Project Number: GUNS

ALTERNATIVE FORMS OF GUN CONTROL

An Interactive Qualifying Project Report:

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by

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1. Abstract

The shooting sports are a part of our nation's history and culture. Law abiding citizens have owned and fired their guns since the dawn of our nation. The politics of today, however, are a threat to that culture. The political issue is split down the middle with gun owners on one side and gun control advocates on the other. No real common ground has been found where a compromise can be made. In an effort to make a technological contribution to increasing the overall safety of the shooting sports, we have investigated and developed specifications for an electronic range safety system.

2. Introduction

This project is an attempt to use technology not normally associated with the shooting sports to improve the overall safety of the shooting sports. The view of the shooting sports from those not involved in the sports may also improve with the results of our work. It is our belief that if the shooting sports can be made safer through the use of technology then more people will be more comfortable living in this society where there are millions of law abiding citizens who own firearms.

2.1. Background

Firearms have existed for over five centuries and have seen much advancement during this time. The very first firearms were terribly unreliable and many times cost their users their lives. Refinements in the construction of firearms were made and firearms have become much more reliable and safer over time. Advancements such as the locking flint, percussion cap and the internal priming charge have all served in succession to move the exploding gunpowder further and further from the user and make the firearm safer to the user. The uses of firearms can be inherently dangerous to others.

Firearms have three main uses. First there is the military/offensive application, where the firearm can be used directly against another human. Second, there is the use of firearms in hunting. In this application the hunter uses a firearm to kill a game animal for either the meat of the animal or the pelt of the animal. Third, there is the sporting use of firearms. In this application shooting at a target tests the accuracy and precision of the shooter. The first use of firearms seems to have a limitless future. The future of the last two uses of firearms is currently in jeopardy due to gun control legislation.

Firearms shooting ranges have a long tradition of service to a wide variety of citizen groups in local communities. However, population shifts from urban to suburban or rural areas have moved new groups of citizens in closer proximity to existing ranges. In recent years, this has resulted in hundreds of lawsuits and complaints filed by newcomers against range owners or the passage of local ordinances aimed at closing ranges. Ranges serve a wide variety and can be considered very beneficial if viewed in the proper prospective. For example, shooting ranges often serve as training facilities for local law enforcement officials and military personnel. On top of this, these shooting ranges offer firearm and hunter education and safety courses, providing invaluable hands-on instruction in the safe and proper handling and use of firearms for shooting club members or citizens exercising their fundamental right to self-protection. Finally, shooting ranges serve as a location to hold both informal practice sessions and organized competitions for those engaged in recreational and competitive shooting.

The recent trend toward increased gun control has brought about radical changes in the gun industry. The world in general has recognized the need for some means to address the negative issues associated with guns. As the world breaks into the 21st century, these needs have just started to be addressed in an attempt to reduce the negative image that guns currently portray. The Colt Firearms Company can be recognized as one of the front-runners in this need to address the negative image that guns are receiving because of their research pertaining to a "smart" gun. This quote is taken from Colt issued after long research of their groundbreaking "smart gun". (Colt, Reference 5)

"It may take a generation of smart gun systems to come and go before a smart gun is not only common but is favored over a non-smart gun . . .. To accomplish this goal a great deal of time and resources will have to be expended for the smart gun application."

Its not so much important to look at how Colt attempted to solve one of the gun issues, more importantly it is important to realize that they understand that something needs to be done. Each year, millions of hand gunners enjoy the most common target shooting sport: recreational "plinking". They practice for or compete in marksmanship competitions, "sight in" their guns in advance of hunting season, perfect personal protection skills, or test hand-loaded ammunition. Hundreds of thousands participate in thousands of local, state, regional and national handgun matches annually, using a wide variety of pistols and revolvers in a broad range of formal competitive disciplines. These matches take place in commercial indoor and outdoor ranges as well as military ranges. (NRA website fact sheet, Reference 3)

2.2. Identification Of Need

Gun Control has become a prevalent issue in today's society. Different views on which form of gun control would best solve our society's problems related to these issues have caused a feeling anxiety relating to guns. This anxiety has become a problem for the law-abiding sportsman who owns his or her gun for the pure pleasure of the sport. Gun ranges all over the United States are being closed down due to the fact that the range has been deemed "no longer safe to operate in its present condition".

Another large part of the range issue is how the public feels about ranges. Its not only important to make people feel safe knowing that a range is in their town or area, but it is also important to make them feel safe while in the range. It's not rare to hear complaints about gun ranges being too close to residential areas. It is this public pressure that has been a large factor in closing ranges. The stray bullets that leave the range provide an excellent reason why these people are worried or concerned about possible accidents. By eliminating these stray bullets we may be able to remove a large part of their concerns on this issue.

The question becomes what do we consider a "safe" standard that would be acceptable to both parties. The first party would be defined as the range owners and the sport shooters, while the opposing/second party would be the insurance companies and people who oppose guns. It would not be worth it for the range owners if they have to spend a great deal of money updating their ranges to this standard. So the solution for them would have to be reasonable inexpensive, or able to save them money over the course of a few years. The people who use the range, the sport shooters, are not going to want any drastic changes to their sport. Ranges have existed for hundreds of years and they have seen little change over the course of their existence. To bring about a radical change in range design or methodology would result in unhappy shooters, leading to a lack of interest in the sport as a whole. Finally, in order to satisfy those opposed to guns, we would need to prove that we could ensure that bullets being fired within the range would be contained to the range.

2.3. The Issue of Gun Control

Gun control is a global issue. Australia has a complete ban on citizen ownership of firearms. England has a complete ban on citizen ownership of handguns[1]. The United States of America has many federal, state and local policies towards firearm importation, ownership, usage and transportation. At the heart of the matter in the United States is the second amendment to the Constitution, which reads:

> *A well-regulated Militia, being necessary to the security of a free State, the right of the people to keep and bear Arms, shall not be infringed.*

The second amendment has been analyzed and argued over since ever since it was passed. There is considerable confusion and varying viewpoints as to what right this amendment

[1] This law in England forces their Olympic pistol team to have to practice in another country.

guarantees to the citizens of the United States. Many gun control laws have been passed at every level of the United States Government in efforts to regulate, restrict and in some cases, deny firearm ownership from law-abiding citizens.

2.4. Ranges

Shooting ranges are designed to provide shooters a safe place to shoot. The construction of a backstop is generally used to control the trajectory of bullets and prevent the bullets from leaving the range area. The Shooter stands at the firing line with his gun aimed downrange. Targets are set up in an area in front of the backstop and the shooters fire from their positions at the targets. Most of the time, even if the bullet hits the target, the bullet continues its trajectory until it meets a force large enough to stop the momentum of the bullet. Unfortunately carelessness and accidents can cause bullets to be fired that miss the backstop. When this occurs, the bullet flies through the air and may bounce off of the ground several times prior to stopping. During this flight the bullet may travel through residential area, or across roads, or into other dangerous situations. This causes a sizable liability for the owners of the ranges. Almost every range in suburban and urban areas due to this liability must acquire costly insurance policies.

Knowing that these dangers exist due to the stray bullets, the public is very wary about the location of gun ranges. Most outdoor ranges are found in unpopulated areas where the chance of accidents in less severe. Indoor ranges as well have met strong public opposition to construction in urban areas. Because of this opposition and the dangers of stray bullets, most of these indoor ranges have a dungeon-like atmosphere with concrete walls and no form of natural light for visibility. (Figure 1) Notice the concrete walls and the lack of windows that would allow for natural light. The large light brown object in the background is the backstop and bullet trap. Bullets hit this area and are directed upward into an area where they are collected.

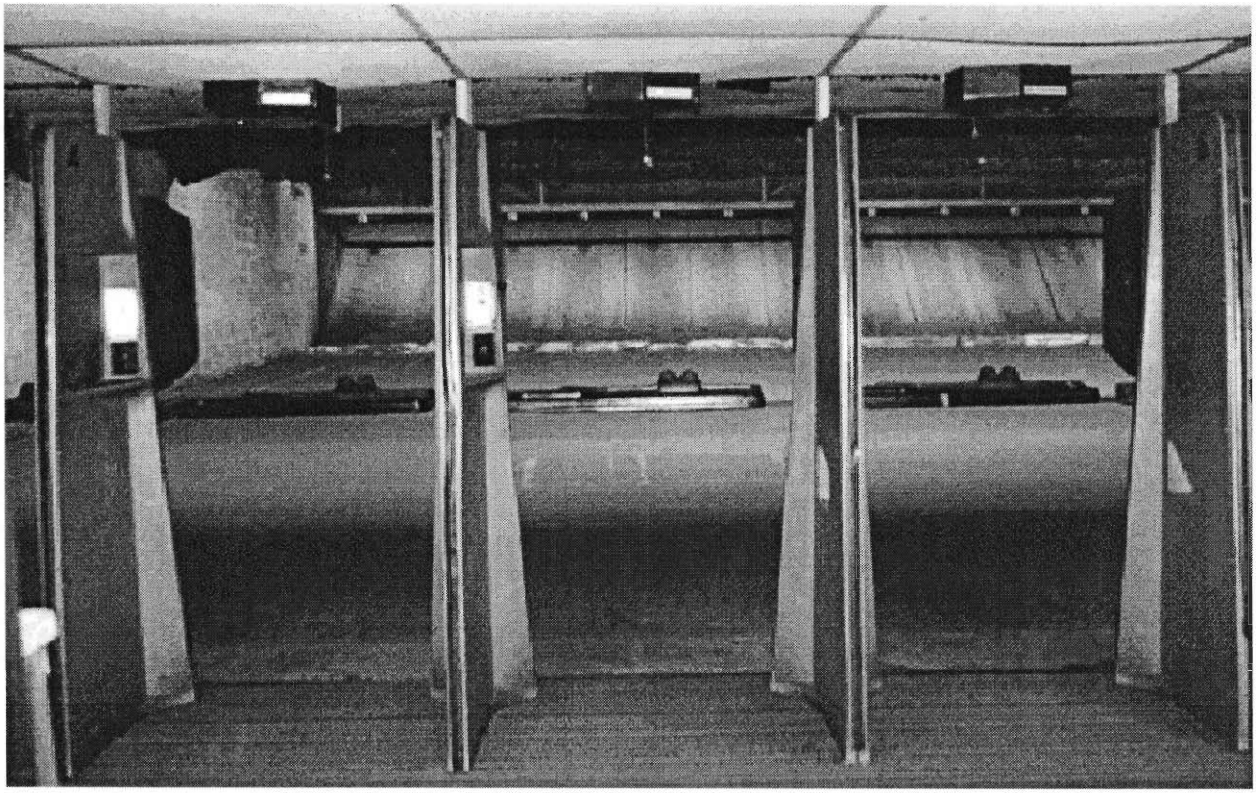


Figure 1: Typical Indoor Range

One point we want to emphasize is the possibilities for further advances in shooting ranges. By removing the fear that a bullet will leave the range by not hitting the backstop, we can get rid of the dungeon-like atmosphere that we discussed already. Windows and skylights would not be far-fetched concepts when designing new ranges. It is not unreasonable to say that ranges could have plants and rocks to provide for the most natural feeling atmosphere possible.

A second possibility for a new type range would be something that may interest gun companies. With the use of the retrofit device that we have conceptualized, gun companies could have their own ranges where potential buyers could come and test out any of their products. Each firing station would have a certain gun that could be on display for anyone to test and try out. The reason this idea becomes more feasible with our device is the fact that we are adding a large safety factor. Even though people are not familiar with these new weapons, the

potential for accidents will be greatly reduced to the point where this "testing" range concept becomes possible.

When attempting to identify the situations that are causing this public anxiety about gun ranges, we found some specific examples that provide a strong backing for this anxiety. The following range is the epitome of an unsafe range.

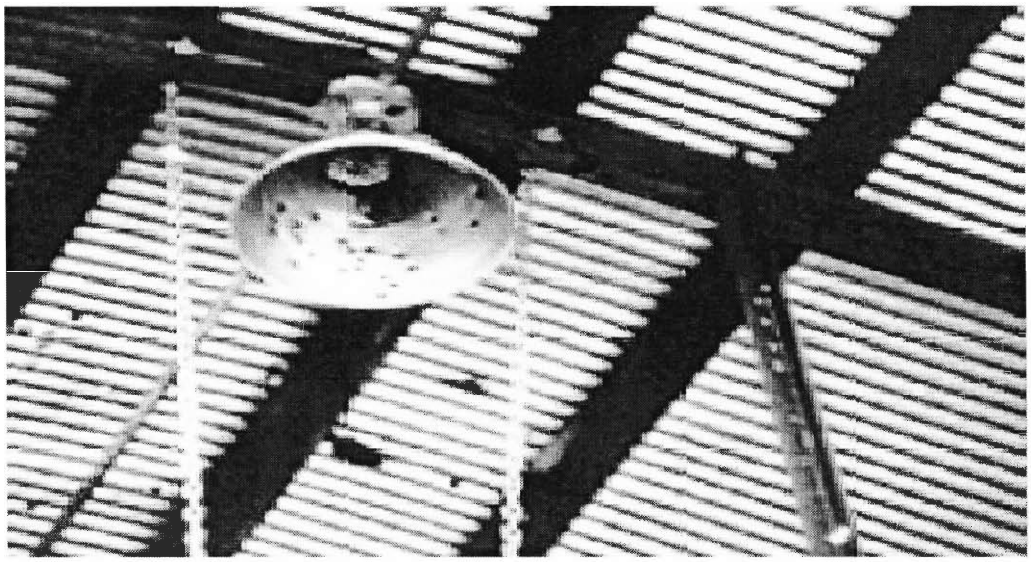


Figure 2: Results of unsafe shooting at a range

The bullet holes in the light fixture and ceiling are a great example of what we are trying to avoid and get rid of at these ranges. If the bullet is going to go through the metal light, what is going to stop the bullet from piercing the metal roof and leaving the range? Although this range is not a great example of the majority of today's ranges, it provides a good example of how containing bullets to the range can be beneficial.

