Safety Plan

Oklahoma State University

College of engineering Architecture and Technology

Reduction of Shoulder CTDs From Firearms Through the use of Suppressors

Standard Operating Procedures (SOP)

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I. Procedure Overview

The goal of our Project is to show the difference in the recoil felt by the shooter when utilizing a range of firearms with a suppressor attached and not attached. Many people utilize firearms without fully understanding the recoil forces and how they can lead to CTDs (cumulative trauma disorders) or subdermal hematomas (bruising). Our group has decided to measure the acceleration of the shoulder to quantify the recoil felt by the shooter. To accomplish this, we will attach a single axis shear accelerometer to the firearm and another single axis shear accelerometer to the back of the shooter's shoulder. The weapon systems we have chosen for our experiment are of two categories a bolt action system (single shot), and modern sporting rifle (semi-automatic system) chambered in .300AAC Blackout, .308, 7.62x39, and 12 gauge. All these weapon systems will be tested with and without a suppressor. With this data we hope to show that suppressors can aid people with pre-existing conditions who may have had to stop the activity of shooting due to discomfort or switch to a smaller cartridge to avoid further injury. By some users moving to a smaller cartridge, it makes taking down larger game animals more difficult and less humane for the animal.

II. Health and Safety Information of Hazards

When participating in the act of shooting a firearm, there are many hazards that pose a threat to the shooters that are involved. These include a squib fire, negligent discharge, baffle strike, and hang fire, however, the chances of these events occurring will be severely decreased if a stringent level of care and awareness is provided by all parties involved. Beginning with the firearm, it should always be treated as if it was loaded. This includes always pointing the barrel in a safe direction, keeping the finger off the trigger until the firearm is ready to be fired, and keeping the firearm on safety until it is ready to fire. With respect to the ammunition being used, a bullet does have the potential to discharge on its own if not properly handled. Do not drop the bullets from any height and keep them out of the pockets of the shooters, there is a potential to affect the powder in the bullets, which can cause a squib fire, as well as the primer could be struck, and the round could discharge. This is an extreme situation and is not likely to happen, however, it is not impossible. Continuing the topic of ammunition, they have the potential to bounce off objects in different directions, also known as a ricochet. They are most common when encountering metallic objects, round objects such as rocks, or flat horizontal surfaces such as water. The shooting ranges at Louthan Gunworks consist of dirt mounds backed by wooden railroad ties to minimize the chance for a ricochet as much as possible.

Every individual that is present at the range is required to be wearing ear and eye protection at all times. When it comes to shooting, every member of the group will fire a total of 48 rounds, so every group member will be allowed to take breaks between firearms if needed. This experiment is going to take a toll of the shoulders of all participants involved since the firearms used consist of a .300 blackout, .308, 7.62x39, as well as a 12-gauge. When it comes to

shooting a firearm, being aware of the hazards present and how to negate them is a simple process and can make shooting an enjoyable experience for everyone involved.

III. Hazard Control Measures

Our group will institute an array of hazard control techniques including Administrative controls, PPE, and engineering controls to manage the risk of the hazards effectively. Upon arriving on site cell phone coverage must be observed to ensure the ability to call quickly for help is maintained. It is also the responsibility of each group member to be familiar with the route and address of the facility to ensure the ability to give effective directions to incoming EMS personnel in case of emergency. When scheduling testing days the weather shall be considered as rain, high winds, and other severe weather could damage equipment and injure personnel. If weather conditions deteriorate during testing procedures, then testing shall be stopped, clean-up procedures taken, and testing rescheduled.

Chamber flags should be used on weapons that are out of their respective cases in-between tests. The chamber flag allows all individuals present that the weapon is not loaded and not in the firing position. The chamber flag shall only be removed if a weapon is not loaded in its respective case or out of its case at the shooting position during testing. Administrative controls will be implemented during testing to ensure a safe and efficient atmosphere during testing. Group members will be assigned tasks to ensure a smooth and quick testing day as well as being cross trained to take over each other's tasks during testing. Procedures such as Handling weapons, ammunition, testing instrumentation, and shooting the guns. All members shall have a basic understanding about how each task works and will be required to follow gun range safety procedures.

The handling and shooting of firearms shall be supervised by a qualified person with a minimum certification of BSA Range Safety Officer or equivalent. Before testing Range Safety Officer

will hold a safety briefing. In this briefing they will go over the procedures and expectations in accordance with the testing activities and range safety guidelines. All members and bystanders will have high awareness and be watching for potential hazards with the notion of if you see something say something. Personal Protective Equipment is required for all members this includes safety glasses meeting minimum ANSI z87.1+, earmuffs, closed toed shoes, and long pants.

