what determines wound severity, not kinetic energy, momentum, or velocity.

Projectiles which travel at supersonic velocity form a sonic wave which trails in the air behind the projectile. Because the speed of sound in tissue is four times faster than the speed of sound in air, the Sonic Wave jumps ahead of the projectile as the skin surface is penetrated, and then precedes the projectile through tissue. This sonic wave is often erroneously referred to as a "shock wave". There are no shock waves or hydrostatic shock effects in tissue. The sonic wave produces no tissue movement or tissue damage; it is not a wounding mechanism and should not be confused with temporary cavitation. The benign nature of a sonic wave is illustrated by lithotripter treatment of kidney stones, where similar sonic pressure waves cause no gross injury to the soft tissue surrounding the kidney stones.

A basic knowledge of external ballistics is necessary in order to understand the principles of wound ballistics. Because projectiles must overcome air resistance during their flight to the target, they have an elongated, pointed, aerodynamic shape that reduces drag in the air. However, this position places the bullet's center of gravity at the rear of the projectile, an inherently unstable position that would cause the bullet to deviate from a nose forward position during flight and tumble end over end through the air if not

rotationally stabilized by the spin imparted by the barrel's rifling. Yaw in flight is the angle of deviation of the projectile's longitudinal axis from its forward trajectory; in other words, the bullet turns sideways in relation to its direction of forward movement. Properly stabilized bullets have a negligible yaw angle in flight, usually less than three degrees, and do not tumble while in the air. Projectiles such as arrows and flechettes resist this tendency to yaw in the air because of the stabilization provided by their rear fins. Intermediate obstacles, including foliage, can disrupt bullet stabilization and induce tumbling while in flight, drastically compromising bullet accuracy and range. Bullets that are destabilized in flight can exhibit a large AOA on impact, causing increased tissue disruption at a shallower penetration depth than properly stabilized bullets.

A variety of equally important methodologies are used for terminal performance testing, including actual shooting incident reconstruction, forensic evidence analysis, and post-mortem data and/or surgical findings; properly conducted ethical animal test results; and laboratory testing—this includes the use of tissue simulants proven to have correlation with living tissue. The last several years of OCONUS military operations have provided a tremendous amount of combat derived terminal performance information. The U.S. government gathered numerous experts from a variety of disciplines, including military and law enforcement end-users, trauma surgeons, aero ballisticians, weapon and munitions engineers, and other scientific specialists to form the Joint Service Wound Ballistic Integrated Product Team to conduct a 4 year, 6 million dollar study to determine what terminal performance assessment best reflected the actual findings noted in combat the past few years. The test protocol that was found to be correct, valid, and became the agreed upon JSWB-IPT "standard" evolved from the one first developed by Dr. Fackler at LAIR in the 1980's, promoted by the IWBA in the 1990's, and used by most reputable wound ballistic researchers. The JSWB-IPT, FBI BRF, AFTE, and other organizations get to assess an extensive amount of post-shooting forensic data. The whole raison d'être of these independent, non-profit organizations is to interpret and disseminate information that will help LE and military personnel more safely and effectively perform their duties and missions. Physiological damage potential is the only metric that has been shown to have any correlation with field results in actual shooting incidents, based on law enforcement autopsy findings, as well as historical and ongoing combat trauma results.

PARTIAL LIST OF REFERENCE MATERIALS

Albanese M: "Debrief of 28 Feb 97 L.A.P.D. North Hollywood Bank Robbery Shoot Out". **SFPD**. 28 April 1997.

Amato JJ, Syracuse D, Seaver PR, Rich N: "Bone as a Secondary Missile: An Experimental Study in the Fragmenting of Bone by High Velocity Missiles". **The Journal of Trauma**. 29(5):609-612; May 1989.

Armstrong DP: "TR/4081/C01/1236—H&K 4.6x30mm PDW Comparative Penetration Test Report". **Naval Surface Warfare Center, Crane, Indiana**. 05 April 2001.

Bellamy RF: "Little Arrows". **Military Medicine**. 152(7):359-360; July 1987.

