INTERIM REPORT OF THE
VIRGINIA STATE CRIME COMMISSION

PERSONALIZED HANDGUNS

TO THE GOVERNOR AND
THE GENERAL ASSEMBLY OF VIRGINIA

SENATE DOCUMENT NO. 48

COMMONWEALTH OF VIRGINIA
RICHMOND
2000

COMMONWEALTH of VIRGINIA

VIRGINIA STATE CRIME COMMISSION

Senator Ken Stolle
Chairman

Rich Savage
Director

January 10, 2000

To: The Honorable James S. Gilmore, III
Members of the Virginia General Assembly

Senate Joint Resolution 377 and House Joint Resolution 679 agreed to by the 1999 General Assembly, directed the Virginia State Crime Commission to conduct a study on "personalized" handguns and to submit its findings and recommendations to the Governor and the Members of the 2000 Session of the General Assembly.

In fulfilling this directive, a study was conducted by the Virginia State Crime Commission in 1999. I have the honor of submitting herewith the study report.

Respectively submitted,

Kenneth W. Stolle
Chairman

KWS:sr

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Executive Summary

Virginia State Crime Commission

Personalized Handguns (Interim Report)

January 2000

In 1999, the Virginia General Assembly passed Senate Joint Resolution 377 (Howell) and House Joint Resolution 679 (Almand) directing the Virginia State Crime Commission to study and evaluate the technology known as personalized handguns. Specifically, SJR 377 and HJR 679 requested that the Crime Commission:

- Review the status of present technology to develop personalized handguns;
- Present the future accessibility and availability of personalized handguns; and
- Determine the feasibility of developing future legislation regarding personalized handguns.

Interim Findings

The Crime Commission found:

- Personalized handguns are firearms that, by definition and design, cannot be discharged by anyone other than the gun's owner or his or her authorized designee.
- According to data available from the Federal Bureau of Investigation, the National Institute of Justice, and the National Centers for Disease Control and Prevention, unauthorized handgun shootings result in death or injury to numerous Americans each year. Specifically, six (6) of the sixty-one (61) police officers feloniously killed in 1998 (approximately ten percent [10%]) were shot with their own service firearm after it was taken away by a perpetrator. In 1996 (the most recent year for which data is available) 259 people ages 19 and under were unintentionally killed by a firearm in the United States. Furthermore, fifty-one (51) Virginians ages 19 and under committed suicide with a firearm in 1996 (the most recent year for which data is available).
- Currently, fourteen technologies exist that are either being used or may be suitable for use in personalized firearms. Each technology identified is in a different stage of development.
- While some low-tech, mechanical versions of personalized handguns are already available, most high-tech

electronic and biometric personalized handgun technologies are in the prototype or concept stage of development.

- Staff identified four (4) personalized handgun technologies currently commercially available. Three (3) rely on the user to wear a magnetic ring to authorize the firearm to discharge. One requires the user to enter a combination on a set of toggle switches prior to shooting the gun.

- Staff identified three (3) personalized handgun technologies in the prototype stage of development. One relies on the user entering a combination on a built-in lock; one requires the user to wear a small bracelet that emits a radio frequency code to authorize discharge of the handguns; and one discriminates between authorized and unauthorized fingerprints.

- Staff identified seven (7) concept technologies that may be appropriate for use in personalized handguns. These technologies range from remote control to voice recognition to capacitive sensors.

Recommendations

This interim report contains only findings. Additional findings and recommendations will be included in the final Crime Commission report on personalized handguns presented to the 2001 General Assembly.

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Introduction

Authority for Study

During the 1999 session of the Virginia General Assembly, Senator Janet Howell and Delegate James Almand sponsored Senate Joint Resolution 377 (SJR 377) and House Joint Resolution 679 (HJR 679), respectively, directing the Virginia State Crime Commission to study the technology know as "personalized" handguns (See Appendix A). Specifically, SJR 377 directs the Commission to: (i) review the status of present technology to develop personalized handguns, and the present and future accessibility and availability of such technology, and (ii) determine the feasibility of developing future legislation that conforms with the Commission's findings regarding "personalized" handguns.

Section 9-125 of the **Code of Virginia** establishes and directs the Virginia State Crime Commission "to study, report, and make recommendations on all areas of public safety and protection." Section 9-127 of the **Code of Virginia** provides that "the Commission shall have the duty and power to make such studies and gather information in order to accomplish its purpose, as set forth in Section 9-125, and to formulate its recommendations to the Governor and the General Assembly." Section 9-134 of the **Code of Virginia** authorizes the Commission to "conduct private and public hearings, and to designate a member of the Commission to preside over such hearings." The Virginia State Crime Commission, in fulfilling its legislative mandate, undertook the study of the technology known as "personalized" handguns.

Introduction

Study Design

According to SJR 377 and HJR 679, the Crime Commission's study of personalized handguns is to be completed by the 2001 session of the General Assembly with interim and final reports issued to the 2000 and 2001 session of the General Assembly, respectively. This is the interim report.

A study work-plan was developed to identify relevant study issues, form research methodologies, and set a study schedule. The Crime Commission, at its April 21, 1999, meeting, approved this plan. The primary issues identified for study were:

1st Year

- What working personalized handgun technologies are currently available and what technologies will be available in the near future? (2000)

2nd Year

- What are the needs of various handgun-using populations in Virginia? (2001)
- What personalized handgun technologies meet those needs? (2001)
- Will matching particular personalized handgun technologies with the needs of specific handgun-using populations result in increased public safety? (2001)

The first year of this study, as reflected in this interim report, primarily focused on identifying existing personalized handgun technologies. Specifically, staff catalogued personalized handgun technologies into three categories: 1) those that are currently available commercially; 2) those that are in the prototype stage of development; and 3) those that are in the pre-prototype, or concept, stage of development.

