Live Round Interrupter (LRI) Technical Implementation White Paper

BlankSafe Inc

Authors: Craig Lathrop and Wes Inskeep

Jul 29th 2014

ABSTRACT

This white paper discusses the Live Round Interrupter (LRI), a device that renders a weapon unable to fire live ammunition while preserving the ability to fire blank ammunition. The LRI replaces the standard Blank Fire Adapter (BFA).

Blank-Fire Training Dangers

A weapon that is configured for blank-fire is still capable of firing live ammunition. Thus, during training operations, there is a real chance that live ammunition will be introduced, resulting in the death or injury of a friendly operator. This scenario can occur when rounds of live ammunition are inadvertently mixed in with blanks or when a magazine has not been fully downloaded after a live shoot, leaving live ammunition at the bottom. These mistakes are difficult to catch, especially at night and in situations of duress and fatigue; the very situations in which military forces train.

The military has made an effort to prevent these mistakes through increased inspections, by keeping live and blank ammunition separated and by requiring that all live rounds be turned in after every live-fire event. Yet despite these precautions, serious reported incidents still occur many times every year, with countless additional incidents that don't result in human or weapon casualty (demanding a report) going completely unreported.

Even if caught in inspection; when a live round is discovered during training exercises it results in an exercise stoppage, often costing millions of dollars per day.

Live Round Interrupter Overview

The last cycle action of the weapon prior to allowing the firing pin to engage the primer cap is to fully engage the chamber/bolt locking lugs. The LRI takes advantage of the fact that an interference of just 0.027" (0.69mm) will prevent the chamber lugs from engaging, rendering the weapon unable to fire.

The Live Round Interrupter (LRI) securely attaches to the weapons muzzle in a similar manner to a traditional BFA, and extends down the barrel of the weapon. If a live round

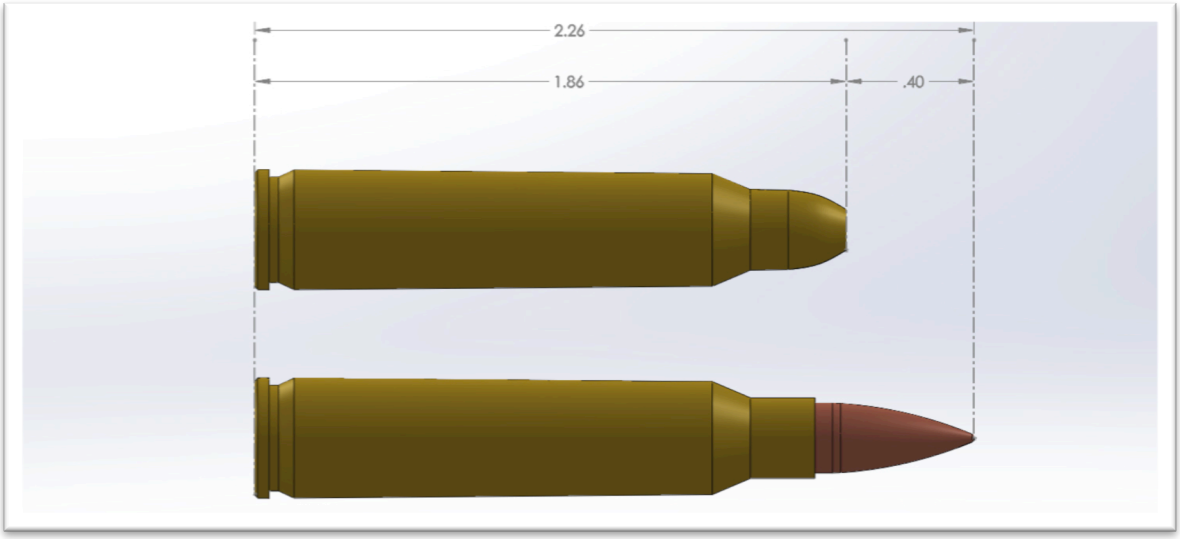

Figure 1 - Length Difference Between a Blank and Live Round

is loaded, the tip of the round will impact with the LRI creating between 0.33" (7.112mm) and 0.20" (5.08mm) of interference. With the LRI in place, the weapon will not chamber a live round.