This second example portrays an extremely dangerous situation in range bullets were found along a school bus route. Grossenbacher Road in San Antonio was a quiet lane offering a rural atmosphere to a number of homes until a shooting range was opened on a 10 acre tract a few years ago less than 6/10 mile from those homes. Since that time, bullet fragments landing in the yards of these houses has changed the lives of these residents. School buses use

Grossenbacher Road daily. One man, who lives in the area, walks this road frequently. Below is a drawing showing where he has picked up bullets or fragments of bullets along Grossenbacher Road (Figure 3). It is real possibility that a bullet may at some point stray from the range and strike the school bus. This is a tragedy that we would like to avoid. (Saferange, 4)

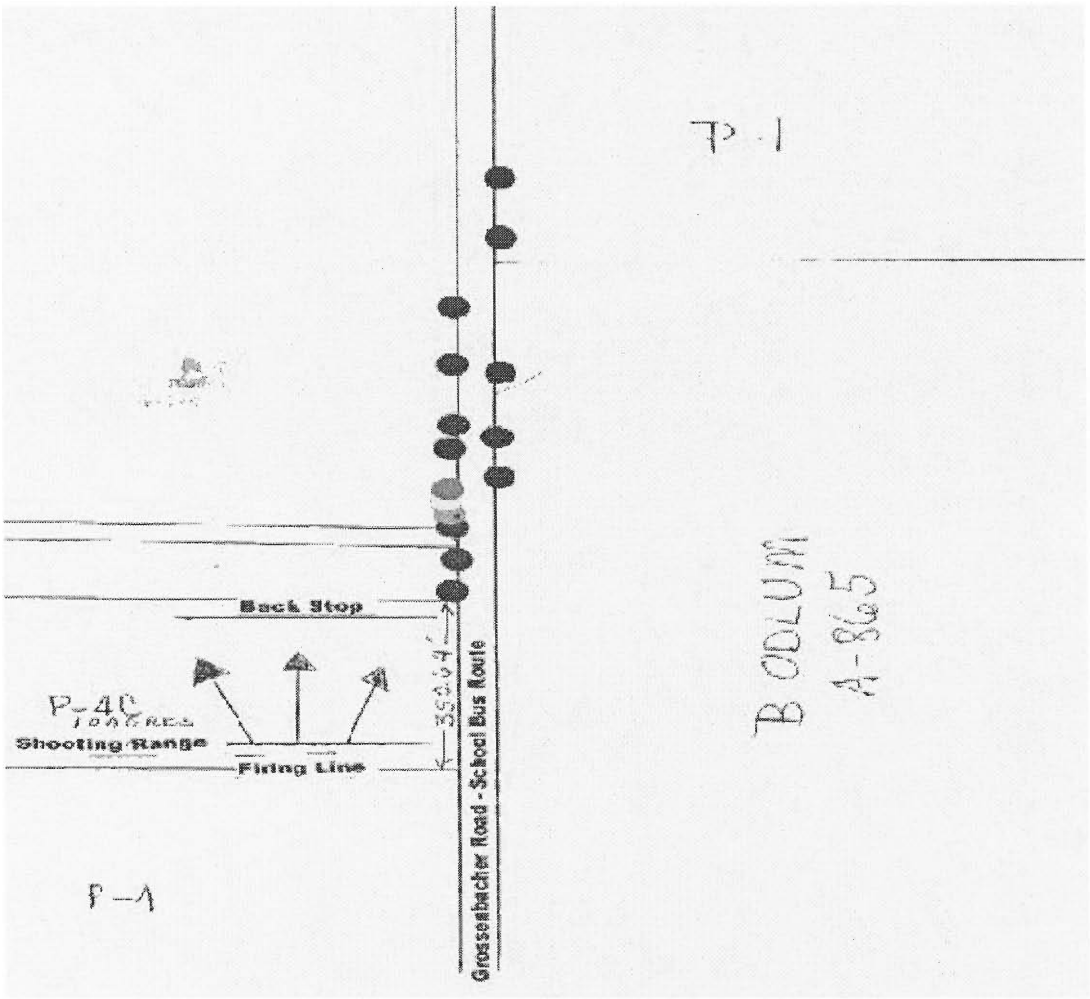


Figure 3: Bullet map of Grossenbacher Road

The red, green, yellow, and blue dots represent bullet fragments that have been picked up by this man. Stray bullets from this range are by no means limited to the number of dots shown on this bullet map. This bullet map shows only the bullets that this man has found when he walks Grossenbacher Road. It is not unreasonable to suggest that there are many more bullets that have not been contained to the range.

2.4.1. Social Issues

When we take a look at the social issues associated with ranges, three main issues arise. These issues include noise pollution from the ranges, the lead pollution, and the stray bullets. The general public has voiced strong opinion on these subjects when issues concerning new and existing ranges have been discussed. Encroachment has been one of the interesting words that some shooting range owners have inserted into the current dialog on this issue. Usually it occurs in a statement like, "My range was operating just fine until people encroached on it. Now they think they the range should be closed because they don't like the noise."

This shows how the person that phrases a statement takes the advantage by how he or she words the issue. In this example, the shooting range owner tries to create the impression that the range's neighbors are somehow in the wrong because they have "encroached" on the range.

Obviously, a shooting range never has God-given rights to send loud noises, lead pollution or stray bullets off its property whether or not the neighboring property is occupied. Occupied or not, it is still owned by someone else. On the other had, it is not fair for the people to say that a range is "encroaching" even if the people lived there before the range was constructed. Most ranges operate as a business. The owner of a range has the right to set up his business and attempt to make a successful living.

The issue can be fought both ways. On the side of the range owner, why should the neighboring houses have rights over the range owners? For the neighboring houses, why should a range have the right to build in a populated area where they impose the potential for accidents and pollution? As of right now, the debate has been fought on the basis that one party has existed in that specific location before the others.

The noise pollution generated from the explosion of gunpowder used to propel the bullet from the gun has presented itself as one of the three major issues. Gunfire noise is characterized as impulsive in character, meaning that a loud sound occurs in a short interval of time. For example, typical gunfire noise may have a sound peak of about 160 dB occurring over a period of several hundred milliseconds. Due to regulations states have imposed to prohibit the use to silencers, this noise pollution remains a large problem when analyzing the social issues associated with ranges.

Lead pollution can be divided into the following three categories: Lead pollution resulting from bullets leaving the range, Lead pollution from bullets that are contained to the range, and Lead pollution resulting from the airborne elements associated with firing the gun. The problem of lead leaving the range and polluting the environment is directly correlated to the main issue of bullets leaving the range. If we contain the bullets to only the range, we can eliminate this problem. Pollution caused from exploding primers containing lead styphnate and the friction from lead slug against the gun barrel creates airborne lead. High lead dust levels can accumulate inside indoor ranges with inadequate ventilation. This airborne effect of firing a gun is extremely small and hardly a factor when looking at the big picture. The final problem is the lead that stays on the range. Bullets that are fired into the backstop eventually pollute the water and cause environmental problems. Because of the nature of bullet traps, indoor ranges have been more successful at avoiding this pollution. The major problem lies in outdoor ranges. The dirt berms that serve as bullet backstops do not prevent this pollution. As of right now, the US army is working to find a solution to this problem. The South Range in Fort Rucker, Alabama is one of the Army's latest environmental innovations. It is an "environmentally re-engineered" test bed for new methods to curb soil erosion and prevent lead from reaching the underground water. A large berm was designed by engineers to hinder erosion and control rainfall run-off. The

steepness of the front and rear slopes was reduced to decrease water speed. Hills called "wing walls" were added on each end of the berm to direct rainfall to drainage ditches on the range floor. The ditches lead to a manmade detention pond, which catches water until the sediment "settles out." [USAEC article, Reference 6]

The last, but certainly not the least, issue to consider is that of stray rounds fired from the ranges. Bullets do not have brains; they are objects that, when fired, do not stop until they meet a force great enough to oppose the force of the bullet. This simple fact based on the laws of physics has presented itself as a large problem for gun ranges all over the world. When a bullet is fired at a gun range, whether indoor or outdoor, it must hit the backstop of the range. The backstop can be defined as a large area that has been constructed in order to stop bullets after they have been fired. This area provided enough force to stop bullets so that they will not travel off the range site. If the bullet does not hit this designated area, there is a chance that the bullet will leave the range property. In the event that a bullet does leave the confines of the range, the potential for accidents greatly increases. Below is an example of how these stray bullets can cause injury. Luckily, the bullet did not inflict a fatal injury on this young boy who was standing in his carport over a mile away.

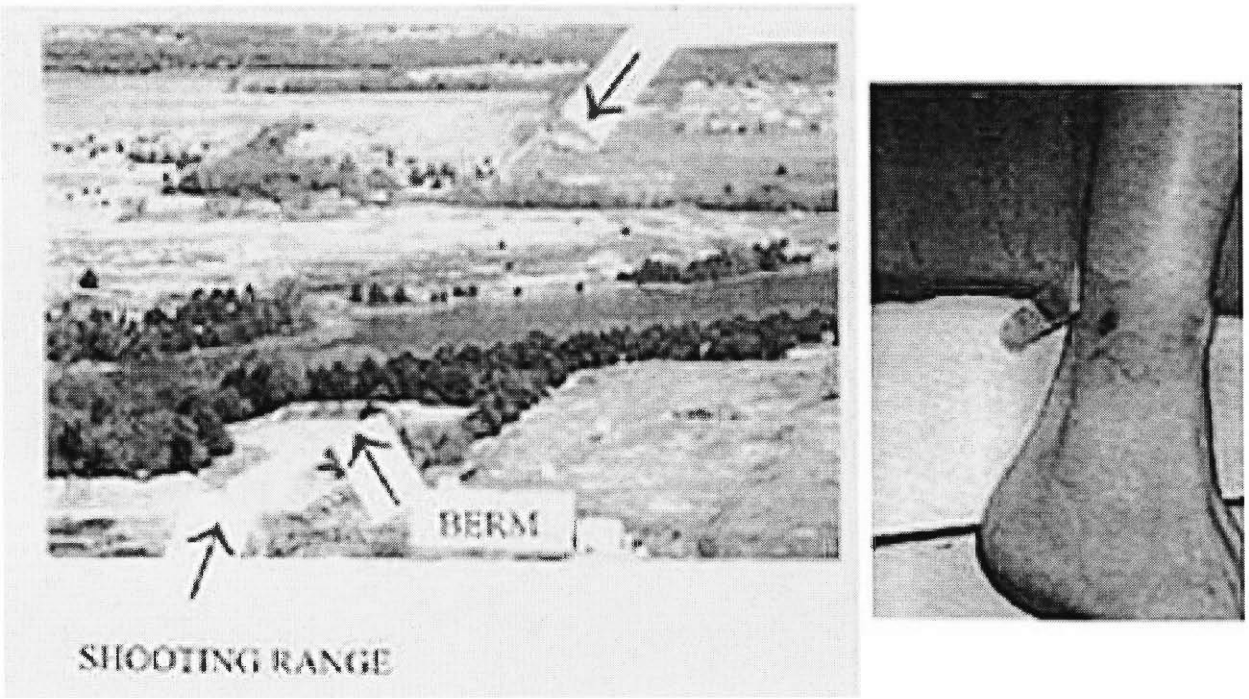


Figure 4: Stray bullet resulting in an accident

The picture above shows an outdoor shooting range. The Lower two arrows represent the firing line at the range and the backstop where the bullet was supposed to stop. The upper arrow shows the location of the boy at the time of the injury. Even though you don't hear or read about accidents such as this everyday, when they do occur, they cause setback on any common ground that has recently been gained on either side of the gun debate. Compared to the baby steps that the world takes in the positive direction on the gun control issues, giant leaps are taken backward due to gun related accidents that are blown up by the media.

The two easiest ways for a bullet to leave a firing range are ricochets and careless while participating in the sport of shooting. Ricochets occur when a bullet strikes a surface that is not perpendicular to the trajectory of the bullet's path. The result is that the bullet does not loose much velocity; instead its originally intended direction is changed relative to the angle at which the bullet strikes the surface. Carelessness while shooting may be the result of lack of education or "horseplay" at the range. Lack of shooter education can pose a problem if the shooter does not realize the potential of his firearm. He may be less inclined to make sure that his gun is

aimed directly at the backstop. The "horseplay" at shooting ranges contributes to a large number of bullets leaving the range. For example, a tin can on the ground poses as an excellent target for the uneducated shooter interested in having some fun while at the range. This person does not realize that a tin can will not stop a bullet. If fired at, the bullet will not stop when it hit the tin can. Now, we have a bullet traveling at high speeds where it may bounce off the ground or strike a rock. Another example of "horseplay" at gun ranges can be seen in figure 2. The hanging light fixture found in the range appears to be a fun target when people forget to consider what happens to the bullet after it hits the light. The bullet map below from Texas represents numerous bullets that were not contained to the range property. They may have left the range due to these reasons listed above.

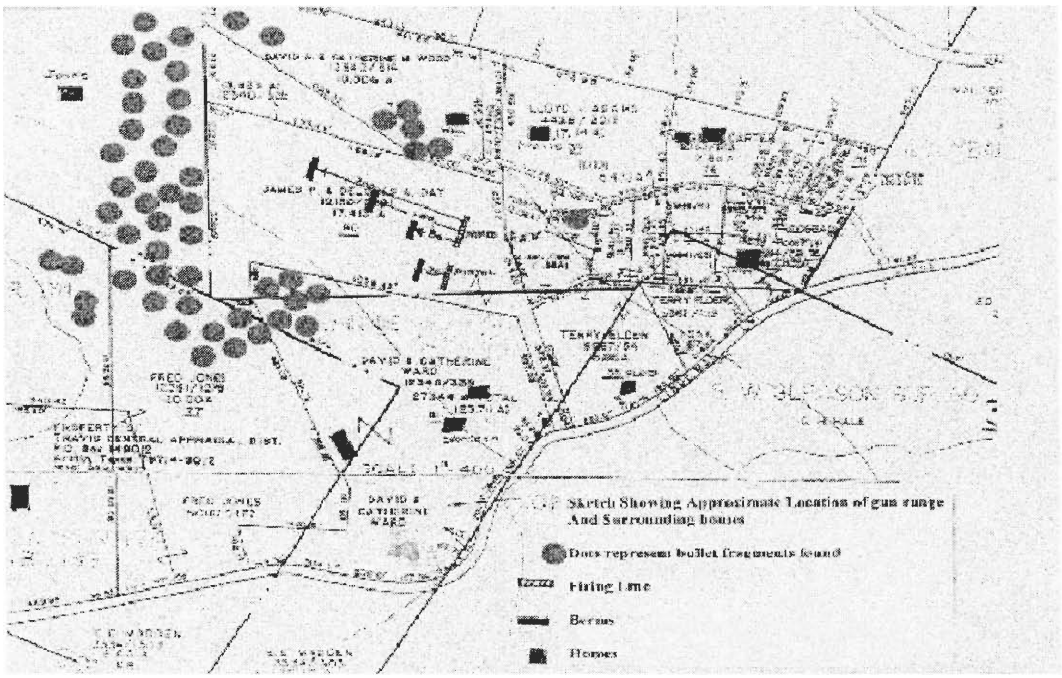


Figure 5: Complete Bullet Map of a Texas Firing Range

Similar to the previous bullet map, bullet fragments in this figure are represented by red dots on the map. The small area surrounded by red dots is the firing range. If you look closely, u will see that the dark lines on the map show the range backstops while the hashed lines represent the firing lines for pistols and rifles. An interesting thing found on this bullet map is

the bullets immediately off to the right and left of the backstops as well as behind the firing line. The fact that these bullets are not even remotely in line with the backstop suggests possible ricochets or horseplay at the range.

In order to provide some common ground for this gun control issue, two of these social issues must be addressed when considering a solution. The lead pollution and stray bullets are both feasible issues to be addressed. Due to the state regulations of silencers, addressing the noise issue is not a very feasible concept for this project.

3. Technical Aspects

The technological aspect of this project was undertaken in an effort to prove the technological feasibility of an electronic range safety system. The specific goals within this area of the project were aimed at proving the feasibility of such a device, not necessarily developing an actual design.

In an effort to make the shooting sports safer for both participants and those near by, this project aims to develop specifications and preliminary designs for a safer range. The new specifications for this range are developed to allow for retrofitting of older firearms and ranges so as to avoid the requirement of the purchasing of new firearms by gun owners. This new system will be designed to prevent the pulling of the trigger of a gun when it is aimed such that its bullet will not hit the backstop.

The specifications call for the implementation of two new pieces of technology to be employed. First, an array of radio frequency transmitting devices and electronics will be required to be installed into the range itself. Second, a small electronic system will need to be attached to the firearm so that a communications link exists between the firearm and the range. The specifics of these systems will be discussed later in this chapter. It was not the goal of this project to neither produce nor test prototypes of these designs. The project will simply attempt to assess the feasibility of the construction of and the effect of such devices.

