

# Microstamping

*A Technology to Help Solve Gun  
Crimes, Identify Gun Trafficking  
Networks and Reduce Gun Violence*



THE EDUCATIONAL FUND  
TO STOP GUN VIOLENCE

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## About the Educational Fund to Stop Gun Violence

Founded in 1978, the Educational Fund to Stop Gun Violence (Ed Fund) seeks to make gun violence rare and abnormal. A 501(c)(3) affiliate organization of the Coalition to Stop Gun Violence, the Ed Fund uses public health and equity lenses to identify and implement evidence-based policy solutions and programs to reduce gun violence in all its forms.

The Ed Fund is the gun violence prevention movement's premier research intermediary and founder of the Consortium for Risk-Based Firearm Policy. The Ed Fund makes communities safer by translating research into policy; it achieves this by engaging in policy development, advocacy, community and stakeholder engagement, and technical assistance.

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<sup>†</sup>Ms. Matsangos and Ms. Allchin are no longer on staff at the Educational Fund to Stop Gun Violence.



*Gun-related violent crime* often has traumatic effects on a community. Officers responding to those scenes are confronted with the aftermath and often the same scenario; no suspect information and a street or roadway scattered with multiple shell casings. The lack of cooperating witnesses and/or eyewitnesses unfortunately means all too often these crimes go unsolved. Microstamping will greatly improve the success of law enforcement identifying suspects and guns used in these crimes.



The National Integrated Ballistic Information Network (NIBIN) is an effective and useful tool in identifying the firearms used in crimes, but the technology has limitations. If the firearm is not in the NIBIN system, the ballistics from the recovered shell casing do not provide the vital information of who is the owner of the firearm. A recovered microstamped shell casing would provide law enforcement immediately with the name of the first purchaser of the firearm. This allows for a more focused investigation, and the first step in the roadmap of how the weapon made its way from the first purchaser to the crime scene.

The leads generated from a microstamped shell can help officers narrow the number of people questioned and shorten the amount of time suspects are detained. This has the potential to help law enforcement quickly and effectively solve gun-related crimes while limiting negative interactions with law enforcement, especially in minority communities.

Microstamping will become essential in fully implementing an effective gun-related crime reduction strategy. NIBIN technology will still be needed for identifying guns that are currently in circulation, but knowing new weapons will have microstamping provides that immediate knowledge of the date of the first purchaser. Microstamping will allow investigations to be more efficient and free detectives to focus on tracking down additional investigative leads.

Orrin Gallop

*Assistant Chief, Commander of Investigative Services, Hampton Police Division*



# Executive Summary

Microstamping is a powerful crime-solving tool that can help law enforcement quickly solve gun crimes, build trust, and prevent gun violence within communities most impacted by unsolved shootings and daily gun violence. While microstamping could be incorporated into firearms today, manufacturers have not produced firearms equipped with this crime-solving technology.



## What is Microstamping?

Microstamping is a ballistics identification technology that allows law enforcement officers to quickly link cartridge cases found at crime scenes to the firearm from which they were discharged. It starts with a firearm that has microscopic identification codes engraved into the gun's firing pin. When the gun is fired, these codes are stamped onto each cartridge case. These codes correspond with the firearm's serial number, allowing law enforcement to match spent cartridge casings to a specific firearm in a manner similar to how law enforcement can use a license plate to quickly identify the make, model, VIN, and registered owner of a car.

With microstamping, law enforcement can collect cartridges from crime scenes, identify the codes using a microscope, and connect the microstamped codes to the firearm used in the shooting. As a result, microstamping provides law enforcement with objective intelligence to develop leads and begin to identify trafficking networks within a matter of hours.

Microstamping is a reliable ballistics identification tool. Multiple peer-reviewed studies found that microstamping marked accurately through thousands of rounds of firing across a variety of different firearm models: codes were legible on over 95% of cartridge cases tested.<sup>1</sup>

## How Does Microstamping Enhance the Current Ballistic Identification Process?

The current ballistic identification process often provides vital intelligence to police departments, yet it currently faces challenges: it requires a recovered firearm and can require significant time and resources.

Microstamping enhances the current process by providing a direct link between a spent cartridge case and a firearm – even when the firearm is not recovered. Within hours, microstamped code can be quickly linked to a specific firearm and matched to other shootings where the same firearm was used. Microstamping has the potential to revolutionize the current ballistics identification process by helping law enforcement officers to develop new leads, disrupt trafficking networks, identify perpetrators, and solve gun crime.

## How Will Microstamping Help Address the Crisis of Unsolved Shootings and Community Gun Violence?

In cities across America the majority of shootings and homicides remain unsolved. This is especially true in under-resourced Black communities that are disproportionately impacted by gun violence. In many cities suffering from high rates of gun violence, law enforcement agencies often don't have the tools or resources to thoroughly investigate shootings. One analysis of major U.S. cities found that law enforcement makes an arrest in only 35% of firearm homicides and 21% of firearm assaults when the victim was Black or Hispanic.<sup>2</sup>

As cases remain unsolved, the victims of gun violence experience both the trauma of shootings and a lack of closure. This leads victims of gun violence and the larger community to lose trust in law enforcement's ability to protect their community and bring about justice. As a result, families and friends of victims seek to protect themselves and carry out justice on their own. This causes increases in gun carrying and retaliatory shootings, further perpetuating a cycle of gun violence in many communities of color.

Microstamping can help stop the cycle by helping law enforcement solve shootings and reduce violence. With microstamping, police departments will be equipped to quickly analyze evidence and develop leads, thereby solving more shootings and bringing closure for victims of violence, their loved ones and communities. As law enforcement solves more cases, people impacted by gun violence may no longer feel the need to carry a firearm in order to protect themselves or to carry out justice on their own. This could lead to a decrease in gun carrying and retaliatory shootings, and an improvement in police-community relations, which will further drive down gun crime.

### *Law enforcement makes an arrest in only*



## What is the Policy Landscape for Microstamping?

The evidence is clear that microstamping is effective, easy to implement, and can be mass produced. Indeed, firearm manufacturers have developed prototypes of similar intentional marking technologies and already use similar laser engraving technologies to imprint logos and decorative features on their firearms. Yet, manufacturers refuse to incorporate this simple crime-solving technology.

In 2007, the California State Legislature passed a microstamping law that required all new models of semi-automatic pistols sold or manufactured in California be equipped with microstamping,

which, if successful, could encourage uptake of microstamping in other states as well. But for over a decade, the firearms industry has fought against this law and resisted incorporating microstamping into the manufacturing processes, engaging in lengthy and costly court battles.

The current policy environment is ripe for microstamping legislation both at the state and federal levels. The courts have resolved microstamping challenges, and in 2020 the California legislature revised its microstamping law to incentivize firearm manufacturers to bring new microstamped firearm models to market. Microstamping technology is available for manufacturers to implement today, and technological advancements in manufacturing processes are underway, thus making the technology even more affordable, reliable, and feasible for mass production.

## Why Write This Report?

The Educational Fund to Stop Gun Violence has advocated for microstamping technology for nearly two decades. In coordination with our partners, we supported lawmakers in passing a microstamping requirement in California in 2007, and we fought against the industry's misinformation campaign and series of legal challenges. In 2020 we helped policymakers revise the California microstamping law, bringing us one step closer to having microstamped firearms in the market.

Why write this report now? For three key reasons:

- 1** The U.S. faces a persistent crisis of gun homicides that appears to have worsened in 2020, as preliminary FBI data finds homicides in the first six months of 2020 were up nearly 15% compared to the first six months of 2019.<sup>3</sup>
- 2** A troubling percentage of homicides – specifically gun homicides – continue to go unsolved.
- 3** At least one manufacturer has recently introduced a new commercially viable machine tool capable of producing microstamping equipped firing pins in volume, and able to be incorporated into the firearm manufacturing process within months. These new developments underscore the timeliness of the issue, and the powerful potential of this technology.

## Recommendations

To maximize the potential of microstamping technology, the Educational Fund to Stop Gun Violence recommends the following:

### **State:**

- States should require that new semi-automatic pistols manufactured and/or sold in their jurisdictions be equipped with microstamping technology.

### **Federal:**

- Congress should require that all semi-automatic pistols manufactured in or imported into the U.S. be equipped with microstamping technology.