Berlin R, Janzon B, Rybeck B, Sandegard J, Seeman T: "Local Effects of Assault Rifle Bullets in Live Tissues" **Acta Chirurgica Scandinavica Supplementum 459**. Stockholm 1976.

Boone B: "FBI Weapon Selection, Rev II", **FBI BRF**. Quantico, VA. 18 January 2002.

Boone B: "Ammunition Selection", **National SWAT Sniper Symposium**. Quantico, VA. 26 January 2007

Bowen TE and Bellamy RF (ed). "Chapter II: Missile Caused Wounds", **Emergency War Surgery: Second United States Revision of the Emergency War Surgery NATO Handbook.** Washington D.C., U.S. Government Printing Office, 1988.

Bowen TE and Bellamy RF (ed). "Chapter XVI: Wounds and Injuries of the Soft Tissues", **Emergency War Surgery: Second United States Revision of the Emergency War Surgery NATO Handbook.** Washington D.C., U.S. Government Printing Office, 1988.

California Highway Patrol Academy Weapons Training Staff: "10mm Testing and Evaluation", September 1989.

California Highway Patrol Academy Weapons Training Staff: "Test and Evaluation 10mm Semi-Automatic Pistol", May 1990.

Corzine AJ and Roberts GK: "*Correlation of Ordnance Gelatin Penetration Results Between 20% Gelatin at 10°C and 10% Gelatin at 4°C*". **AFTE Journal**. 25(1):2-5, January 1993.

California Highway Patrol Officer Involved Shootings Investigation Team conference. Vallejo, CA. November 1997.

CTTSO/TSWG: **Test Evaluation Report for the M4A1/Mk12 Modified Upper Receiver Group (MURG).** Arlington, VA. July 2007.

CTTSO/TSWG: **Congressional Briefing and Demonstration.** Quantico, VA. 11 July 2008.

CTTSO/TSWG: **AIM I-V Proceedings.** 2009-2013.

Defense Forum: "Wound Ballistics: A Target for Error". **International Defense Review.** 8:895-897; 1988.

DOD JSWB-IPT. Cummulative Testing and Results. 2002-2006.

Ezell EC. **The AK-47 Story.** Harrisburg, Stackpole Books, 1986.

Ezell EC (ed.). **Small Arms of the World, 12th Revised Edition.** Stackpole Books, Harrisburg, 1983.

Fackler ML: "Introduction" in La Garde LA. **Gunshot Injuries, 2nd Revised Edition.** Lancer Militaria, Mt. Ida, 1991.

Fackler ML and Dougherty PJ: "Theodor Kocher and the Scientific Foundation of Wound Ballistics". **Surgery, Gynecology, and Obstetrics.** 172:153-160; February 1991.

Fackler ML: "The Ideal Police Bullet", Internal Security and Co-In Supplement to **International Defense Review.** 11(Supplement #2):45-46; 1990.

Fackler ML: "Wound Ballistics". Lecture to German Police Academy in Wittlich, Germany; 23-24 October 1990.

Fackler ML: "Wound Ballistics: The Management of Assault Rifle Injuries: **Military Medicine.** 155:222-225; May 1990.

Fackler ML, Malinowski JA, Hoxie SW, Jason A: "Wounding Effects of the AK-47 Rifle Used by Patrick Purdy in the Stockton, California, Schoolyard Shooting of January 17, 1989". **The American Journal of Forensic Medicine and Pathology.** 11(3):185-189; 1990.

Fackler ML and Kneubuehl BP: "Applied Wound Ballistics: What's New and What's True". **Journal of Trauma (China).** 6(2) Supplement:32-37; 1990.

Fackler ML: "Letter to the Editor" **British Journal of Surgery.** 76(11):1217; November 1989.

Fackler ML and Peters CE: "Letter to the Editor". **The Journal of Trauma.** 29(10):1455; October 1989.

Fackler ML: "FBI Chooses a 10mm Bullet". **International Defense Review.** 9:1138; 1989.