3.1. The Basic Problem

The basic problem that needs to be addressed is the ability to determine whether or not the firearms on the range are pointed in a safe direction. The basic way that we approached this problem was to find a way for the firearm to have sensors attached to it that would in some way

be used to determine if the firearm was pointed downrange. This idea then lead us to identifying the need to have some form of moderately powerful computational power in the system to perform calculations on the incoming data and determine the safety of the direction that the firearm is pointed in. Once this information is processed, the system must be able to prevent the firearm from firing via an electronic signal. In order to this, an electronically controlled safety must be installed in the firearm. To summarize, there are three main tasks that the system must be able to perform:

- Collect input data from onboard sensors mounted on the firearm
- Process data and determine direction, via computerized system
- Enable safety device if necessary

3.1.1. Determining a Safe Direction

We looked at many possible ways of obtaining the directional data about the firearm's position and direction, but many of the methods were deemed either too difficult to design for, or simply lacking in the area of reliability. We investigated two of the more promising methods thoroughly. In the first case, an array of microwave frequency transmitters will need to be employed to define the limits of the backstop. These transmitters emit signals that a receiver attached to the gun can detect, and based upon those signals, the information can be used to determine if the gun is pointed in a safe direction. The second school of thought is to use a combination of an electronic compass and an electronic level[2] to determine if the gun is pointed in a safe direction.

3.1.2. Onboard Safety

Almost every firearm in use today has any number of manual safety devices integrated to the firearm. In order to give the computer system control over one of the safeties, the firearm

[2] A mercury switch may be employed in this use.

must be fitted with some form of an electromechanical interface. The simplest form of such a device would be in the form of a single solenoid that would have the ability to block some part of the firing mechanism of the firearm. This can take the form of a very small solenoid inside of a newly designed firing mechanism, or even in the form of a larger solenoid that can be used to block the trigger from being pulled back. This second concept, the external solenoid will allow older firearms, even black powder muzzleloaders can be brought up to specifications if a retrofit design is created.

3.2. Microwave Transmitter Solution

In order to use microwave frequency signals to determine the direction of the firearm is a complicated issue. The theory behind this approach is to have four microwave sources, one at each corner of the "safe" target area, usually the backstop of the range (Figure 6). As seen below, the blue circles represent the microwave transmitters[3], the lavender line represents the firing line, and the red box denotes the safe area to shoot in. In one way of making this approach to work, a strict protocol must be adhered to in the operation of the transmitters. In an effort to avoid interference from the other transmitters, each transmitter is turned on individually, and each firearm records the signals from each transmitter individually. Alternatively, instead of cycling the transmitters[4], digitally encoded signals may be used to uniquely identify each of the transmitters. If this approach is used, then the processing requirement of the system will increase. In either case, the strengths of these signals can be used to triangulate the point at which the gun barrel is aimed at with respect to the backstop. This procedure is very similar to how earthquake centers triangulate the epicenters of earthquakes. In this case, however, there is one receiver and many transmitters, instead of there being many receivers and one transmitter. The signal strength should be enough to determine the angle between the firearm barrel and the

line between the transmitter and the firearm. With the data from any three of these transmitters, the direction of the firearm can be determined, and the fourth transmitter can be used for redundancy and improved reliability. The calibration of such a system is beyond the scope of this project team, but should be looked at as one of the key components in the successful development of a prototype system.

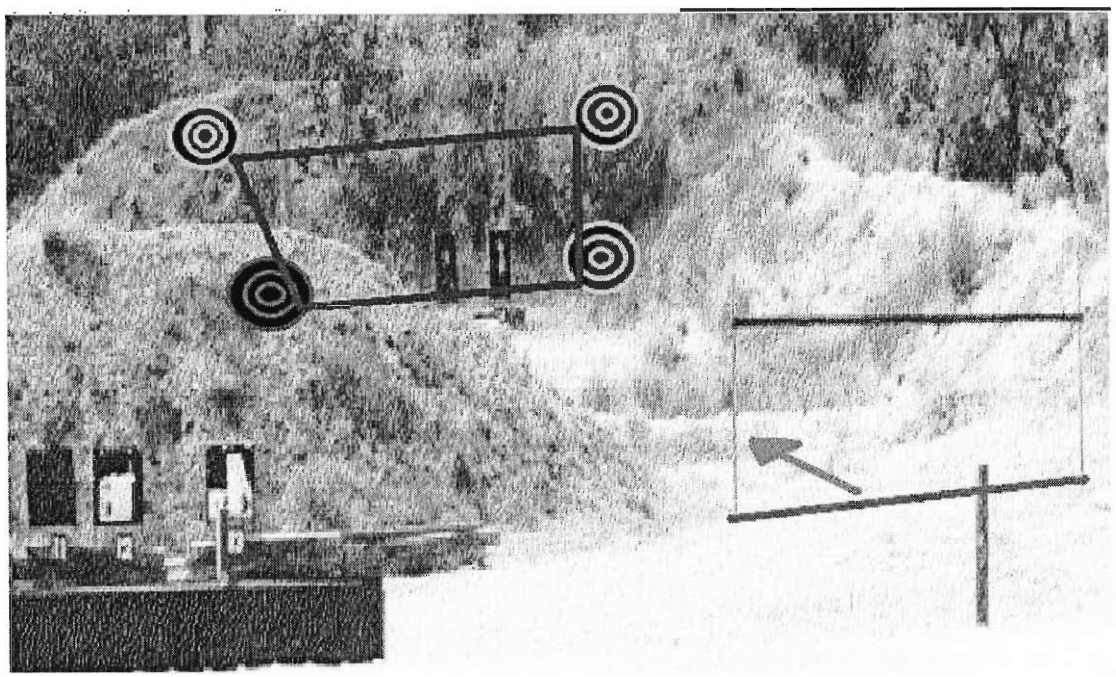


Figure 6: Microwave transmitter locations

3.3. Compass and Level Solution

The second and more conventional solution to the directional problem incorporates two devices that are much more commonly used. The use of the combination of an electromagnetic compass and level may adequately solve the problem of determining the firearm's direction. With this approach, each firearm must be fitted with a compass, aligned with the firearm's barrel and a mercury switch such that the elevation of the barrel may be calculated. The range itself must also be fitted with an electronic compass aligned in the direction of fire. This compass will enable the computer system to have a current reading of what the "safe" direction should be.

[3] The darker transmitter in the lower left is darkened because it is actually behind the closer berm, and would be out of view.

The information from each compass on each gun will provide real-time information regarding the heading of the individual firearm, which will be analyzed by the computer to determine if the firearm is aimed too far to one side or the other. The mercury switch will provide real-time information regarding the inclination angle of the firearm. This can be analyzed by the computer system to determine if the firearm is aimed too high, which can result in missing the backstop, or too low, which may result in a ricochet that will bounce over the backstop.

3.4. Integrating into the Current Range Environment

This new technology may prove to be a useful tool in limiting the number of stray shots there are from a range. In order for it to stand a chance of being accepted into the shooting sports community, everything must be able to be integrated in without any major changes from the viewpoint of the shooter. To this end our team has investigated methods that may be employed to make this system more easily integrated with the shooting sports.

3.4.1. Range Electronics

The Range will need to be fitted with a computer system. The complexity of this computer system is directly related to the number of firing points on the range. The computer may be as simple as a single terminal for a single range officer. The computer system may be as complex as an array of consoles where each range officer can log in. In the latter case, each officer will take responsibility for and control over a set number of firing points, according to that range officer's skill and preference. This more complex system will help to ensure that a range officer does not become overworked by trying to control too many firing points.

Each firing point will be equipped with a cable that will interface with onboard devices that meet the specifications for the system. The use of the cables will prevent overcrowding of

[4] The time that it takes to enable and disable the transmitters may prove to be too long to be feasible.

ranges, and will ensure that the firearms are operated from the firing points, and that the shooters do not shoot from any position other than the firing line.

3.4.2. Onboard Device

The onboard device must include all the hardware necessary to produce the directional data for each firearm, as well as the hardware necessary to interface with the central computer. This may include the electronic compass and level, or the sensors needed to receive signals from the range's transmitters, as well as a small micro-controller system and an electromechanical device to physically block the firing mechanism. Power may be supplied to the device with the same cable that will contain the signal wires. The device must be fail-safe to insure the safety of the area should a loss of power occur. Ideally a battery backup will be available to notify the range officer of the condition.

These specifications may be designed into new firearms rather easily, or alternatively a retrofit device may be designed to meet these specifications. We have envisioned this retrofit device to be a clamp-on device that will attach to the trigger guard, and position a solenoid behind the trigger preventing it from travelling back. The weight of the device must be kept to a minimum, as too much weight can easily unbalance a firearm. It is our belief that the encumbrance of the cable is necessary for two reasons. First, the cable will restrict the shooter to only firing from a small area on the firing line, which ensures that the firearm may not travel more than a short distance from the firing point that the cable defines.

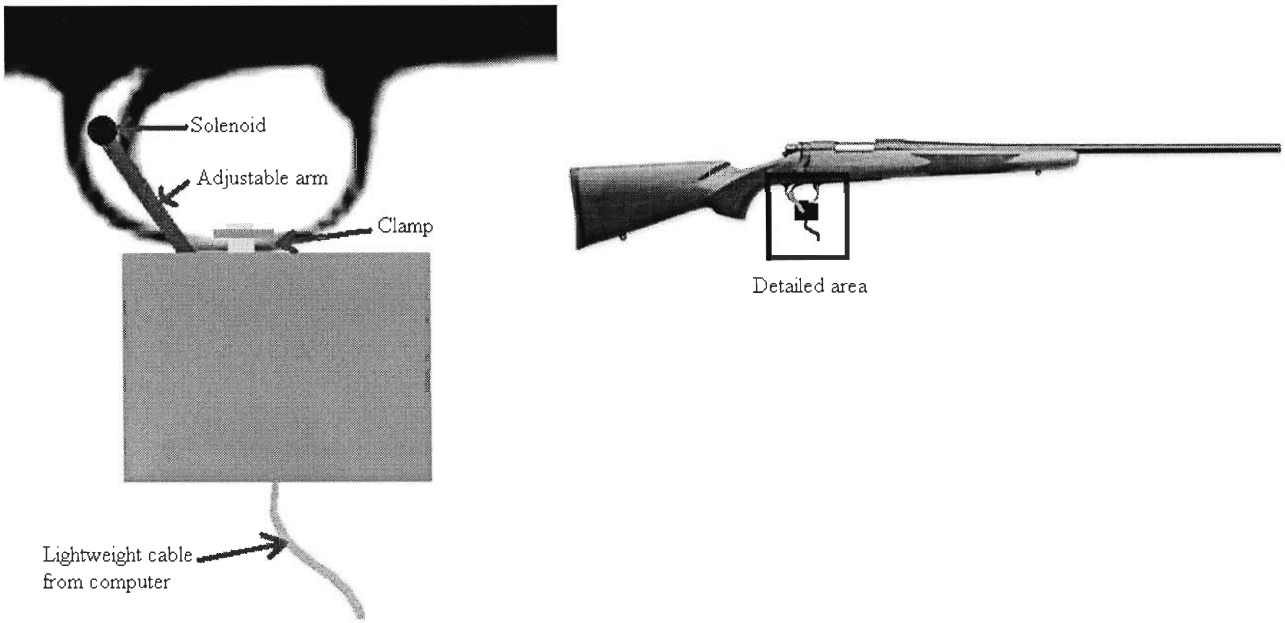


Figure 7: Onboard retrofit device concept

4. Social Aspects

In an effort to analyze the impact of the proposed electronic range safety system we held a series of conferences to introduce this system to some of the members of the greater WPI community. The turnout to the conferences was not what we had hoped for, however we were able to collect sufficient data from the conference and from other surveys that we administered to get a feel for the effect on the community that this proposed system may have.

4.1. ERSS Conference

On the 10th of April 2001, our team presented our project three times, administering surveys before and after the presentation to the audience. Originally we had hoped that local firearms manufacturers would have been able to send representatives to the conference, but we did not have any such representatives at our conference[5]. The National Rifle Association (NRA) was able to send a member of their range technical team to the conference. The conference consisted of about a 20-minute presentation by our team, followed by an open discussion with all that were present.

4.2. General Opinion Survey

In order to judge the opinions of the community we designed a survey. (Survey, Appendix A) In designing our survey, we wanted to present a broad range of questions that would allow us to find out what the general public opinion was on the issue of firearm's and firearm safety. We decided that we would issue two surveys. The first would be presented before respondents attended our presentation or read a written version of our proposal. We knew that we would need some logistical data in order to classify the people that we were conversing

[5] The companies that were invited to the conference are Bushmaster Firearms company, Colt, and Smith and Wesson.

with. The General questions of Age, Sex, Occupation, and Residence were the first data that we wanted to collect. We also thought it was important to classify people as gun owners or non-gun owners. Our first survey question read as follows:

- Do you personally own a handgun, rifle, shotgun, or any other type of firearm?

Respondents were asked to check off all that they owned. This question was key in our assessment of our data. We knew that gun owners would have a much more supportive opinion about firearms than non-gun owners would. By classify individuals into two separate groups we could see what group our presentation would have the most effect on. We then constructed a set of 4 questions that would allow us to flush out how safe firearms were perceived by the general public. The questions were asked to be judged on a scale of 1 to 6, with 1 being very safe and 6 being very unsafe. The following questions were asked:

- How safe do you think it is to carry a firearm?
- How safe do you feel when you are in the presence of someone with a firearm?
- How safe is it to go practice marksmanship at a firing range?
- How safe do you feel personally firing a firearm?

We chose a range from 1 to 6 so we could eliminate a middle ground. We wanted to have a clear line drawn between people who thought guns were safe and those who thought guns were unsafe. We then shifted the focus of our survey to the idea of opening a firing range in your hometown, or having a rifle team at a local area high school. The following questions were asked:

- Would you support or oppose the opening of a firing range in your hometown?
- How desirable would it be to have a varsity and J.V rifle tam in the local high school?

The latter question was asked to be judged on a scale from 1 to 6, where 1 signified "Very Desirable" and 6 signified "Very Undesirable". Because the main focus of our project

was to design a "safe range", we though it pertinent to get the opinion about firing ranges and range safety. To help explain or flesh out why people voted as they did on our previous question about a high school rifle team, we then wanted to know if our respondents had children attending school. We were concerned with all levels of education so we asked if they had children in Pre-school, grade school, high school, or college. We thought that the answers from this question would be useful in analyzing any discrepancies in the previous question.

To this point in our survey, we had composed questions to get the public perception about firearms and firing ranges. We now wanted to divide our population further. By asking the following question:

- Would you support or oppose a federal amendment strictly limiting the right of citizens (not military or police personnel) to own a firearm, to those who can show cause to the Bureau of Alcohol Tobacco and Firearms that they need one?

We were able to divide our population into people who were opposed to firearm ownership and those who supported the right to own firearms. The question was judged on a range from 1 to 6, where 1 represented someone who was strongly supportive to such a bill and 6 represented an individual strongly opposed to such a bill. In order to help us analyze the results of the previous question, we asked a follow up question:

- Have you ever been threatened with a gun or shot at?