# Introduction

Our country faces an ongoing crisis of gun violence that leaves tens of thousands killed or injured each year. Americans from all walks of life are affected, but gun violence particularly devastates Black and Brown communities already suffering from a legacy of structural racism.<sup>4</sup> In many Black and Brown communities, the vast majority of shootings go unsolved.<sup>5</sup> Indeed, over the last decade more than half of all homicides in major U.S. cities – most of them fatal shootings – remain unsolved, leaving mourning loved ones with the added burden of knowing justice is not served. Perpetrators remain free to murder with impunity, trust in law enforcement deteriorates, and cycles of retaliatory violence devastate underserved Black and Brown communities.<sup>6,7</sup>

The ongoing crisis of gun violence is further complicated by racial injustice and questions around police legitimacy. In the wake of the killings of George Floyd, Breonna Taylor and countless others by police, our country has been grappling with the ramifications of racism and bias that has long been embedded in all of our institutions – especially in our law enforcement, causing many communities to lose trust in these institutions.

Find a definition for highlighted words and phrases throughout the report in the glossary on page 33.

Many solutions are required to tackle these systemic problems, but microstamping is one actionable tool that could help.

## ***A powerful tool to solve gun crime***

Cartridge casings are often recovered from shooting scenes where there are few leads, but rarely does this evidence alone empower law enforcement to take action quickly, identify a suspect and make an arrest. Microstamping has the potential to change this.

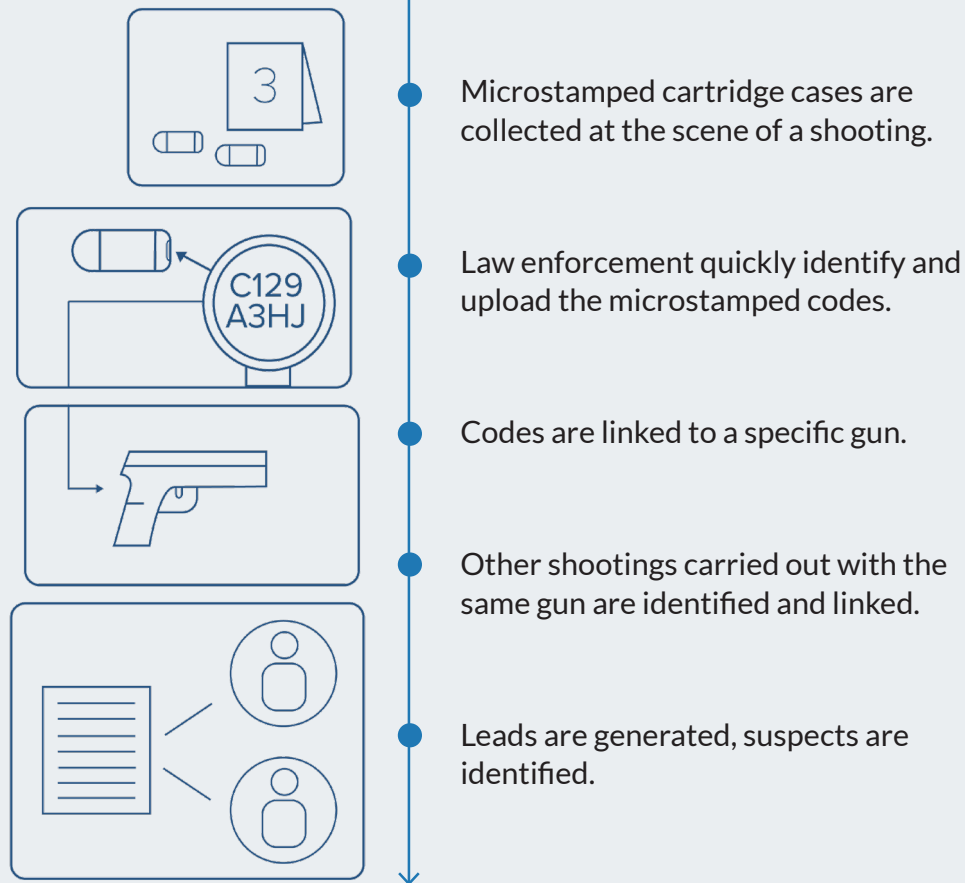


**Microstamping** is a powerful crime-solving tool that can allow law enforcement officers to quickly solve gun crimes and prevent gun violence within the communities most impacted by unsolved shootings.

With microstamping, microscopic identification codes are engraved into the firing pin (among other locations) of each firearm. When the gun is fired, these codes are stamped onto each cartridge case. The codes correspond with the firearm's serial number, allowing law enforcement to collect cartridge cases from crime scenes, connect the microstamped codes to the firearm used in the shooting, and develop leads, all within a matter of hours.

Microstamping transforms cartridge casings into powerful, actionable evidence that law enforcement can use to identify shooters, and gun trafficking networks. By improving the ability to gather intelligence and solve crimes, microstamping may help reduce gun violence and increase trust between law enforcement and communities impacted by daily gun violence.

## How Microstamping Can Help Solve Shootings



### What's in this report

The report contains four sections, starting with a discussion of the mechanics of microstamping technology and examination of how microstamping can help law enforcement improve upon the [ballistics analysis](#) techniques they use today. The second section explores how unsolved shootings contribute to the cycle of gun violence devastating many American communities, and the potential for microstamping as a tool to help law enforcement interrupt those cycles of violence. The third section describes the development of microstamping technology and discusses the current legal and political landscape for such technology. Finally, we offer a set of microstamping technology policy recommendations.

We hope that this report will illuminate microstamping's potential to help mitigate the converging crises of gun violence and policy legitimacy, engendering greater trust in law enforcement by increasing the percentage of gun crimes that are solved.

# Advancing Ballistics Analysis for the Modern Era

Currently, law enforcement must recover the firearm used in a shooting in order to access its serial number and track it to the original purchase. As a result, it's often all-or-nothing for law enforcement: either they recover the firearm and thus the serial number intelligence that comes with it, or they don't recover the firearm and thus none of this vital information. Microstamping addresses this issue by creating a pathway to identifying the firearm's serial number and collecting information about the original purchase of a gun *without* a recovered firearm.

*It is a powerful intelligence tool that quickly provides the most critical “time to crime” data point – the length of time between the first sale and the use of a firearm in a crime.*

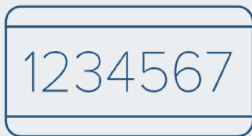
Microstamping technology etches a unique microscopic array of characters onto the firing pin or other internal surfaces of the firearm during manufacturing. When a firearm is discharged this code is stamped onto that cartridge case (see glossary, page 33). This code corresponds with the firearm's serial number, allowing law enforcement to search for the microstamped code using the ATF's firearm tracing system, identify the manufacturer, and begin a firearm trace. Microstamping links cartridge casings to the firearm from which they were shot without having to recover the firearm itself.

With microstamping, law enforcement officers can arrive at the site of a shooting, collect a microstamped cartridge and, using a simple microscope, quickly gather the information needed to identify the firearm used in the shooting – similar to how law enforcement can use a license plate to identify the make, model, VIN and registered owner of a car. By examining whether cartridge casings found at a shooting match those found at other shootings, they can link shootings perpetrated with the same firearm within hours of arriving at the crime scene. This empowers law enforcement to map shootings carried out using the same firearm and thereby gain real-time intelligence on common suspects and gun trafficking networks. Consequently, microstamping has tremendous potential to improve upon traditional ballistics analysis and help law enforcement solve shootings.



**Microstamping works in a similar way as a license plate; it can help law enforcement quickly gain intel and develop leads.**

### Law enforcement:



**1**

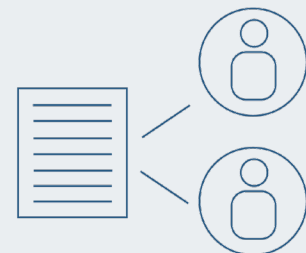
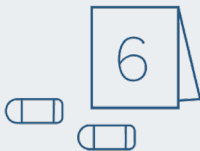
Captures a photo of a license plate from a car used in a crime.

**2**

Uses the license plate to identify the make, model and VIN of the car.

**3**

Identifies the registered owner of the car and develops leads.



**1**

Responds to a shooting and recovers a microstamped cartridge case - a case that has a unique identification code imprinted on it.

**2**

Uses the microstamped cartridge case to identify the make, model and serial number of the gun.

**3**

Collects information about the original purchase of the gun and develops leads.

**Microstamping** is a ballistics identification technology that can allow law enforcement to quickly link cartridge cases found at crime scenes to a specific firearm.