Fackler ML: "ACR Candidates: Assessing Their Wounding Potential". **International Defense Review.** 8:1091-1092; 1989.

Fackler ML and Bellamy RF: "Considering the Wounding Effects of a Hit". **Army Times**. 49(46):24; June 1989.

Fackler ML, Bretau JPL, Courbil LJ, Taxit R: "Open Wound Drainage Versus Wound Excision in Treating the Modern Assault Rifle Wound". **Surgery.** 105(5):576-584; May 1989.

Fackler ML: "Effects of Small Arms on the Human Body". **Proceedings of the 11th International Symposium on Ballistics**. Brussels, 9-11 May 1989.

Fackler ML: "Letter to the Editor" **Wall Street Journal.** A-15; 10 April 1989.

Fackler ML: "Misinterpretations Concerning Larrey's Methods of Wound Treatment". **Surgery, Gynecology, and Obstetrics.** 168:280-282; March 1989.

Fackler ML: "Wounding Patterns of Military Rifle Bullets". **International Defense Review.** 1:59-64; 1989.

Fackler ML: "Stockton--The Facts". **Letterman Army Institute of Research**. 1989.

Fackler ML, Bretau JPL, Sendowski ICP, Martin PDF: "Perforating Wounds of the Abdomen by the Modern Assault Rifle". **Proceedings of the 6th International Wound Ballistics Symposium.** Chonquing, China, 1-4 November 1988; and **Journal of Trauma (China).** 6(2) Supplement:192-199; 1990.

Fackler ML: "Wound Ballistic Research of the Past Twenty Years: A Giant Step Backwards". **Proceedings of the NATO Wound Ballistics Research Group 11.** London, 18 October 1988; and **Letterman Army Institute of Research: Institute Report #447**. January 1990.

Fackler ML: "Wound Ballistics: A Review of Common Misconceptions". **Journal of the American Medical Association**. 259(18):2370-2736; May 1988.

Fackler ML: "Handgun Bullet Performance". **International Defense Review.** 5:555-557; 1988.

Fackler ML, Breteau JPL, Coubil LJ, Taxit R, Glas J, Fievet JP: "Open Wound Drainage Versus Wound Excision on the Modern Battlefield". **Letterman Army Institute of Research: Institute Report #256.** February 1988.

Fackler ML: "The Wound Profile: Illustration of the Missile-Tissue Interaction". **The Journal of Trauma**. 28(1 Supplement):S21-S29; January 1988.

Fackler ML and Malinowski JA: "Internal Deformation of the AK-74; A Possible Cause for its Erratic Path in Tissue". **The Journal of Trauma**. 28(No.1 Suppl):S72-S75; January 1988.

Fackler ML and Malinowski JA: "Ordanance Gelatin for Ballistic Studies: Detrimental Effect of Heat Used in Gelatin Preparation". **Letterman Army Institute of Research: Institute Report #245**. December 1987; and **The American Journal of Medicine and Pathology**. 9(3):218-219; 1988.

Fackler ML: "Letter to the Editor". **Military Medicine**. 152: 531-533; October 1987.

Fackler ML: "Letter to the Editor". **Combat Handguns.** 8(4):74; August 1987.

Fackler ML: "What's Wrong With the Wound Ballistic Literature". **Letterman Army Institute of Research: Institute Report #239**. July 1987.

Fackler ML and Malinowski JA: "Letter to the Editor". **Journal of Forensic Sciences.** 32:837-838; July 1987.

Fackler ML: "Wounds and Injuries of the Soft Tissues". **Letterman Army Institute of Research: Institute Report #232**. April 1987.

Fackler ML: "Missile Caused Wounds". **Letterman Army Institute of Research: Institute Report #231**. April 1987.

Fackler ML: "Letter to the Editor: Bullet Performance Misconceptions". **International Defense Review.** 3:369-370; 1987.

Fackler ML: "Physics of Missile Injuries" in McSwain NE and Kerstein MD (ed). **Evaluation and Management of Trauma**. Norwalk, Appleton-Crofts, 1987.