In addressing this issue, staff relied on a well-developed research design grounded in qualitative data collection methods with the goal of enhancing both the reliability and validity of this report's findings. Staff began by conducting an extensive literature review of research and development reports, law enforcement journals, industry reports, and popular press medium.[1]

[1] Access to private research and development reports was limited. While staff issued requests for information to various companies and individuals involved in the development of personalized handguns, few were forthcoming with information, citing concerns over its proprietary nature and possible loss of competitive advantage. The inability to review this research and development information resulted in a

Study Design (continued)

With a knowledge foundation established from the literature review, staff developed questions and hypotheses that served as the basis for both discussion and interviews with those qualified to comment knowledgeably on the subject area. Specifically, staff met with industry representatives, military and security personnel, and federal, state and local law enforcement officials.

From the methods listed above, staff generated findings to address the question, "What personalized handgun technologies are available and what technologies will be available in the near future?" These findings are contained herein.

Report Organization

The remaining sections of this interim report present the results of the Virginia State Crime Commission's analysis of personalized handguns. The Background section presents a general overview of the definition of personalized handguns and information regarding unauthorized shootings. The Personalized Handgun Technology section identifies these various technologies and categorizes them by stage of development.

decreased ability to assess the potential of certain prototype and pre-prototype personalized handgun technologies, and limited staff's ability to validate the claims of certain manufacturers of this technology.

Personalized Handguns

Personalized handguns, also known as smart or childproof guns, are firearms that can only be discharged by an authorized user. By definition and design, personalized handguns cannot be discharged by anyone other than the gun's owner or his or her authorized designee. In the broadest sense of the definition, a personalized handgun is any gun designed to be operated with one hand and that uses or contains a lock to prevent the firearm from being discharged by an unintended user. Under this particular definition, handguns used in combination with barrel and trigger locks would be considered to be personalized firearms. However, for the purposes of this study, only handguns containing a locking device incorporated into the design of the gun will be considered to be personalized handguns.[2] Handguns sold with, or that rely upon, barrel or trigger locks that must be removed and replaced each time the firearm is used will not be considered under this study.

In 1996, Sandia National Laboratory, in its report on personalized handguns, developed the following analogy to describe the operation of this technology:

> A [personalized handgun] system may be viewed as a type of security system for a firearm. As an analogy, it is described in terms of a key operated padlock. The analogy is organized into three pieces: a key, a discriminator, and a latching mechanism. The key does not have to be a metal key like that of a pad lock. The key can be any item that has some unique property that can be sensed. Items like a fingerprint, an electronic code, or a combination can all be considered a key. The discriminator is the device that distinguishes the characteristics that make one key different from another. Each key has some associated technology that can distinguish its properties. The latching mechanism is like the shackle on the padlock; the latch physically locks the firearm and prevents it from being fired.[3]

[2] While research literature regarding personalized handguns often includes in the definition of these firearms guns that have been immobilized by barrel and trigger locks, staff assumes the intent of SJR 377 and HJR 679 was to study handguns containing automatic locking devices. (The study resolutions distinguish locking devices that must be removed and replaced each time a firearm is used from the types of technology to be studied. The resolutions also discuss the integration of electronics into law enforcement.)

[3] D.R. Weiss, *Smart Gun Technology Project Final Report*, Sandia National Laboratories, 1996.

Background

This description is applicable to all of the personalized firearm technologies discussed herein. This interim report will focus on differentiating between the various keys and discriminators being used and considered for use in personalized firearms.[4]

Personalized handgun technologies comprise a broad spectrum of devices. To use the analogy above, each personalized handgun technology uses a different combination of various keys, discriminators, and latching mechanisms in its design. Examples of low-tech personalized handguns include mechanical devices, such as combination locks, built into the grip of a handgun, which the user must release prior to discharging the firearm. Toward the most advanced end of the spectrum are high-tech, electronic and biometric devices that can recognize a user's fingerprint or voiceprint and automatically unlock a firearm for discharge. Each of these technologies is in a different stage of development. While some low-tech, mechanical versions of personalized firearms are currently available commercially, most high-tech, electronic versions of these handguns are in the prototype or pre-prototype (concept) stage of development.

A fundamental design feature upon which all of these technologies can be distinguished is technology failure response. Each personalized handgun technology falls within one of two categories regarding technology failure response: 1) when the personalized technology fails, the gun remains locked and unable to fire; or 2) when the personalized technology fails, the gun unlocks and is able to fire. Into which category a firearm falls (while applicable in practice only to personalized firearms containing electronics) is an important factor in determining the discharge reliability of these firearms in emergency or combat situations.[5]

Unauthorized Shootings

The theory behind the development of personalized guns is they will save innocent lives by preventing unauthorized discharges. Fatal shootings and shootings

[4] Discussion of the various latching mechanisms and their reliability will most likely be included in the final report issued to the 2001 General Assembly.

[5] Mechanical versions of these firearms inherently remain locked until enabled by the user.

resulting in injury occur each year in the United States wherein the person who discharged a handgun was not authorized to do so. [6] These handgun shootings can be grouped into four categories: 1) take away situations in which a police officer or handgun owner is shot by another person with his or her own gun[7]; 2) accidental shootings by persons under the age of eighteen who gained access to a handgun; 3) intentional self-inflicted or suicidal shootings by persons under the age of eighteen who gained access to a handgun[8]; and 4) miscellaneous shootings involving unauthorized handguns. These unauthorized shootings will be examined in detail below.