## Microstamping Mechanics

Microstamping equips a firearm with internal stamping features that imprint a unique code onto the cartridge case as it is fired. These internal stamping features are created through the use of micro-machining that use laser engraving. This type of machinery has a wide range of uses, including in biomedical and semiconductor industries.<sup>8</sup> There are multiple parts of a firearm that can be laser-engraved with a microstamp, including the *firing pin* and the *breech face*. The stamp is generally an alphanumeric code supplemented with a geometric code in the rare case an alphanumeric code is only partially legible. When the gun is fired, the identification codes are stamped onto either the *primer* (by the firing pin) or *back surface* (by the breech face) of the cartridge casing as it is ejected from the firearm (see Figures 1a-c).<sup>9</sup>

Multiple researchers have conducted peer-reviewed studies examining the effectiveness and durability of microstamping technology. They fired thousands of rounds from a wide variety of firearm models equipped with microstamping and examined cartridge cases under a microscope. In one study microstamping technology was found to have marked accurately and legibly through 2,500 rounds of firing across a variety of different firearm models with 97% accuracy.<sup>10</sup> Another study found that using just a standard optical microscope microstamped codes were legible on more than 95% of 1,500 cartridge casings tested.<sup>11</sup> A third study demonstrated that in a real world setting, where firearms examiners also use traditional ballistics analysis techniques, microstamped codes can be read with near 100% certainty.<sup>12</sup> These findings indicate that microstamping is a consistent and reliable ballistics identification tool.

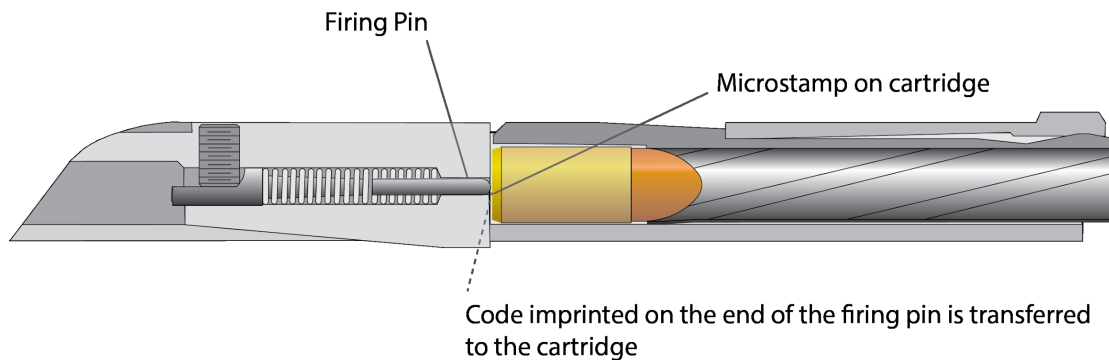


Figure 1a: Depiction of how a cartridge is microstamped as the gun is fired. Graphic reproduced with permission from TACLABS, Inc.

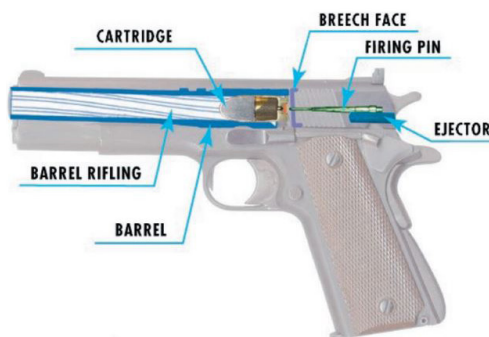


Figure 1b: Side view of a handgun with key internal components identified.

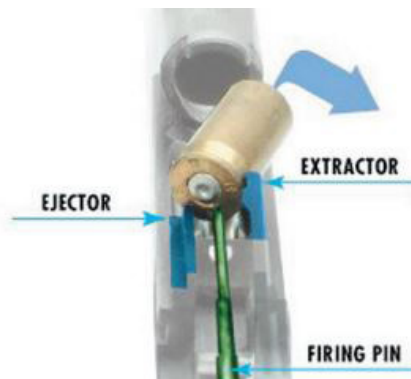


Figure 1c: Top view of a handgun with key components identified.

## Mass Producing Microstamping Technology

Featured in this section are images from TACLABS, Inc. that highlight the streamlined microstamping manufacturing process and demonstrate how the technology is one step closer to mass production. These TACLABS™ machines equip firing pins with microstamping capability in volume and can easily be incorporated into the firearm manufacturing process. As these images demonstrate, the evolution of microstamping technology from prototype to commercially viable product is complete. The technology is fully matured and ready for market.

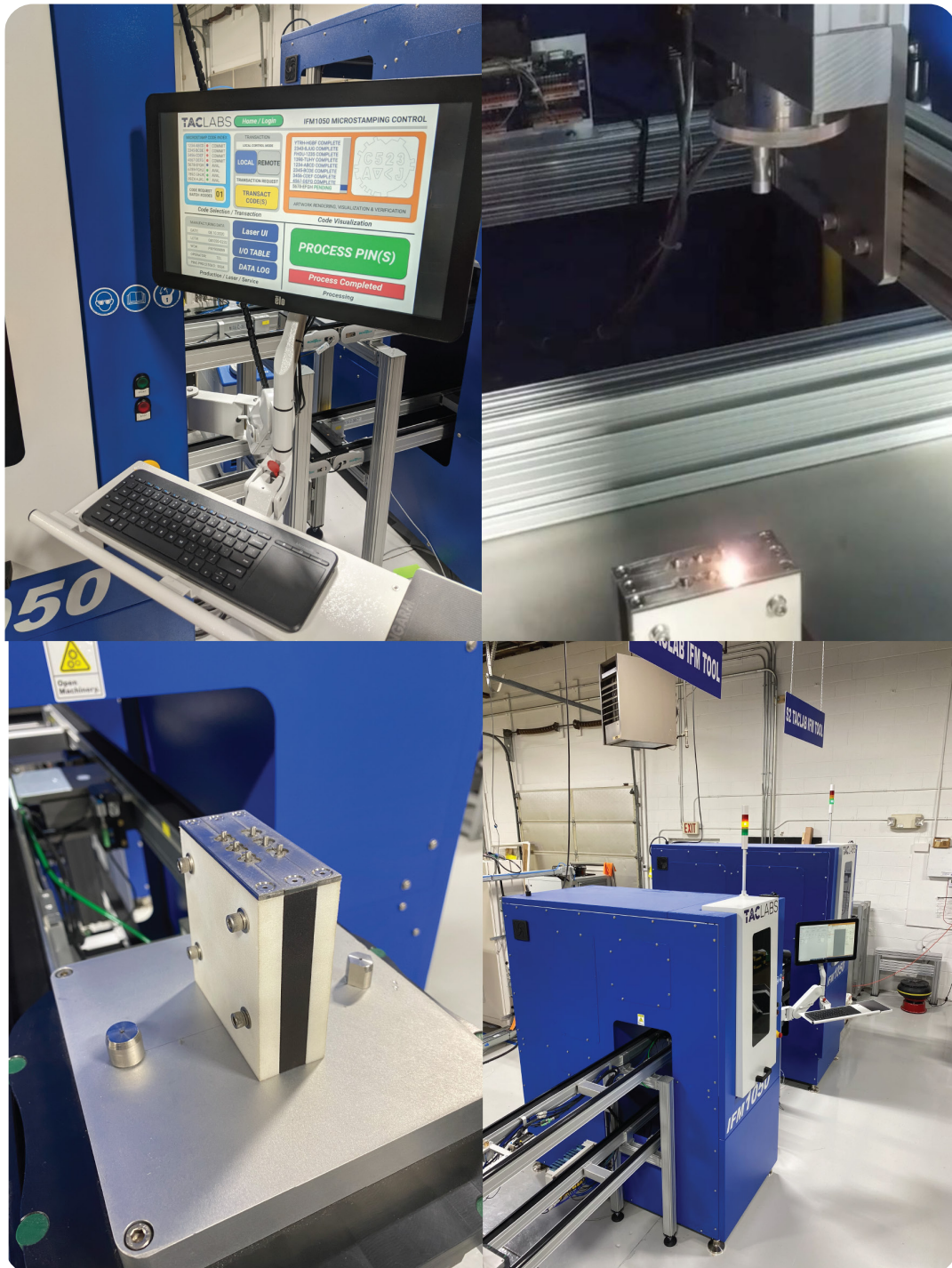


Figure 2: A machine tool that uses lasers to engrave the microstamping codes on the firing pin of the firearm.





Figure 3: A firing pin equipped with microstamping technology.

