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# Taser Technology Research Paper

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TECHNICAL REPORT
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Submitted by:
Victoria Police Service

NOTE: Further information about this report can be obtained by calling the CPRC information number (613) 998-6343

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## EXECUTIVE SUMMARY

In December 1998, the Victoria Police Service began a six month trial of the Tasertron TASER® pulse wave technology weapons.

This report contains background material relating to the weapons tested and includes such things as the history of the devices, testing and training, and a discussion of strengths and weaknesses. The document also includes reports of the incidents in which the weapons were used during the trial period.

The Canadian Police Research Centre would like to thank Sgt. Darren Laur and the Victoria Police Service for the opportunity to publish this report and to circulate it to the Canadian law enforcement community.

## SOMMAIRE

En décembre 1998, le service de police de Victoria a mis à l'essai pendant six mois des armes à impulsions Taser®.

Ce rapport contient des renseignements généraux concernant les armes mises à l'essai, l'historique des appareils, des essais et de la formation, ainsi qu'une étude des forces et des faiblesses. Il aborde en outre les incidents lors desquels les armes ont été utilisées pendant la période d'essai.

Le Centre canadien de recherches policières remercie le serg. Darren Laur et le service de police de Victoria de lui avoir donner l'occasion de publier ce rapport et de le diffuser aux services canadiens d'application de la loi.

# TASER Technology Research Paper

## *The Canadian Perspective*

In December of 1998, the Victoria Police Service became the first police agency in Canada to deploy Tasertron TASER® pulse wave technology weapons in a six month field study. During this testing and evaluation period, this force option was used on fourteen (14) occasions with extremely good results. In five (5) cases, voluntary compliance was obtained simply through the threat of use, or by using the laser sights on the suspect. In the remaining cases, the unit was fired at the suspect and caused incapacitation, allowing the officers to arrest the suspect without further incident. In all cases, the subjects fully recovered within minutes and without injury or after-effect. Since the release of this study, the Victoria Police Service has been inundated with inquiries from Canadian police services and correctional agencies requesting information on the TASER and the results of the research. This research paper has been compiled to assist Canadian agencies with TASER technology and to acquaint them with the manufacturers of this technology. (Appendix A)

The TASER is classified as a prohibited weapon in Canada. In fact, there has never been a police agency in Canada that has ever used an electric stunning device for general patrol duty use. Since the completion of the Victoria Police Service study, a number of police agencies are showing interest in either testing or purchasing TASER technology for their Services. The two major companies that manufacture and sell TASER pulse wave technology weapons to law enforcement are Tasertron and Taser International. The information contained within this paper has been accumulated from research into both companies and the less lethal systems they represent. Information was also obtained from a number of law enforcement agencies and other experts in the field of TASER technology from the United States. It is the purpose of this paper to assist Canadian agencies with an unbiased and truthful look at what is presently available in the way of TASER technology, products and training.

## History of the TASER

In the mid 1960's, as a result of the civil unrest in the United States, President Lyndon Johnson formed a blue ribbon crime commission to look at ways of quelling the increasing violence in their country. One of the many recommendations made by this commission was that police should be looking for new non-lethal methods of controlling violent behaviour. When the recommendations of this commission made the national media, it caught the eye of John Cover, the inventor of the TASER. A couple of days after this report, Cover read another article about a hiker who had grabbed onto a high voltage wire, become frozen to it for several hours and lived to tell his story. As a result of these two media reports, John Cover began his journey in developing the TASER. By 1969,

Cover had developed the idea of a high voltage low amperage pulsed weapon, that would knock a person down without injury. By 1970, Cover had built his first prototype electrical weapon which he called the "TASER," an acronym for the "Thomas A Swift's Electrical Rifle," which was named after the Tom Swift fantasy stories of Cover's childhood.

After 1970, Cover began to demonstrate the TASER to a number of interested groups who either really loved it, or really hated it. Many of the law enforcement organizations saw the TASER as just another gimmick in the same class as water cannons and rubber bullets, and non-lethal technology really did not interest them. The American air line industry, on the other hand, saw it as an option that they could use, rather than a conventional hand gun, when flying at 30,000 feet. Due to the fact that law enforcement in the United States really did not show any interest in the TASER, Cover began to concentrate his efforts towards the civilian markets, especially the airlines, who were beginning to place orders in large numbers.

Just as Cover's efforts were starting to bear fruit, in 1975 the United States Consumer Products Safety Commission (CPSC), a congressional watchdog began to investigate the TASER as a result of some political interference and pressure from outside influences. Due to the fact that the NRA and Law Enforcement organizations were up in arms with the fact that the TASER was being sold to civilians, the CPSC halted all sales of the TASER. In the spring of 1976, just as the CPSC was lifting its ban on the TASER, the Treasury Department, specifically the Bureau of Alcohol, Tobacco and Firearms (ATF), classified the TASER as a Title II firearms. This placed it under their jurisdiction even though years earlier they had stated to Cover that the TASER was not considered a firearm. This was a major blow to Cover, as a level II designation meant that the TASER was in the same category as a machine gun. It was therefore extremely hard to sell to the civilian market upon which he was dependant upon for the financing of his invention. Not to be defeated, Cover, through some redesigning of his original TASER, was able to have the ATF reclassify the TASER to a Title I conventional firearm and thus ease the restrictions on its sales to civilians.

Just as Cover thought his last fight with the federal government, regarding the sales of his TASER, was over, the Department of State declared the TASER proprietary technology, and put it on their Munitions Control Act list. This meant that before Cover could sell the TASER to any other country in the world, he would first require approval from the State Department, on a one time only basis, and this would require months of paper work. As a result of this decision and the fact that the State Department felt that the TASER could be used as a weapon of torture overseas, sales of TASERs dropped to almost zero.