Take-Away Shootings

Take-away shootings are shootings that occur when the rightful possessor of a handgun is deprived of that possession by another party and such party discharges the firearm, striking the original holder of the gun. The main focus of concern regarding take-away shootings is on police officers. In 1998, sixty-one (61) law enforcement officers were feloniously slain in the line of duty nationwide (compared to sixty (60), who were killed accidentally). Handguns were used in forty (40) of these murders.

Six (6) of these officers, approximately ten percent (10%), were killed with their own firearm. [9] No officers have been feloniously killed in Virginia since 1994.[10] The chart in Appendix B reflects the trend in the number of officers who were shot with their own gun.

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[6] Robinson KD, Teret SP, Vernick JS, Webster, DW. *Personalized Handguns: Reducing Gun Deaths through Design Changes.* 2nd ed. Baltimore, MD: The John Hopkins Center for Gun Policy and Research, 1998.

[7] No reliable statistical data is kept regarding "take-away" shootings of private gun owners.

[8] Reliable data was not available regarding accidental and suicidal shootings committed by persons under the age of eighteen and involving the use of unauthorized handguns. Staff extrapolated this data based upon the following assumptions: 1) Federal and State (Virginia) law prohibits persons under the age of eighteen from possessing a handgun (Chapter 44, Part 1 of Title 18 of the United States Code [18 U.S.C. 922(x)(2)(A)] and Article 7, Chapter 7 or Title 18.2 of the Code of Virginia [18.2-308.7], respectively; 2) all handguns possessed by persons under the age of eighteen are thereby unauthorized; 3) therefore, all accidental shootings and suicides committed by persons under the age of eighteen are committed with unauthorized handguns.

[9] U.S. Department of Justice, Federal Bureau of Investigation, Press Release. May 10, 1999: Washington, D.C.

[10] U.S. Department of Justice, Federal Bureau of Investigations, *Law Enforcement Officers Killed and Assaulted.* 1997: Washington, D.C.

Accidental Shootings

In 1996, the most recent year for which data is available, 693 persons, ages fourteen and under, died as the result of a shooting. Approximately 139 of these deaths, or twenty percent (20%), were unintentional.[11] In the fifteen to nineteen age range, 3,950 persons were killed by firearms in 1996. Approximately 119 of these deaths, or three percent (3%), were unintentional.

Firearm Suicides

Death by firearm is the chosen method for many suicide victims. Young victims, because of legal restrictions on youth purchase and ownership of firearms, often use guns belonging to others to commit suicide.[12] In theory, persons under the age of eighteen could not commit suicide with a personalized handgun as they would not be authorized to discharge the gun (see chart in Appendix C).

Violence Prevention via Personalized Handgun Use

The primary goal of those developing personalized handgun technologies is to created a reliable firearm, capable of rapid and valid discrimination between users, which will prevent persons not authorized to discharge the gun from so doing. If such a technology could be developed, it may prevent police officers from being killed with their own firearms, prevent children from accidentally shooting themselves and others, and prevent suicides in which the victim uses a handgun belonging to another. The current status of personalized handgun technology development is discussed in the following section.[13]

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[11] U.S. Department of Justice, Office of Juvenile Justice and Delinquency Prevention, *Promising Strategies to Reduce Gun Violence*, February 1999: Washington, D.C.

[12] See note 6.

[13] The purpose of this interim report is to simply identify various personal handgun technologies. Staff anticipates the final report issued to the 2001 General Assembly will attempt to determine if any personalized handgun technologies meet the goals outlined in this section.

Personalized Handgun Technology

Staff identified fourteen (14) technologies that are either currently being used, or may be suitable for use, in personalized handguns.[14] Each of these technologies is in a different stage of development. This section of the report catalogues these technologies into three categories: 1) personalized handgun technologies that are currently available; 2) personalized handguns that are in the prototype stage of development; and 3) technologies that may be suitable for use in personalized handguns but for which no model or prototype currently is under development.

Currently Available Technologies

Staff identified four (4) existing personalized handgun technologies that are currently available to the public through commercial markets. Descriptions of each follow.

Magloc®

Magloc® is a device manufactured by Smart Lock Technology, Inc. that uses a combination of magnets and hand pressure to release a trigger blocking mechanism. This device uses only magnetic energy and hand pressure and no batteries are required. Magloc® requires an external magnetic force, contained in a ring worn by the user, to repel a magnetic blocking device located inside the grip of the gun.[15] Once the magnetic ring releases this blocking device, the user is able to depress a palm grip switch that enables the trigger and thereby allows the gun to be fired. Magloc® is currently available only as an after-market conversion for Colt® 1911A1 semi-automatic handguns, Beretta® 92/96 semi-automatic handguns, and small frame Smith & Wesson® revolvers.

[14] In attempting to identify personalized handgun technologies, staff conducted literature reviews, spoke with manufacturers, performed patent searches, and interviewed patent holders. All personalized handgun technologies identified by this search are contained in this report. Although this search was thorough, additional unidentified technologies may exist. While staff underwent extensive due diligence, no methodology currently exists to prove the negative.

[15] The magnets used in Magloc® lose their magnetic energy if exposed to temperatures in excess of 175 degrees Fahrenheit.

Smart Lock Technology, Inc. is also working to make the Magloc® available for several models of the Glock® semi-automatic pistol and various shotguns.

To install Magloc® in a handgun, the firearm owner must make several modifications, including changing the grips. The manufacturer claims it takes approximately ten (10) minutes to install the device. Once Magloc® is installed, it must be adjusted such that the blocking magnet contained within the firearm aligns with a ring worn by the user given the user's normal grip pattern. This alignment is normally done at the factory showroom or by authorized dealers. Customers that order this technology by mail are provided with a piece of double-sided tape to hold the blocking magnet in place within the grip of the gun.