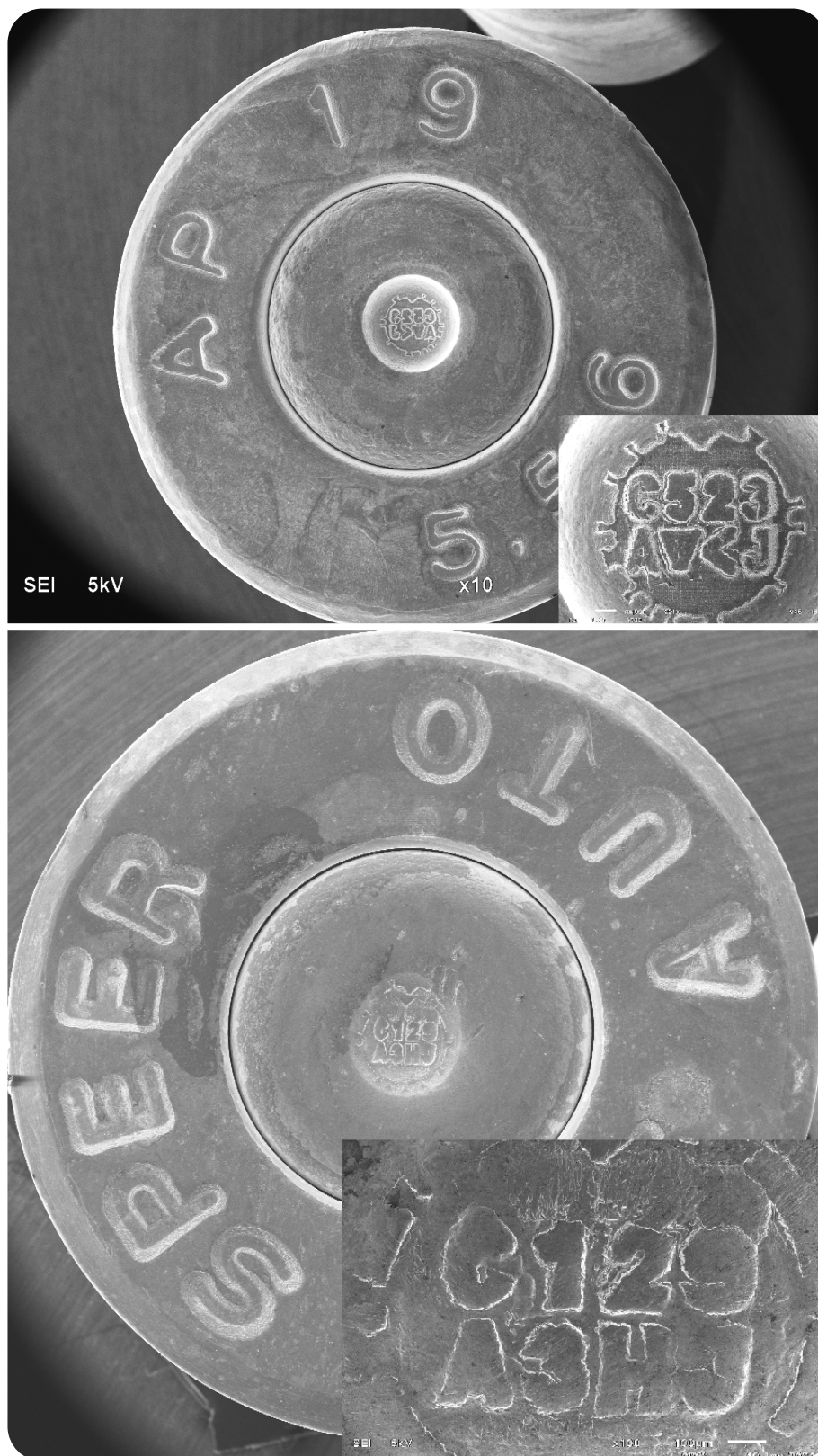


Figure 4: Images of microstamped cartridge cases discharged from a firearm equipped with microstamping technology: a 5.56x45 mm cartridge fired from a AR-15 rifle after 341 rounds of firing (top), and a 45 caliber cartridge fired from a semiautomatic handgun after 8,532 rounds of firing (bottom).

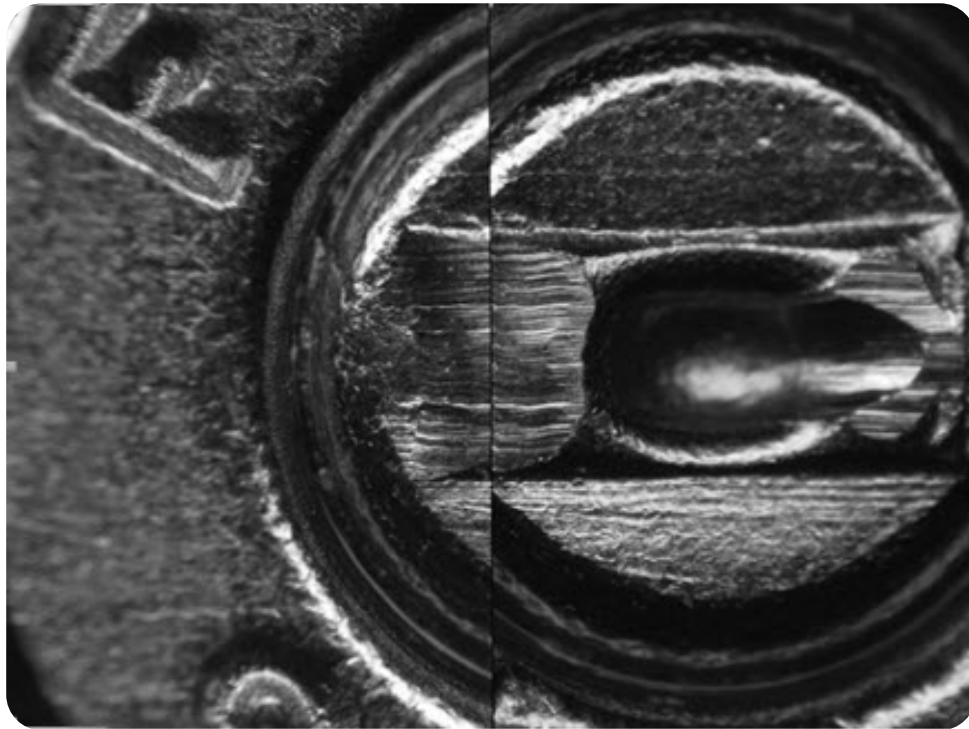
Photos provided by TACLABS, Inc. (2020).



## Traditional Ballistics Analysis and NIBIN

Since the early 1900s, firearms examiners have studied unintentional, microscopic toolmarks on spent cartridge cases to help solve crimes.<sup>13</sup> The powerful combustion of a firearm's machinery naturally creates these unintentional markings when a firearm is discharged. In order to match spent cartridge casings to a specific firearm, investigators shoot the recovered firearm in a controlled setting, and directly compare the toolmarks on the test-fired cartridge casings to those recovered at the crime scene to determine a match (see Figure 5).<sup>14</sup>

This traditional analysis can help law enforcement link the firearm to an owner or potentially track a firearm's history, but it can be slow, labor intensive, and most importantly, requires a *recovered* firearm.



*Figure 5: Two images compared side-by-side of unintentional toolmarks left on cartridge cases. The corresponding markings suggest that both cartridges were fired from the same firearm.<sup>15</sup>*

The development of digital imaging and computers in the 1990s greatly enhanced the power of ballistics analysis. Thanks to these advancements, investigators could capture digital images of the unintentional markings on cartridge cases and use a computer software program to analyze them.

In 1999 the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) began administering the National Integrated Ballistics Information Network (NIBIN) to create a national database of ballistics images. Under the NIBIN program, firearms examiners upload images of ballistic evidence and automatically cross-reference a new image with those already in the NIBIN database. This allows law enforcement to compare, and potentially match, firearm evidence from one crime scene against a collection of firearm evidence from crime scenes across the country.<sup>16</sup>

The deployment of NIBIN was a pivotal moment for gun crime intelligence. For example, just four years after the database was operational, researchers found that the Boston Police Department experienced a more than six-fold increase in monthly ballistic evidence matches.<sup>17</sup>



As of June 2020, NIBIN has captured and stored approximately 4.2 million pieces of ballistic evidence yielding more than 223,000 investigative leads and 126,000 ballistic matches during its 23-year history. The power of NIBIN increases as more data is entered into the system. For example, in 2019 alone, 67,000 investigative leads were generated using NIBIN.<sup>18</sup> These leads have helped police departments arrest and prosecute shooters. Yet, many challenges remain with the way ballistics analysis is conducted today.