The length difference between a live round and a blank round enables the ability to selectively block the chambering of a live round. With the LRI installed a weapon will chamber and fire the shorter blank ammunition. The LRI replaces the standard Blank Fire Adapter (BFA) normally fixed to the muzzle for blank-fire operations.

LRI Operations Details

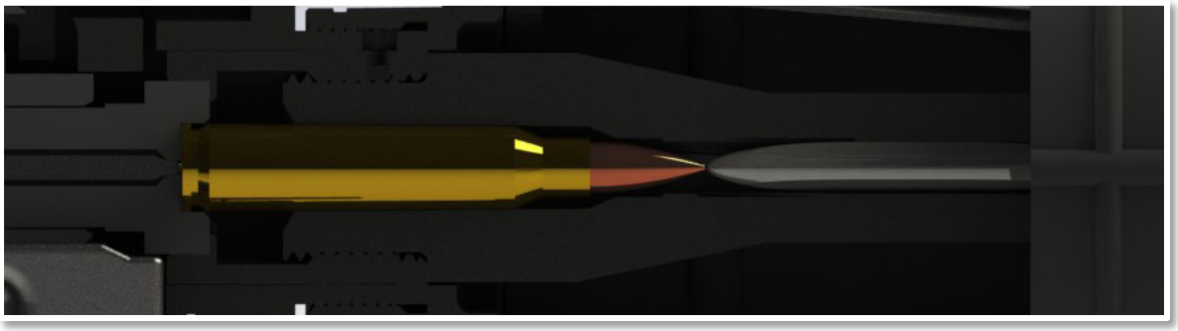

Figure 2 - Live Round Interface (The live round protrudes .28" into the receiver. The weapon will not fire in this condition)

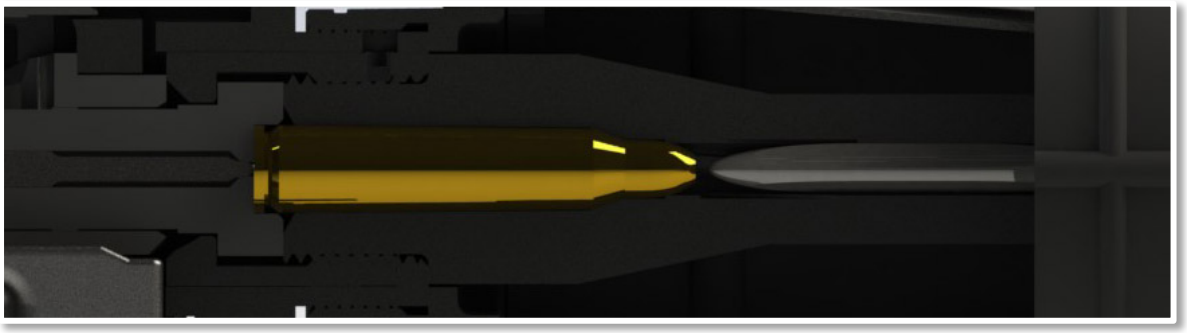

Figure 3 - Blank Round Interface (The blank round has .06" tolerance allowing the weapon to cycle normaly)

The LRI consist of three primary components; a pressure cap, a fixed length barrel device and an interference device. The LRI maintains appropriate barrel pressures to cycle the weapon when blank ammunition is fired. The barrel and interference devices extend down the barrel of the weapon, creating a physical block just in front of the chamber. With the device in place, the longer live round will not properly chamber, interrupting the feed cycle and rendering the weapon unable to fire.

