



Feasibility and Practicality of Improvised Full Automatic Fire

Introduction

November 28, 2014

Improvised full automatic fire can be deployed on many types of semi-automatic firearms. Being improvised, there is no standard way to apply the technique.

The pertinent distinction between conventional semi-automatic firearms and full automatic firearms is the rate of fire. Semi-automatic firearms are commonly employed for both civilian and military purposes whereas full automatic firearms are almost exclusively deployed for military purposes where the higher rate of fire offers a tactical advantage and collateral damage is less of a concern.

A conventional semi-automatic firearm has a mechanism which employs the energy of the discharge of a cartridge to operate the mechanism to extract and eject the spent cartridge case and reload another cartridge from the magazine into the chamber. A semi-automatic firearm fires only one cartridge per pull of the trigger. The trigger must be released after each shot to reset the mechanism before another shot can be fired. The practical (and tactical) advantage of a semi-automatic action is that it permits the operator to focus on aiming and firing the firearm. Once the magazine is charged and the firearm loaded and cocked, reloading for subsequent shots is effected by the semi-automatic mechanism without diverting the attention of the operator. The absolute maximum rate of fire depends on how quickly the operator can pull the trigger. The practical maximum rate of semi-automatic fire will be somewhat less as it would take into account thermal and mechanical factors that affect the firearm as well as the time required for the operator to select and aim at targets.

A conventional full automatic firearm generally has all the functions of a semi-automatic firearm with the addition of a mechanism to automatically fire the cartridge immediately after reloading. The automatic firing mechanism operates much more quickly than manual pulling of the trigger and thus permits bursts of shots to be fired as opposed to a sequence of single shots. The rate of fire for small arms (assault rifles, submachine guns, light machine guns), commonly referred to as the cyclic rate, varies from 500 shots per minute to 1200 shots per minute, although higher rates of fire are possible. Such rates of fire cannot be sustained indefinitely due to thermal and mechanical stresses. The length of time (or number of shots) that full automatic fire can be sustained without damage to the firearm varies according to design and calibre.

Semi-automatic versions of military small arms are widely manufactured for sale to the civilian market. Typically, the semi-automatic version differs from the full automatic version of the firearm only by



deletion of the full automatic fire capability. Improvised full automatic fire is a means of restoring the full automatic fire capability to such semi-automatic variants without employing the conventional full automatic mechanism. It is also possible to apply improvised techniques to sporting semi-automatic firearms which never had an original full automatic fire capability.

Improvised methodology is rarely deployed for institutional use, such as police and military applications, as these agencies generally have full access to the conventional full automatic mechanisms. Rather, improvised techniques are typically used by curious experimenters and by criminals who do not have access to conventional full automatic mechanism components.

Improvised methodology can take many forms

The effectiveness of any particular method will depend on the design and calibre of the target firearm.

Scope

This report is limited to the use of similar materials to adapt common semi-automatic firearms to fire in a full automatic manner.

The purpose of the report is to assess the feasibility of adapting semi-automatic rifles to fire in a full automatic manner using such materials, and to assess the practicality of employing the adaptation, under field conditions.

The US M14 selective fire battle rifle family of firearms will be studied in greater detail than other varieties as one of its semi-automatic variants (the Poly Technologies M305 rifle) was used in the murders of RCMP members in Moncton in June, 2014. Although improvised full automatic fire using was not actually attempted in that case, the concept was considered by the perpetrator.

Principle of Operation

A typical formulation employs



The semi-automatic firearm i
the firearm will discharge in a full automatic manner



Genuine Full Automatic Fire

Modern assault rifles and submachine guns typically have selective fire capability. They can fire in either the full automatic mode or semi-automatic mode depending on the position of a mechanical switch known as the selector. Most modern designs fire from the closed bolt position, that is, the bolt is fully forward and locked in place at the moment of discharge. Closed bolt designs employ internal components within the full automatic portion of the firing mechanism to ensure the firearm action is completely locked before firing each cartridge in the full automatic mode. This is for both the safety of the operator and the integrity of the firearm as premature discharge before bolt lock-up can cause damage to the firearm and injury to the shooter. Some firearm designs however fire from the open bolt and are not mechanically locked at the moment of discharge. They typically are chambered for less energetic calibres which mitigates the risk.