## Microstamping Augments Current Ballistics Analysis

Many law enforcement agencies benefit from the current form of ballistics analysis using NIBIN to help solve shootings, although there are still challenges with this approach. First, it requires recovering the firearm in order to link a spent cartridge case to it. Second, the process can take significant time and resources. Microstamping has the powerful potential to work around these limitations. While there is no doubt that NIBIN is a state-of-the-art investigative tool today, it can be augmented with microstamping, allowing law enforcement to generate more investigative leads and solve more gun crime.



### CHALLENGE 1

#### ***Current ballistics analysis requires a recovered firearm***

Currently, when a law enforcement officer recovers a cartridge case – but not a firearm – from a crime scene, they have a limited ability to uncover the history of the gun the perpetrator used. Authorities can enter the image of the cartridge case into NIBIN to identify potential matches to other cartridge cases found at different crime scenes, but they cannot match that evidence to a specific firearm. Only if the firearm is eventually recovered and a test fired cartridge case is entered into the NIBIN system can they link a shooting to a specific firearm.

Quickly linking a shooting to information about a specific firearm is an important piece of evidence that can help law enforcement both solve shootings and identify firearm trafficking networks. NIBIN's limited ability to quickly link evidence from a shooting to a firearm without recovering the weapon itself continues to pose challenges to law enforcement.



### SOLUTION 1

#### ***Microstamping provides a direct link between a spent cartridge case and a firearm***

A microstamping code corresponds directly to a firearm's serial number, allowing investigators to quickly link a cartridge case to the specific firearm from which it was shot even when the weapon itself is not recovered. Thus, microstamping expands the power of current ballistics analysis by transforming a single spent cartridge case into an actionable lead. With a single piece of evidence found at a shooting, law enforcement can identify the make, model, and serial number of the firearm used. They can then identify the time and place where this gun was first purchased.



## CHALLENGE 2

### ***Current ballistics analysis takes significant time and resources***

While NIBIN clearly is a useful tool for many police departments, traditional firearm analysis and tracking can be time-consuming and labor-intensive. To maintain NIBIN as an investigative resource, law enforcement agencies must remain committed to the comprehensive process of ballistic evidence collection and entry, timely turnaround, follow-up, and evaluative feedback, which may be a challenging and resource intensive feat.<sup>19</sup> As a result, many police departments do not upload most of their ballistic evidence into NIBIN, and some do not use NIBIN at all.<sup>20, 21</sup> For example, a 2018 investigation found that nationally, only around 25% of ballistic evidence recovered by police was entered into NIBIN.<sup>22</sup>

In addition to this often onerous process, a limited number of the cartridge casings law enforcement upload into NIBIN lead to a match. Baltimore's 2018 police report illustrates the benefits and challenges of NIBIN for a city struggling to tackle high rates of firearm violence. The Baltimore Police Department analyzed and uploaded images of 4,500 casings and 1,000 projectiles into the database in 2018. Of these 5,500 images uploaded, only 391 matches were identified by NIBIN.<sup>23</sup> These matches identified through NIBIN are clearly valuable but there is enormous potential for microstamping to increase the number of hits identified in a city like Baltimore.



## SOLUTION 2

### ***Microstamping simplifies the ballistic identification process***

Microstamping simplifies the ballistics identification process by supplying law enforcement with actionable evidence to quickly make a match to a firearm for almost every microstamped cartridge case. Microstamped cartridge casings can be examined under a simple microscope and within minutes, the codes can be identified and entered into NIBIN to check for a match.

If there are no known matches, a microstamped cartridge will still lead the investigator to the serial number of the firearm and allow the firearm to be traced to at least its first purchaser. Microstamping transforms a process that can sometimes take weeks, or even months, into a task that can be completed by local law enforcement within hours, allowing investigators to spend more time analyzing the links between shootings and investigating gun trafficking networks.

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# Microstamping: A Tool to Help Resolve the Crisis of Community Gun Violence

Microstamping has tremendous potential to assist law enforcement in solving shootings and reducing gun violence in communities across America. It is particularly equipped to assist law enforcement in reducing community gun violence that disproportionately impacts under-resourced Black and Hispanic communities. In many cases, this violence is exacerbated when law enforcement lacks the resources and tools to solve shootings. Microstamping is a tool that can help law enforcement disrupt cycles of violence and unsolved murders.

## The Crisis of Community Gun Violence

On average, more than 36 Americans die each day by firearm homicide.<sup>24</sup> Communities of color, particularly those distinguished by poverty and underinvestment, are disproportionately impacted, such that Black Americans are 10 times, and Hispanic Americans twice as likely to die by firearm homicide compared to white Americans.<sup>25,26</sup>

This firearm violence is highly concentrated geographically in a small number of neighborhoods often suffering from the legacy of discriminatory policies. In 2015, 26% of all firearm homicides in the United States occurred in census tracts that contained only 1.5% of the American population.<sup>27</sup> Even within cities, this violence is highly concentrated. For example, in St. Louis, a city with one of the highest homicide rates in the nation, 40% of all firearm homicides occurred in only eight out of a total of 79 residential neighborhoods.<sup>28</sup>

Looking closer still reveals that the majority of gun violence occurs within small, interconnected groups of people who are often caught in cycles of violence as both perpetrator and victim.<sup>29</sup> In Oakland, for instance, just 0.1% of the population was responsible for the majority of the city's homicides at any given time, while in New Orleans, networks of 600 to 700 people drive the city's high murder rate.<sup>30,31</sup> One study found that people living in some of Chicago's highest violence neighborhoods were 900% more likely to die of homicide if someone in their social network was murdered than their neighboring residents.<sup>32</sup> Firearms are used in the vast majority of homicides in each of these cities.<sup>33</sup>

The likelihood of future gun violence increases when police are unable to arrest those responsible. One reason, of course, is that the shooter is able to commit future acts of gun violence. Secondly, the threat of arrest or legal consequences does not deter those at highest risk for gun violence perpetration because they do not believe they will be caught. A 2019 study found that only 10% of young adults between the ages of 18 and 26 who have carried a firearm in high-violence Chicago neighborhoods believed that they would be caught if they shot at someone.<sup>34</sup> In many respects they are right – the vast majority of firearm violence cases within under-resourced communities of color go unsolved. And these unsolved shootings fuel cycles of retaliatory violence.

## Most Shootings Remain Unsolved

Jurisdictions use “clearance rates” to measure the number of crimes they solve. For firearm homicide, the clearance rate is the percentage of homicide cases where an arrest was made or the police have evidence to make an arrest, but cannot because of exceptional circumstances, such



**Nearly four out of every 10 murders from 2014–2018 remain unsolved.**

as the suspect's death. A high clearance rate indicates that most perpetrators are arrested and thus there is a high proportion of *solved* homicides. A low clearance rate indicates most perpetrators were not arrested and thus there is a high proportion of *unsolved* homicides. The national homicide clearance rate was only 58.3% from 2014–2018, meaning that during these five years nearly four out of every 10 murders remain unsolved.<sup>35</sup> While the FBI data does not differentiate homicide clearance rates by the perpetrator's weapon, firearms account for nearly three of every four homicides, and in many cities firearms are used in 85–90% of homicides.<sup>36</sup>

### ***Unsolved Homicides***

These low national homicide clearance rates are startling, yet much like national homicide totals, they fail to uncover profound racial disparities. The same under-resourced communities of color that experience daily gun violence are also disproportionately burdened by unsolved homicide cases. An analysis of homicide reports and FBI homicide data from 55 major cities from 2007 to 2017 found that more than half of homicides go unsolved.<sup>37</sup> A separate analysis of clearance rates in cities found that police made arrests in only 35% of firearm homicides and 21% of firearm assaults when the victim was Black, while these rates were 18 and 16 percentage points higher when the victim was white.<sup>38</sup>