Due to the combined efforts of both the Treasury Board and the State Department, TASER sales dropped to less that 200 units a month. These sales were also now in jeopardy due to the fact that a number of TASERs had been used in robberies across the United States, and a number of individual states were now looking at passing crime bills to ban TASERs at both local and state levels. A number of high level governmental meetings took place in

an attempt to prevent bills from banning the TASER, and as a result of these meetings, only two states, New York and Michigan, passed bills making the possession of TASERs illegal.

Finally in early 1976, the TASER was beginning to make positive headlines in printed media, due to the fact that some progressive police departments and correctional facilities had purchased and used the TASER on several occasions with very positive results. It was not until November 1980 that Cover got his biggest break. After an extensive testing and evaluation period, the Los Angeles Police Department purchased 700 of the two-shot model TF-76 TASERs for general patrol duty use.

Since the LAPD purchase in 1976, the TASER has enjoyed a healthy growth curve within the law enforcement community. Today, hundreds of police departments in the United States use TASER technology. Even the State Department now allows exportation of TASER technology to preferred overseas countries, without the crippling delays they once imposed.

John Murray and Barnet Resnick, the CEO of Tasertron, have written an excellent book called, "A Guide To TASER Technology." This book contains more information on the history of the TASER and is a must read for any instructor or department that is considering adopting a TASER pulse wave technology weapon for use within their department. Filled with information regarding the who, what, where, when, why, and how of TASER technology, it explains everything a person should know about the TASER in simple and plain language that is easily understood. Although the book primarily represents Barnet's company and the products they represent, it is still an excellent reference guide, and answers a lot of questions about TASER technology.

## Why the TASER is effective

The human nervous system communicates by means of simple electrical impulses. When the TASER darts strike a subject, a pulsating current of 50,000 volts and 5 watts is directed through the subject's body between the two dart points. The TASER technology sends electrical impulses that are quite similar to those used by the human body. As such, these TASER impulses interfere with, and override the body's neuromuscular system. Consequently, voluntary muscle control is lost between the two dart points. As a result of this current being delivered into a subject, they will usually fall to a grounded position or freeze in place. The TASER technology is extremely effective because it does not rely on the conventional 'pain compliance' approach of police tactics. (Appendix B)

## Medical Research

To say that TASER pulse wave technology has been over studied by the medical community would be an understatement. Since the TASER was first invented, there have been concerns about applying its electrical current to human subjects and the direct medical consequences. Some of the medical consequences that were hypothesised to be caused by the TASER's current included; heart attacks, long term seizure activity, and the potential to cause pace makers to fail. To date, all medical research involving the TASER has found that, when used on a normally healthy adult, the electrical current, supplied by a TASER with 50,000 volts and 5 watts, is extremely safe to use, and will not affect cardiac muscle, will not affect pace makers, or cause long term seizures. (Appendix C) In July 1999, Constable John McDonald, of the Ottawa-Carleton Regional Police Service, supplied Dr. Harrison, Research Professor, Department of Electronics, Carleton University, Ottawa, with all pertinent TASER technical information. After reviewing all relevant information, Dr. Harrison recommended "…the adoption of the TASER as an alternative to more lethal ways of controlling violent subjects." (Appendix D)

Constable McDonald also supplied the University of Ottawa Heart Institute with all of the U.S. medical research available on the TASER for their review. Dr. Hendry, Co-Director of the Pacemaker Clinic, stated, "I have reviewed the information you provided and I am reassured that this system appears to be safe for its use in controlling violent offenders." Dr. Hendry went onto say, "Certainly the device appears to be quite effective in controlling violent offenders and I suspect that the extremely limited potential for causing serious injury is far outweighed by the importance of controlling the offender safely and quickly." (Appendix E)

To date, there has never been a death directly related to the current used by the TASER. Although there have been some serious injuries sustained as a result TASER use, these were secondary injuries - blunt trauma injuries from a person falling after being shot with a TASER, an incident of a TASER dart puncturing an eye, and two incidents where the TASER current ignited subjects who were soaked in a flammable liquid. These types of injuries, although possible, are not very probable especially if an officer has received proper training as to when and when not to deploy a TASER.

The most common injury reported are the puncture wounds that are left by the TASER darts if they puncture a subject's skin. Although easily removed by medical staff, the darts will leave a small bee sting type puncture wound. Associated with this puncture wound will be discoloration (redness) about the diameter of a pencil shaft. This redness is medically classified as a first-degree burn caused from the electrical current of the TASER. If the TASER current is applied for more than 4-5 seconds, a small blister (second-degree burn) may appear at both probe points. This blistering is the body's natural defence against the slight heat being generated by the TASER current. The redness and the blistering will usually disappear within a week without any complications or medical intervention needed.

It can not be emphasised enough that the TASER pulse wave technology weapons, which use 50,000 volts and 5 watts, have been medically proven to be safe when used on normal healthy subjects. Although there are always risks when using any force option to control violent behaviour, the medical risks posed by the TASER are very minimal when compared to blunt trauma injuries caused by empty hand impact techniques, baton strikes, kinetic energy impact munitions, or even the trauma caused by an officer's firearm.

## The manufacturers and their products

There are presently two companies that offer TASER Pulse Wave technology weapons to law enforcement, Tasertron and TASER International.

## Tasertron

Located in Corona, California, Tasertron (a division of Electronic Medical Research Laboratories Inc.) was formed in 1986 under the leadership of CEO Barnet Resnick. Since 1992, Tasertron has been the leader in the sales of TASER technology to law enforcement agencies around the world, and does not sell any of their products to the civilian market. It should be noted that up until the fall of 1998, Tasertron was the only company, under legal agreement, that was allowed to sell TASER Technology weapons to law enforcement agencies in North America. Since then, this legal agreement has expired and other companies are now allowed to sell their TASER products to the North American law enforcement market.

Tasertron currently offers three TASER products to the law enforcement community, the TE-86, TE-95, and the TE-93. Because the Tasertron cartridges use a rifle primer as their propellant, all of the Tasertron TASERs are classified by the United States Bureau of Alcohol Tobacco and Firearms, as a Title I firearms and therefore regulated as such.