We thought that this question could provide some insight into why someone answered strongly supportive to the previous question. Our thinking was that those who had a negative experience with firearms in the past would be more likely to support a bill that would severely limit access to firearms. Our next question also was designed to perceive how safe people felt with guns readily available to the public. The question was as follows:

- Would you refuse to let a child of yours go play in the home of a neighbor where a firearm was present?

We wanted to know if the respondents felt safe with firearms in their neighborhood, around themselves and their children. If they did indeed say that they would refuse to let their children play in a home where a firearm was present, we asked if it would effect their decision if the firearm were locked up. The purpose of this sub question was to find out if the respondent's problem was with the firearm itself, or if it was more a matter of access to the firearm. The final question of our survey asked the respondents to rate a series of activities according to how dangerous they were. The activities were the following: Big game hunting, Archery, Hunting, Skiing, Snow Boarding, Bungee Jumping, Jet Skiing, Snow Mobiling, League Hockey, and Horseback Riding. The reason that we included a question such as this in our survey was to establish a basis for what the respondent's idea of safe and dangerous was. Obviously the opinion of someone who thought Bungee Jumping was very safe would have to be judged differently than someone who thought the total opposite.

4.3. Distribution of the Survey

With our survey complete, we now needed to decide what population we wanted to target. After considering our options we decided to target a population concentrated at Worcester Polytechnic Institute. However, we did not want to restrict our survey to simply students and professors. We did not think that this would be a good representation of the general public. We wanted to represent all flavors of life, different education levels, different sexes and races, different backgrounds. We thought the best way to sample a population such as this would be to survey, not only students and professors, but also faculty, administrators, maintenance workers, food service workers, and law enforcement.

We wanted to personally invite upwards of 100 individuals to a presentation that we were holding. We decided against mailing out invitations and surveys, as previous experienced had shown that this was not the most effective method to stimulate ones interest. As a result, we decided to walk around campus and personally invite people to our conference. This had two advantages as we saw it. First, we could pick a wide range of individuals to ensure that a diverse group would fill out our survey. Second, we could tell them a little bit about what we were doing and stimulate the public interest, which would help increase the chances that our population would indeed fill out our survey.

4.4. Second Survey

As I mentioned earlier, we issued two surveys, the first has been described in detail. Our second survey was similar to our first, as it was a modification of 3 questions that we had asked on our initial survey. The Three post questions were as follows:

- How safe is it to go practice marksmanship at a firing range equipped with a range safety device?
- Would you support or oppose the opening of a firing range equipped with a range safety device in your city or hometown?
- How desirable would it be to have a varsity or J.V rifle team in the local high school, if their firing range were equipped with a range safety device?

These questions were issued to find out if our presentation had any influence on our respondents' opinions about firearms and firing ranges. This second survey was administered to our respondents after they had seen our presentation, or in some cases after they had read a written version of our proposal.

4.5. Response

Through our three presentations and through further efforts we were able to obtain 50 pre and post presentation surveys. We pushed for this number because we knew that it would be hard to produce any statistically significant results with a population of less than 50.

5. Analysis

After receiving back our 50 pre- and post-presentation surveys, we entered all of our data into an excel spreadsheet. This data was then imported into a statistical analysis program named Statistical Package for the Social Sciences (SPSS). This program allowed us to create several graphs showing the distribution of our data. It also provided an easy means for calculating the frequencies for each variable that we had in our survey. We ran a battery of calculations on our data including cross tabulations of several variables, T-Tests, and several non-parametric tests, such as the McNemar test and the Wilcoxon signed ranks test.

5.1. Cross Tabulation

Cross tabulation is a way of representing how categories of one variable, the independent variable are distributed across the categories of another variable, the dependent variable. Thus one can see if there are patterns of association between two variables in a cross tabulation matrix. The variables can be nominal, ordinal, and grouped-interval data. Cross tabulation has specific statistics associated with it that tell us something about the degree to which variables are related, called a measure of association, and the likelihood that the patterns, or lack of patterns, represented by the sample data did not occur by chance. Chi- Square is a measure of statistical significance. It will not tell you how closely the variables are related, but rather it indicates whether it is likely that the sample distribution is a reflection of the larger population rather than the result of chance. After experimenting with SPSS and trying a battery of different tests, we decided that these four would allow us to use our data in the most effective manner.

5.2. The T Test

The T-test is used to determine whether samples have different means. Essentially, the t-test is the ratio between the sample mean difference and the standard error of that difference. The t-test makes some important assumptions:

- Interval/Ratio level data
- One or two levels of one or two variables
- Normal distributions
- Equal variances (relatively)

We realize that our data does not exactly fit the requirements for a T-test, however we thought that it would still be useful in proving that our presentation did indeed have an effect on our respondents' opinions. To be sure to cover all of our bases we also ran a range of non-parametric tests. Non-Parametric tests may be, and often are, more powerful in detecting population differences when certain assumptions are not satisfied. All tests involving ranked data, i.e. data that can be put in order are non-parametric. In our case we decided to run the Wilcoxon Mann-Whitney test and the Wilcoxon signed ranks test.

5.3. The McNemar Test

The McNemar test determines if the proportion of cases in the first category of one variable equals the proportion of cases in the first category of another variable. The test assumes these proportions are equal, computes expected frequencies, and uses a Chi-square statistic to compare the expected to the observed frequencies. A small significance level (less than 0.05) indicates that the proportions are not equal.

5.4. The Wilcoxon Signed Ranks Test

The Wilcoxon Signed Ranks test is designed to test a hypothesis about the location, or median, of a population distribution. It often involves the use of matched pairs, for example,

before and after data, in which case it tests for a median difference of zero. The Wilcoxon Signed Ranks test does not require the assumption that the population is normally distributed. This test can also be applied when the observations in a sample of data are ranks, that is, ordinal data rather than direct measurements.

6. Results

To get an initial idea of how our presentation affected our population we determined the distribution for our pre-presentation and post presentation surveys. Since the post-presentation surveys only consisted of three questions, we could quickly see that our proposal did in fact have an effect on people's opinions. The results of some of the more important questions are tabulated below.

Before Presentation

Opinion	Frequency	Percent
Very Safe	8	16
Safe	13	26
Somewhat Safe	20	40
Somewhat Unsafe	7	14
Unsafe	2	4
Total	50	100

After Presentation

Opinion	Frequency	Percent
Very Safe	11	22
Safe	22	44
Somewhat Safe	10	20
Somewhat Unsafe	6	12
Unsafe	1	2
Total	50	100

Table 1: Response to Q3, regarding the practicing of marksmanship at a firing range

By simply looking at the numbers you can see that there is a clear shift in distribution towards the safe side after hearing our presentation (Table 1). The distribution for our second question "How desirable would it be to have a J.V and varsity shooting team in your local high school?" Looks as follows:

Before Presentation

Opinion	Frequency	Percent
Very Desirable	7	14
Desirable	5	10
Somewhat Desirable	12	24
Somewhat Undesirable	13	26
Undesirable	10	20
Very Undesirable	3	6
Total	50	100

After Presentation

Opinion	Frequency	Percent
Very Desirable	7	14
Desirable	10	20
Somewhat Desirable	17	34
Somewhat Undesirable	10	20
Undesirable	5	10
Very Undesirable	1	2
Total	50	100

Table 2: Response to Q6, regarding high school rifle team

Again, by looking at the numbers, you can clearly see a shift towards the "Desirable side" after the presentation was seen (Table 2). Our third post-presentation question, "Would you support or oppose the opening of a firing range in your city or hometown?" ranked as follows:

Before Presentation

Response	Frequency	Percent
Support	26	55.3
Oppose	21	44.7
Total	47	100

After Presentation

Response	Frequency	Percent
Support	34	69.4
Oppose	15	30.6
Total	49	100

Table 3: Response to Q5, regarding the opening of a new range

Although we had a few people who did not answer this question, we still achieved the result that we wanted. After hearing our presentation there is a shift from oppose to support (Table 3).

We were very pleased to see that our presentation did influence people's opinions, and we were even more pleased that they shifted people's opinions in the direction that we were striving for. After looking at the numbers alone, we decided to run paired T-tests on the pre-presentation and post-presentation questions. We were very pleased with the results, which looked as follows:

	Mean	Std.Deviation	Lower	Upper	Chi Squared
Practice	0.36	0.66	0.17	0.55	.001 0
New Range	0.48	0.65	0.3	0.6	.001 0

Table 4: Results of T-test for New Range variable

The variable Practice represents the Question "How safe is it to practice Marksmanship at a firing range?". The difference in the means of the distribution of the pre-presentation and post-presentation question was 0.36, which translated to a shift from a mean of 2.64 to 2.28. If you recall, a value of 2 represented a "Safe" to this question and a value of 3 represented a "Somewhat safe". The shift in mean tells us that our presentation caused people to consider it safer to practice in a range where our safety system was in place. The difference in the standard deviation from pre-presentation to post-presentation was 0.66. The Lower and Upper column in the table represent the 95% Confidence interval of the difference. The Chi squared number is what we are most concerned with. When statistically analyzing data, you strive to have a chi squared of less than 0.05, when you are working with a 95% confidence level. As you can see in

our data, we have a chi squared of 0.000, meaning that our claim that opinion shifted towards the "Safe side" is statistically significant. The variable New Range (Table 4) represents the question "How desirable would it be to have a varsity or J.V rifle team to open in your local high school?" The difference in the means of the distribution of the pre-presentation and post-presentation question was 0.48, which translated to a shift from a mean of 3.46 to 2.98. If you recall, a value of 4 represented a "Somewhat Undesirable" to this question and a value of 3 represented a "Somewhat Desirable". The shift in mean tells us that our presentation caused people to consider it more desirable to have a high school rifle team, if their firing range had our safety system in place. The difference in the standard deviation from pre-presentation to post-presentation was 0.48. Again, we have a chi squared of 0.000, meaning that our claim that opinion shifted towards the "Desirable side" is statistically significant.

Realizing that there may be some discrepancy in using T-tests for our data set, we also ran a series of non-parametric tests. Running the Wilcoxon signed ranks test on our two variables; practice and new range yielded a chi squared of 0.001 and 0.000 respectively. This strengthened our claim by proving that our results were statistically significant. To analyze our third pre-presentation/post-presentation question we made use of the McNemar non-parametric test. This test was perfect for our question, "Would you support or oppose the opening of a firing range in your city or hometown?". It determines if the proportion of cases in our pre-presentation variable equals the proportion of cases in our post-presentation variable. After running this test we obtain a chi-squared value of 0.031, meaning that the proportions are not equal. This proves that our presentation did indeed shift people's opinion to support a firing range in their town, rather than oppose it.

At this point we had proven to ourselves that our presentation had done as we hoped, and increased public opinion about firearms and firearm safety. We now wanted to know what

variables caused different people to answer questions the way they did. The best way that we knew how to do this was by cross tabulation. We knew that sex would have a major issue on how people answered certain questions. Our assumption was that sex would have a major affect on how people answered the following three questions:

- Would you support or oppose the opening of a new firing range in your city or hometown?

To see if our assumption was correct we ran a cross tabulation between the variables Sex and New Range. The results of the cross tabulation yielded a chi squared of 0.046 meaning that sex did have a significant effect on whether or not a respondent would support the opening of a new range in their hometown.

- Would you refuse to let a child of yours play in the home of a neighbor where a firearm was present?

The cross tabulation of these two variable yielded a chi squared value of 0.186, meaning that sex did not have a significant effect on the respondents response. We were a little surprised by this result, as we expected mothers to be more protective of their children than fathers.

- Would it be desirable to have a J.V and varsity rifle team in your local high school?

The cross tabulation of these two variable yielded a chi squared of 0.036 which means that sex does have a significant effect on ones decision to answering this question. This result was as expected. This series of cross tabulations was useful in helping us analyze and interpret our data. If we know that men and women will answer differently on certain questions than we can better understand the distribution of answers for that question.

The question that we posed about an amendment that limited the rights of gun ownership produced an interesting distribution (Figure 8).

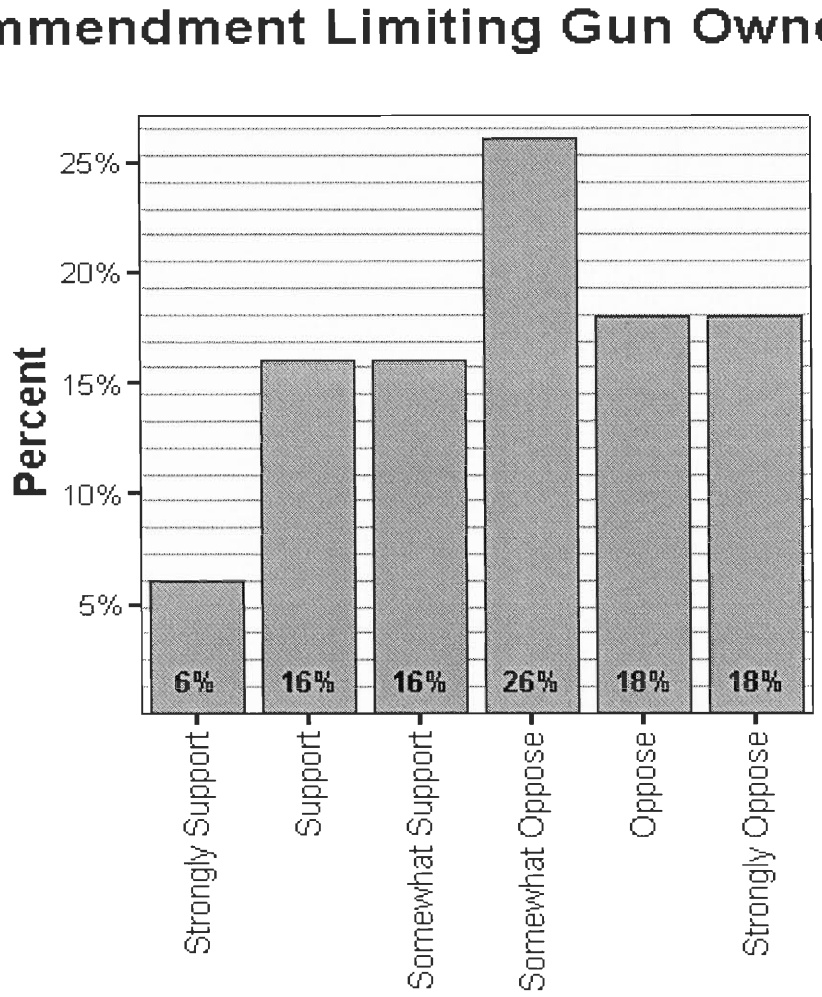


Figure 8: Response to Q8, regarding new amendment

To better understand this distribution we ran a series of cross tabulations. We thought that How safe someone feels in the presence of a firearm, would have a significant effect on whether or not they would support such an amendment. Sure enough, our cross tabulation yielded a chi squared of 0.011, meaning this was a significant factor in their decision. We also thought that how someone felt about the safety involved in practicing marksmanship would have a major effect on how he or she answered the amendment question. However when we ran the cross tabulation we found a chi squared value of 0.071, which meant it did not have a significant effect. The third assumption that we made was that how desirable someone felt it was to have a

high school rifle team, would effect their decision on the amendment question. We were correct in this assumption as our cross tabulation yielded a chi-squared value of 0.020.

The cross tabulation technique proved to be very useful in helping us understand why certain questions received the response that they did. At this point we felt that we had thoroughly examined our data. The thing that we need now was visual affirmation that our presentation had swayed our respondents to view firearms in a safer and more desirable manner. We created bar graphs to further illustrate our point.