Improvised full automatic fire techniques can interfere with the accurate timing of discharge and as a result, can discharge the firearm before it is fully locked up. This introduces an increased risk of damage to the firearm and injury to the operator if the modifications to the firearm are not properly tuned to the operating cycle of the firearm mechanism. **Correctly adjusted, the improvised full automatic fire from an otherwise semi-automatic firearm will be similar in rate to the genuine full automatic fire from the selective fire version of the firearm.** The semi-automatic performance characteristics of the target semi-automatic firearm and the selective fire version operating in semi-automatic mode will also be very similar, if not identical.

Using the 7.62 x 51 mm NATO calibre US M14 selective fire rifle as an example, the US Arms field manual (FM23-8) quotes the following performance statistics. Semiautomatic variants of the M14 rifle would have similar characteristics except for full automatic fire which is not present in the firearms as manufactured.

The maximum range of the standard military projectile is 3725 metres. The effective range for both semi-automatic and full automatic fire is 460 metres. The cyclic rate is 700-750 shots per minute in full automatic mode. Maximum sustained rates, which can be maintained without danger to the operator or damage to the firearm, are detailed in the table below.

Time Period (Sustained Fire)	Maximum Sustained Rate (Semi-automatic Fire)	Maximum Sustained Rate (Full Automatic Fire)
1 minute	40 shots per minute	60 shots per minute
2 minutes	40 shots per minute	50 shots per minute
5 minutes	30 shots per minute	40 shots per minute
10 minutes	20 shots per minute	30 shots per minute
15 minutes	20 shots per minute	30 shots per minute
20 minutes	20 shots per minute	25 shots per minute
30 minutes (or longer)	15 shots per minute	20 shots per minute



Historical Context

While the technique described above has been known for decades in the firearms user community it has always been regarded as a relatively primitive method of implementing improvised full automatic fire. The technique has never been viewed as a conversion equivalent to the conventional notion,

Nonetheless the technique is widely reported on the Internet complete with installation and fitting instructions; and before that in home gunsmith books.

The kinds of firearms most susceptible to adaption to full automatic fire using the technique are the semi-automatic variants of military and para-military automatic firearms, which generally have all the features of the original firearm except for full automatic fire capability, and in particular have the robust construction to withstand the heating and mechanical rigours of full automatic fire. Likewise, large capacity magazines are made for these firearms, without which full automatic fire is not practical. In contrast, genuine hunting and sporting firearms generally are of lightweight construction and have magazine capacities of five shots or less. Even where conversion to full automatic fire is possible for a hunting firearm by employing this technique, it is impractical due to overheating and small magazine capacity issues.

The US Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) has reported similar techniques, for which the ATF issued a formal finding in 1996 establishing the conversion device as a prohibited product under US Federal law. This position was modified in 2007. The conversion device is no longer considered prohibited, but if applied to a firearm, creates a prohibited machine gun.

In Canada during the 1990s the matter was dealt with indirectly via the Criminal Code Regulations (Regulations Prescribing Certain Firearms and other Weapons, Components and Parts of Weapons, Accessories, Cartridge Magazines, Ammunition and Projectiles as Prohibited or Restricted). These regulations were introduced to limit accessibility to para-military and military-type firearms for which no legitimate hunting or sporting role exists. As a result, these types of firearms were regulated as restricted or prohibited firearms by Parts 1 and 2 of the Criminal Code Regulations. Testing has suggested that this type of firearm is most susceptible to adaption to full automatic fire. At the time, the Criminal Code Regulations reduced the risk posed by the technique by taking the firearms most practical for conversion to full automatic fire off the civilian market. Thus the public safety risk posed by improvised conversion techniques was largely negated and rendered moot, and not requiring much police attention.

The restricted and prohibited firearm provisions of Criminal Code Regulations were last updated in 1995 and there are presently numerous models of military and para-military firearms on the Canadian market which are outside the scope of the Criminal Code Regulations, many being non-restricted in classification. For example, the M14 family of firearms, of which the M305 rifle is a semi-automatic



variant, would fall into this category. Indeed, there are several Canadian firearms businesses which specialize in importing such firearms and have sold large numbers of them in Canada.