Magloc® is currently available with only four combinations, all of which are based upon varying the polarity of the magnets in the grip and ring. A Magloc® system can be ordered with multiple matching rings, thus allowing a firearm fitted with this technology to be operated by more than one authorized user. The system also allows for use by non-ring wearers by means of a switch that can be activated by a ring wearer to disable the locking mechanism. With the switch in the "off" position, anyone can fire the gun.

This technology is currently available for prices ranging between approximately $70 and $100, depending on the type of firearm to which it is to be retrofitted. Additional rings are available for $35.

Magna-Trigger

The Magna-Trigger is a device sold by Tarnheim Supply Co., Inc. that works on a principle similar to that of the Magloc®. The Magna-Trigger requires the handgun user to wear a magnetic ring that, when in contact with a specific portion of the grip of a converted handgun, enables the firearm for discharge.[16]

[16] This system works on magnetic energy and requires no batteries for operation.

Like the Magloc®, the Magna-Trigger is available only as an after-market conversion. It is currently available for many Smith & Wesson® revolvers and one Ruger® revolver. Magna-Trigger is not currently available for any semi-automatic pistol and the company has no plans for developing a device to fit semi-automatics.

Unlike the Magloc®, the rings used by the Magna-Trigger system are universal; this means a user wearing any Magna-Trigger ring can discharge any Magna-Trigger converted firearm. Furthermore, Magna-Trigger lacks the "on-off" switch found on the Magloc® system.

The Magna-Trigger conversion costs $250 for each firearm plus $40 for each standard ring. Existing rings such as wedding bands can be retrofitted with magnets, if the wearer so chooses, for an additional cost.

Fulton Arms' SSR-6

The SSR-6 is a handgun manufactured by Fulton Arms, Inc. containing a safety mechanism that, like those technologies discussed above, also relies on users wearing a magnetic ring.[17] However, unlike the Magloc® and Magna-Trigger, the manufacture of the SSR-6 claims it is capable of determining whether the holder of the gun is the authorized user by some type of hand recognition technology.[18] According to reports, the technology would prevent children from discharging the firearm even if they had access to the magnetic ring.

These handguns (.357 magnum revolvers) were available from 1993 until approximately 1997 when Fulton Arms, Inc.'s manufacturing subcontractor filed for bankruptcy. At the time the guns were available, they sold for between $1200 and $1800, two to three times the prices of a high quality .357 magnum revolver. According to the John Hopkins Center for Gun Policy and Research, Fulton Arms has licensed this

[17] While little published information was available regarding the SSR-6, conversations staff had with industry representatives and firearms experts indicate the magnetic release mechanism of the SSR-6 was encoded in such a way that no two were the same. Attempts to verify this characteristic were unsuccessful.

[18] Press reports of this firearm identified Fulton Arms' unwillingness to disclose the working mechanism of this hand recognition technology. Despite repeated efforts, staff was unable to reach Fulton Arms for comment.

technology to Mossberg & Sons, Inc. for use in Mossberg® shotguns, and has plans to build its own manufacturing facility for production of guns containing this technology.[19]

Saf T Lok™

Saf T Lok ™ is an after-market gun-locking device manufactured by United Safety Actions, Inc. utilizing a manual toggle-switch locking mechanism to disable retrofitted firearms. This mechanical technology requires the user of a handgun to enter a combination on a touch sensitive pad to enable the firearm for discharge. The design of the lock allows for over 10,000 possible combinations. Once the combination has been entered, the gun is unlocked and remains unlocked and able to fire until the user activates a switch to re-lock the gun.

The Saf T Lok™ technology differs substantially from the above technologies in one important way. While it meets the definition of a personalized firearm by containing a locking device that is integral to the design of the gun, and allows only an authorized user to discharge the weapon, *it is not automatic.* Saf T Lok™ is also the only technology discussed thus far that requires the users to manually re-lock a firearm after use.

Saf T Lok™ is available as an after-market conversion for approximately ninety (90) different firearms, including semi-automatic handguns and revolvers. The cost for this technology in 1998 was $70 for revolvers and $90 for pistols. According to the John Hopkins Center for Gun Policy and Research, the manufacturer of Saf T Lok™ entered into an agreement in 1998 with an unnamed company to develop a firearm that uses fingerprint recognition technology to identify authorized users and prohibit unauthorized firearm discharges.[20]

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[19] Personalized Gun Technology, Center for Gun Policy and Research, John Hopkins University; Baltimore MD (1997).
[20] *Id.*

Prototype Technologies

Staff identified three (3) personalized handgun technologies that are currently in the prototype stage of development. Descriptions of each follow.

Intraloc[21]

Intraloc is a battery operated, push button lock that automatically relocks when the gun's user removes his or her hand from the grip. Like the Saf T Lok™ (see above), this technology is not automatic and it requires the user to perform several steps to enable the firearm. More importantly for purposes of this classification, this technology is not yet available to the public through existing markets.

When an Intraloc equipped handgun is picked up, the user's palm depresses a grip-switch. To discharge the firearm, the user enters a three-part code on a three-digit touch pad of an electronic lock. If the code is correct, the firearm unlocks and is able to be discharged. When the user removes his or her hand from the gun, the palm switch is released, thereby re-locking the firearm.

While prototypes of handguns containing an Intraloc system exist, Intraloc equipped guns are not currently available to the public. Assessments of preliminary marketing data indicate that sales of this gun will likely target civilian, as opposed to police, populations.