LRI Device Overview

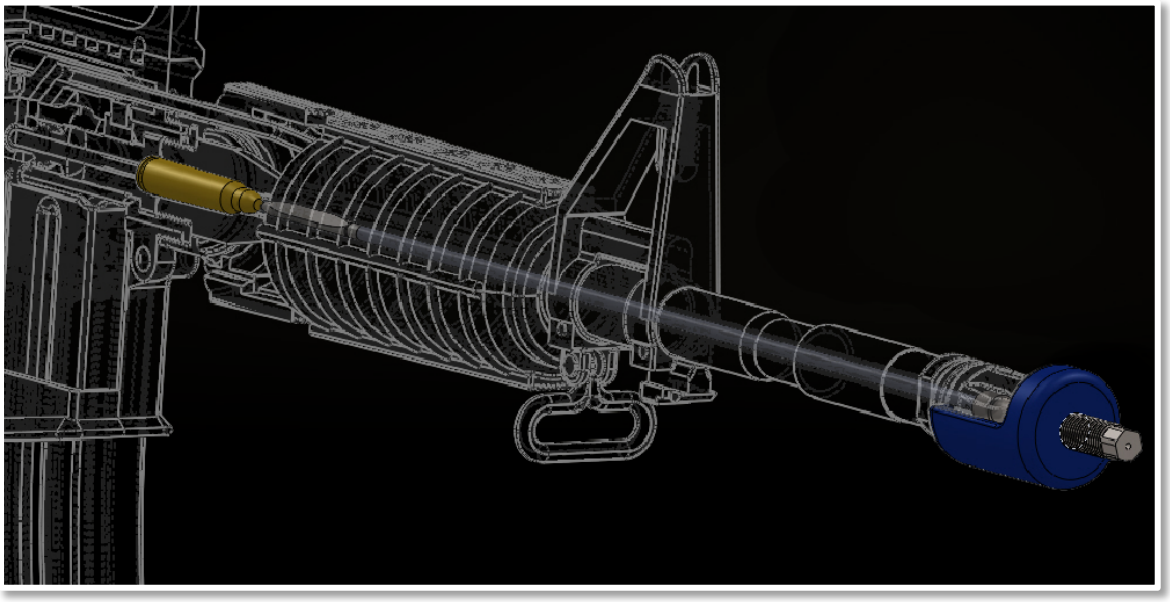

Figure 4 - Isometric Cutaway View of LRI

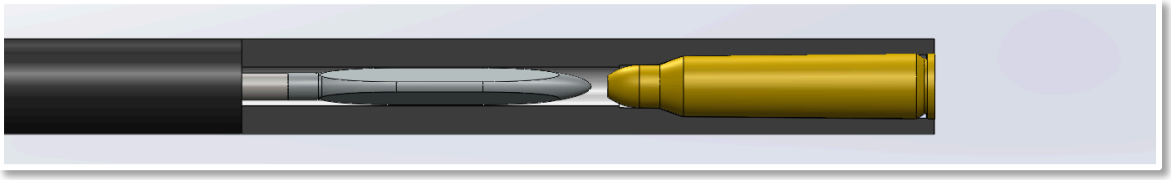

Figure 5 - LRI with Blank Ammunition Loaded

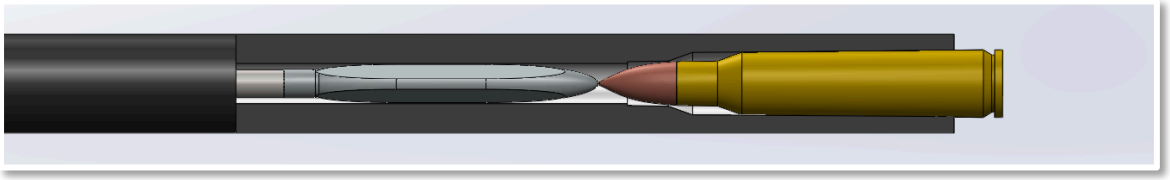

Figure 6 - LRI with Live Ammunition Loaded

Figure 7 - LRI Device – Isolated

Laboratory Testing

In 2014 BlankSafe™ and the US Army Ballistic Structures & Launch Dynamics division of ARL Aberdeen conducted a series of tests of the LRI device. Testing looked at:

- Ability to stop a live round
- Cyclic rate of fire and ability to fire blank ammunition normally
- Durability of the LRI device
- Potential damage to the weapon caused by the LRI device.

During testing the weapon was held in a mount that simulated firing from a shoulder. The displacement versus time measurements were made by attaching a white tracking target to the bolt carrier and allowing it to slide in the charging handle slot. Measurements were observed using a MICROTRAK II laser displacement sensor. Velocity vs. time measurements were recorded at the same time.