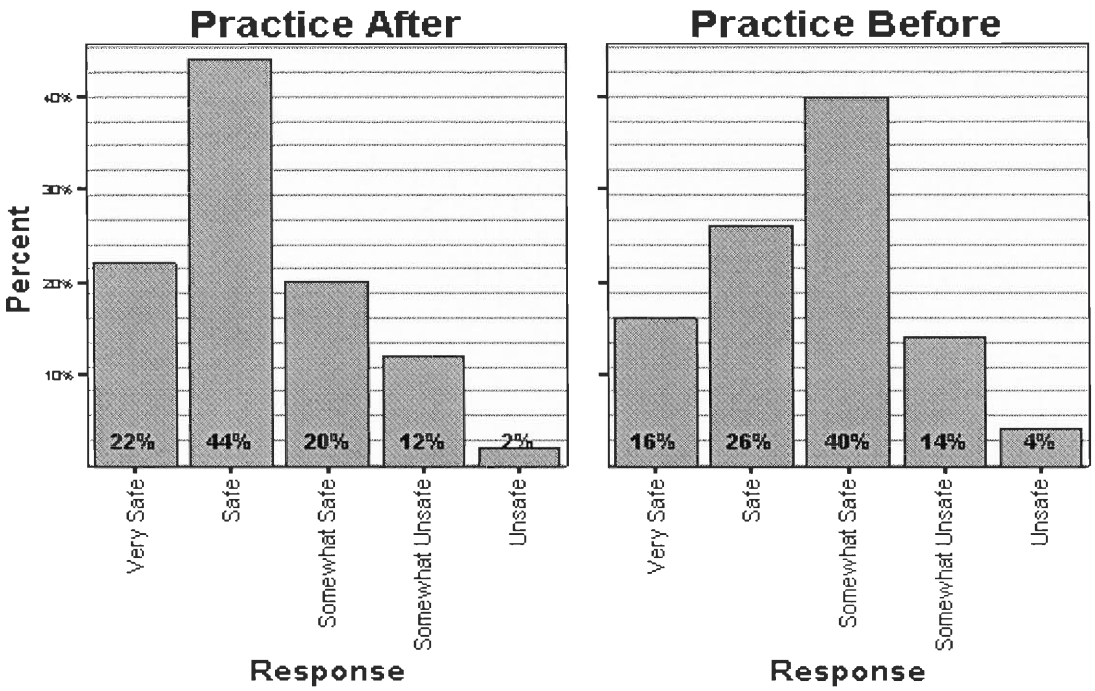


Figure 9: Response to Q5, factor of safety for practicing

The previous bar graph (Figure 9) shows the distribution of opinion before and after our presentation about the safety involved in practicing marksmanship at a firing range. As you can see after the presentation the distribution is skewed towards the "Safe" side.

The following bar chart will show the distribution of support and opposition to the opening of a new range in the respondent's city or hometown.

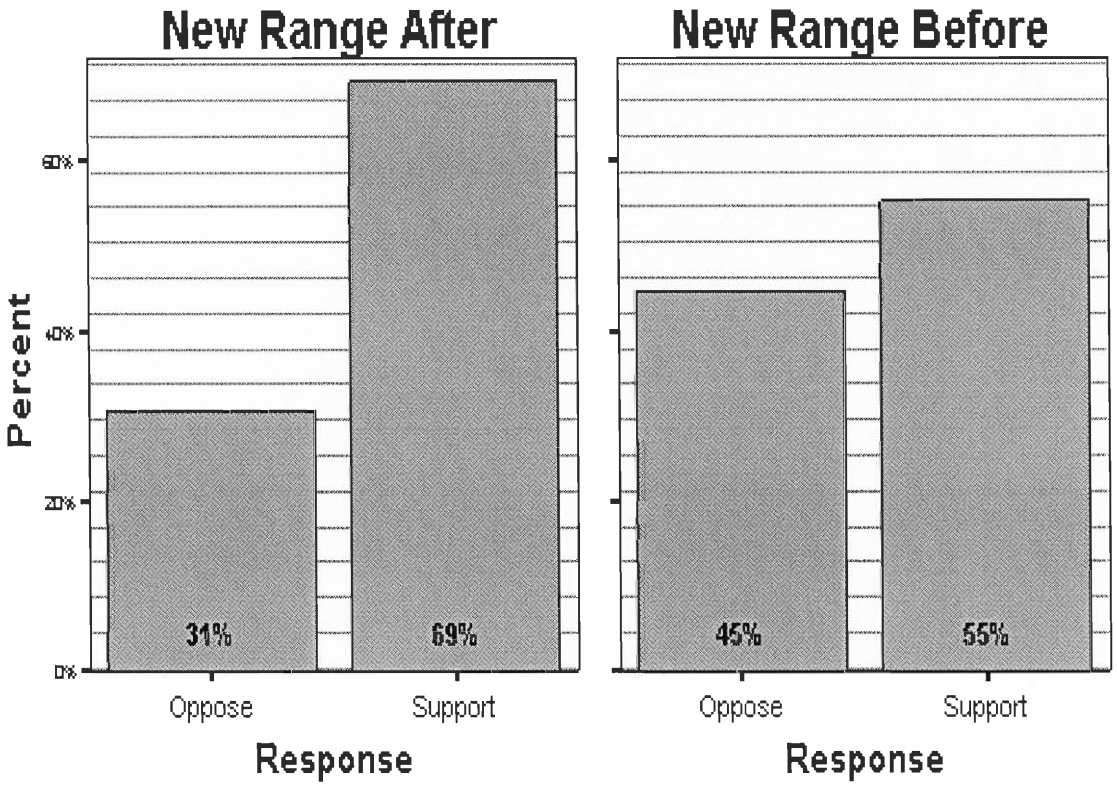


Figure 10: Response to Q5, regarding a new range

As you can see from the above plot (Figure 10), opposition to the idea of opening a new range decreased a fair amount after the respondents heard our presentation.

The next bar chart will show the distribution of opinions about how desirable it would be to have a varsity and J.V rifle team in the respondent's area high school

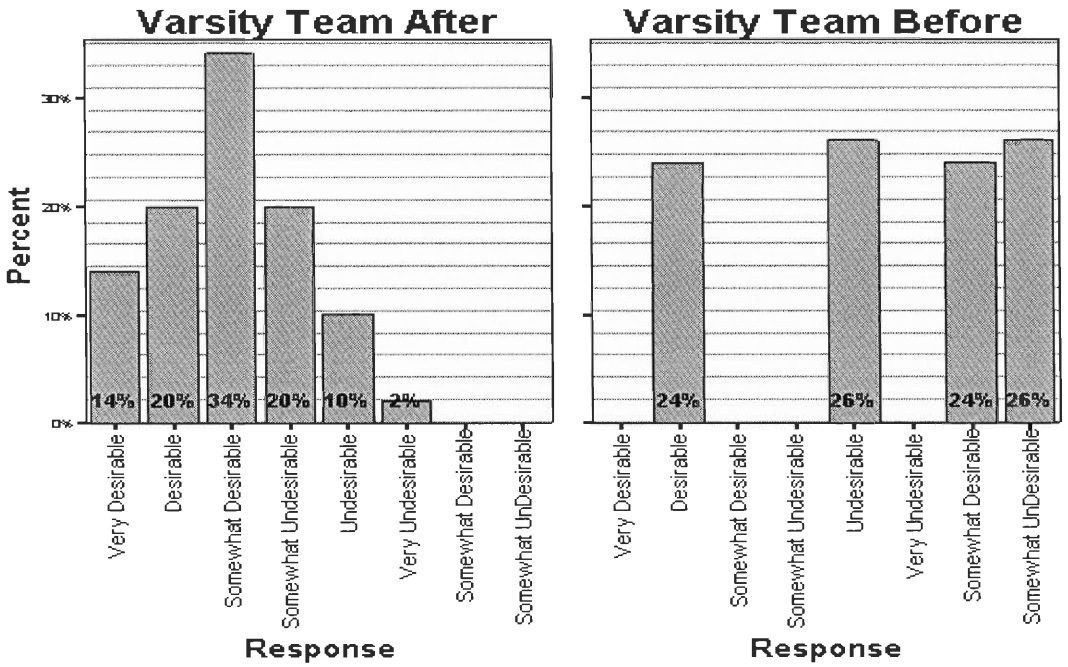


Figure 11: Response to Q6, regarding JV/Varsity high school rifle team

As you can see from the above chart (Figure 11), there is a major shift in the distribution for the undesirable side to the desirable side after the respondents heard our presentation. This in our opinion was a very promising result. To have such support for a high school rifle team in the post Columbine era says a great deal about our proposal.

The results of our survey showed us that there is public support for our proposal. The study has been designed so that it may be expanded upon and done in a more effective matter. This study provides a basis for which further studies may follow. At this point we have proven that our design is not only technically possible, but that it also has public interest and support.

7. Conclusions

This project is to be looked at as a work in progress. This study has only shown that there are grounds for the development of a prototype system. It cannot be conclusively said that this endeavor is neither going to be successful at preventing 100% of accidents, nor is has it been proven to be an economically viable solution to the problem at hand. A prototype system must be engineered, calibrated, tested and analyzed before any conclusions can be drawn about its successful integration in the shooting sports and the American culture surrounding these sports. Once a prototype is developed more information can be gathered:

- Testing can be done with respect to the actual precision of the technologically feasible concepts that we have identified.
- Feedback from active shooters can be collected as to how well the devices can be integrated into the shooting sports.
- Refinements can be made on the basic design concepts to improve precision in the system and user-friendliness.
- Analysis can be performed to measure the economic viability of the system.

We have found the system outlined in this document to be technologically feasible to create, and we have confirmed our assumption that it will have a positive effect on the public's perception of the shooting sports.

7.1. Recommendations

We feel that at this point there is a need for the development of a prototype electronic range safety system. The system approach that we suggest to be followed up is the microwave transmitter approach. This has several advantages over the compass and level approach.

- Mounting of the retrofit device can be less precise as the directional data signal is received using the barrel.

- Design using four transmitters per backstop adds redundancy to the system improving reliability.
- Onboard electronics should be less complex, as the complexity is moved to the transmitter electronics and the computer software.
- It is reasonable to expect the onboard devices to be lighter as the electronics are less complex.

The development of a prototype system will not be a very easy task. A prototype system should be able to handle four firing points for a single backstop. A simple PC computer system with a stripped down operation environment should suffice for this[6]. Controller card(s) will have to be developed to interface with the onboard electronics. Lightweight wiring will be necessary for a final product, but for a prototype device, commercial off the shelf wiring should be sufficient.

[6] If the PC is treated as an embedded system, reliability issues of commercial operating systems can be avoided.

8. References

1. Wilkes, John, Associate Professor of Social Sciences and Policy Studies, Worcester Polytechnic Institute. A special thanks to him, not only for advising this project, but also for his experience and expertise on surveying and statistical analysis were a needed asset to our team.

2. Makarov, Sergey, Associate Professor of Electrical Engineering, Worcester Polytechnic Institute. His experience and expertise in the area of microwave signals was invaluable to our group, and will be invaluable to any group planning to attempt the design and construction of a prototype.

3. National Rifle Association's Institute for Legislative Action has been a valued source of information. http://www.nraila.org/ (April 2001)

4. Saferange Association has provided us with information regarding the poor conditions of certain ranges as well as bullet maps. http://www.saferange.org/ (April 2001)

5. Colt Manufacturing Company, a local manufacturer of firearms and developers of the SMART gun technology. http://www.colt.com/ (April 2001) http://www.colt.com/colt/html/k1_positionpaper.html

6. United States Army Environmental Center, article by Mike Buckley, (April 2001) http://aec-www.apgea.army.mil:8080/prod/usaec/op/update/win97/range.htm

9. Appendices

A Initial Survey

Included here is the initial survey used by our team.

General Opinion Survey

Gender: Male ☐ Age _____
Female ☐ Occupation or Major _____
Residence [city/state] _____

Do you personally own a handgun, rifle, shotgun or any other kind of firearm?

No ☐ Shotgun ☐ Rifle ☐ Pistol ☐ Other ☐

If Yes, How often have you fired it in the last year? _____

Have you ever been on active duty for military training or service for two or more consecutive months?

Yes ☐ less than 1 year ☐ 1-2 years ☐ 2-4 years ☐ more than 4 years ☐
No ☐

Scale:

1	2	3	4	5	6
Very Safe	**Safe**	**Somewhat Safe**	**Somewhat Unsafe**	**Unsafe**	**Very Unsafe**

For questions 1-4, please use the above scale

Q1: How safe do you think it is to carry a firearm (pistol/shotgun/rifle)?

1 2 3 4 5 6 N/A

Q2: How safe do you feel when you are in the presence of someone with a firearm?

1 2 3 4 5 6 N/A

Q3: How safe is it to go practice marksmanship at a firing range?

1 2 3 4 5 6 N/A

Q4: How safe do you feel personally firing a firearm?

1 2 3 4 5 6 N/A

Q5: Would you support or oppose the opening of a firing range in your city or hometown?

Support ☐
Oppose ☐

Q6: How desirable would it be to have a Varsity and J.V rifle team in the local high school?

1	2	3	4	5	6
Very Desirable	Desirable	Somewhat Desirable	Somewhat Undesirable	Undesirable	Very Undesirable

Q7: Do you have children living in your home? If so please classify their age

No ☐ Pre-School ☐ Grade School ☐ High School ☐ College ☐

Q8: Would you favor or oppose a federal amendment strictly limiting the right of citizens (not military or police personnel) to own a firearm, to those who can show cause to the Bureau of Alcohol Tobacco and Firearms that they need one

1	2	3	4	5	6
Strongly Support	Support	Somewhat Support	Somewhat Oppose	Opposed	Strongly Opposed

Q9: Have you ever been threatened with a gun or shot at? If so how many times?

Yes ☐ Once ☐ Twice ☐ Three or More ☐
No ☐

If you answered No to the above question please move to Q10

Did this happen to you as a child or an adult?

Child ☐ Adult ☐ Both ☐

Q10: Would you refuse to let a child of yours go play in the home of a neighbor, where a firearm was present?

Yes ☐
No ☐ If Yes, would it affect your decision if the gun were locked up?

Q11: From the following list of activities, please check all that you participate in and also rank them in accordance with the risk involved.

Scale:

1 Very Safe	2 Safe	3 Somewhat Safe	4 Somewhat Unsafe	5 Unsafe	6 Very Unsafe

Big game Hunting ☐	1	2	3	4	5	6
Archery ☐	1	2	3	4	5	6
Hunting ☐	1	2	3	4	5	6
Skiing ☐	1	2	3	4	5	6
Snowboarding ☐	1	2	3	4	5	6
Bungee Jumping ☐	1	2	3	4	5	6
Jet Skiing ☐	1	2	3	4	5	6
Snow Mobiling ☐	1	2	3	4	5	6
League Hockey ☐	1	2	3	4	5	6
Horseback riding ☐	1	2	3	4	5	6

B Exit Survey

Included here is the post-presentation survey that was used.

General Opinion Survey

Gender: Male ☐ Age _____
Female ☐ Occupation or Major _____
Residence [city/state] _____

Do you personally own a handgun, rifle, shotgun or any other kind of firearm?

No ☐ Shotgun ☐ Rifle ☐ Pistol ☐ Other ☐

If Yes, How often have you fired it in the last year? _____

Have you ever been on active duty for military training or service for two or more consecutive months?