Colt Manufacturing's EP-1

The EP-1 is a handgun manufactured by Colt Manufacturing Co., Inc. containing a safety mechanism that automatically unlocks when it senses the presence of an active radio frequency transponder worn by the gun's user. This gun will only discharge when activated by an enabling device called a transponder that is worn as a bracelet on the wrist of the authorized user.[22] Currently, for the gun to unlock, it must be within several

[21] This technology could be considered a cross-over between those currently available and those in the prototype stage of development. Its design makes it easy to retrofit to several existing firearms; however, the manufacturer chooses not to sell the Intraloc directly to the public and no firearm manufacturer has agreed to sell it as original equipment on any gun.

[22] Colt is working to miniaturize the transponder so that it will fit into a ring.

inches of the bracelet regardless of whether the transponder contained in the bracelet is behind or *in front of* the gun. Colt is working on a technology that would allow the gun to distinguish whether the authorized user was in the line of fire, and only unlock if the opposite were true. This technology, which was developed with the assistance of the National Institute of Justice, is currently in the prototype stage of development.[23]

When available, Colt predicts this .40 caliber handgun will cost approximately $900, compared with $600 for its conventional .40 caliber semi-automatic handgun. Currently, Colt intends to market the EP-1 only to police populations with the possibility of developing a civilian version several years after the EP-1's initial introduction.

Ax36 Video Digital Signal Processor

The Ax36 Video Digital Signal Processor is a microchip device manufactured by Oxford Micro Devices, Inc. which, when combined with a FingerChip thermal imaging fingerprint sensor, is capable of recognizing and distinguishing fingerprints. When incorporated within the design of a handgun, the Ax36 would distinguish between the fingerprints of authorized and unauthorized users. In combination with a small electronic firing-pin locking servo, this technology could prevent unauthorized users, those with fingerprints not matching pre-programmed sets, from discharging an equipped firearm. In theory, an Ax36 equipped firearm will remain disabled until it recognizes an authorized fingerprint. To identify himself or herself to the handgun, the user would pick-up the firearm and swipe his or her finger across the thermal imaging sensor on the grip. If the Ax36 chip recognized the user, it would enable the firearm and signal the user that it was ready to be discharged. According to the manufacturer, an Ax36 equipped handgun would be able to recognize multiple authorized users.

This technology already exists. However, its manufacturer, Oxford Micro Devices, Inc., has been unable to successfully contract with a firearm manufacture for development of a prototype handgun. Oxford is continuing its efforts to identify a

[23] Reports regarding the available date of the EP-1 vary. Some estimates state the EP-1 will be available for purchase as early as 2001; others conclude a marketable form of this technology will be unavailable for five to ten more years.

firearm manufacturer that is willing to develop a personalized handgun using the Ax36 microchip and FingerChip thermal imaging fingerprint sensor.

Concept Technologies[24]

Staff identified seven (7) technologies with possible application for personalized handguns currently in the pre-prototype or concept stage of development. Descriptions of each follow.

Passive Radio Frequency Identification

Passive Radio Frequency Identification (PRFID) is a technology identified by Sandia National Laboratories for possible use in personalized handguns. A PRFID personalized handgun would work similarly to Colt's® EP-1. However, where the EP-1 utilizes a radio transponder worn on the wrist of the authorized user to actively communicate with a receiver/transmitter in the gun (an active radio frequency identification system), the passive system relies on a passive transponder. Active transponders actually generate and send radio frequency signals. Passive transponders, or tags, simply reflex a radio frequency transmission in a way that the transmitter can understand (a process known as modulated backscatter). The most common use for these passive transponders is in automatic toll road collectors.

As applied to personalized handguns, a PRFID system would include a transmitter/receiver and battery located in the gun and a passive radio frequency tag worn by the authorized user or embedded under the skin in the user's hand(s). The transmitter in the firearm would emit a radio frequency signal. If the signal were reflected by a radio frequency tag recognizable by the receiver in the gun, a small servo would be activated to unlock the firing-pin, thereby enabling the gun. Radio frequency tags can be made to modify combinations of radio frequencies and their amplitude and phase; as such,

[24] Staff relied heavily on the 1996 report by Sandia National Laboratories regarding personalized handgun technologies. All quotes in this section were taken from this report which can be cited as follows: D. R. Weiss, *Smart Gun Technology Project Final Report,* Sandia National Laboratories (1996).

practically unlimited combinations exist. This would allow for single or multiple authorized user(s).

Currently, no known manufacturer is working to develop a firearm using this technology.

Remote Control

Remote controls are devices, requiring some human action, that transmit a uniquely coded signal from a transmitting device to a receiving device. The information is then interpreted and used to control some operation.[25] For implementation into a personalized handgun system the authorized user would carry the remote control on his or her person. This remote could be designed to either enable or disable the firearm or both. For example, to prohibit accidental shootings by children, a parent wishing to keep a handgun in the home may purchase a version that remained disabled until activated by a remote the parent keeps on his or her person. A police department attempting to restrict take-away shootings may arm its officers with guns that normally remained enabled but that could be disabled in a take-away situation by the officer activating a remote he or she wore on his or her uniform. The nature of this technology allows for almost unlimited frequency combinations; as such, single or multiple authorized users could be designated. A key distinguishing feature of remote control devices is that, unless combined with some other technology, they do not automatically re-lock the gun.

While prototypes of this technology were developed, it is no longer being considered by any manufacturer for use in a firearm. One inventor designed and patented a device for sale to police departments that used a remote garage door opener to disable a firearm should such firearm be taken-away by a perpetrator. This inventor sold his patent to a major firearm manufacturer that, to the best ability of staff to determine, tabled the technology in favor of a more automatic radio frequency system.

[25] See note 11.