The manufacture, import and use of improvised full automatic conversion devices has been continuously monitored by police and Customs agencies for the past two decades. The primary focus was on modifications

, particularly for well-known devices for legally available firearms such as the drop-in full automatic sear for the AR-15 family of rifles. The AR-15 rifle is a restricted firearm and thus available for purchase by Canadians having a possession and acquisition licence (PAL) with restricted privileges. Conversion methods for the AR-15 family of rifles are widely publicized on the Internet, and before the Internet age, in easily obtainable books.

There is a parallel issue with large capacity cartridge magazines. The kinds of firearms prohibited by the Criminal Code Regulations in 1995 are for the most part the firearms for which large capacity magazines are manufactured. Standard military rifle magazine capacities range from 20 to 40 rounds depending on the design of the firearm and its calibre. Aftermarket magazines are available in capacities up to about 100 shots, again depending on the calibre and design of the firearm for which they are intended. Additionally, some light automatic rifles are belt fed, with capacities starting at about 100 rounds and expandable to any arbitrary amount by linking belts. The introduction of new models of military and para-military firearms not regulated by the Criminal Code Regulations has seen a parallel resurgence of large capacity magazines. Although the large capacity magazines are required to be pinned or otherwise reduced by law, typically to five shots, they are easily reconverted to original capacity.

The Canadian introduction of new types of military and para-military firearms not mentioned in the Criminal Code Regulations, nearly all with large capacity magazine sizes started circa 2005 and has accelerated since. Although ownership rates have dramatically increased, exact numbers are no longer available. The public safety threat posed by improvised conversion to full automatic fire has correspondingly increased. The Moncton shootings have highlighted the potential risk.

Test Protocols

To streamline and simplify the research, the testing was limited to the most widely reported technique which employs

The technique was applied to a small sample of common semi-automatic rifles selected to represent the full gamut of semi-automatic firearms on the Canadian market. Over 1200 test shots have been fired since testing began in July 2014.

The test procedure was the same for all firearms tested:



Magazines were loaded with 20 cartridges except for 7.62 x 51 mm NATO calibre firearms which were loaded with 10 cartridges. The reason for limiting the number of larger and more powerful cartridges was related to safety; controlling the recoil and muzzle climb was much more difficult particularly if a long full automatic burst occurred.

Various materials were tested including

Examples are pictured below.