## TE-86/95

The TE-86/95 is Tasertron's newest two shot model currently available to law enforcement agencies. The only difference between the TE-86 and the TE-95 is that the TE-95 now comes standard with a bore sighted dual laser sight mounting plate for the optional dual laser sight. However, the TE-86 can be factory retrofitted to accept the optional dual laser sight as an option. The TE-86/95 model has been around the longest of any of the TASERs discussed in this report and, as such, it is known as the 'work horse' for Tasertron. The TE86/95 has been the most widely used model being deployed by law enforcement agencies in North America, with over 50,000 deployments by police and correctional agencies to date.

## TE-86/95 Strengths

There is no doubt that the biggest benefit that the TE-86/95 possesses is the ability to deploy two sets of darts if needed. If for some reason the first set of darts either misses a subject or fails to deploy properly, an officer can quickly deploy the second set of darts. The two-dart system also allows an officer to deploy a single TASER on two separate subjects if required, which may be of some benefit when dealing with multiple opponents. In the fourteen incidents in our study, officers did not have to deploy the second set of darts. However, in speaking with the L.A. County Sheriffs, they stated that they have had several occasions where they have had to deploy the second set of darts for the above noted reasons. Hence, they believe that the two shot, TE-86/95 has a tactical advantage over a one shot model.

The second strength of the TE-86/95 is that it has proven itself 'battle tested' by many police departments and correctional facilities around the world, a definite benefit, and its design has not really changed over time due to the fact that it has worked so well. The TE-95's performed extremely well during the Victoria Police Service's six-month study.

A third strength of the TE-86/95 is the optional "probe pack" that can be plugged into the TASER unit to give the officer up to three feet of touch stun capability. This feature is being widely used by a large number of U.S. correctional agencies as a means of subject control and crowd control.

## TE-86/95 Weaknesses

Probably the number one weakness of the TE-86/95 is its size. Because of its design, the TE-86/95 is fairly bulky and therefore not easily carried. Although Tasertron does make a holster for the TE-86/95, the majority of departments, which use this weapon and were contacted during this research, do not use the holster because of its bulkiness. The majority of departments keep the TE-86/95 secured in the trunk. When a member attends a call, where the TASER may be required, that officer must go to the trunk first to retrieve the TASER, and then keep it in hand until the call is over. It should be noted that Tasertron does offer a hard carrying case and vehicle gun locking system for both the TE-86/95. The Victoria Police Service issues its members with cargo pants that have a large side pocket. Members have been using these pockets as a way to holster the TE-86/95 with some success.

A second weakness that has been identified with the TE-86/95 is the fact that when an officer deploys the darts, they must ensure that their thumb remains on the trigger to ensure that the TASER current is passed to the subject being shot with a TASER. If an officer releases his thumb from the trigger after hearing the bang of the rifle primer, a natural instinct for most police officers, once the darts make contact with the subject there will be no current transfer. This has been identified as the number one reason for the 10-15% failure rate associated with the TE-86/95. It should be noted that Tasertron has stated that they are presently designing a 7-second timing cycle for all of their TASER products and hope to have it available as an option within the next few months. If this timer is successful in testing, and works as advertised, it will overcome the problems associated with officers not staying on the trigger.

A third weakness of the TE-86/95 is that members must remember to clean the firing bays after any deployment of the dart cartridges. Due to the fact that the Tasertron cartridges uses a rifle primer to propel its darts, there will be carbon residue from the primer left behind. As carbon is a good conductor of electricity, a misfire could result if it is not cleaned. Even worse, there have been some cases reported in which the carbon residue was so extensive that it caused the electrical current to jump over to the second set of darts, thereby initiating an involuntary discharge. Although carbon residue is a concern, this can be solved as long as members ensure that the firing bays are cleaned after each use.

A fourth weakness identified with the TE-86/95 model is that when these units are deployed in a point and shoot method, without using the laser sighting system, the darts will either fall left or right from centre of mass. The reason for this is the side by side design of the cartridges. During the Victoria Police Service study, officers deployed the right set of darts in the majority of cases. When these darts were plotted at the end of the study, it was interesting to see how many hit the upper left chest region and the lower left abdomen or leg area of a subject. This is only identified as a weakness due to the fact that, depending upon how much of a body target a subject is presenting, an officer might have to adjust his aim point with the TE-86/95 Model. Tasertron has now developed a dual laser sighting system that will also assist officers in aiming.

## TE-93

In 1993, Tasertron came out with a new TASER product for law enforcement that they called the TE-93 also known as the "TASER Partner".

## TE-93 Strengths

The TE-93 is Tasertron's single shot model. Designed to be held and fired like a firearm, the TE-93 is very comfortable in the hand and easily used. The TE-93 is much smaller than its big brother (TE-86/95) and therefore more easily carried.

TheTE-93 is far easier to aim and far more accurate than the TE-86/95 when fired with or without the laser sighting system. Because the TE-93 only uses a single cartridge, it is located in the centre of the unit and thus accuracy was increased when used in a point and shoot situation.

Another strength of the TE-93 is its ability to use it as a hand held stun gun. If an officer missed with the first set of darts, he could use the two top terminals as a touch stun weapon if attacked. The only time that these terminals would be activated would be if there was no cartridge loaded in the TE-93, or if loaded, and fired, the darts missed. In fact, this is probably another benefit to the TE-93 in that there is an immediate feedback, an electrical arcing between the two top mounted terminals, if both darts do not make adequate contact with a subject.

Another strength of the TE-93 is the fact that it comes with a safety wrist strap; if a subject attempts to disarm the office by pulling the unit, the strap will automatically disable the unit. Although there has been only one reported case in which an officer was disarmed of his TASER and it was then used against him, this safety feature would have definitely prevented the occurrence.