Yes ☐ less than 1 year ☐ 1-2 years ☐ 2-4 years ☐ more than 4 years ☐
No ☐

Scale:

1	2	3	4	5	6
Very Safe	**Safe**	**Somewhat Safe**	**Somewhat Unsafe**	**Unsafe**	**Very Unsafe**

For questions 1-4, please use the above scale

Q1: How safe do you think it is to carry a firearm (pistol/shotgun/rifle)?

1 2 3 4 5 6 N/A

Q2: How safe do you feel when you are in the presence of someone with a firearm?

1 2 3 4 5 6 N/A

Q3: How safe is it to go practice marksmanship at a firing range equipped with a range safety device?

1 2 3 4 5 6 N/A

Q4: How safe do you feel personally firing a firearm?

1 2 3 4 5 6 N/A

Q5: Would you support or oppose the opening of a firing range equipped with a range safety device in your city or hometown?

Support ☐
Oppose ☐

Q6: How desirable would it be to have a Varsity and J.V rifle team in the local high school If their firing range were equipped with a range safety device?

1	2	3	4	5	6
Very Desirable	Desirable	Somewhat Desirable	Somewhat Undesirable	Undesirable	Very Undesirable

Q7: Do you have children living in your home? If so please classify their age

No ☐ Pre-School ☐ Grade School ☐ High School ☐ College ☐

Q8: Would you favor or oppose a federal amendment strictly limiting the right of citizens (not military or police personnel) to own a firearm, to those who can show cause to the Bureau of Alcohol Tobacco and Firearms that they need one

1	2	3	4	5	6
Strongly Support	Support	Somewhat Support	Somewhat Oppose	Opposed	Strongly Opposed

Q9: Have you ever been threatened with a gun or shot at? If so how many times?

Yes ☐ Once ☐ Twice ☐ Three or More ☐
No ☐

If you answered No to the above question please move to Q10

Did this happen to you as a child or an adult?

Child ☐ Adult ☐ Both ☐

Q10: Would you refuse to let a child of yours go play in the home of a neighbor, where a firearm was present?

Yes ☐
No ☐ If Yes, would it affect your decision if the gun were locked up?

Q11: From the following list of activities, please check all that you participate in and also rank them in accordance with the risk involved.

Scale:

1 Very Safe	2 Safe	3 Somewhat Safe	4 Somewhat Unsafe	5 Unsafe	6 Very Unsafe

Big game Hunting ☐	1	2	3	4	5	6
Archery ☐	1	2	3	4	5	6
Hunting ☐	1	2	3	4	5	6
Skiing ☐	1	2	3	4	5	6
Snowboarding ☐	1	2	3	4	5	6
Bungee Jumping ☐	1	2	3	4	5	6
Jet Skiing ☐	1	2	3	4	5	6
Snow Mobiling ☐	1	2	3	4	5	6
League Hockey ☐	1	2	3	4	5	6
Horseback riding ☐	1	2	3	4	5	6

C SPSS Tests

Here is the data output of the SPSS software.

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
TOWN * NEW_RNG	45	90.0%	5	10.0%	50	100.0%

TOWN * NEW_RNG Crosstabulation

			NEW_RNG		
			Oppose	Support	Total
TOWN	Urban	Count	8	14	22
		% within TOWN	36.4%	63.6%	100.0%
		% within NEW_RNG	40.0%	56.0%	48.9%
	Suburban	Count	12	11	23
		% within TOWN	52.2%	47.8%	100.0%
		% within NEW_RNG	60.0%	44.0%	51.1%
Total		Count	20	25	45
		% within TOWN	44.4%	55.6%	100.0%
		% within NEW_RNG	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.138[b]	1	.286		
Continuity Correction[a]	.588	1	.443		
Likelihood Ratio	1.144	1	.285		
Fisher's Exact Test				.373	.222
Linear-by-Linear Association	1.113	1	.291		
N of Valid Cases	45				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 9.78.

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Ordinal by Ordinal	Gamma	-.313	.275	-1.082	.279
N of Valid Cases		45			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
NEW_RNG * SEX	46	92.0%	4	8.0%	50	100.0%
P_NEW * SEX	48	96.0%	2	4.0%	50	100.0%
REFUSE * SEX	48	96.0%	2	4.0%	50	100.0%

NEW_RNG * SEX

Crosstab

			SEX		
			male	female	Total
NEW_RNG	Oppose	Count	9	12	21
		% within NEW_RNG	42.9%	57.1%	100.0%
		% within SEX	33.3%	63.2%	45.7%
	Support	Count	18	7	25
		% within NEW_RNG	72.0%	28.0%	100.0%
		% within SEX	66.7%	36.8%	54.3%
Total		Count	27	19	46
		% within NEW_RNG	58.7%	41.3%	100.0%
		% within SEX	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.998[b]	1	.046		
Continuity Correction[a]	2.886	1	.089		
Likelihood Ratio	4.041	1	.044		
Fisher's Exact Test				.072	.044
Linear-by-Linear Association	3.911	1	.048		
N of Valid Cases	46				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.67.

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Ordinal by Ordinal	Gamma	-.548	.219	-2.072	.038
N of Valid Cases		46			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

REFUSE * SEX

Crosstab

			SEX		
			male	female	Total
REFUSE	No, would not refuse	Count	26	12	38
		% within REFUSE	68.4%	31.6%	100.0%
		% within SEX	86.7%	66.7%	79.2%
	Would refuse unless Locked	Count	1	3	4
		% within REFUSE	25.0%	75.0%	100.0%
		% within SEX	3.3%	16.7%	8.3%
	Would refuse even if Locked	Count	3	3	6
		% within REFUSE	50.0%	50.0%	100.0%
		% within SEX	10.0%	16.7%	12.5%
Total		Count	30	18	48
		% within REFUSE	62.5%	37.5%	100.0%
		% within SEX	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.368[a]	2	.186
Likelihood Ratio	3.296	2	.192
Linear-by-Linear Association	1.659	1	.198
N of Valid Cases	48		

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is 1.50.

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Ordinal by Ordinal	Gamma	.472	.265	1.474	.141
N of Valid Cases		48			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
SEX * VARSITY2	49	98.0%	1	2.0%	50	100.0%

SEX * VARSITY2 Crosstabulation

			VARSITY2				
			Desirable	Somewhat Desirable	Somewhat UnDesirable	Undesirable	Total
SEX	male	Count	10	9	7	4	30
		% within SEX	33.3%	30.0%	23.3%	13.3%	100.0%
		% within VARSITY2	83.3%	75.0%	58.3%	30.8%	61.2%
	female	Count	2	3	5	9	19
		% within SEX	10.5%	15.8%	26.3%	47.4%	100.0%
		% within VARSITY2	16.7%	25.0%	41.7%	69.2%	38.8%
Total		Count	12	12	12	13	49
		% within SEX	24.5%	24.5%	24.5%	26.5%	100.0%
		% within VARSITY2	100.0%	100.0%	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.551[a]	3	.036
Likelihood Ratio	8.779	3	.032
Linear-by-Linear Association	7.908	1	.005
N of Valid Cases	49		

a. 3 cells (37.5%) have expected count less than 5. The minimum expected count is 4.65.

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Ordinal by Ordinal	Gamma	-.535	.109	-4.377	.000
N of Valid Cases		50			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Ordinal by Ordinal	Gamma	.588	.161	3.194	.001
N of Valid Cases		49			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Ordinal by Ordinal	Gamma	-.500	.118	-3.886	.000
N of Valid Cases		49			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	29.936[a]	20	.071
Likelihood Ratio	33.433	20	.030
Linear-by-Linear Association	13.269	1	.000
N of Valid Cases	50		

a. 29 cells (96.7%) have expected count less than 5. The minimum expected count is .12.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	43.928[a]	25	.011
Likelihood Ratio	44.361	25	.010
Linear-by-Linear Association	14.348	1	.000
N of Valid Cases	49		

a. 36 cells (100.0%) have expected count less than 5. The minimum expected count is .24.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	41.603[a]	25	.020
Likelihood Ratio	44.205	25	.010
Linear-by-Linear Association	22.436	1	.000
N of Valid Cases	50		

a. 36 cells (100.0%) have expected count less than 5. The minimum expected count is .18.

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Ordinal by Ordinal	Gamma	-.682	.085	-7.002	.000
N of Valid Cases		50			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Crosstab

			PRESENCE						
			1.00	2.00	3.00	4.00	5.00	6.00	Total
Ammendment Limiting Gun Ownership	Strongly Support	Count					1	2	3
		% within Ammendment Limiting Gun Ownership					33.3%	66.7%	100.0%
		% within PRESENCE					25.0%	40.0%	6.1%
	Support	Count		1	2	2		2	7
		% within Ammendment Limiting Gun Ownership		14.3%	28.6%	28.6%		28.6%	100.0%
		% within PRESENCE		16.7%	12.5%	15.4%		40.0%	14.3%
	Somewhat Support	Count	1		3	3		1	8
		% within Ammendment Limiting Gun Ownership	12.5%		37.5%	37.5%		12.5%	100.0%
		% within PRESENCE	20.0%		18.8%	23.1%		20.0%	16.3%
	Somewhat Oppose	Count		1	6	3	3		13
		% within Ammendment Limiting Gun Ownership		7.7%	46.2%	23.1%	23.1%		100.0%
		% within PRESENCE		16.7%	37.5%	23.1%	75.0%		26.5%
	Oppose	Count	2		3	4			9
		% within Ammendment Limiting Gun Ownership	22.2%		33.3%	44.4%			100.0%
		% within PRESENCE	40.0%		18.8%	30.8%			18.4%
	Strongly Oppose	Count	2	4	2	1			9
		% within Ammendment Limiting Gun Ownership	22.2%	44.4%	22.2%	11.1%			100.0%
		% within PRESENCE	40.0%	66.7%	12.5%	7.7%			18.4%
Total		Count	5	6	16	13	4	5	49
		% within Ammendment Limiting Gun Ownership	10.2%	12.2%	32.7%	26.5%	8.2%	10.2%	100.0%
		% within PRESENCE	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Crosstab

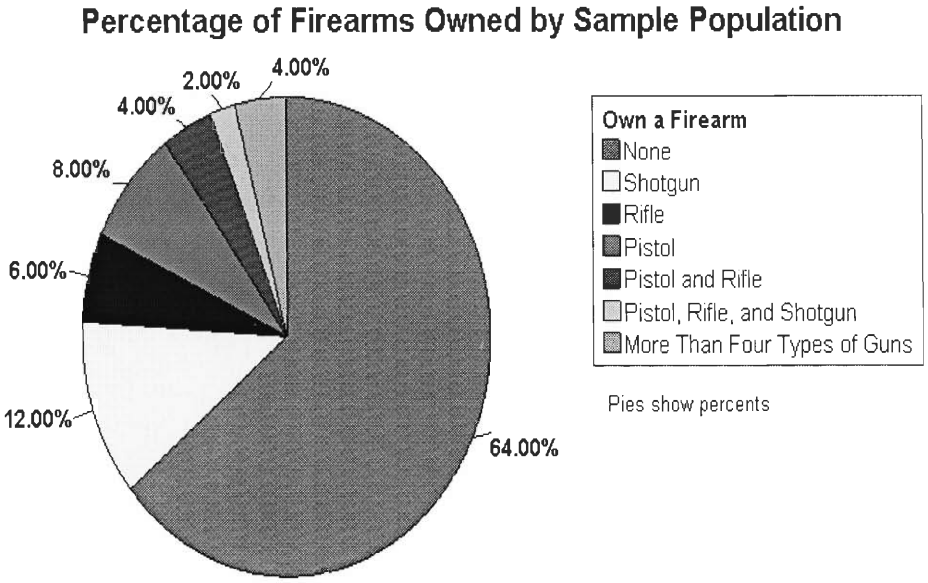
			Practice Before					
			Very Safe	Safe	Somewhat Safe	Somewhat Unsafe	Unsafe	Total
Ammendment Limiting Gun Ownership	Strongly Support	Count			1	2		3
		% within Ammendment Limiting Gun Ownership			33.3%	66.7%		100.0%
		% within Practice Before			5.0%	28.6%		6.0%
	Support	Count		2	3	2	1	8
		% within Ammendment Limiting Gun Ownership		25.0%	37.5%	25.0%	12.5%	100.0%
		% within Practice Before		15.4%	15.0%	28.6%	50.0%	16.0%
	Somewhat Support	Count	1	3	3		1	8
		% within Ammendment Limiting Gun Ownership	12.5%	37.5%	37.5%		12.5%	100.0%
		% within Practice Before	12.5%	23.1%	15.0%		50.0%	16.0%
	Somewhat Oppose	Count		2	8	3		13
		% within Ammendment Limiting Gun Ownership		15.4%	61.5%	23.1%		100.0%
		% within Practice Before		15.4%	40.0%	42.9%		26.0%
	Oppose	Count	3	3	3			9
		% within Ammendment Limiting Gun Ownership	33.3%	33.3%	33.3%			100.0%
		% within Practice Before	37.5%	23.1%	15.0%			18.0%
	Strongly Oppose	Count	4	3	2			9
		% within Ammendment Limiting Gun Ownership	44.4%	33.3%	22.2%			100.0%
		% within Practice Before	50.0%	23.1%	10.0%			18.0%
Total		Count	8	13	20	7	2	50
		% within Ammendment Limiting Gun Ownership	16.0%	26.0%	40.0%	14.0%	4.0%	100.0%
		% within Practice Before	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