Bar Codes

"A bar code is a symbol consisting of light and dark bars forming a unique code."[26] The most common use for bar code readers is in identifying goods and prices at checkout counters in retail stores. For use in a personalized handgun system, a bar code scanner and reader would be installed in the firearm. The user would either wear a glove or a pin with the bar code printed on it, or have the bar code tattooed to his or her hand(s). The user would grip the handgun; if the firearm recognized the bar code as belonging to an authorized user, it would enable the firearm. Bar codes are limited in combination only by the area needed to print large codes. This flexibility allows for designation of single and multiple users systems.

While this technology has been identified as one possible for use in a personalized handgun system, no known firearm manufacturing is currently considering it.

Voice Recognition

Implementation of a voice recognition system follows the basic analogy of the personalized handgun system.

> *"The person's voice, or whatever the person says, is the key. A microphone mounted on the firearm receives the voice and sends it to the discriminator. The discriminator then attempts to recognize the speaker, or the utterance. If the recognition is completed successfully then the latching mechanism is enabled."*[27]

Because voices and command words are infinitely variable, unlimited combinations exist. As such a personalized handgun system could be designed to serve one or multiple users.

To staff's knowledge, no manufacturer is currently working to design a gun using voice recognition technology.

Capacitive Sensing

Capacitance is the ability of an object, including a human body, to store an electrical charge. "A capacitance sensor measures the change in stored charge as it is

[26] See note 11.
[27] *Id.*

brought nearby or in contact with another object."[28] Presently, sensors can only roughly determine an object's size and are unable to discern details. A goal of those developing capacitance sensors is to develop the ability to construct a three dimensional map of the object being sensed.

As applied to personalized handguns, capacitance sensors currently in existence could discern the hand of a child from that of an adult, and thereby prohibit unauthorized firearm discharges by children in guns so equipped. However, until this technology advances, firearms using capacitance sensors will be unable to discriminate between authorized and unauthorized adult handgun users. At this time, no known manufacturer is developing a firearm utilizing this technology.

Color Sensors

A typical color sensor consists of a photo-sensor and a set of optical filters.[29] As applied for use in a personalized handgun, a color sensor would be incorporated into the design of the gun. The authorized user would wear a ring or a glove containing the key color. When a user grips the handgun, the color sensor would distinguish the ring's or glove's color attributes, and compare them to the authorized colors stored in the database. If the system determined a match, it would enable the firearm to discharge. Currently, no known manufacture is developing a personalized firearm using this technology.

Touch Memory™

Touch Memory™ is a technology manufactured by Dallas Semiconductor, Inc. which is used to automate the identification of objects. "The device consists of a digital memory device placed in a small can. The can acts as both the reader interface and physical protection for the memory."[30] The information contained in the memory can be read simply by touching the can to the reader.

As applied for use in a personalized handgun, the firearm user would wear a ring or glove embedded with the memory chip. When the user grips the handgun, the can

[28] *Id.*
[29] *Id.*

would come in contact with a reader contained in the handgun. If the reader recognized the chip as authorized, it would enable the firearm to discharge. The design of the chip allows for unlimited combinations; as such, a handgun containing this device could have a single or multiple authorized user(s).

Currently, no known manufacturer is developing a firearm using Touch Memory™ as an authorizing device.

Summary

Each of the fourteen (14) technologies identified above either fits or has the potential to fit the definition of a personalized handgun. Those technologies categorized under the exiting technology section of the report can be purchased through existing commercial channels. (e.g., local gun dealers, factory direct, catalogue, etc.).

The technologies listed under the prototype section of this report may or may not be available soon. Some estimate certain types of these prototype technologies will be available within one year. Other sources suggest it may be ten years before they are available. Staff will continue to monitor the availability of these technologies over the upcoming year and issue additional findings regarding their future availability in its final report to the 2001 General Assembly.

A comparable approach will be used in analyzing the concept technologies. This preliminary analysis indicates some of the concept technologies may be available in a suitable form for use in personalized handguns within several years. Others are more likely to take a greater amount of time before development to a stage where their use would be appropriate in firearms. Because staff cannot predict the possibility of technological leaps that may occur over the next year, they will continue to monitor these concept technologies for development.

[30] *Id.*

Appendix A

(SJR 377 / HJR 679)

SENATE JOINT RESOLUTION NO. 377

Directing the Virginia State Crime Commission to study the technology known as "personalized" or "smart" handguns.

Agreed to by the Senate, February 9, 1999
Agreed to by the House of Delegates, February 25, 1999

WHEREAS, a personalized handgun is a firearm that cannot be fired by an unauthorized user, including a child or criminal; and

WHEREAS, personalized handgun technology may help to establish future statewide handgun safety standards and thereby help to prevent needless firearm deaths and injuries; and

WHEREAS, unlike a trigger lock that must be removed and replaced each time a handgun is used, a personalized handgun contains a mechanism that is incorporated into the design of the handgun; and

WHEREAS, 14 different personalized handgun technologies are under research and development and range from low-tech combination locks built into the grip of the handgun to high-tech devices that can recognize an authorized user's fingerprint; and

WHEREAS, personalized handguns are technologically feasible; and

WHEREAS, the integration of electronics into law-enforcement and consumer handguns and rifles is a natural evolution of technology which can be used for safety, performance and reliability; and

WHEREAS, national consumer initiatives and legislation have challenged consumer industries to improve the safety and design of several products, including automobiles, pharmaceutical packages and cigarette lighters; and

WHEREAS, firearms presently are the second leading cause of death among children and youth, guns presently are the leading cause of death for young African-American males, and, in 1995, 440 American children and teenagers were unintentionally killed by firearms in the United States; and

WHEREAS, in the Commonwealth of Virginia, 63 children and adolescents under the age of 18 were killed by gunfire in 1994, and such deaths were the second leading external or unnatural cause of death for this age group; now, therefore, be it

RESOLVED by the Senate, the House of Delegates concurring, That the Virginia State Crime Commission be directed to study the technology known as "personalized" or "smart" handguns. The Commission shall (i) review the status of present technology to develop "smart" guns, and the present and future accessibility and availability of such technology, and (ii) determine the feasibility of developing future legislation which conforms with the Commission's findings regarding "personalized" or "smart" guns.