## TE-93 Weaknesses

The number one weakness of the TE-93 is the fact that when the darts are deployed, like the TE-86/95 models, the officer must keep his finger on the trigger to ensure that the TASER current is passed to the subject being shot with a TASER. This appears to be more of a concern with the TE-93 when compared to the TE-86/95, due to the fact that it is held, deployed, and fired more like a firearm. Due to the fact that most officers carry either revolvers or semi-automatic firearms, they have been conditioned, on deploying the trigger and hearing the bang, to release the trigger to cycle a second, third, or fourth round. Because of this conditioning, there is a very real and strong possibility that when the TE-93 is deployed, officers will not keep their finger on the trigger.

In fact, these concerns were realised when observing video tape footage of an American SWAT team using a TE-93 during a training exercise. The team had just received its training on the TE-93; it was fresh in their minds. They were now utilising it in role-play scenarios in which they had to cycle from a deadly force option to the less

lethal option of the TE-93. In this videotape footage, all of the SWAT officers forgot to keep their finger on the TE-93 trigger after deploying the darts. The team leader was heard on several occasions to criticise his team members for not remembering their training to keep fingers on the trigger. Under high stress, an officer will resort to the dominant response, in this case firing the TE-93 as if it was their 9mm or their MP5. Although training may be able to overcome this weakness, in a high stress situation an officer will have some difficulty staying on the trigger. Again, the number one reason for failures of the TE-86/93/95 is due to the fact that officers are not staying on the trigger when the darts are deployed.

Another weakness not directly associated with the TE-93 is its holster system. Although much smaller than the TE-86/95, it is still somewhat bulky. The holstering system presently offered by Tasertron is less than adequate and is presently being re-designed. The TE-93 also comes with a belt clip attachment, but according to one department in the U.S., the clips break very easily and because of this fact are not recommended.

The last weakness identified with the TE-93 is that it is a single shot model. Although it can be used as a touch stun device if the first set of darts miss or malfunction, to quickly load a second cartridge under high stress may be difficult.

## Tasertron contact and price information

Tasertron has a home page on the Internet that can be located at **http://www.Tasertron.com**. For more information on Tasertron you can contact them at:

**Tasertron**

**1785 Pomona Rd, Suite C**

**Corona, CA 91720**

**Phone: 909-340-0896**

**Fax: 909-340-0899**

E-mail: barlaw@deltanet.com

The Canadian distributor for Tasertron is Highpoint Security Technologies Inc. and they can be contacted at 1-613-652-4623 or E-mailed at: **hipoint@sympatico.ca**

Tasertron does offer a quantity discount on all their products. For information with regard to pricing, contact the appropriate distributor.

# TASER International

Formed in 1993, TASER International, formerly known as AIR TASER, began business when brothers Rick and Tom Smith started the company. As a result of a family friend being shot with a .357 handgun, the Smith brothers began researching ways that civilians could effectively physically defend themselves against the increasing threat of violent crime in their country. As a result of their research, they became very interested in TASER technology, but learned that it was only available to the law enforcement community. Due to this fact, the Smith brothers sought out Jack Cover, the inventor of the TASER, and asked him to design a TASER weapon that could be used by anyone, not just law enforcement. Although TASER International's sales were primarily geared towards the civilian market, they have now re-focused their attention to the North American law enforcement community due to the expiration of Tasertron's exclusive patent right, which opened the market to law enforcement and correctional institutions in both Canada and the United States.

TASER International presently offers only one unit to law enforcement – the AIR TASER model 34000. Because the AIR TASER model 34000 cartridge uses compressed nitrogen as its propellant and not a rifle primer, it is not considered a firearms by the United States Bureau of Alcohol Tobacco and Firearms and is therefore not regulated by them.

## Model 34000 Strengths

The first identifiable strength of the 34000 is its size, much smaller and lighter than Tasertron's TE-86/95 and even the TASER Partner, it is easily held in the hand. Because of its size, it is also easily carried on a duty belt without taking up a lot of space, a definite advantage. TASER International has several leather holstering systems manufactured by one of the top holster makers in the U.S. Because of this fact, the 34000 can be easily carried by officers on their person during an entire tour of duty.

A second strength of the 34000 is that when the darts are deployed, the officer does not need to stay on the trigger to apply current to the subject being shot with a TASER. The 34000 has an automatic 30-second timing cycle that is activated once the darts have been deployed. This 30-second cycle can also be turned off and on at any time by the officer controlling the unit, depending upon a TASER subject's level of resistance or compliance being exhibited. This feature addresses the number one problem with the Tasertron units of having to stay on the trigger when the darts are deployed.

Like the TASER Partner, the 34000 also has a touch stun capability if the darts either miss or malfunction for some reason, and the subjects attacks the officer.

Unlike the Tasertron cartridges that use a rifle primer to propel their darts, the AIR TASER uses compressed nitrogen. As compressed nitrogen is used, there is no carbon residue that is left behind when its darts are deployed and, therefore, there is no clean up associated with the AIR TASER.

The AIR TASER was extremely accurate when used in a point and shoot situation without the laser sight attachment from distances of 5 feet, 10 feet, 15 feet, and 21 feet. When the 34000 was fired with its laser sight, the top dart consistently hit within a one-inch circle of the illuminated laser dot at the above noted distances. (Appendix F)

## Model 34000 Weaknesses

The number one weakness of the AIR TASER is the fact that it only has a single shot capability. Initially, this was a concern. However, after several practices, an operator is able to reload the AIR TASER in less than a second and a half. This reloading procedure takes very little time to perfect and is easily learned. Because of this fact, the two-shot capability, although a tactical advantage, has become less of a concern. Also, because the AIR TASER can be easily carried on a duty belt, the fact remains that if issued to all patrol members in a police department, there will likely be more than one AIR TASER on scene at any one time. Thus, if one member misses with his/her AIR TASER or it malfunctions, a second officer on scene could deploy his/hers. The only time that this would not be tactically feasible is in a deadly force situation, where the subject confronting the officer is armed with a knife or club and there are only two officers on scene. In this situation, one officer should have their firearm out and pointed at the subject, while the other may deploy a TASER if reasonable to do so. There is no doubt that a two-shot TASER would be a tactical advantage in this situation, should the primary set of darts miss the subject or malfunction.