IV. Method Procedures

Procedures for our testing goes as follows.

1. Before Inspection of the firearms, ensure weapon is on safe, and unloaded.
2. Before testing, the weapons shall be inspected for any imperfections and operational issues.
3. Make sure the suppressor is in place and attached properly.
4. Before any member or bystander is allowed to go down range the weapon must be cleared of any rounds, placed on safe, put on table and a chamber flag must be inserted.
5. Attach the accelerometers to the test weapon and to the shoulder of the shooter.
6. Make sure all members and bystanders have ear protection and eye protection.
7. Double check that all participants are in the safe zone behind the shooter.
8. Audibly announce that the firearm will be loaded and remove the chamber flag.
9. Load the weapon with the selected amount of rounds.
10. Audibly announce that the range is HOT.
11. Shooter takes their position and switch the weapon to fire.
12. Shooter will fire the weapon and record how many are fired.
13. If weapon jams or malfunctions immediately stop the test. Assess the situation and fix it.
14. If hang fire occurs keep weapon pointed downrange for 60 seconds before emptying the weapon of ammunition.
15. If there is an unusual kick or change in sound, stop the test, as it could be a squib round. A malfunction where the bullet does not exit the gun and lodges itself in the barrel. empty the weapon and prepare to disassemble the firearm. once the barrel is separated from the rest of the weapon system. Inspect the inside of the barrel looking for any obstructions. If

an obstruction is found utilize a wooden dowel to tap the bullet and dislodge it towards whichever direction it is closest to.

16. If a bullet comes into contact with the baffles in the suppressor, also known as baffle strike, empty the firearm and turn it on safety so that you can take the suppressor off. In this case, the suppressor would not be useable anymore.
17. After the shooter is done utilizing the weapon the weapon will be checked to ensure it is empty and placed back on the table or in the case.

V. Waste Disposal Procedures

When discharging firearms regardless of the reason, waste will be generated. That waste consists of shell casings as well as lead rounds being discharged from the firearm. The lead bullets will be fired down range into a wooden wall also known as a backstop. The shell casings are made from brass and will be collected after each group member and advisor finishes shooting. To properly dispose of the shell casings, team members will collect all casings from the ground and put them in a five-gallon bucket. If there are any dud rounds, they will be disposed of in a steel container. In the case of having dud rounds, the local number for Stillwater Police will be called, so that they can be notified of the disposal. It is very important that 911 is not dialed for this. Once the dud rounds are properly disposed of, the general cleanup procedures for bullets that discharge normally will be taken. Along with any other types of trash that as accumulated in the testing area will be thrown into a trashcan. When Rounds are fired lead is released into the environment, the lead released into the environment by this experiment is the responsibility of Louthan Gunworks.

VI. First Aid Procedures

If any kind of injury occurs, whether it be severe or not, a first aid kit will be present at all times at the shooting range. If an incident takes place and the injury is severe, 911 will be called immediately and initial care will begin by using the first aid kit that is provided. The Medkit/Tourniquet on site is an Individual First Aid Kit with a Combat Action Tourniquet (IFAK w/ CAT). This medkit allows us to treat insignificant and serious injuries that could potentially occur during testing. One member must obtain first aid training and all participants shall have a general understanding of treating injuries that is supplemented by this video provided by the Mass General Hospital showing how a tourniquet is applied: https://youtu.be/tOm8lJLRWF0. If an injury does occur, the medkit/tourniquet will be used to treat the injury until emergency personnel arrive. Our supervisor, Dr. Robert Agnew, has completed first aid training and is appointed to being in charge of treating injuries.