All agencies of the Commonwealth shall provide assistance to the Commission,upon request.

The Virginia State Crime Commission shall complete its work in time to submit its findings and recommendations to the Governor and the 2001 Session of the General Assembly, and shall submit an interim report to the Governor and the 2000 Session of the General Assembly, as provided in the procedures of the Division of Legislative Automated Systems for the processing of legislative documents.

991113112

HOUSE JOINT RESOLUTION NO. 679

AMENDMENT IN THE NATURE OF A SUBSTITUTE

(Proposed by the House Committee on Rules
on February 1, 1999)

(Patron Prior to Substitute-Delegate Almand)

Directing the Virginia State Crime Commission to study the technology known as "personalized" or "smart" handguns.

WHEREAS, a personalized handgun is a firearm that cannot be fired by an unauthorized user, including a child or criminal; and

WHEREAS, personalized handgun technology may help to establish future statewide handgun safety standards and thereby help to prevent needless firearm deaths and injuries; and

WHEREAS, unlike a trigger lock that must be removed and replaced each time a handgun is used, a personalized handgun contains a mechanism that is incorporated into the design of the handgun; and

WHEREAS, 14 different personalized handgun technologies are under research and development and range from low-tech combination locks built into the grip of the handgun to high-tech devices that can recognize an authorized user's fingerprint; and

WHEREAS, personalized handguns are technologically feasible; and

WHEREAS, the integration of electronics into law-enforcement and consumer handguns and rifles is a natural evolution of technology which can be used for safety, performance and reliability; and

WHEREAS, national consumer initiatives and legislation have challenged consumer industries to improve the safety and design of several products, including automobiles, pharmaceutical packages and cigarette lighters; and

WHEREAS, firearms presently are the second leading cause of death among children and youth; guns presently are the leading cause of death for young African American males; and in 1995, 440 American children and teenagers were unintentionally killed by firearms in the United States; and

WHEREAS, in the Commonwealth of Virginia, 63 children and adolescents under the age of 18 were killed by gunfire in 1994, and such deaths were the second leading external or unnatural cause of death for this age group; now, therefore, be it

RESOLVED by the House of Delegates, the Senate concurring, That the Virginia State Crime Commission be directed to study the technology known as "personalized" or "smart" handguns. The Commission shall (i) review the status of the present technology to develop "smart guns," and the present and future accessibility and availability of such technology, and (ii) determine the feasibility of developing future legislation which conforms with the Commission's findings regarding "personalized" or "smart" guns.

All agencies of the Commonwealth shall provide assistance to the Commission,upon request.

The Virginia State Crime Commission shall submit an interim report to the Governor and the 2000 Session of the General Assembly, and shall complete its work in time to submit its findings and recommendations to the Governor and the 2001 Session of the General Assembly, as provided in the procedures of the Division of Legislative Automated Systems for the processing of legislative documents.