A second weakness found with the 34000 was in the safety switch that arms the unit. Due to it being very narrow, it may be difficult to place one's thumb properly on the unit's switch to activate it. Over a short period of time, and with some motor skill practice, one should be able to activate the safety without a problem. A concern with the safety is that, under high stress, fine complex motor skills deteriorate and some officers may fail to place their thumb properly on the narrow switch. An easy solution would be to widen the top of the safety switch to make its activation much easier.

A third weakness identified with the 34000 is that, due to the fact it is fairly new to the law enforcement market, it has not been used and abused and 'battle tested' like the Tasertron products have. Although the company has shipped approximately 100,000 units, mostly to the civilian market, and has had a number of successful uses to date by law enforcement agencies, it still needs more time on the road with law enforcement agencies before it can truly be classified as 'battle tested'. It appears that the 34000 will have no problem meeting this mark.

## TASER International contact and price information

TASER International has a home page on the Internet and can be located at **http://www.airtaser.com**. For more information on TASER International you can contact them at:

**TASER International**

**7339 East Evans Rd, Suite 1**

**Scottsdale, AZ 85260**

**Phone: 1-800-978-2737 ext. 2006**

Fax: 1-480-991-0791

E-mail: sales@airtaser.com

The Canadian distributor for TASER International is M.D. Charlton and they can be contacted at 1-250-652-5266. Email: **mdc@mail.island.net**.

TASER International does offer a quantity discount on all their products. For information with regard to pricing, contact the appropriate distributor.

# Training certification

## Tasertron

Tasertron offers several training courses for their products that range from a basic operator program up to and including Instructor level training. Their training programs follow current adult learning theories and are backed up by handouts and booklets. At the completion of all programs, officers are tested verbally, in writing and via hands on demonstration. All instructors for Tasertron are active law enforcement officers.

### TASER International

TASER International also offers several training courses that range from a basic operator program, up to and including Instructor level training. Their training programs follow current adult learning theories and are backed by handouts and a C.D. containing live video footage of the AIR TASER being tested, product information, press reviews, technical data, medical studies, as well as all lesson plans, tests, and certificates needed to run a basic user program. For the computer literate, this is definitely an advantage especially if you are an instructor who utilises power point in your presentation style. At the completion of all programs, officers are tested verbally, in writing and via hands on demonstration. Due to the fact that TASER International is so new to the law enforcement market, they are still in the learning curve and are changing their lesson plans to meet law enforcement training standards and needs. Although their most experienced trainers are company employees who have no law enforcement background, they are quickly bringing on a number of law enforcement officers and military experts to be trained as instructor trainers.

### Summary of research

Both Tasertron and TASER International offer excellent instructor and end user training programs that are court defensible. Currently both companies also offer a free 60-90 days Testing and Evaluation period on their TASER products.

## Laser Sighting System

### Tasertron

Tasertron offers a patented dual laser sight for both their TE-95 and TE-93 systems. When utilized, the laser offers an officer an excellent force presence, in which a subject can often exhibit voluntary compliance when illuminated with just the laser sights. In the Victoria Police Service study, this occurred in five of the fourteen cases in which the TASER was deployed.

Because Tasertron uses a dual laser sighting system, it will give an officer a better judgement of distance and angulation of the darts between himself and the subject to be shot with a TASER. In the testing of this laser sighting system, although not pin point accurate, the Tasertron darts will consistently hit within a 3-4 inch circle of the illuminated laser dots.

There are two concerns with Tasertron's laser sighting system. First, the TE-95 model's laser system is activated by a small pressure switch. In the testing and training of the TE-95, there were several occasions observed where members, who were pressing this switch with their bottom fingers, had an involuntary muscle response that also

caused their trigger thumb to press down simultaneously. This is a major concern if the officer's thumb is on the trigger while the laser pressure switch is being activated. This involuntary response of the thumb could cause an involuntary discharge of a dart cartridge. It should be noted that such an occurrence has not taken place to date. Because of this danger, members should not attempt to illuminate the laser sights with the same hand with which they are going to activate the trigger. It should be noted that this is not a concern in the TE-93 laser sighting system due to its design. Tasertron has stated that they have presently developed an on/off switch for the TE-93 laser sighting system. This will definitely be an improvement over the TE-93's pressure switch.

Secondly, to keep the Tasertron's laser sight activated, the officer must keep constant pressure on its activation switch. Again, this may prove to be a liability if an officer's thumb is anywhere near the trigger. For officers with smaller hands, activation of the laser pressure switch and the trigger with one hand, all at the same time, may be difficult. As a result of this concern, Tasertron recommends that the pressure switch be placed on the center bottom of the handle about one half to two thirds of the way from the end of the handle. This placement of the switch will allow the laser sights to remain on, as long as the officer is holding the gun with sufficient force to aim and fire the weapon. Again, this is not a concern with the model TE-93 because of its design.

## TASER International

TASER International also has a laser sighting system for its model 34000. Unlike the Tasertron's dual laser sights, AIR TASER uses a single red laser dot. Although the 34000 only uses one laser dot, in my opinion it still has the same force presence as the dual laser system. The 34000 laser sight is extremely accurate. When the darts were fired, the top dart consistently hit within a one-inch circle every single time. The one disadvantage of the one-dot laser sight in the 34000, is that an officer cannot judge distance or bottom dart angulation as accurately as with the dual laser system offered by Tasertron.

Another feature with the 34000 laser sight system, is that it is activated via a separate off and on switch that is very easy to use no matter what an officer's hand size. This is an advantage over the pressure switch for obvious reasons.

## Summary of research

When it comes to the single verses dual laser sighting system, it is a matter of user preference. With Tasertron's dual system, the most important laser point is the top one, due to the fact that it ensures where the top dart is going to fly. Under high stress, officers may not be able to see the laser dots and will fall back instinctually to a point and shoot method of deployment even if the laser sight(s) are active and on target. The biggest benefit to the laser sight is the force presence it possesses and its ability to obtain voluntary compliance, where appropriate and

reasonable to do so, by just illuminating a subject with a red laser dot(s), and giving a verbal warning that they are about to get hit with 50,000 volts of electricity if they do not comply voluntarily.