Some displacement testing was performed with a live round loaded at the bottom of the magazine. The live round would attempt to chamber after the blank ammunition was expended.

Laser mapping of the barrel before and after testing was utilized to determine if the LRI caused any damage to the barrel of the weapon.

All tests were performed on an M4A1 carbine. M855 ball ammunition was utilized for live round interference tests.

Test Results

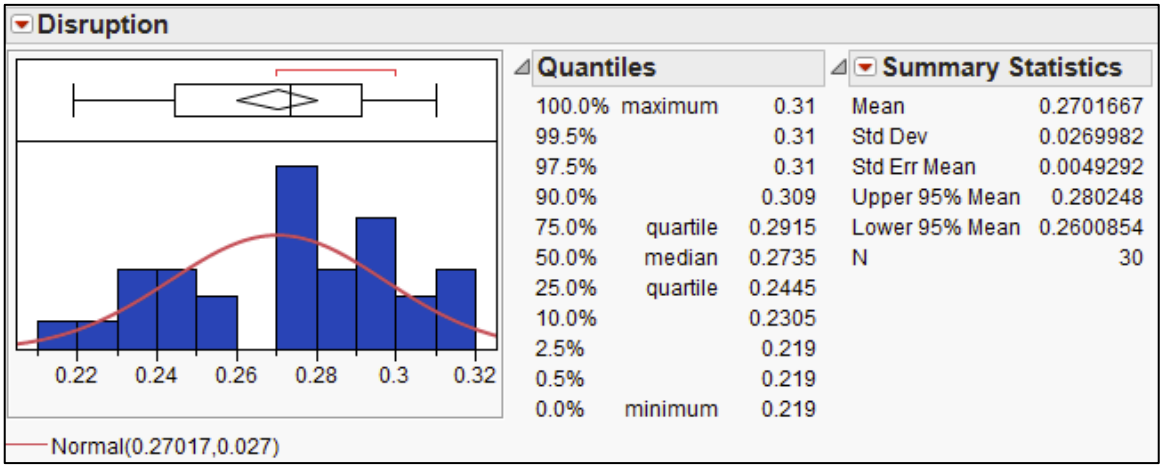

Figure 8 - Live Round Disruption Testing (units in INCHES)

Ability to Stop a Live Round

The disruption distance needed to prevent a weapon from firing is the gross depth of the firing pin strike. On average this is between .030” (0.76mm) and .035” (0.89mm). The average M4 will accept a 0.008” (0.203mm) light strike without firing, so the net depth needed to disrupt firing is .027” (0.69mm).

During testing the LRI performed with a 100% success rate. No live rounds were chambered to a depth that the firing pin could engage. Bolt displacement was 0.28" (7.11mm) on average leaving 0.253" (6.43mm) of safe distance; 9 times the necessary interrupt.

Cyclic Rate of Fire and Time Displacement

The cyclic rate of fire for the production variant of the LRI firing M200 blank ammunition was 95.6ms (1.7σ) compared to 82.0ms (0.6σ) for a weapon firing M885 ball ammunition.