VII. Spill/Release Containment, Decontamination, and Clean-up Procedures

The biggest release that the group faces are bullet casings from discharged firearms. Once the shooter is done with testing, the group will pick up all casings and dispose of them in a five-gallon bucket. The five-gallon bucket will serve as the containment apparatus for the bullet casings. Once the bullet casings are picked up and disposed of properly, all group members will wash their hands with soap and water to get rid of any lead residue from the bullet casings. Washing hands with soap and water will help to mitigate the risk of chronic lead poisoning. All lead released from the experiment is the responsibility of Louthan Gunworks. Once testing is concluded for the day, all firearms will be placed on a table to be inspected and cleaned. Before inspection and cleaning of the firearms, the accelerometer attached to the firearm will be removed using the manufacturer's recommendations. For all firearms and suppressors, a gun cleaning kit will be utilized to clean them to manufacturer specifications. The firearms should also have their chambers brushed out and cleared of any residue. After this process, the final step with regards to cleaning the firearms is to apply gun oil with a cloth rag so that they are lubricated, which will also provide smooth operation and help to minimize wear. After the firearms are inspected and cleaned, they will be placed into their respected cases. The next step in the cleanup process upon conclusion of testing is to inspect and clean the accelerometers and the associated equipment that comes with them (ie cables). The accelerometers will be cleaned following the manufacturer's recommendations. The cables will also be inspected to make sure that there is no damage to them. Once the accelerometers and the cables are inspected and cleaned, they will be placed in their respected cases. The final step upon conclusion of testing is to fold up tables and clean up any trash that has accumulated while performing this experiment.

VIII. Author and Approver Signatures

Authors:

Approver:

IX. Job Hazard Analysis

Hazard	Result/cause	Mitigation Technique
Weapons Discharging	Loud Noise	Hearing Protection
Flying objects to the eye	Debris and or ricochet	Eye Protection meeting a minimum rating of ANSI Z87.1+
Negligent discharge	Getting shot	1) 12 Rules of Gun Safety 2) Range Master 3) First aid kit 4) Combat Action Tourniquet used with stop the bleed training
Lead exposure	Lead dust from discharging firearms	Wash hands and face after participating in the act of discharging a firearm. Especially Prior to eating.
Falls to same level	Slips Trips and Falls	1) Appropriate closed toe shoes with a rubber sole 2) NO RUNNING
Dud cartridge	Faulty Cartridge	Keep weapon pointed in safe direction and keep finger off trigger. Wait at least 15 seconds. If round has not fired in 15 seconds open breech and extract round place round into predesignated steel container.
Shoulder discomfort while utilizing firearms	Recoil force to the shoulder of the shooter	Let group members know if discomfort is experienced and take breaks.
Squib fire	Due to faulty powder charges yielding the bullet not to make it all the way out of the gun creating a blockage in the barrel	When shooting the firearm pay attention to any slight difference in sound, recoil, or feel. If any difference is detected unload the firearm immediately and disassemble to check the barrel for any obstructions.
Baffle strike	A misaligned suppressor can yield the bullet striking a baffle and damaging the suppressor	Ensuing the suppressor is properly aligned.
Pinch points	Failure to eject	Ensure the bolt is locked back on the modern sporting rifle. And ensure the bolt is open on the bolt action.
Stove pipe weapon malfunction	A brutal failure to eject	Keep weapon pointed in safe direction and keep finger off trigger. If the weapon is equipped with a magazine remove it first. Then open the breech and clear the casing that failed to eject.

Hang fire	Due to a fault in the round causing either a delay for the powder to ignite or the powder to not ignite at all.	Keep weapon pointed in safe direction and keep finger off trigger. Wait at least 60 seconds. If round has not fired in 60 seconds open breech and extract round place round into predesignated steel container.
Pro-Longed UV exposure	Sun burn	1) Long sleeves 2) minimum SPF 30 sun block
Pro-longed exposure to High temperatures	Heat exhaustion	1) Let others know if you do not feel well. 2) Go in an airconditioned place. 3) Drink plenty of liquids. 4) Slowly acclimate to high temps. 5) Ask others how they feel.
Ricochet	Bullet bouncing off metal or large rock	1) Pre-experiment range inspection 2) Remove any objects that could cause a Ricochet
Pro-longed exposure to High temperatures	Heat Stroke	1) Take breaks. 2) Drink plenty of fluids. 3) Let others know if you do not feel right. 4) Check up on others.
Extreme Weather	*Force majeure*	Cancelation and rescheduling of experiment
Dehydration	Lack of fluid intake	Drink Fluids
Lyme disease or other tick-borne illness	Tick bites	Long pants, Bug spray with *deet*, avoid tall grass, avoid standing under trees.
Necrosis due to Rattle snake bites	Rattle snake bite	Avoid rattle snakes, and if you hear or see something say something.
Necrosis from the brown recluse, or flu like symptoms from the black widow	Spider bites	Shake out clothing before putting on, watch for spiders, notify group member if any symptoms start to appear.
Anaphylaxis and discomfort	Wasp stings	Avoid Wasps
Damage to surrounding life and property	Inadvertent injury either direct or indirectly related to the experiment	Notify neighbors of test day, Check behind backstop, Range safety inspection