## Durability

### Tasertron

All of the Tasertron products are extremely durable and virtually police proof. Drop tests were conducted with all three of Tasertron's products from distances of three feet, five feet and six feet. At each distance, the TE-86/93/95 was dropped three times and at different angles. At all distances, the units functioned properly after being dropped.

The second drop test conducted was on the Tasertron cartridges. When dropped onto a hard surface from three feet, five feet and six feet, the front covers on the cartridges, in most cases, broke open very easily thus making them unusable.

### TASER International

The AIR TASER model 34000 is also extremely durable and police proof. As with the Tasertron units, drop tests with the 34000 were conducted from heights of three feet, five feet and six feet. At each distance, the AIR TASER was dropped three times and at different angles. At all distances, the unit functioned properly after being dropped.

The second drop test conducted was on the AIR TASER cartridges. When dropped onto a hard surface from three feet, five feet, and six feet, all the cartridges remained intact and fired correctly.

### Summary of research

Both Tasertron and TASER International offer units which are very rugged and durable, extremely important in the police world. There appears to be a lack of durability with respect to the Tasertron cartridges due to the fact that, when dropped, the front cover plates would often break off, leaving the cartridge unusable. This did not happen with the AIR TASER cartridges. Both companies will replace any cartridges that are damaged in this way, or fail to fire.

# Wind Test

## Tasertron

Wind deviation tests were conducted utilising a TE-93. At a 40-50mph cross wind, the darts deviated about one inch from point of aim when shot from a distance of fifteen feet.

## TASER International

Wind deviation tests were also conducted utilising the AIR TASER Model 34000 at the following estimated crosswind speeds when shot from a distance of fifteen feet:

- 40-50 mph, one inch deviation from point of aim
- 60-80 mph, four inch deviation from point of aim.
- 100-120 mph, six inch deviation from point of aim

## Summary of research

Because TASER International uses a dart that is longer than the Tasertron dart, there has been some concern voiced about its accuracy in windy conditions voiced by Tasertron. After conducting the above noted wind tests, there appears to be no concern when the wind speed is under 40mph, of hitting a human size target. This is not a problem with the TE-86/93/95 or the AIR TASER model 34000 from a distance of fifteen feet. Even at higher wind speeds of 60-80mph, if aimed at centre of mass, the darts should still be able to make contact with the body based upon the above noted calculations. It should be noted that these wind tests were not scientific but rather empirical in nature. A professional wind tunnel was not used, but rather a twin engine Cessna and the wind that was created by its propeller backwash. Although not as scientific as using a wind tunnel, it did create the above noted estimated crosswind speeds. When the TE-93 and The AIR TASER 34000 were fired during this test, their specific laser sighting systems were utilised.

There have been comments made regarding the fact that the TASER International's dart is slightly longer than Tasertron's dart. High-speed video footage was observed of the Tasertron dart and the TASER International dart in flight. This, along with the observed higher accuracy of the TASER International's system during firings, supports the conclusion that the longer dart design appears to be more stable.

# Electrical Arc Penetration

## Tasertron

Several arc tests were conducted to measure how far the Tasertron TE-95 was able to arc from dart to dart. The length of the maximum spark is a key in determining the maximum clothing penetration of each system. TASER technology can penetrate through clothing by creating an electrical arc, somewhat like a small lightning bolt, which jumps from the tip of the dart, through the clothing, to the skin of the subject. The longer the arc that can be created from the dart tip to dart tip, the more clothing the unit can penetrate. To conduct this test, one dart was taped onto a wooden surface and then the second dart was placed immediately in front of it so that the barbs were pointing at each other. Then the darts were separated at ¼ inch increments and the power was activated. With both of the TE-95 units, separation was successful up to the point of 1.25 inches, with an electrical arc still appearing. Any further separation would not result in an arc, meaning the circuit was not complete.

## TASER International

The same arc test was conducted using the AIR TASER model 34000. Utilising the same test conditions and separation increments, the separation of the darts of the 34000 went up to the point of 2.25 inches with an electrical arc still appearing. Any further separation would not result in an arc, meaning the circuit was not complete.

## Summary of research

It would appear from this arc test, that the AIR TASER has a better clothing penetration distance when compared to the TASER TE-86/93/95. Both companies do state that their products current will pass through up to two inches of clothing. This may be an important issue in those parts of Canada where people may wear thick and heavy clothing during the cold winter months, and where a TASER may have to be deployed outside in the elements.

# Cartridges

## Tasertron

The Tasertron cartridges are propelled using a small rifle primer. When fired, the darts travel approximately 200 feet per second. The Tasertron cartridge's top dart is designed to travel a straight line, while the bottom dart has been placed in a downward angle of twelve degrees. Separation distances of the Tasertron darts are:

- 5 feet - 12 inch separation
- 10 feet- 24 inch separation
- 15 feet- 36 inch separation

Maximum range of the Tasertron cartridges is 15 feet from the end of the gun. Tasertron cartridges have a shelf life of 2 years.

One of the weaknesses identified with the Tasertron cartridge is the fact that it can be loaded upside down and jammed in the TASER unit being used making it inoperable. Secondly, they are prone to breakage if dropped onto a hard surface. Lastly, the Tasertron Cartridge's are not individually stamped or marked with an expiration date. However, the boxes in which the cartridges come are marked. Care should be taken not to mix the contents of different boxes in case expired cartridges are mixed with good ones.

## TASER International

The AIR TASER Model 34000 cartridges are propelled via compressed nitrogen. When fired, the AIR TASER darts travel at approximately 175 feet per second. The AIR TASER has an eight-degree angle spread designed into its cartridge. Due to this fact, the AIR TASER cartridge has been designed to angle into the 34000 in such a manner that the top dart will always fly straight and the bottom dart will angle down. Separation distances of the AIR TASER cartridges are:

- 5 feet, 8 inches
- 10 feet, 16 inches
- 15 feet, 24 inches
- 21 feet, 36 inches

TASER International now offers the 15-foot and the 21-foot cartridge to law enforcement agencies. (Appendix F) TASER International cartridges have a shelf life of five (5) years.