Fackler ML: "Ballistic Injury". **Annals of Emergency Medicine**. 15:(12); 1451-1455, December 1986.

Fackler ML: "Letter to the Editor". **The Journal of Trauma**. 26(12):157-1158; December 1986.

Fackler ML: "Letter to the Editor". **Orthapedics**. 9(10):1336-1342; October 1986.

Fackler ML: "Wound Ballistics" in Trunkey DD and Lewis FR (ed). **Current Therapy of Trauma--2**. Toronto, B.C. Decker, 1986.

Fackler ML: "The Wound Profile: A Visual Method for Quantifying Gunshot Wound Components". **The Journal of Trauma**. 25(6):522-529; 1985.

Fackler ML: "Letter to the Editor". **American Surgeon.** 50:515; 1984.

Fackler ML, Surinchak MA, Malinowski JA, Bowen RE: "Wounding Potential of the Russian AK-74 Assault Rifle". **The Journal of Trauma**. 24(3):263-266; 1984.

Fackler ML: "Bullet Fragmentation: A Major Cause of Tissue Disruption". **The Journal of Trauma**. 24(1):35-39; January 1984.

FBI Academy FTU and BRF. **Ammunition Tests 1989-2012**. Quantico, U.S. Department of Justice--Federal Bureau of Investigation.

FBI Academy Firearms Training Unit. **Semiautomatic Pistols**. Quantico, Department of Justice--Federal Bureau of Investigation, 1987-1988.

FBI Academy Firearms Training Unit: "9mm vs. .45 auto". **FBI Wound Ballistic Workshop**. Quantico, 15-17 September, 1987.

FBI BRF and DSU: "PA OIS Incident 29 November 2006". 2006.

Frost R (ed). "Bullet Holes in Theories". **International Defense Review.** 8:875; 1988.

Gong J: "Shotgun Replacement". **City of Sunnyvale Department of Public Safety, CA**. April 24, 1997.

Greenwood C: "The Political Factors" in Warner K (ed). **Gun Digest 34th Edition**. Chicago, Follet, 1980.

Gunsite Training Center Staff: "The Call-Out Bag, A Comparison of .223 Penetration versus Handgun Calibers". **The Tactical Edge**. Summer 1994, p. 63-64.

IWBA Conference Proceedings, Sacramento, CA. 1994.

IWBA Conference Proceedings, Long Beach, CA. 1997.

Jason A and Fackler ML. **Body Armor Standards: A Review and Analysis--Final Report, 2nd Edition.** Pinole, Center for Ballistic Analysis, 1990.

Jason A. **Deadly Effects: Wound Ballistics**. Pinole, Anite Productions; 80 minute videotape, 1987.

Karcher SK: "TR/2024/C91/586--Test and Evaluation Report of 9mm Jacketed Hollow-Point (JHP) Cartridges for Naval Investigative Service (NIS) use in the XM11 9mm Compact Pistol". **Naval Surface Warfare Center, Crane, Indiana**. 30 October 1991.

Lazzarini D: "Firearms Study--Long Rifles". **Santa Clara, CA Police Department**. 1995.

Letterman Army Institute of Research, Division of Military Trauma Research. **Laboratory Logs of Wound Ballistic Testing.** November 1986 to May 1991.

Lindsey D: "The Idolatry of Velocity, or Lies, Damn Lies, and Ballistics". **The Journal of Trauma**. 20(12):1068-1069; 1989.

MacPherson D: **Bullet Penetration: Modeling the Dynamics and the Incapacitation Resulting from Wound Trauma**. Ballistic Publications, El Segundo, CA, 1994.

Marsh C: "Comparison of Terminal Ballistic Performance of M855, Mk318, 115 gr 6.8 SPC and Mk319". **Naval Surface Warfare Center, Crane, Indiana**. 21 December 2009.

NDIA: Proceedings of Joint Small Arms Meetings. 2002-2012.

Patrick UW: "Handgun Wounding and Effectiveness". **FBI Academy Firearms Training Unit**. Quantico, 14 July, 1989.