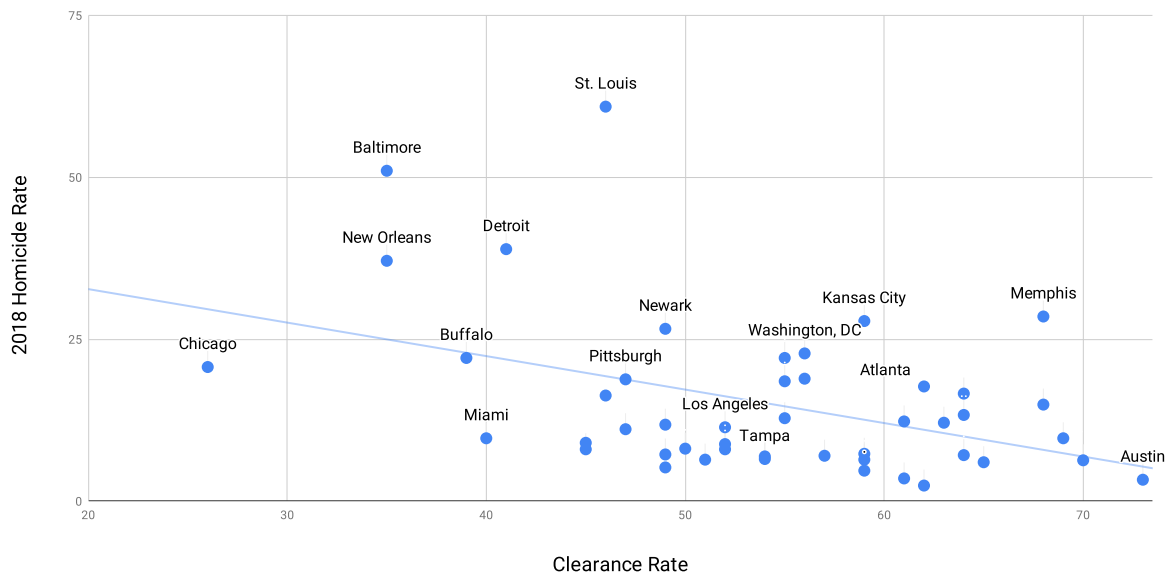
Cities with the highest rates of gun violence are often found to have high levels of unsolved homicides. For example, the U.S. cities with the four highest homicide rates in 2018 – St. Louis, Baltimore, Detroit, and New Orleans – were also among the top cities with the lowest homicide clearance rate (see Figure 6).<sup>39,40</sup>

*Figure 6: Cities with low clearance rates over the past decade have high homicide rates in 2018.*

City	2018 Homicide Rate per 100,000 (Rank) <sup>41</sup>	Clearance Rate Over the Past Decade (Percent of Homicides that Result in an Arrest) <sup>42</sup>
<b>St. Louis</b>	61 (1st)	46%
<b>Baltimore</b>	51 (2nd)	35%
<b>Detroit</b>	39 (3rd)	41%
<b>New Orleans</b>	37 (4th)	35%

Figure 7 highlights the correlation between law enforcement's inability to solve homicides and high levels of violence. When police cannot consistently arrest perpetrators of gun homicide, violence within cities can spiral out of control, further straining law enforcement, decreasing clearance rates, and leading to additional violence.

Figure 7: Link between cities with low clearance rates over the last decade and high 2018 homicide rates



### Unsolved Non-Fatal Shootings

While most cities do not collect data on non-fatal shootings (as it is not a category included in the federal crime reporting systems), those that do found that police solve non-fatal shootings at rates well below those of than fatal shootings.<sup>43</sup> For example, in Milwaukee from 2006–2016, clearance rates for non-fatal shootings ranged between 16–34%; 28–69 percentage points lower than the city’s firearm homicide clearance rates.<sup>44</sup>

Increasing numbers of unsolved non-fatal shootings contribute to the rise of fatal shootings, as cycles of retaliatory violence are likely to continue when law enforcement cannot apprehend the small number of people responsible for most of the shootings. Research consistently finds that individuals admitted to a hospital for a non-fatal firearm injury are at significantly heightened risk for being both a victim and perpetrator of future firearm violence.<sup>45</sup> Solving both non-fatal and fatal shootings is vital to improving homicide clearance rates and reducing violence overall, but significant challenges hamper the ability of law enforcement to accomplish this goal.

### Examples of non-fatal shooting clearance rates in U.S. cities

#### CHICAGO, IL



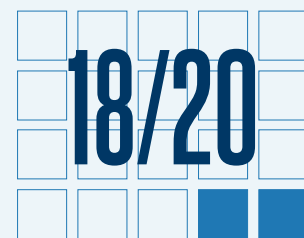
19 out of every 20 non-fatal shootings remained unsolved in 2016.<sup>46</sup>

#### SAN FRANCISCO, CA



Law enforcement were unable to make arrests in 17 out of 20 non-fatal shootings in 2016.<sup>47</sup>

#### DURHAM, NC



18 out of 20 non-fatal shootings did not result in an arrest in 2015.<sup>48</sup>



## Shootings Pose Unique Challenges to Law Enforcement

Firearm homicides are half as likely to lead to an arrest when compared to non-firearm homicides and assaults.<sup>49</sup> Indeed, shootings pose unique challenges to the law enforcement officers tasked with solving them. This is partly because shootings can occur from a distance, and evidence that police can analyze is often sparse.<sup>50</sup> As a result, law enforcement must rely on witness cooperation to augment whatever limited evidence (e.g. spent cartridge casings, bullet fragments, or weapons) is recovered at the scene in order to develop leads and solve crimes.<sup>51</sup>

While reliable witness statements considerably improve the likelihood that police will solve a shooting, lack of cooperation can undermine law enforcement's ability to conduct investigations.<sup>52</sup> Witnesses, especially those impacted by daily gun violence, are often reluctant to share information about a shooting with law enforcement due to a fear of retaliation and/or distrust of police officers.<sup>53</sup>

*Firearm homicides are half as likely to lead to an arrest when compared to non-firearm homicides and assaults.*



Witness reluctance to share information with law enforcement is exacerbated in cities and communities that have experienced high-profile cases of police violence and civil unrest. For example, after police in Milwaukee brutally beat Frank Jude, an unarmed Black man, residents of Black neighborhoods were far less likely to call 911 to report crime. This resulted in an estimated 22,200 fewer 911 calls from Milwaukee residents to report crime over one year and a simultaneous uptick in homicides.<sup>54</sup>

Police violence damages the legitimacy of law enforcement in many communities of color, lowering the likelihood that witnesses of gun violence come forward. This reluctance to share information, while often understandable, makes it significantly harder for police to solve shootings.<sup>55</sup> Without witness cooperation, law enforcement must rely on the finite physical evidence left at the crime scene.

## Benefits of Microstamping

Microstamping technology has the potential to help transform the way law enforcement works and reduce gun violence in disproportionately impacted communities of color in four important ways.

- Microstamping decreases strain within law enforcement agencies by allowing police officers to gather more actionable ballistic evidence, develop new leads, and increase clearance rates.
- Microstamping can help law enforcement identify and disrupt gun trafficking channels.
- Microstamping helps law enforcement link shootings and identify the small networks of people at high risk for perpetuating or becoming a victim of gun violence, and thus provides opportunities to intervene before the next shootings occur.
- Microstamping can help law enforcement build trust and increase cooperation within communities of color as more shootings are solved and cycles of gun violence are interrupted.

### 1

#### ***Improve Evidence Collection and Gun Crime Clearance Rates***

Research suggests that police departments can improve homicide clearance rates by collecting more forensic evidence, and by improving technology and analytical tools. For example, studies of the Boston Police Department found that forensic testing increased the likelihood that a shooting would be solved,<sup>56</sup> and that instituting changes allowing the department to analyze more physical evidence increased the city's homicide clearance rate by nearly 10%.<sup>57</sup> Researchers have also found that forensic evidence is often an important component in establishing probable cause for an arrest and encouraging witnesses to cooperate.<sup>58</sup> Investigative practices, including ballistics analysis, can improve clearance rates and reduce violence.

Microstamping can help law enforcement officers analyze more ballistic evidence using fewer resources and less time. Through quick identification of microstamped codes, microstamping will help police quickly identify leads in fatal and non-fatal shootings alike without having to allocate the significant resources needed for traditional ballistics analysis. This ability to quickly collect more ballistic evidence will help police identify suspects and have probable cause to make swift arrests. Further, this will allow police to spend more time identifying and building rapport with potential witnesses, and give witnesses the added assurance of clear ballistic evidence to support their cooperation. Ultimately, this can facilitate improved clearance rates.

### 2

#### ***Identify and Disrupt Gun Trafficking Channels***

Microstamping has tremendous potential to help law enforcement identify and dismantle firearm trafficking networks and identify the ties between firearm dealers, traffickers, and those who perpetrate community gun violence. Gun traffickers typically identify states with weak gun purchasing laws and buy guns in bulk from sellers who are often complicit in firearm trafficking.<sup>59</sup> They then transfer guns into cities, often with strong gun laws, and sell guns to the high-risk networks that fuel high rates of gun violence.<sup>60</sup> Using only a microstamped cartridge, law enforcement can gain vital intelligence about where and when a specific firearm was purchased, begin to understand how firearms are being diverted into high-risk networks, and identify those responsible for firearms trafficking.



### **Firearm trafficking fuels high levels of gun violence in the District of Columbia.**

In 2018 alone, the ATF reported 2,095 recovered firearms at crime scenes in the District of Columbia, only 43 of which were traced back to an original purchase in the District.<sup>61</sup> The rest had been brought in from elsewhere, often by firearm traffickers.