Figure 3: C2 R58 Tactical ZP semi-automatic rifle -- close up view



Figure 3: C2 R58 Tactical ZP semi-automatic rifle -- close up view

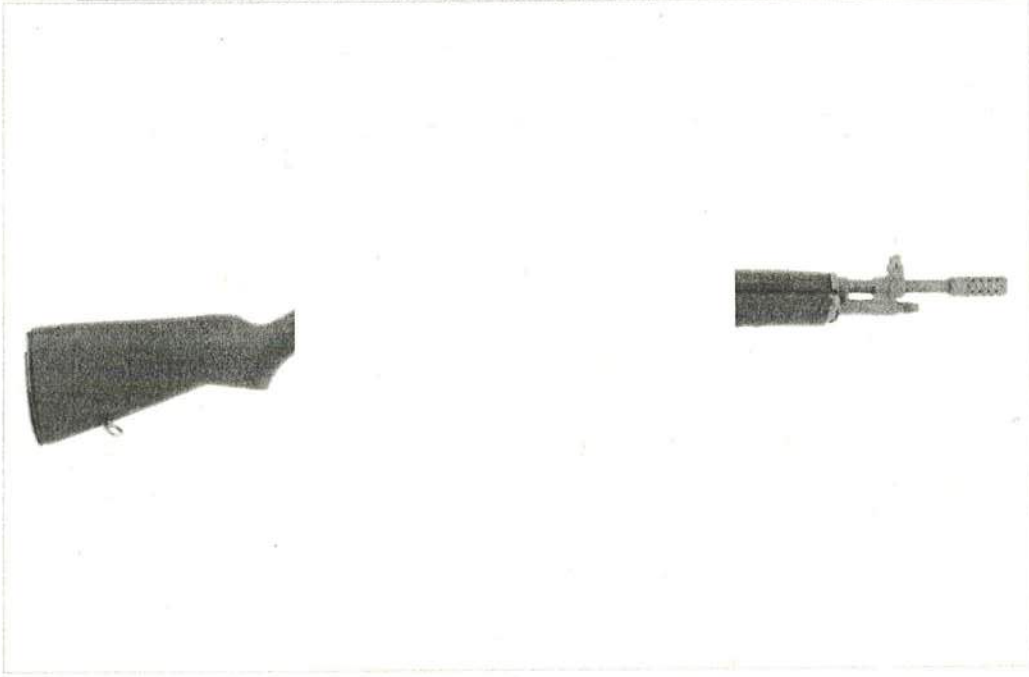


Figure 4: Dominion Arms 500727 15 semi-automatic rifle



Figure 5: Dominion Arms 500727 15 semi-automatic rifle - close up view

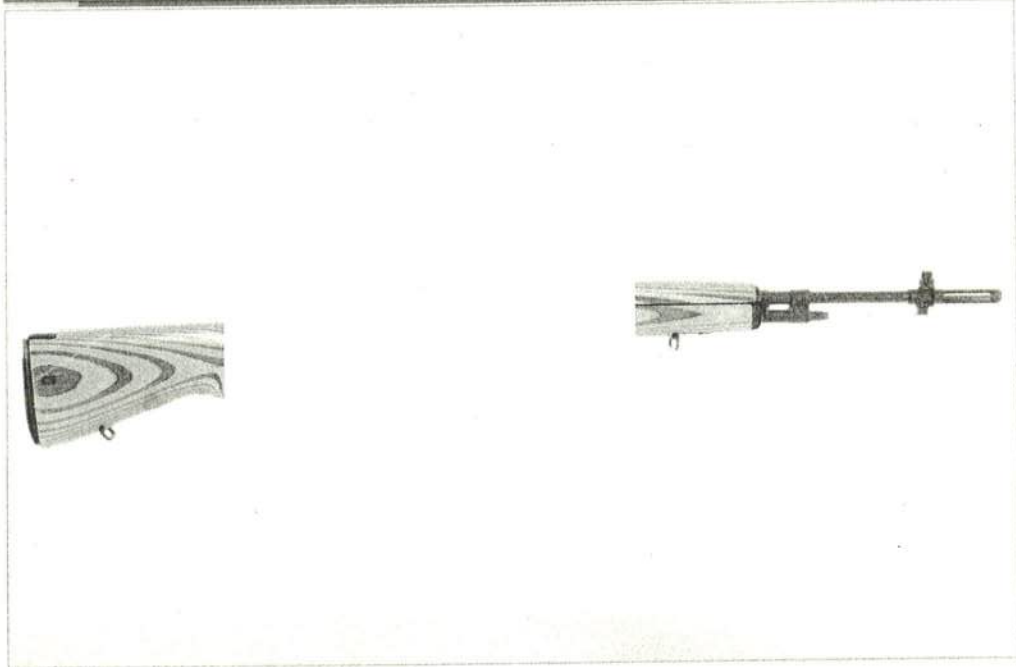


Figure 6: Springfield Armory M1A semi-automatic rifle

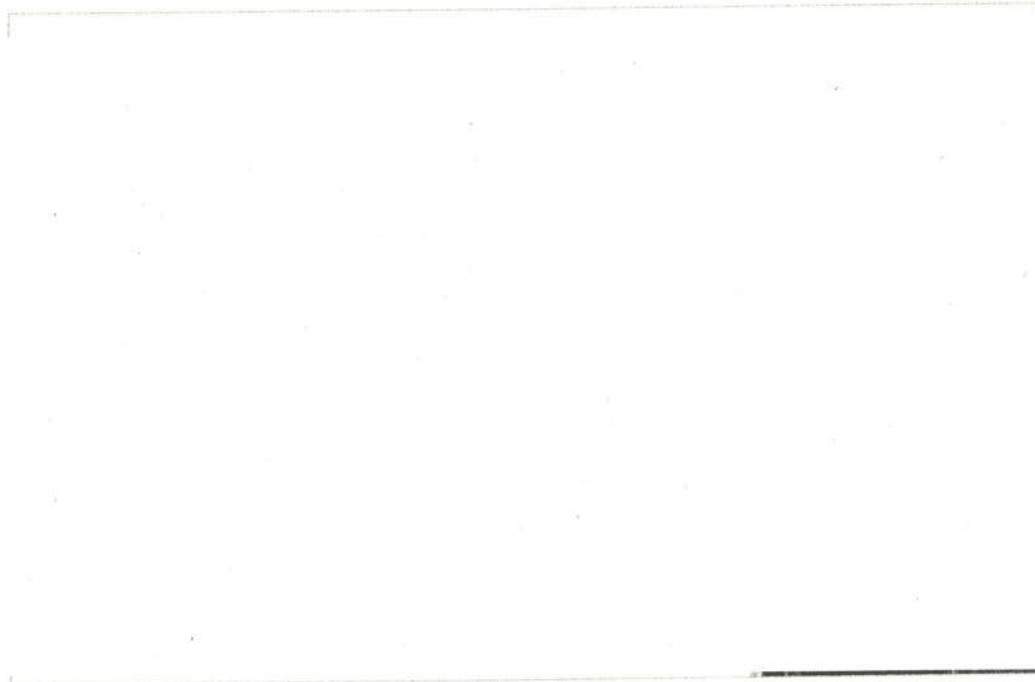


Figure 7: Springfield Armory M1A semi-automatic rifle - close up view

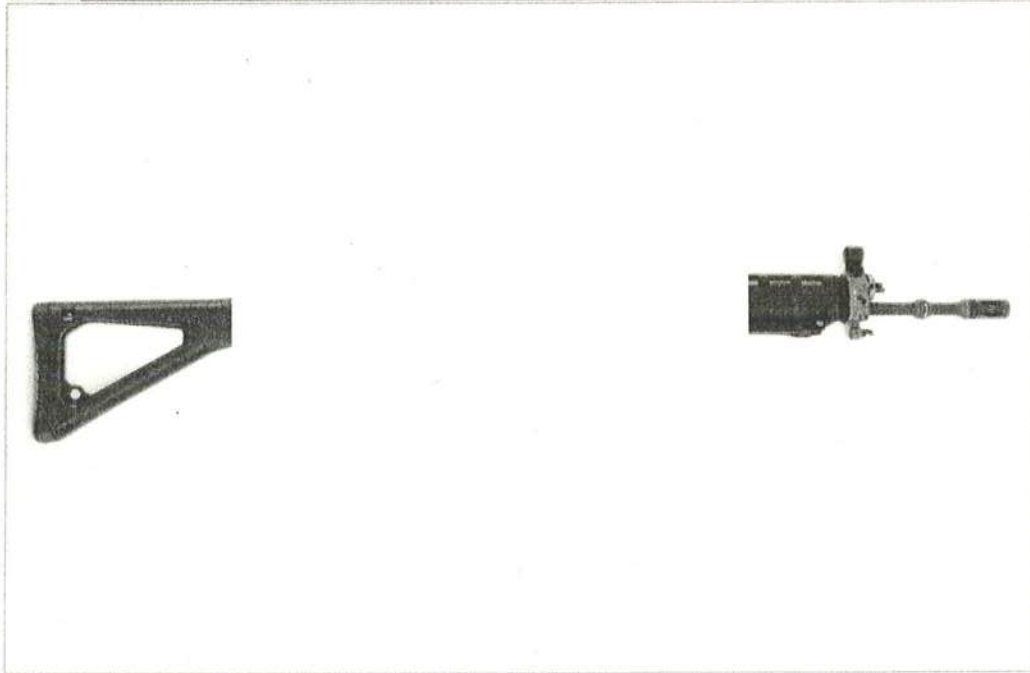


Figure 8: Swiss Arms Blue Star semi-automatic rifle

Figure 9: Swiss Arms Blue Star semi-automatic rifle – close up view

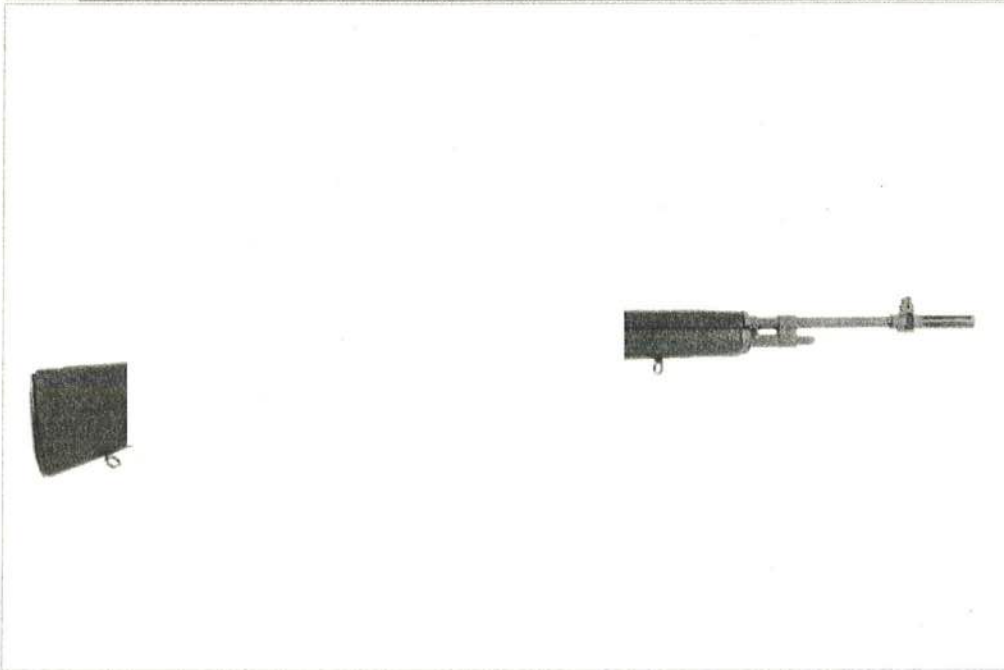


Figure 10: Polytechnologies M305 semiautomatic rifle

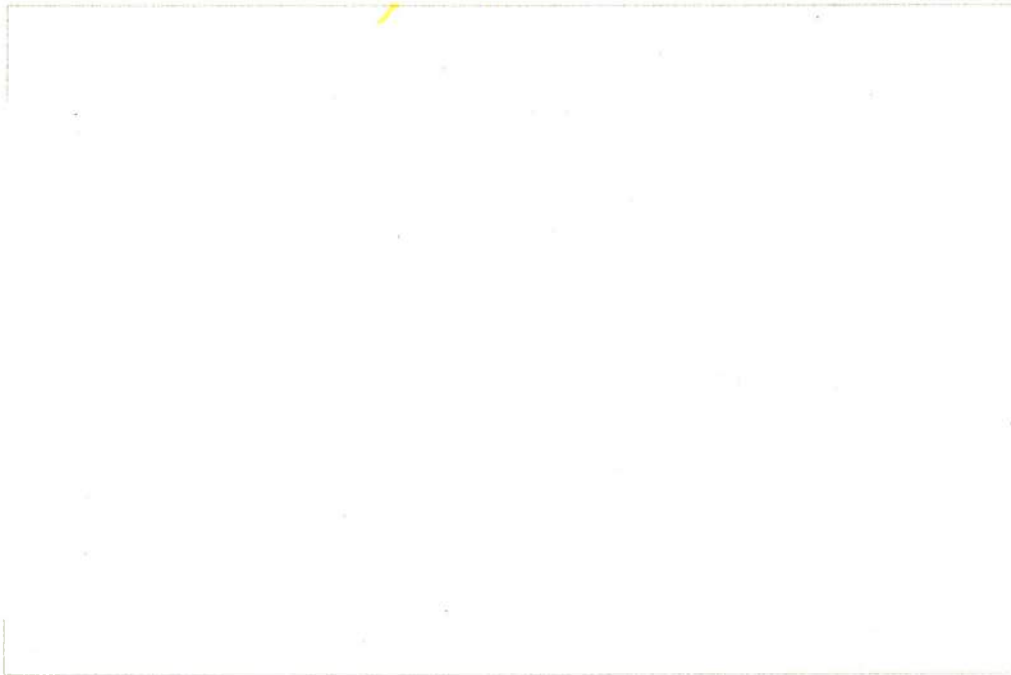


Figure 11: Polytechnologies M305 semiautomatic rifle - close up view

PROTECTED B



Test Results

Broadly speaking, rifles chambered for mid-range military calibres such as 5.56x45 mm NATO (223 Remington), 7.62x51 mm NATO (308 Winchester) and 7.62x39 mm Russian. low power firearms such as those chambered for 22 Long Rifle calibre due to insufficient force available from the moving cocking handle. There are also some models of rifles which do not have a cocking handle which reciprocates during firing, such as the M16/AR15 family and the FN-FAL family,