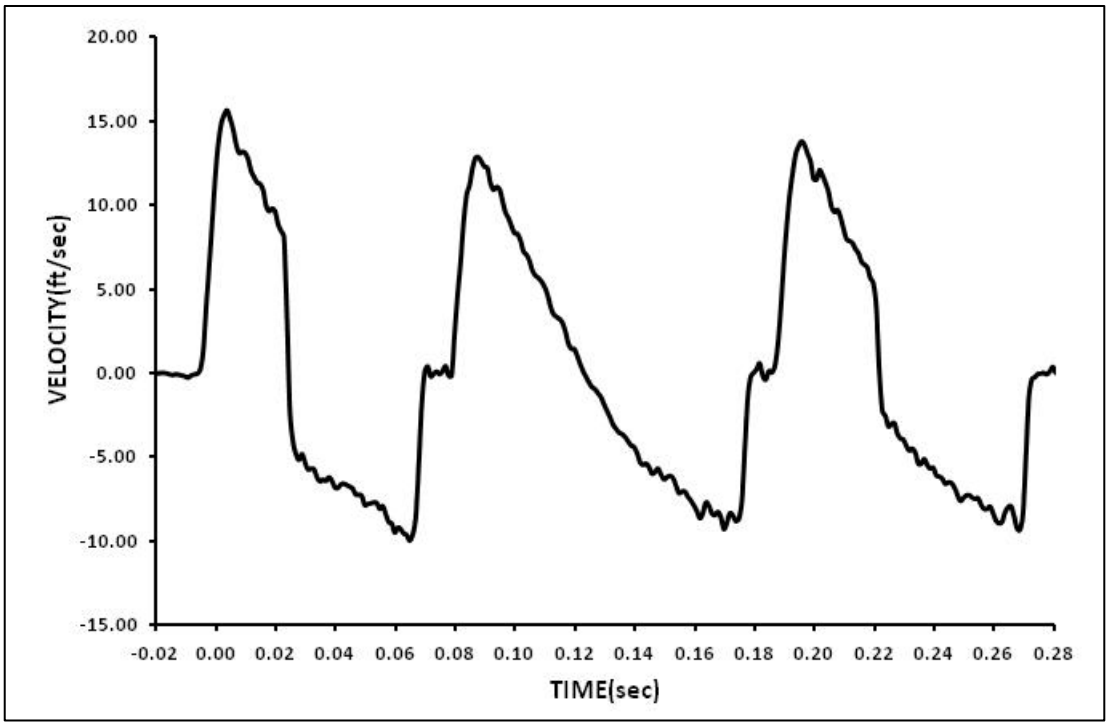

Figure 9 - Velocity for an M4A1 firing M200 Blank Ammunition

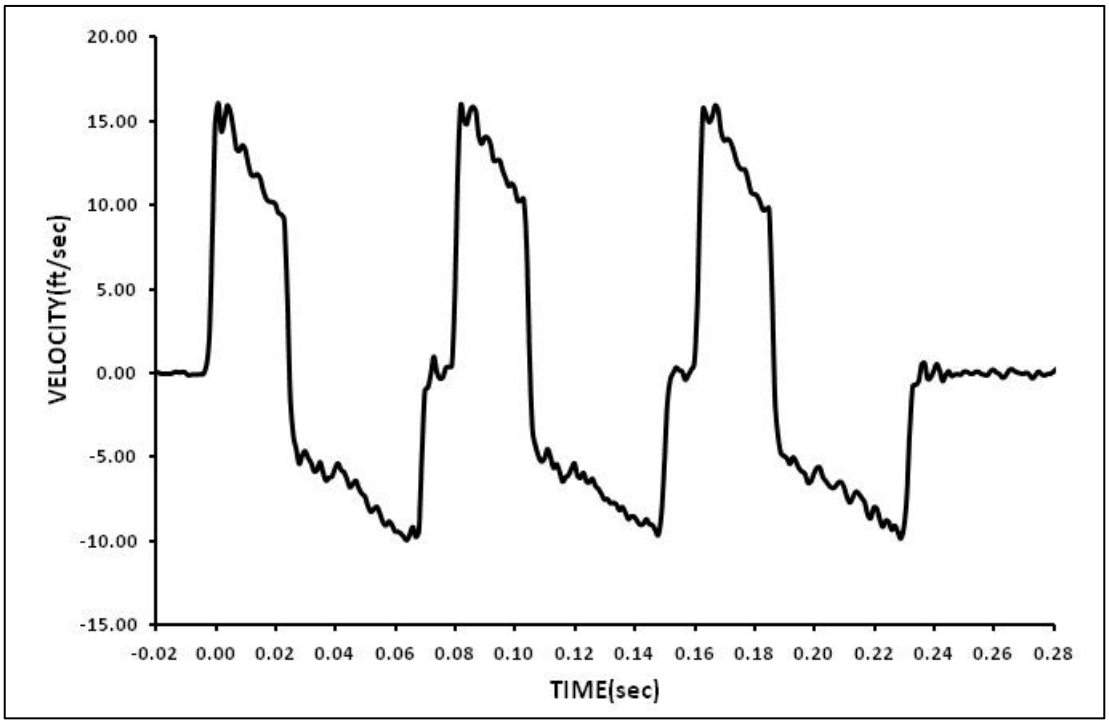

Figure 10 - Velocity for an M4A1 firing M855 Live Ammunition

Cyclic rate of fire and velocity are considered to be comparable to an M4A1 firing live ammunition.