Unlike the Tasertron cartridge, the TASER International cartridge's can not be loaded up side down, and therefore it is impossible for it to become jammed in its gun. As noted earlier, the TASER International cartridges are extremely durable.

Because the TASER International cartridge uses compressed nitrogen as its propellant, a freeze test was conducted to see if cold conditions would effect the pressure of the propellant in a negative way. After leaving the cartridge it in a deep freezer overnight, it was then immediately fired the next morning without incident.

The TASER International cartridges are individually marked with an expiration date, which reduces the risks of deploying an expired cartridge on the street.

## Summary of research

Dart separation is extremely important when it comes to the knock down factor of a TASER. The wider the separation, the better the TASER effect. However, too much spread can impair accuracy at longer ranges.

Jack Cover, the inventor of TASER Pulse Wave technology, states that the minimum dart spread needed for best results is six inches. Based upon the fact that the wider the dart spread the better the takedown, Tasertron's 12 degree separation would have a better TASER effect over a larger body surface especially within the 2.5-12 foot range where most TASER applications take place**.** The TASER International's cartridge is still above the 6-inch minimum separation, at three feet, which is needed for a takedown. TASER International stated they choose the 8 degree angle due to the fact that they felt that it was better to trade a little spread at close range to gain usability and accuracy at extended ranges. This is a valid tactical argument.

It should be acknowledged that the above noted separation distances for both the Tasertron TASER and the TASER International AIR TASER are best case scenarios based upon averages. There may be a slight deviation in dart spread from cartridge to cartridge in both products.

The biggest advantage that the AIR TASER cartridge has over its competitor is the fact that it has 21 feet of range. Although most TASER applications may take place within the 5-12 foot range, it is a tactical advantage to be able to deploy a force option at greater distances if necessary. The other advantage to the 21 foot cartridge is the fact that if deployed at 12 feet, an officer still has 9 feet of wire in the cartridge which can be easily let out should the subject shot with the TASER attempt to walk away. This would prevent the wires from stretching and breaking, which is a common occurrence in this type of incident.

The last concern deals with the issue of dart wobble. It has been stated in some literature that the AIR TASER's longer and lighter dart had a wobble effect during flight, which affected its accuracy. It should be noted that the darts presently being used by AIR TASER are longer than those used by Tasertron and are in fact slightly heavier. On viewing a professional slow-speed video of the TASER International dart presently being used, it appears dart wobble is almost non existent during flight. Based upon this fact, and the results of the accuracy testing with the

TASER International, the dart wobble is a non-issue. In fact, when observing a high-speed video of the Tasertron dart, the longer TASER International dart appears to be the more stable design.

# Power Supply

## Tasertron

Tasertron recommends that all of its TASER units only be operated with a specifically recommended NiCad battery. For best results, it is recommended that NiCad batteries be replaced every shift with a freshly charged one. On a fully charged NiCad, the Tasertron units will operate for about 70-140 seconds and only half of this should be considered reliable power. In other words, due to the fact that Tasertron recommends a 5-10 second TASER burst be utilized when deployed, members are only guaranteed to have at maximum 7-10 five-second usage's per battery before it needs to be changed or recharged.

One of the biggest disadvantages with a NiCad is the inability to test how much power it has left. There is no device on today's market that can reliably tell how much charge remains in a used NiCad battery. This is why it is so important that departments which use NiCad batteries ensure that they have a regimented battery exchange program in effect, to ensure that freshly charged NiCad batteries are always being deployed in Tasertron units. This has been one of the biggest problems with many of the agencies that were contacted. It is also recommended that old NiCad batteries be rotated out every six months and be replaced with new ones.

## TASER International

The AIR TASER model 34000 uses only the alkaline 9v Eveready Energizer® battery as its power source. In testing, they found that it performed well within the required parameters needed to operate TASER pulse wave technology. Due to the fact that the AIR TASER uses an alkaline battery and not a NiCad, the 34000 has a power indicator light on the handle that, when blinking, tells the operator that the battery has enough power for at least 2-3 thirty-second applications.

## Summary of research

There is no doubt that the NiCad battery performs better when it comes to TASER pulse wave technology, due to its ability to dump power out quickly. However, even Tasertron now recommends the Eveready Energizer as an alternate power source for their units. Conversely, AIR TASER acknowledges that fact that if a NiCad was used in their product, it would perform marginally better as well.

It appears the NiCad is the choice for better performance with TASER weapons. If your department is not able to be regimented enough to ensure that NiCad batteries are always fully charged, alkaline Energizer batteries might be the way to go. During the last year, approximately 200 Canadian police and correctional volunteers have been shot with both a NiCad Tasertron product and an Eveready Energizer alkaline AIR TASER, and the effects experienced were identical with both products.

The other factor that needs to be considered here in Canada is the effect that cold weather has on alkaline batteries and, to a lesser extent, on the NiCad. In colder weather, the performance of alkaline batteries decreases very quickly. In cold weather, AIR TASER recommends the use of a lithium or NiCad battery as its power source, due to the fact that they perform very well in extremely cold conditions. It is important to know that if a lithium or NiCad battery is used in the Air TASER the battery indicator light will not be accurate and should not be depended upon.

# Warranty

## Tasertron

Tasertron has a five-year full warranty, parts and labour, on all their TASER units. As well, the Canadian distributor, Highpoint Technologies, has added another 5 years onto the warranty of all Tasertron products. This increases the total warranty coverage to 10 years in Canada.

## TASER International

TASER International has a lifetime warranty on their AIR TASER model 34000. If for any reason the 34000 does not function or breaks for any reason, TASER International will replace it for a cost of $25.00 American, no questions asked.