Firearms for which	
FIREARM	CALIBRE
CZ 858 Tactical 2P rifle	7.62x39 mm Russian
Ruger Mini-14 rifle	5.56x45 mm NATO (223 Remington)
Ruger Mini-30 rifle	7.62x39 mm Russian
Domlnlon Arms SOCOM 18 rifle (M14 clone)	7.62x51 mm NATO (308 Winchester)
Polytechnologies M305 rifle (M14 clone)	7.62x51 mm NATO (308 Winchester)
Springfield Armory M1A rifle (M14 clone)	7.62x51 mm NATO (308 Winchester)
Swiss Arms Blue Star rifle	5.56x45 mm NATO (223 Remington)

Firearms for which	
FIREARM	CALIBRE
FAMAE SG540 rifle	7.62x51 mm NATO (308 Winchester)
Ruger 10/22 rifle	22 Long Rifle
Ruger 22 Charger pistol	22 Long Rifle
Russian SKS Carbine	7.62x39 mm Russian
US M1 Carbine	30 Carbine

The firearms tested generally represent their class of firearms. For instance, the Swiss Arms Blue Star rifle This outcome would apply equally to the other colour variations of that family of rifles, including the Classic Green rifle, Red Devil rifle, Black Special rifle and others, as they differ only in colour and model name; the mechanism is otherwise the same. Likewise the CZ 858 Tactical 2P rifle has the same mechanism as the 2V, 4P and 4V variants. The Ruger 10/22 rifle and 22 Charger pistol tests indicate :