In 2015, one man illegally trafficked 224 guns into the District over the course of just five months, selling them out of the trunk of his rental car to whomever would buy, including rivals in an ongoing feud.<sup>62</sup>

Cases like this illustrate how identifying even one trafficker can make significant, tangible progress toward disrupting the flow of illegal firearms, and microstamping can provide tremendous support to that effort.

## **3**

### **Deter Future Violence**

The majority of firearm violence in cities occurs within small networks of high-risk people.<sup>63</sup> Microstamping technology is poised to help law enforcement identify these networks, especially when combined with other information-gathering techniques already employed by many police departments. With microstamping, each spent cartridge case could quickly generate leads and link shootings across the city, assisting law enforcement in identifying a common suspect and making a swift arrest. This will help to prevent future violence, as closing violent firearm cases and holding shooters accountable has a deterrent effect within high-risk networks; people are less likely to engage in gun violence if they believe that it will result in an arrest.<sup>64</sup>

The use of microstamping to identify high-risk networks can also enhance law enforcement's capacity to prevent retaliatory violence, and connect people at risk for becoming involved in gun violence to community supports and resources. There is a large body of evidence that gun violence intervention programs (often known as *Group Violence Intervention* or *Focused Deterrence*) can lead to sizable reductions in shootings.<sup>65</sup>

In order for these programs to work, law enforcement must identify the small groups of individuals responsible for much of the firearm violence within a city. They then collaborate with community partners to engage these individuals, by calling them into a meeting where it is explained that there is evidence linking them to past shootings, and if they continue to engage in gun violence they will be arrested and prosecuted. However, they are told that if they change their behavior they will have access to community support and a range of community support and public services. Microstamping can bolster these programs by providing law enforcement with intelligence to identify the groups involved in violence as well as evidence law enforcement can leverage to encourage these individuals to change their behavior.

## Microstamping can amplify the power of intelligence-gathering techniques while minimizing privacy and equity concerns.

Starting in the mid-1990s, police departments began adopting computer technologies to help them gather more evidence, efficiently evaluate intelligence, and increase transparency.<sup>66</sup> Over the next two decades, these evolved to encompass a wide range of technologies such as body-worn cameras, gunshot detection (Shotspotter), and predictive policing.<sup>67</sup>

While intelligence-gathering technologies have shown promise in advancing policing, some may infringe on individual privacy rights and could potentially be used in a discriminatory manner. For example, predictive policing models and analytics used to identify potential criminal activity can rely on biased assumptions and perpetuate racially discriminatory practices. As a result, community members and researchers express racial equity concerns around such intelligence-gathering technologies and call for strict community oversight and input to determine if the benefits of these technologies outweigh the potential costs.<sup>68</sup>

Gunshot detection technology like Shotspotter uses audio surveillance to detect gunshots within a city and determine their location, helping law enforcement respond more quickly to shootings. While this technology is designed to detect only the unique sounds of gunfire, individuals may perceive it as a form of surveillance. When law enforcement doesn't communicate or consult with community members before instituting technologies like Shotspotter, misperceptions can spread through communities further deteriorating trust between law enforcement and communities impacted by gun violence.<sup>69</sup>

Microstamping avoids the concerns of the previously mentioned intelligence-gathering technologies. Unlike video or audio surveillance, a microstamped code left on a cartridge does not infringe on privacy rights. Likewise, microstamping acts as an objective piece of evidence and is not prone to the biased assumptions that can turn up in predictive policing models. Instead, it provides clear, objective evidence to help law enforcement solve gun crime.

Further, microstamping has the power to amplify the positive impact of other intelligence gathering technologies while minimizing the privacy and equity concerns.<sup>70</sup> Shotspotter and COMPSTAT are two technologies that microstamping can enhance:

**Shotspotter:** Many police departments use geospatial information systems to quickly analyze spatial and temporal information from recovered evidence.<sup>71</sup> One such technology is Shotspotter, which uses sensors to pinpoint where shootings occur within a city and sends that information to police within seconds.<sup>72</sup>

When paired with microstamping, law enforcement will have the ability to immediately respond to a shooting, collect a microstamped cartridge casing, and begin the firearm identification process in a matter of hours. While microstamping does not eliminate the privacy concerns associated with Shotspotter, it can increase the benefits of the technology by producing objective leads. Those concerned about privacy and equity may view the increased effectiveness of Shotspotter when paired with microstamping technology as providing more benefit to the community than potential harm.

**COMPSTAT** (short for COMPare STATistics): combines data-gathering technologies with performance management systems to help police departments quickly share intelligence, analyze data, and respond to crime trends in real-time.<sup>73</sup> Microstamping can enhance COMPSTAT strategies by providing law enforcement with more real-time intelligence to quickly map gun crimes, identify high-risk networks, and prevent future shootings. Microstamping can mitigate some of the potential racial equity concerns related to COMPSTAT by providing objective evidence that allows police departments to rely less on potentially biased assumptions to inform their practices.

## *Technological advances in law enforcement*

can be helpful in making communities safe, and law enforcement agencies should be able to take advantage of these tools to investigate and deter crime. Unfortunately, many of the current technological tools bring their own set of issues, with detrimental consequences for the most marginalized communities. For example, police-worn body cameras and aerial surveillance programs can be helpful in solving crimes, but they do not come without a cost. These tools also capture facets of everyday life and encroach on the privacy of law-abiding residents of communities where crime occurs.



In contrast, microstamping technology offers a less intrusive way to trace firearms used in crimes, without encroaching on the privacy rights of others. This extremely valuable technology makes it possible to trace the weapon used in a crime and develop leads, while also providing a valuable deterrent.

As a former prosecutor, I understand the value in addressing violent crime. I also understand that holding law-breakers accountable and protecting the privacy of other residents are not mutually exclusive. Thankfully, microstamping is a valuable tool that law enforcement officers can use in their efforts to solve gun crime and prevent future acts of violence.

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## **4**

### ***Build Trust in Law Enforcement and Increase Cooperation within Communities of Color***

Police legitimacy – the way community members trust in and are willing to work with the police – is a vital component in reducing violence. When communities view the police force as legitimate, they are more willing to work with law enforcement to identify those who commit violence and to intervene before conflicts develop into shootings. Likewise, when police legitimacy is strong, victims of violence feel safe and can rely on formal channels of justice to bring about closure. Some studies have found that police legitimacy can be a stronger factor in reducing violence than the threat of punishment.<sup>74</sup>

Unfortunately, in many communities of color, law enforcement is not perceived as a legitimate institution that can be trusted. While this distrust in law enforcement stems from a legacy of racist policies and discriminatory police practices, it also is determined by the direct actions of law enforcement within the community.<sup>75</sup> Law enforcement's inability to solve shootings in many communities of color compounds the distrust in police. Consequently, community members are less likely to report criminal activity or act as witnesses in criminal investigations. Instead, some rely on informal channels of justice – like retaliatory violence – to resolve conflict.<sup>76</sup>



Microstamping technology helps law enforcement solve more shootings and spend more time developing trust within communities most impacted by gun violence. Community perceptions of police may shift as police solve more violent crime and bring closure to victims and their families. This may increase community members' willingness to work with police to reduce violence by acting as witnesses, reporting crime, and communicating violent disputes before they erupt in gunfire.<sup>77</sup> Retaliatory shootings may decrease as the community begins to trust in and rely on law enforcement and the formal channels of justice.<sup>78</sup> While microstamping alone will not fix the deep-rooted problem of weak police legitimacy in many impacted communities of color, it can help law enforcement begin the process of mending relationships and building trust.

### **Long-Term Goal: Reduce Community Gun Violence**

Cities across America face an ongoing crisis of gun violence that disproportionately impacts communities of color. When cases remain unsolved, the victims of gun violence experience both the trauma of shootings and the lack of closure resulting from an open case. This leads victims of gun violence and the community at large to lose trust in law enforcement's ability to protect them and bring about justice. As a result, families and friends of victims seek to protect themselves and carry out justice on their own terms. This causes increases in gun carrying and retaliatory shootings, further perpetuating the crisis of gun violence in many communities of color.

Cities find themselves stuck in a vicious cycle of gun violence fueled in part by law enforcement's inability to solve firearm crime within the communities most impacted by gun violence.

Microstamping can play a role in stopping vicious cycles of unsolved shootings and gun violence. In the immediate, microstamping can help reduce the strain on police departments by allowing them to more quickly analyze evidence, identify trafficking patterns and develop leads. This will help agencies increase their clearance rates and bring about closure for victims of violence and the communities that are impacted. As police solve more cases, people impacted by gun violence will hopefully begin to feel safer, rely more on police for community protection, and be less inclined to carry out justice on their own. This will lead to a decrease in gun carrying and retaliatory shootings and improvements in police-community relations, which further drive down gun crime.