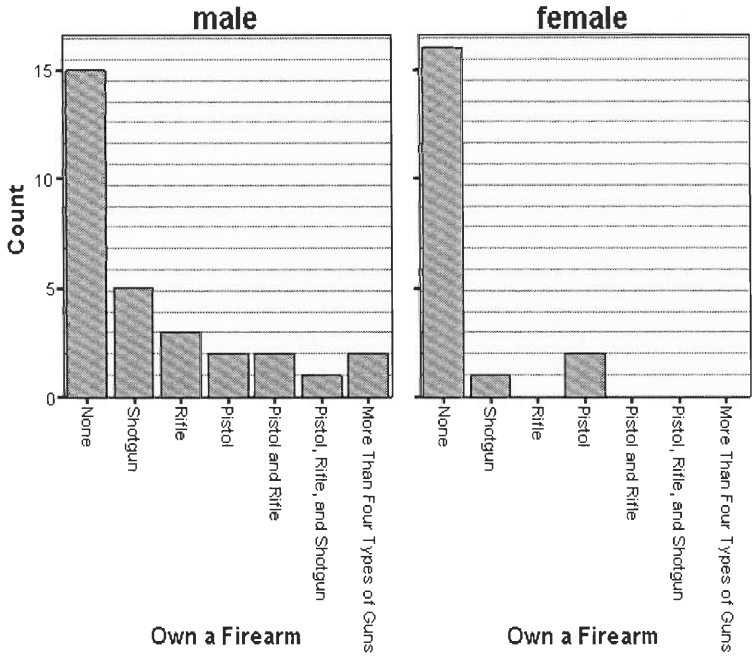
Crosstab

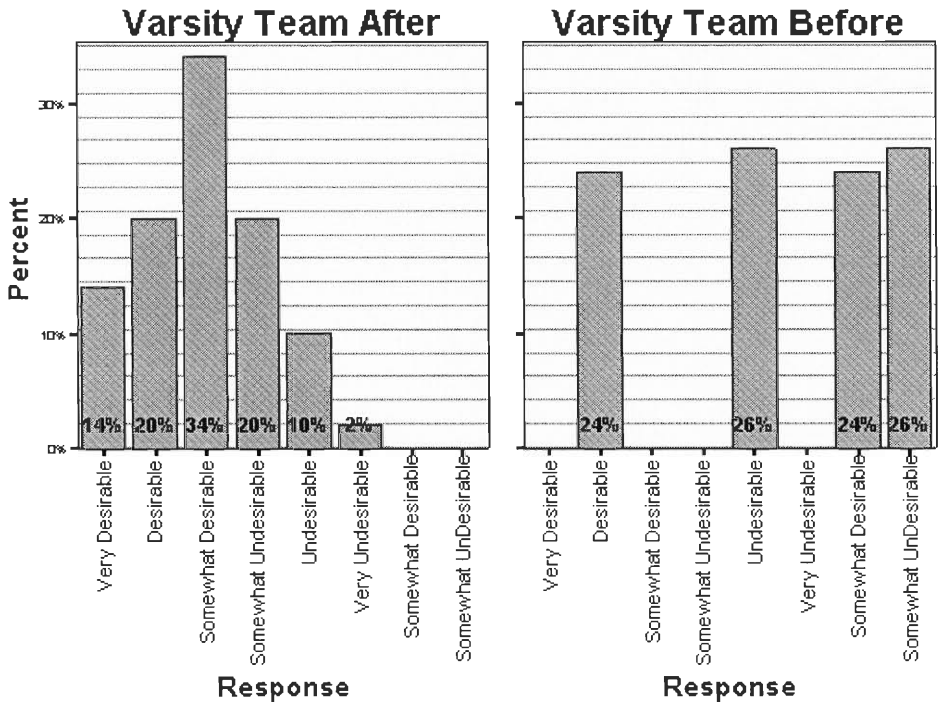
			Varsity Team Before						Total
			Very Desirable	Desirable	Somewhat Desirable	Somewhat Undesirable	Undesirable	Very Undesirable	
Ammendment Limiting Gun Ownership	Strongly Support	Count					2	1	3
		% within Ammendment Limiting Gun Ownership					66.7%	33.3%	100 0%
		% within Varsity Team Before					20.0%	33.3%	6.0%
	Support	Count			2	2	4		8
		% within Ammendment Limiting Gun Ownership			25.0%	25.0%	50.0%		100 0%
		% within Varsity Team Before			16.7%	15.4%	40.0%		16.0%
	Somewhat Support	Count		1	1	3	2	1	8
		% within Ammendment Limiting Gun Ownership		12.5%	12.5%	37.5%	25.0%	12.5%	100 0%
		% within Varsity Team Before		20.0%	8.3%	23.1%	20.0%	33.3%	16.0%
	Somewhat Oppose	Count		1	4	5	2	1	13
		% within Ammendment Limiting Gun Ownership		7.7%	30.8%	38.5%	15.4%	7.7%	100 0%
		% within Varsity Team Before		20.0%	33.3%	38.5%	20.0%	33.3%	26.0%
	Oppose	Count	2	1	4	2			9
		% within Ammendment Limiting Gun Ownership	22.2%	11.1%	44.4%	22.2%			100 0%
		% within Varsity Team Before	28.6%	20.0%	33.3%	15.4%			18.0%
	Strongly Oppose	Count	5	2	1	1			9
		% within Ammendment Limiting Gun Ownership	55.6%	22.2%	11.1%	11.1%			100 0%
		% within Varsity Team Before	71.4%	40.0%	8.3%	7.7%			18.0%
Total		Count	7	5	12	13	10	3	50
		% within Ammendment Limiting Gun Ownership	14.0%	10.0%	24.0%	26.0%	20.0%	6.0%	100 0%
		% within Varsity Team Before	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

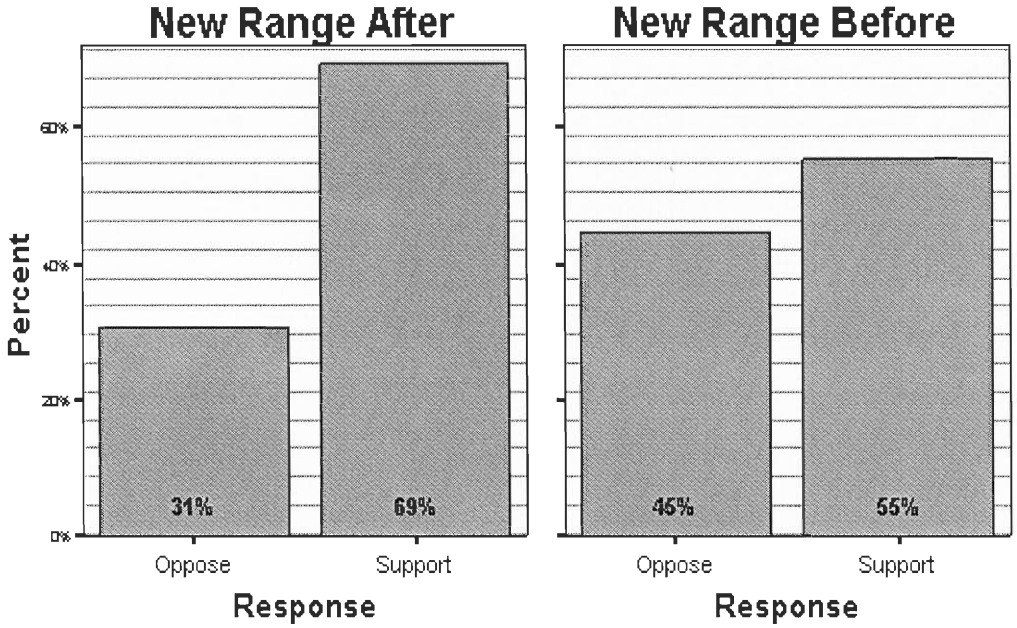
D SPSS Charts

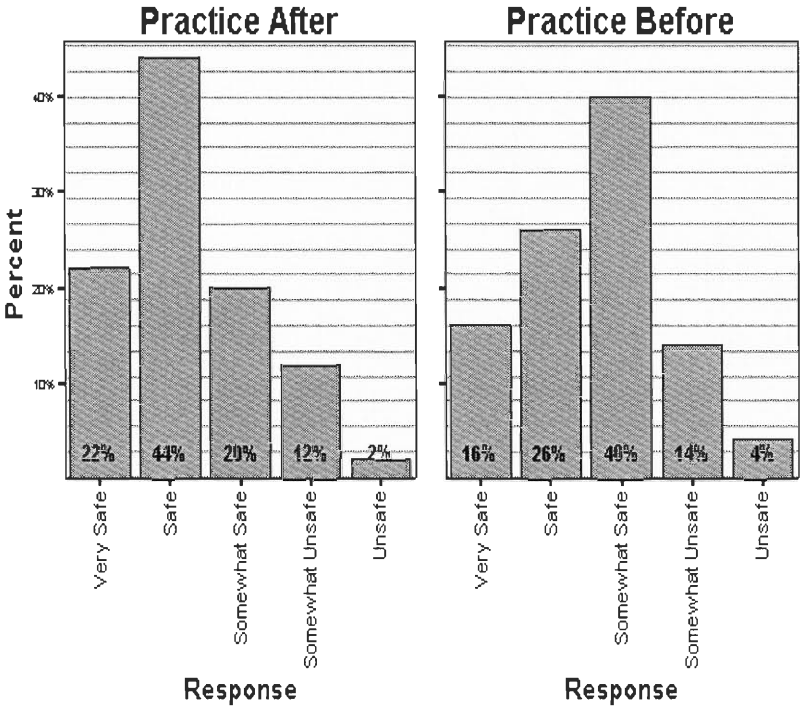
Included here are charts that were produced by the SPSS software.



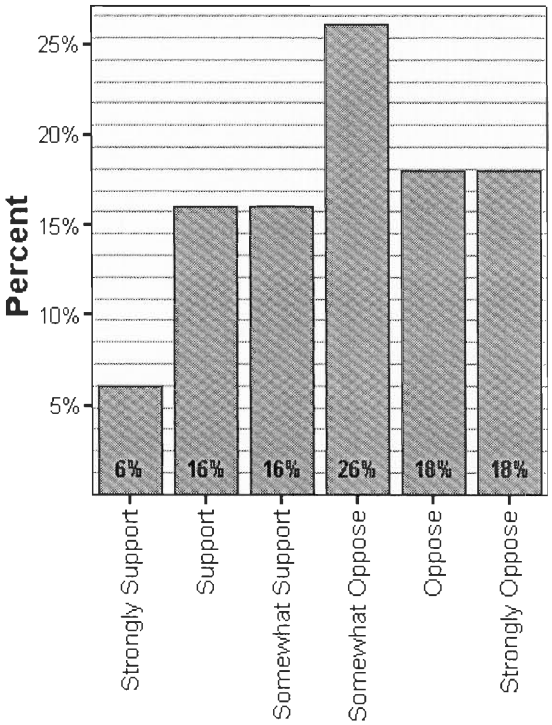



Varsity Team After
Varsity Team Before
Percent
30%
20%
10%
0%
14%
20%
34%
20%
10%
2%
24%
26%
24%
26%
Very Desirable
Desirable
Somewhat Desirable
Somewhat Undesirable
Undesirable
Very Undesirable
Somewhat Desirable
Somewhat UnDesirable
Response
Response


New Range After
New Range Before
Percent
60%
40%
20%
0%
31%
69%
45%
55%
Oppose
Support
Response
Response



Ammendment Limiting Gun Ownership



E T Tests

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Practice Before	2.64	50	1.05	.15
	Practice After	2.28	50	1.01	.14
Pair 2	New Range Before	.55	47	.50	7.33E-02
	New Range After	.68	47	.47	6.87E-02
Pair 3	Varsity Team Before	3.46	50	1.45	.20
	Varsity Team After	2.98	50	1.25	.18

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Practice Before & Practice After	50	.793	.000
Pair 2	New Range Before & New Range After	47	.762	.000
Pair 3	Varsity Team Before & Varsity Team After	50	.895	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Practice Before - Practice After	.36	.66	9.37E-02	.17	.55	3.841	49	.000
Pair 2	New Range Before - New Range After	-.13	.34	4.92E-02	-.23	-2.86E-02	-2.595	46	.013
Pair 3	Varsity Team Before - Varsity Team After	.48	.65	9.14E-02	.30	.66	5.250	49	.000

NPar Tests
Wilcoxon Signed Ranks Test

Ranks

		N	Mean Rank	Sum of Ranks
Practice After - Practice Before	Negative Ranks	21[a]	13.10	275.00
	Positive Ranks	4[b]	12.50	50.00
	Ties	25[c]		
	Total	50		
Varsity Team After - Varsity Team Before	Negative Ranks	22[d]	12.07	265.50
	Positive Ranks	1[e]	10.50	10.50
	Ties	27[f]		
	Total	50		

a. Practice After < Practice Before

b. Practice After > Practice Before

c. Practice Before = Practice After

d. Varsity Team After < Varsity Team Before

e. Varsity Team After > Varsity Team Before

f. Varsity Team Before = Varsity Team After

Test Statistics[b]

	Practice After - Practice Before	Varsity Team After - Varsity Team Before
Z	-3.402[a]	-4.217[a]
Asymp. Sig. (2-tailed)	.001	.000

a. Based on positive ranks.

b. Wilcoxon Signed Ranks Test

Test Statistics[b]

	New Range Before & New Range After
N	47
Exact Sig. (2-tailed)	.031[a]

a. Binomial distribution used.

b. McNemar Test

Sign Test

Frequencies

		N
Practice After - Practice Before	Negative Differences[a,b]	21
	Positive Differences[c,d]	4
	Ties[e,f]	25
	Total	50
Varsity Team After - Varsity Team Before	Negative Differences[a,b]	22
	Positive Differences[c,d]	1
	Ties[e,f]	27
	Total	50

a. Practice After < Practice Before

b. Varsity Team After < Varsity Team Before

c. Practice After > Practice Before

d. Varsity Team After > Varsity Team Before

e. Practice Before = Practice After

f. Varsity Team Before = Varsity Team After

Test Statistics[b]

	Practice After - Practice Before	Varsity Team After - Varsity Team Before
Exact Sig. (2-tailed)	.001[a]	.000[a]

a. Binomial distribution used.

b. Sign Test

NPar Tests
McNemar Test
Crosstabs

New Range Before & New Range After

	New Range After	
New Range Before	0	1
0	15	6
1	0	26

F Frequencies

Frequency Table

AGE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	19	2	4.0	4.0	4.0
	20	5	10.0	10.0	14.0
	21	5	10.0	10.0	24.0
	22	3	6.0	6.0	30.0
	23	1	2.0	2.0	32.0
	26	1	2.0	2.0	34.0
	28	1	2.0	2.0	36.0
	31	1	2.0	2.0	38.0
	32	1	2.0	2.0	40.0
	33	1	2.0	2.0	42.0
	34	1	2.0	2.0	44.0
	35	2	4.0	4.0	48.0
	36	1	2.0	2.0	50.0
	37	2	4.0	4.0	54.0
	38	1	2.0	2.0	56.0
	39	2	4.0	4.0	60.0
	40	3	6.0	6.0	66.0
	41	2	4.0	4.0	70.0
	43	1	2.0	2.0	72.0
	44	1	2.0	2.0	74.0
	45	2	4.0	4.0	78.0
	48	1	2.0	2.0	80.0
	49	1	2.0	2.0	82.0
	50	3	6.0	6.0	88.0
	51	1	2.0	2.0	90.0
	52	1	2.0	2.0	92.0
	56	1	2.0	2.0	94.0
	57	1	2.0	2.0	96.0
	59	1	2.0	2.0	98.0
	62	1	2.0	2.0	100.0
	Total	50	100.0	100.0	

SEX

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	30	60.0	61.2	61.2
	female	19	38.0	38.8	100.0
	Total	49	98.0	100.0	
Missing	System	1	2.0		
Total		50	100.0		

MAJOR

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	6	12.0	12.0	12.0
	2.00	1	2.0	2.0	14.0
	3.00	5	10.0	10.0	24.0
	4.00	2	4.0	4.0	28.0
	5.00	3	6.0	6.0	34.0
	6.00	13	26.0	26.0	60.0
	7.00	1	2.0	2.0	62.0
	8.00	4	8.0	8.0	70.0
	9.00	8	16.0	16.0	86.0
	10.00	1	2.0	2.0	88.0
	11.00	5	10.0	10.0	98.0
	12.00	1	2.0	2.0	100.0
	Total	50	100.0	100.0	

TOWN

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Urban	24	48.0	51.1	51.1
	Suburban	23	46.0	48.9	100.0
	Total	47	94.0	100.0	
Missing	System	3	6.0		
Total		50	100.0		

Own a Firearm

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	None	32	64.0	64.0	64.0
	Shotgun	6	12.0	12.0	76.0
	Rifle	3	6.0	6.0	82.0
	Pistol	4	8.0	8.0	90.0
	Pistol and Rifle	2	4.0	4.0	94.0
	Pistol, Rifle, and Shotgun	1	2.0	2.0	96.0
	More Than Four Types of Guns	2	4.0	4.0	100.0
	Total	50	100.0	100.0	