Analysis

a wide range of semi-automatic firearms, particularly those chambered for a mid-range calibre and based on a military or para-military design. to firearms without a moving cocking handle or firearms chambered for a low power cartridge.

The production of full automatic fire using the technique i models. On other models of firearms the technique model of firearm, some individual specimens

n some Even for a given make and

Conclusions

improvise full automatic fire on otherwise semi-automatic firearms does work as illustrated on numerous internet sites. //x

The reliability of the technique varies considerably, depending primarily on the design of the rifle and the calibre of ammunition.



the modified firearm is required for full automatic fire to be effective.

Criminal and Regulatory Implications

At present, semi-automatic firearms are generally available on the Canadian market as restricted or non-restricted firearms, and comprise a mixture of sporting and military models. A limited range of military and para-military firearms are prohibited, some of which remain in circulation with grandfathered owners. Large capacity magazines are widely available for the military and para-military firearms, and although limited in capacity by law and generally reduced to five shots by a pin or similar modification, the original capacity is typically readily restorable. The materials required for improvised full automatic fire are ordinary everyday products.

This raises questions around the relevance of Section 102(1) of the *Criminal Code* about making a firearm capable of automatic fire, whether the application of the technique would fall within the trigger actuator provisions of Part 4 Paragraph 1 of the *Criminal Code* Regulations, which appear to target only electrical and mechanical devices and whether there could be consequences for the classification of unmodified semi-automatic firearms which are amenable to the improvised full automatic fire technique.

Further to the questions raised above, it is possible that any present or future firearms related criminal investigation undertaken by any police force in Canada will reveal evidence of the use, or contemplated use of techniques for improvised full automatic fire. The matter may well find its way before the Courts and its legal status judicially determined.

Operational Implications and Public Safety Risk



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