## Summary of research

Both companies offer good warranties on their products.

## Liability Insurance

### Tasertron

Tasertron has a full, 5 million-dollar liability insurance on all their products.

### TASER International

TASER International also has 5 million-dollar liability insurance on all their products.

### Summary of research

Both companies have adequate liability insurance, and both stated that they would assist in any court challenge to their product.

## Manufacturer Advertisements

### Tasertron

Some of the statements contained in the Tasertron advertising literature need clarification:

1. Tasertron states that their TASER is non-lethal. To date, there has never been a reported death that has been directly attributed to the TASER current. However, there is always a potential that death may occur anytime force is used to control a person. To advertise a product as non-lethal, when it may in fact cause a death at a later time, may open a department and its trainer to liability issues. Agencies in Canada should adopt the phrase "Less Lethal." This is a recognised term in Canada and also allows for proper articulation at an inquest should a death occur. It should be noted that the U.S. Consumer Products Safety Commission directed Tasertron's statement on non-lethality. Legal counsel for this federal agency directed Tasertron to state, "The medical director of the U.S. Consumer Product Safety Commission has stated that electrical output of the TASER when used as directed on a normally healthy adult is non-lethal".

2. Tasertron also states in some of their literature that their products will "immediately and totally incapacitate the subject." This may be more of a sales pitch, it is far from true. A number of agencies reported little or no effect when a Tasertron TASER was used on a subject. As noted previously, since the Victoria Police Service study, there have been approximately 200 Canadian peace officers voluntarily shot with both products; many were not immediately and totally incapacitated. With all subjects shot with a TASER, there is a scale of

reactions that goes from no reaction at all, at one extreme, to total incapacitation at the other. On average it takes between 3-5 seconds for most subjects to be controlled using current TASER technology.

Recently in the U.S., a well known pepper spray manufacturer had to pay a large financial award to a plaintiff who's husband had been killed in the line of duty after he used a pepper spray product that was advertised to be immediately effective in controlling a subject. Because the pepper spray product did not work as advertised, the wife of the slain police officer sued not only the manufacturer of the pepper spray product, but also his police department who issued the product believing that it would work as advertised. If trainers in this country make the same mistake with the TASER and state that it "immediately and totally incapacitates a subject," they are opening themselves and their departments to a huge liability issue.

## TASER International

Like their competition, TASER International also makes certain claims about their products that need to be clarified:

1. Like Tasertron, some of the literature distributed by TASER International states that their products are both non-lethal and also immediately effective. These issues were dealt with under the Tasertron heading. The comments made there hold true for this company as well.

2. TASER International has also stated that "unconsciousness" is one of the responses that officers should expect from a subject who has been shot with a TASER. In all the current research, unconsciousness has never been a reported effect. It appears that this 'time loss' may be better understood as a result of survival stress. Bruce Siddle, who is considered an authority on such issues, states that during a high stress event (such as being shot with a TASER) individuals may experience 'critical stress amnesia'. This is where time either stops, slows down, or even speeds up, and specific events about a stressful incident may not be immediately remembered. Although totally conscious during this type of event, it is very common that people believe that they were unconscious.

## Summary of research

It is important to understand the claims made about any product by their manufacturers. The same holds true with both TASER manufacturers. Both companies have been contacted with regard to the above noted concerns. Both companies have stated they will be making the necessary changes immediately. (Appendix G)

# Research Paper Summary

## Manufacturers of the TASER technology

Although neither company will state this publicly, the TASER TE-86/93/95 and the AIR TASER model 34000 are designed to do the same thing. Both systems are designed to deliver TASER pulse wave technology of 50,000 volts and 5 watts of current. What differs with both companies is the proprietary technology used in the design of their specific weapon systems. Each product has its own strengths and weakness as has already been brought forth in this research paper. Both companies offer quality products that have a necessary place in Canadian law enforcement and correctional facilities. The comparison between the Tasertron TASER and the Taser International AIR TASER Model 34000 is no different than comparing a Glock 9mm to a Smith and Wesson 9mm. The design of the two guns may be different, but the end result is the same. Both manufacturers offer Canadian police and correctional services an extremely safe and effective less lethal option.

## TASER technology

Regarding the use of TASER technology, the Victoria Police Services six-month operational TASER study and this research paper have confirmed and concluded the following:

- Increased officer safety
- Increased subject safety
- Decreased number of injuries to officers
- Decreased number of injuries to subjects
- Increased success with subjects immune to pain compliance tactics
- Established as medically safe for “normal healthy adults”
- Medically established that TASER has no effect on heart rhythm or pacemakers
- Electrical output is well within safe levels for International and North American standards
- No fatalities directly related to TASER
- Extensively field tested over a 20 year operational history
- Morally and legally responsible less lethal option
- Decreased liability issues for Management (successful less lethal option)
- Not reliant on pain compliance tactics
- More humane use of force option
- Target specific (accurate and no cross contamination concerns)
- Up to a 21 ft range–edge weapon concerns (TASER International only)

- Maintenance free (TASER International only), minimal maintenance with Tasertron
- No contamination concerns (as with chemical agents)
- Laser sight systems act as deterrent
- High deterrent with use of electricity
- Extremely cost effective

The purpose of this research paper is to bring to light the factual information regarding both TASER manufacturers and their less lethal technology. The Victoria Police Service Study and this research paper strongly endorses the TASER less lethal system as a necessity in the required multifaceted approach regarding less lethal options and response.

Nationally, the inventory for less lethal options has been restricted to chemical agents (OC, CN, CS) and various kinetic energy impact munitions (Beanbag, Sage, Arwen munitions). These have proven themselves to be excellent options for less lethal deployment situations. However, these conventional less lethal options rely on pain compliance tactics, and consequently have their limitations. In contrast, the TASER less lethal system does not rely on pain compliance. The Victoria Police Service Study and this research paper confirm the TASER pulse wave technology systems to be a safe, reliable and an effective less lethal option for the Canadian police and correctional agencies.