AMMO

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	37	74.0	74.0	74.0
	1.00	1	2.0	2.0	76.0
	3.00	1	2.0	2.0	78.0
	5.00	2	4.0	4.0	82.0
	6.00	1	2.0	2.0	84.0
	10.00	2	4.0	4.0	88.0
	20.00	1	2.0	2.0	90.0
	30.00	3	6.0	6.0	96.0
	50.00	1	2.0	2.0	98.0
	1000.00	1	2.0	2.0	100.0
	Total	50	100.0	100.0	

MIL

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	41	82.0	82.0	82.0
	1.00	1	2.0	2.0	84.0
	2.00	2	4.0	4.0	88.0
	4.00	3	6.0	6.0	94.0
	8.00	3	6.0	6.0	100.0
	Total	50	100.0	100.0	

CARRY

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	5	10.0	10.0	10.0
	2.00	13	26.0	26.0	36.0
	3.00	13	26.0	26.0	62.0
	4.00	9	18.0	18.0	80.0
	5.00	8	16.0	16.0	96.0
	6.00	2	4.0	4.0	100.0
	Total	50	100.0	100.0	

PRESENCE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	5	10.0	10.2	10.2
	2.00	6	12.0	12.2	22.4
	3.00	16	32.0	32.7	55.1
	4.00	13	26.0	26.5	81.6
	5.00	4	8.0	8.2	89.8
	6.00	5	10.0	10.2	100.0
	Total	49	98.0	100.0	
Missing	System	1	2.0		
Total		50	100.0		

Practice Before

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Safe	8	16.0	16.0	16.0
	Safe	13	26.0	26.0	42.0
	Somewhat Safe	20	40.0	40.0	82.0
	Somewhat Unsafe	7	14.0	14.0	96.0
	Unsafe	2	4.0	4.0	100.0
	Total	50	100.0	100.0	

PERSONAL

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	1	2.0	3.7	3.7
	1.00	7	14.0	25.9	29.6
	2.00	14	28.0	51.9	81.5
	3.00	3	6.0	11.1	92.6
	4.00	2	4.0	7.4	100.0
	Total	27	54.0	100.0	
Missing	System	23	46.0		
Total		50	100.0		

New Range Before

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Oppose	21	42.0	44.7	44.7
	Support	26	52.0	55.3	100.0
	Total	47	94.0	100.0	
Missing	System	3	6.0		
Total		50	100.0		

Varsity Team Before

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Desirable	7	14.0	14.0	14.0
	Desirable	5	10.0	10.0	24.0
	Somewhat Desirable	12	24.0	24.0	48.0
	Somewhat Undesirable	13	26.0	26.0	74.0
	Undesirable	10	20.0	20.0	94.0
	Very Undesirable	3	6.0	6.0	100.0
	Total	50	100.0	100.0	

CHILDREN

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	22	44.0	44.0	44.0
	1.00	4	8.0	8.0	52.0
	2.00	5	10.0	10.0	62.0
	4.00	7	14.0	14.0	76.0
	6.00	3	6.0	6.0	82.0
	8.00	8	16.0	16.0	98.0
	12.00	1	2.0	2.0	100.0
	Total	50	100.0	100.0	

Ammendment Limiting Gun Ownership

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Support	3	6.0	6.0	6.0
	Support	8	16.0	16.0	22.0
	Somewhat Support	8	16.0	16.0	38.0
	Somewhat Oppose	13	26.0	26.0	64.0
	Oppose	9	18.0	18.0	82.0
	Strongly Oppose	9	18.0	18.0	100.0
	Total	50	100.0	100.0	

THREAT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	36	72.0	72.0	72.0
	1.00	7	14.0	14.0	86.0
	2.00	4	8.0	8.0	94.0
	3.00	3	6.0	6.0	100.0
	Total	50	100.0	100.0	

THREAT_A

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	35	70.0	70.0	70.0
	1.00	3	6.0	6.0	76.0
	2.00	12	24.0	24.0	100.0
	Total	50	100.0	100.0	

REFUSE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No, would not refuse	38	76.0	77.6	77.6
	Would refuse unless Locked	4	8.0	8.2	85.7
	Would refuse even if Locked	7	14.0	14.3	100.0
	Total	49	98.0	100.0	
Missing	System	1	2.0		
Total		50	100.0		

BIGGAME

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	3	6.0	21.4	21.4
	2.00	4	8.0	28.6	50.0
	3.00	2	4.0	14.3	64.3
	4.00	3	6.0	21.4	85.7
	5.00	2	4.0	14.3	100.0
	Total	14	28.0	100.0	
Missing	System	36	72.0		
Total		50	100.0		

ARCHERY

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	2	4.0	15.4	15.4
	2.00	7	14.0	53.8	69.2
	3.00	2	4.0	15.4	84.6
	4.00	2	4.0	15.4	100.0
	Total	13	26.0	100.0	
Missing	System	37	74.0		
Total		50	100.0		

HUNTING

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	4	8.0	19.0	19.0
	2.00	9	18.0	42.9	61.9
	3.00	5	10.0	23.8	85.7
	4.00	1	2.0	4.8	90.5
	5.00	2	4.0	9.5	100.0
	Total	21	42.0	100.0	
Missing	System	29	58.0		
Total		50	100.0		

SKIING

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	4	8.0	16.0	16.0
	2.00	10	20.0	40.0	56.0
	3.00	7	14.0	28.0	84.0
	4.00	3	6.0	12.0	96.0
	5.00	1	2.0	4.0	100.0
	Total	25	50.0	100.0	
Missing	System	25	50.0		
Total		50	100.0		

SNOWBRD

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2.00	7	14.0	53.8	53.8
	3.00	4	8.0	30.8	84.6
	4.00	1	2.0	7.7	92.3
	6.00	1	2.0	7.7	100.0
	Total	13	26.0	100.0	
Missing	System	37	74.0		
Total		50	100.0		

BUNGEE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2.00	2	4.0	22.2	22.2
	3.00	2	4.0	22.2	44.4
	4.00	3	6.0	33.3	77.8
	5.00	1	2.0	11.1	88.9
	6.00	1	2.0	11.1	100.0
	Total	9	18.0	100.0	
Missing	System	41	82.0		
Total		50	100.0		

JETSKI

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	1	2.0	8.3	8.3
	2.00	3	6.0	25.0	33.3
	3.00	6	12.0	50.0	83.3
	4.00	2	4.0	16.7	100.0
	Total	12	24.0	100.0	
Missing	System	38	76.0		
Total		50	100.0		

SNOMOBIL

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	3	6.0	18.8	18.8
	2.00	7	14.0	43.8	62.5
	3.00	3	6.0	18.8	81.3
	4.00	2	4.0	12.5	93.8
	5.00	1	2.0	6.3	100.0
	Total	16	32.0	100.0	
Missing	System	34	68.0		
Total		50	100.0		

HOCKEY

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2.00	1	2.0	11.1	11.1
	3.00	4	8.0	44.4	55.6
	4.00	4	8.0	44.4	100.0
	Total	9	18.0	100.0	
Missing	System	41	82.0		
Total		50	100.0		

HORSE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	3	6.0	27.3	27.3
	2.00	4	8.0	36.4	63.6
	3.00	2	4.0	18.2	81.8
	4.00	2	4.0	18.2	100.0
	Total	11	22.0	100.0	
Missing	System	39	78.0		
Total		50	100.0		

Practice After

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Safe	11	22.0	22.0	22.0
	Safe	22	44.0	44.0	66.0
	Somewhat Safe	10	20.0	20.0	86.0
	Somewhat Unsafe	6	12.0	12.0	98.0
	Unsafe	1	2.0	2.0	100.0
	Total	50	100.0	100.0	

P_FIRE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	1	2.0	3.3	3.3
	1.00	7	14.0	23.3	26.7
	2.00	18	36.0	60.0	86.7
	3.00	3	6.0	10.0	96.7
	4.00	1	2.0	3.3	100.0
	Total	30	60.0	100.0	
Missing	System	20	40.0		
Total		50	100.0		

New Range After

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Oppose	15	30.0	30.6	30.6
	Support	34	68.0	69.4	100.0
	Total	49	98.0	100.0	
Missing	System	1	2.0		
Total		50	100.0		

Varsity Team After

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Desirable	7	14.0	14.0	14.0
	Desirable	10	20.0	20.0	34.0
	Somewhat Desirable	17	34.0	34.0	68.0
	Somewhat Undesirable	10	20.0	20.0	88.0
	Undesirable	5	10.0	10.0	98.0
	Very Undesirable	1	2.0	2.0	100.0
	Total	50	100.0	100.0	

REFUSE2

		Frequency	Percent
Missing	System	50	100.0

Varsity Team Before

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Desirable	12	24.0	24.0	24.0
	Somewhat Desirable	12	24.0	24.0	48.0
	Somewhat UnDesirable	13	26.0	26.0	74.0
	Undesirable	13	26.0	26.0	100.0
	Total	50	100.0	100.0	

G Slides

Included here are the slides used during the conference.

The Feasibility of an Electronic Range Safety System

Presented by: Jamie Romaniak
Jonathan Graham
Rob Koch

Advised by: Professor John Wilkes

General Outline

1. Background Information
   - Existing Safety
   - Needed Range Improvements
   - Bullet maps and Photographs
2. Conceptualization
   - Thought Process
   - Different approaches and solutions to the problem
3. Initial Design Thoughts
   - Level and Compass
   - Microwave Transmitter and Receiver
4. Conclusion
5. Open Discussion

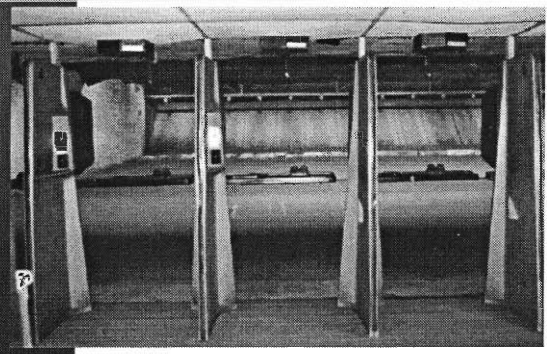
Background Research

State of Current Ranges
A Few Range Rules
The Public Issues
Examples of Shortcomings

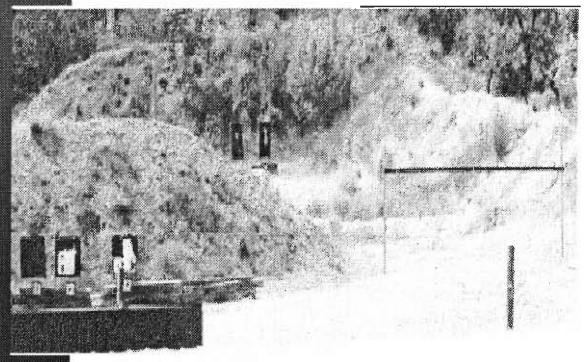
State of Current Ranges

- **Extremely diverse**
- **Outdoor ranges pose a larger problem**
- **Tour of Indoor and Outdoor Range facilities**

Indoor Range



Outdoor Range



A few Range Rules

- Cease fires must be obeyed whenever called for
- Aiming at flat surfaces other than the backstop are not allowed
- Never fire from any other point besides the designated firing range area

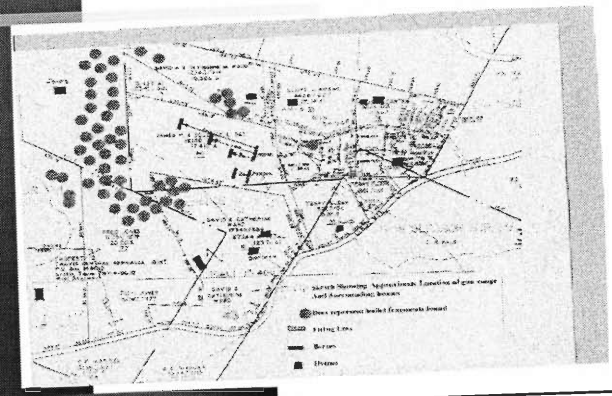
Public Issues at Hand

- Noise Pollution
- Lead Pollution
- Stray Bullets from Ricochets and misfires

Examples of Shoo...

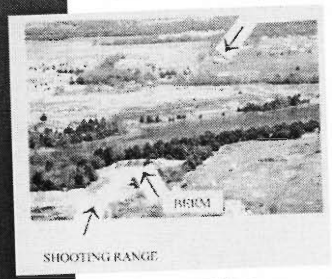
- Bullet maps from outdoor range
- Ricochets
- Holes in range walls

Bullet map from outdoor ra...



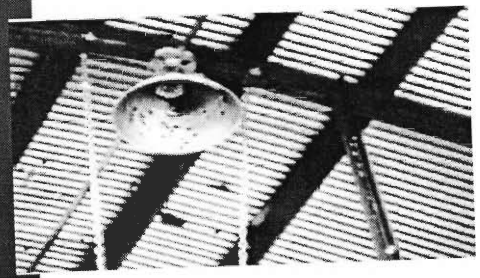
Ricochets

– The arrow below points to a home where a 14 year old boy received an injury from a ricochet bullet.



Holes in Range Walls

– Exactly what we are trying to avoid



Conceptualization

- Four main design goals
  - Reliability
  - Maintain enjoyment of shooting
  - Empower the Range Officer
  - Ability to retrofit existing firearms

Specifications

- Use a computerized system
  - Determine direction of gun
  - Engage safety device if necessary
  - Range Officer has control of the "cease fire" where all firearms are disabled

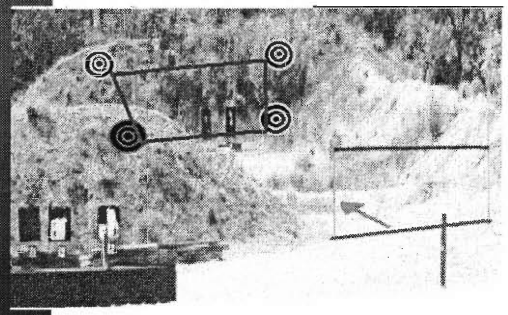
Directional determination

- Compass and Level approach
- Microwave transmitter approach

Compass and Level

- Electronic compass
  - determines the direction of the firearm with respect to magnetic north
  - computer compares the gun's compass heading with the known "downrange"

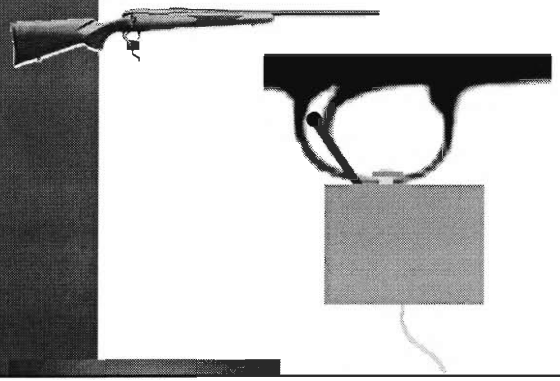
Microwave Transmitter



Possible Computer Use

- Central computer
  - Accesses each gun as a separate device
  - Gives the Range Officer onscreen feedback and control
  - Controls the individual safety devices

Retrofit Device



Conclusions

- Electronic Range Safety System
  - Technologically possible
  - Requires more research and development
    - Series of MQP's may be able to develop a prototype system
  - Public support would make this a worthwhile venture, perhaps even a commercial success
  - This project may provide some common ground which has been lacking in the gun control debate