Roberts GK and Wolberg EJ: "*Book Review—Handgun Stopping Power: The Definitive Study by Marshall EP and Sanow EJ. Boulder, Paladin Press, 1992*". **AFTE Journal**. 24(3):383-387, October 1992.

Roberts GK and Bullian ME: "*Protective Ability of the Standard U.S. Military Personal Armor System for Ground Troops (PASGT) Fragmentation Vest Against Common Small Arms Projectiles*". **Military Medicine**. 158:560-563, August 1993.

Roberts GK: "*Terminal Performance of 9mm 147 gr Jacketed Hollow Point Bullets fired from the HK MP-5, using 10% Ordnance Gelatin as a Tissue Simulant*". **AFTE Journal**. 30(2):330-333, Spring 1998.

Roberts GK: Personal Communication with Eugene J. Wolberg regarding the wounds produced by Winchester and Federal 9mm 147 gr JHP bullets in nearly 150 officer involved shootings at the San Diego Police Department. May 2000.

Roberts G, Lazzarini D, Pomerleau P. "*Wounding Effects of Choke™ 12 Gauge 00 Buckshot Loads Intended for Law Enforcement Duty Using 10% Ordnance Gelatin*". **AFTE Journal**. 34(3):287-288, Summer 2002.

Roberts G and Bullian M: Unpublished data from CHP Academy wound ballistic testing 1992-1999.

Roberts G and Lazzarini D: Unpublished data from SCPD wound ballistic testing. 2000-2004.

Roberts GK: Unpublished data from SJPD wound ballistic testing. 2005-2012.

Roberts GK and Bullian M: "Comparison of the Wound Ballistic Potential of 9mm vs. 5.56mm (.223) Cartridges for Law Enforcement Entry Applications". **AFTE Journal**. 25 (2):142-147; April 1993.

Roberts GK: "*Preliminary Evaluation of the Terminal Performance of the 5.7 x 28 mm 23 Grain FMJ Bullet Fired by the New FN P-90 Using 10% Ordnance Gelatin as a Tissue Simulant*". **AFTE Journal**. 30(2):326-329, Spring 1998.

Roberts GK: "Review of Current Military Wound Ballistics". **USMC**. 26 June 2009.

Taubert RK: "Evaluation of the 5.56x45mm/.223 Caliber Round for Close Quarter Battle (CQB) Applications". **FBI Memos**. 8/18/93, 4/20/94, 7/28/94.

Trunkey DD: "Editorial: Comments on the Article by Fackler, et al". **Surgery.** 105(5):693-694; May 1989.

USMC: **Wound Ballistic Review**. SOTG, Camp Pendleton, CA. 06 August 2002.

USMC: **Ammunition Selection and Procurement Briefing**. I MEF, Camp Pendleton, CA. 15 August 2002.

USMC: **Wound Ballistic Review**. MARSOCOMDETONE, Camp Pendleton, CA. 27 October 2003.

USMC: **Wound Ballistic Review**. SOTG, Camp Pendleton, CA. 15 June 2004.

USMC: **Test Evaluation Report for the Alternative Ammunition Study Phase I.** PM-IW MARCORSYSCOM, Quantico, VA. 11 August 2006.

USMC: **Wound Ballistic Review**. SOTG, Camp Pendleton, CA. 14 August 2007.

USN: **NSW Sniper Terminal Ballistics**. NSWG2, Camp Atterbury, IN. 12 September 2002.

USSOC: **Joint Service SOPMOD OCONUS Combat Review**. 5th SFG(A), Ft. Campbell, KY. 22 August 2002.

USSOC: **SOF Weapons IPT**. WARCOM, Coronado, CA. 26 February 2003.

Wakefield D: "Shot Spread Reducing and Shot Spread Eliminating Wads". **AFTE Journal**. 32(4):361-162, Fall 2000

IWBA: **Wound Ballistics Review**. Volumes 1-5; 1991-2001.

Expert Testimony:

Deposed in *Wilson v. Cook County, IL.*