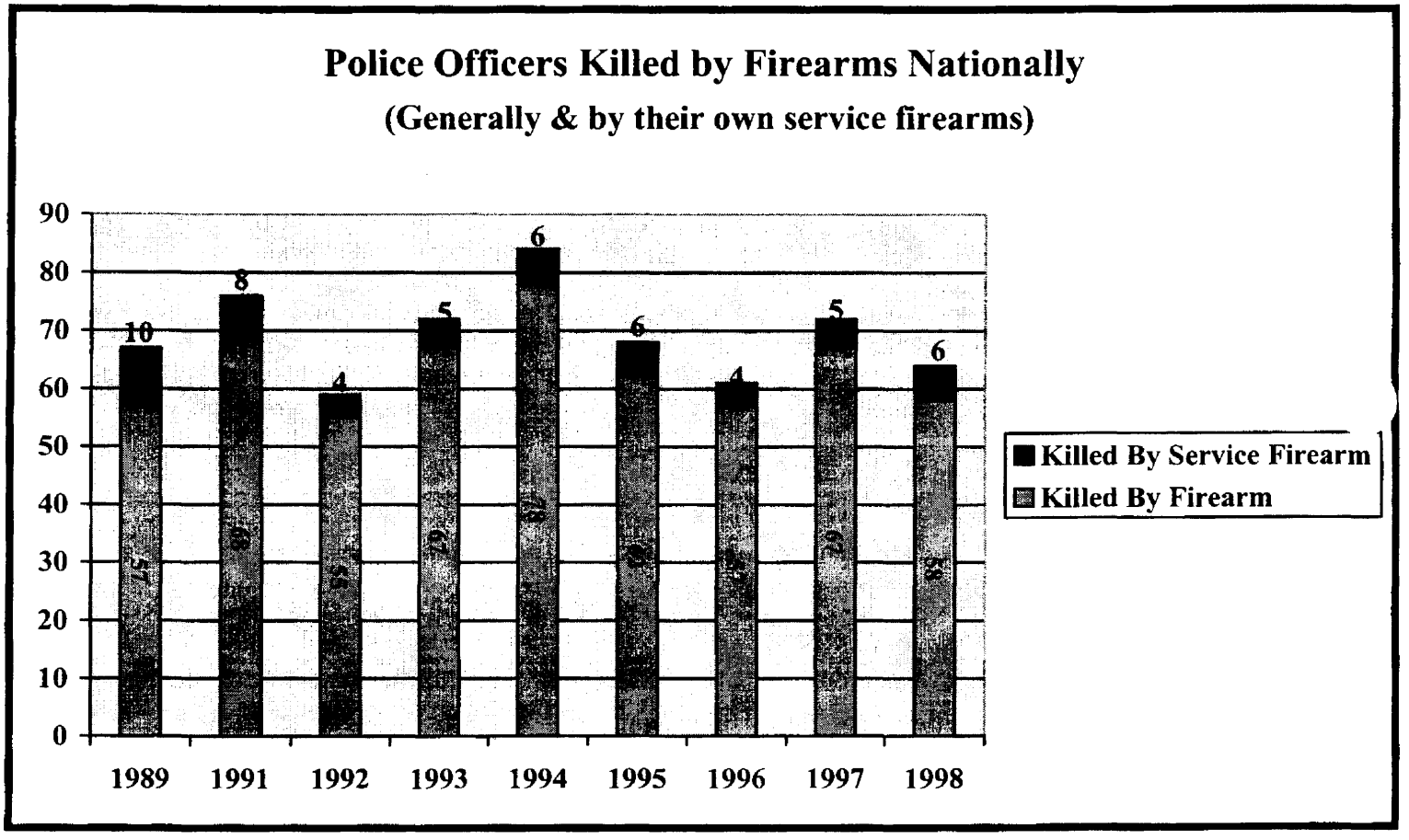
Official Use By Clerks

Passed By The House of Delegates		Passed By The Senate	
without amendment	☐	without amendment	☐
with amendment	☐	with amendment	☐
substitute	☐	substitute	☐
substitute w/amdt	☐	substitute w/amdt	☐

Date: _____ Date: _____

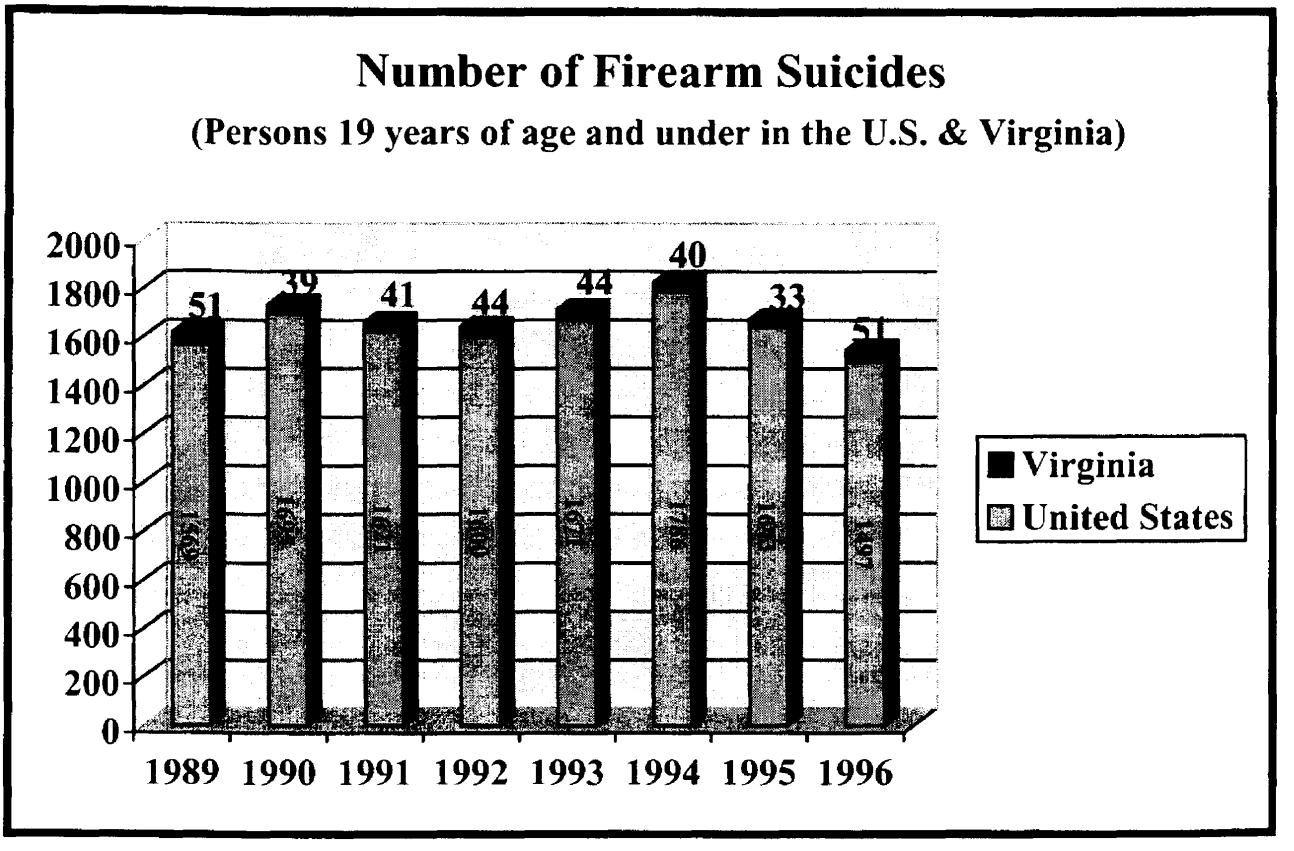
Clerk of the House of Delegates | Clerk of the Senate

Appendix B



Source: Virginia State Crime Commission interview with Federal Bureau of Investigation statistician, July 1999.

Appendix C



Source: Virginia State Crime Commission Interview with Federal Bureau of Investigation statistician, July 1999.

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