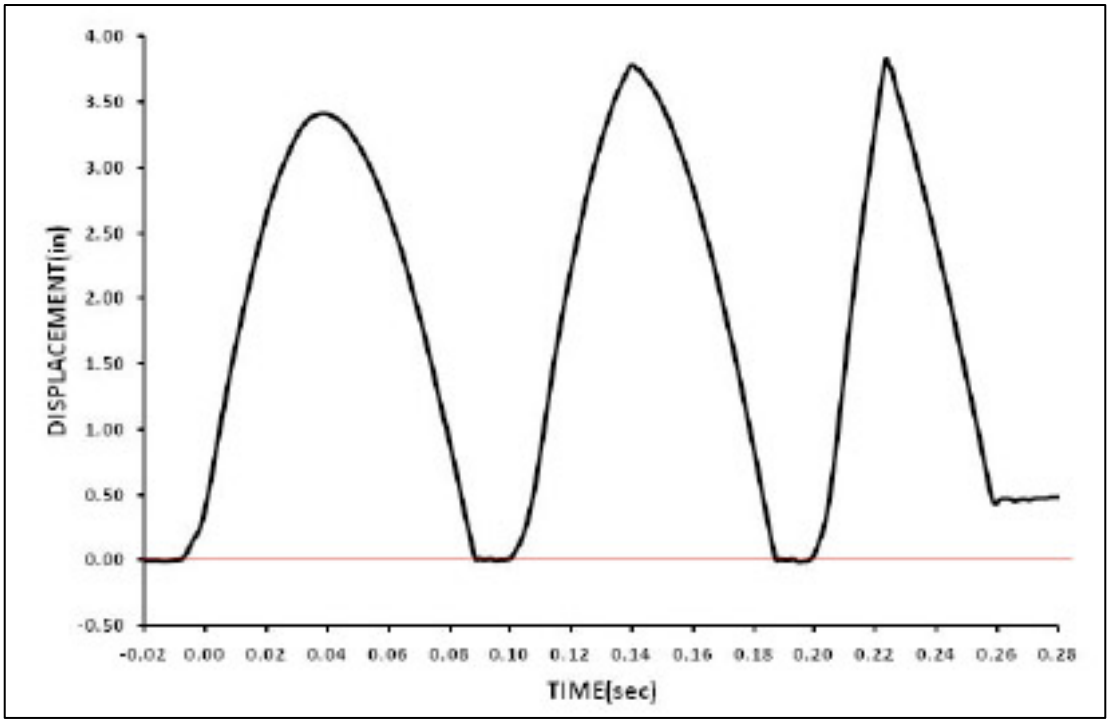

Figure 11 - Bolt displacement vs time.

Figure 11 shows bolt displacement vs time for the LRI. Three blank rounds were fired followed by a live round. In the chart it is clearly visible that the bolt is unable to return home.

Intellectual Property

BlankSafe Inc. has been awarded patent US8683728 B2 for a “Barrel Safety Device.”

Patent Abstract:
Devices and methods for altering a firearm to prevent firing of rounds of a first size while allowing the firing of rounds of a smaller, second size are provided. In one embodiment, a barrel safety device prevents a live round from fully chambering in a firearm, while allowing a blank to be chambered and fired from the firearm.

Conclusion

This LRI represents a major step forward in blank-fire training safety. By preventing the weapon from ever firing a live round there is greatly reduced risk to those down range of the weapon and to the weapon operator. This device represents a last and certain layer of defense in multi-layered safety system.

The ability to non-destructively attach this device to the weapon reduces the overall cost of the system and will not require any retooling of the weapons themselves or replacement of the weapon barrel. This method of live round prevention is possible for a wide range of magazine and belt fed weapons making it a simple and universal solution. With little to no increase in the weight or geometry over a standard BFA this device will have only a positive impact on training while preventing expensive training stops and worse, tragic force on force live fire accidents.

Additional information including videos demonstrating the LRI can be found at www.blanksafe.com.