# Microstamping Policy Landscape

Microstamping technology as outlined in this report could easily be incorporated into all new semi-automatic handguns. The evidence is clear that this simple yet effective technology is reliable, easy to implement, and can be mass produced. In fact, firearm manufacturers have developed prototypes of other intentional marking technologies and already use a laser engraving process similar to microstamping to engrave logos and decorative features onto their products.

Nonetheless, while gun violence takes the lives of tens of thousands of American each year, devastating families and communities across the country, firearms manufacturers refuse to act. The industry has instead spent more than a decade engaged in lengthy legislative and legal battles against microstamping requirements that would help law enforcement solve more cases, bring justice to victims and their families, and disrupt the cycle of gun violence plaguing the country.

*State and federal lawmakers have an opportunity to incentivize firearm manufacturers to help law enforcement solve gun crime and address gun violence by passing measures that require that all new semi-automatic handguns be equipped with microstamping technology.*

## History of Microstamping

For more than forty years, ballistic experts, inventors, and even firearm manufacturers have continued developing new prototypes of intentional marking technology with a similar aim as microstamping outlined in this report. For example, a patent filed in 1977 described a process of cutting small grooves into the barrel of a firearm, that would leave unique markings on the bullets fired; a New York Times article highlighted the approval of this patent and its potential to solve crimes.<sup>79,80</sup>

From 1977–2005, at least eight intentional firearm marking patents were granted, including one by Gaston Glock, the founder of a top firearm manufacturer and one of the largest suppliers of handguns to U.S. law enforcement.<sup>81,82</sup> Glock developed the Enhanced Bullet Identification System (EBIS) – known as the “Miami Barrel” – in 2003, following several high-profile shootings involving Miami police officers that went unsolved.<sup>83</sup> While EBIS is a form of intentional marking technology, it is unlike microstamping because the bar-code like pattern added to the barrel is not a unique code; the same bar-code is added to the barrel of multiple firearms.<sup>84</sup>

Glock’s EBIS technology highlights that firearm manufacturers have had the ability – and occasionally the willingness – to employ intentional marking technology. Nearly two decades have passed since the EBIS was developed, years that firearms manufacturers could have expanded upon EBIS and produced technology, like microstamping, that leaves a unique and easily identifiable intentional marking on each bullet or cartridge case. They have chosen instead to ignore, resist, or actively fight efforts to incorporate microstamping technology into the firearm manufacturing process.

## Invention of Microstamping

The microstamping technology described in this report was invented in the early 2000s by mechanical engineers Todd Lizotte and Orest Ohar, who discovered that with the use of lasers and micro-machining, unique codes could easily and efficiently be etched onto a firearm's firing pin and breech face. In the laboratory of their first startup high tech company they successfully outfitted a firing pin with microstamping technology in the hopes that manufacturers would adopt it for branding logos and cosmetic designs on fired cartridge casings. Lizotte and Ohar later came to realize that the technology they had invented could be a vital tool to help law enforcement solve shootings. In the mid-2000s they secured a series of patents (now in the public domain) for Intentional Firearm Microstamping (IFM).<sup>85</sup> The two went on to publish several articles in scientific journals demonstrating the reliability of microstamping technology and its utility to law enforcement.<sup>86,87</sup>

## Mass Production and Commercialization

In 2018, TACLAB, Inc., founded by Todd Lizotte, began developing a machine tool that can quickly and efficiently produce large numbers of firing pins equipped with microstamping technology. In January, 2021 TACLABS™ publicly introduced its machine tool to market making it available to firearm manufacturers. After decades of claiming they were unable to mass produce firing pins equipped with microstamping technology, firearm manufacturers can now purchase machines or partner with companies like TACLABS™ to mass produce microstamping outfitted semi-automatic pistols.

## Policy and Litigation about Microstamping

In 2005, law enforcement agencies, prosecutors, and gun violence prevention organizations began advocating to establish firearm microstamping requirements in California state law. In 2007, the Crime Gun Identification Act was passed by the California State Legislature and signed into law by then-Governor Arnold Schwarzenegger.<sup>88</sup> This law amended the Unsafe Handgun Act, which established design and safety requirements for firearms, requiring that all new models of semi-automatic pistols sold or manufactured in California be equipped with microstamping technology once such technology became unencumbered by patent restrictions. Once patent restrictions were lifted in 2013, the law became fully effective. In order to avoid the new law, firearm manufacturers simply refused to sell new firearm models in California. (Instead, they offer only newly-manufactured but older-model guns).<sup>89</sup> Simultaneously, gun rights groups and the firearm industry challenged the microstamping law in two specific court cases, both of which led to lengthy legal battles.

### ***Pena v. Lindley***

In 2009, two gun rights organizations, the Second Amendment Foundation (SAF) and Calguns Foundation, Inc. (CGF), as well as several individuals filed suit in a case called *Pena v. Lindley* claiming that the safety requirements of the Unsafe Handgun Act (UHA) violated the Second Amendment.<sup>90</sup> The complaint was later amended to include microstamping.<sup>91</sup> A federal district court dismissed the plaintiff's claim and on appeal the Ninth Circuit determined that the safety requirements of the UHA, including microstamping, do not substantially burden the Second Amendment and affirmed the lower court's ruling. The SAF and CGF appealed the decision to the U.S. Supreme Court by filing a petition for a writ of certiorari; however, the court denied certiorari on June 15, 2020.<sup>92</sup> Therefore, the ruling of the lower court stands.

### ***National Shooting Sports Foundation v. California***

In 2013, following the certification of microstamping, the National Shooting Sports Foundation (NSSF) filed suit alleging that dual placement microstamping technology is impossible to implement.<sup>93</sup> The trial court granted the attorney general's motion for a judgment on the pleadings dismissing the case.<sup>94</sup> NSSF appealed and the California Supreme Court ruled that the trial court was correct and upheld its ruling.<sup>95</sup>

### **Current Policy Landscape in California and Beyond**

In September 2020, California Governor Gavin Newsom signed into law a revision of its microstamping requirement, creating a new incentive for manufacturers to adopt microstamping technology, spurring competition between manufacturers and rewarding manufacturers that bring microstamped firearm models to market.<sup>96</sup> With the previous legal challenges resolved and the successful passage of California's revised microstamping law, the current policy environment is ripe for microstamping legislation both at the state and federal levels.

As the environment for passing microstamping legislation improves, so too does the technology itself. Microstamping technology is available for manufacturers to implement *today*, and technological advancements in the manufacturing process are underway, which will make it more affordable, reliable, and ready for mass production.

# Microstamping Recommendations

Based on

- 1 research demonstrating the effectiveness and durability of microstamping technology;
- 2 evidence that such technology is commercially viable and can feasibly be adopted by firearms manufacturers; and
- 3 the potential contributions microstamping can make in helping law enforcement solve gun crimes and reduce gun violence, the Educational Fund to Stop Gun Violence makes the following state and federal policy recommendations:

## State Recommendations

States should require that new semi-automatic pistols manufactured and/or sold in their jurisdictions be equipped with microstamping technology. This legislation should ensure that manufacturers cannot avoid the microstamping requirements through grandfather clauses or exemptions on the continued manufacture of existing models of firearms.

## Federal Recommendations

Congress should require that all semi-automatic pistols manufactured in or imported into the U.S. be equipped with microstamping technology. This legislation should ensure that manufacturers cannot avoid the microstamping requirements through grandfather clauses or exemptions on the continued manufacture of existing models of firearms.



## Conclusion

- Microstamping technology has the power to help law enforcement identify
- firearms used in shootings, disrupt gun trafficking networks, and hold shooters
- accountable while greatly enhancing the value of NIBIN. By increasing law
- enforcement's capacity to solve shootings, microstamping has the potential to
- help improve relationships between law enforcement and community members,
- interrupt cycles of violence, and ultimately prevent future shootings.
- 
- Now is the time for policymakers to require microstamping technology in
- new semi-automatic pistols. Microstamping's impact will grow as more guns
- equipped with the technology reach the market. Requiring manufacturers to add
- this simple, cost-effective technology today will empower law enforcement with
- the tools needed to save countless lives over the next decade and beyond.
-

# Glossary

**Ballistic identification:** Analysis of the unique markings left on the bullet and cartridge case by the firearm from which they were fired to identify the specific firearm, or the make and model of the firearm, used to fire a given bullet or cartridge case.

**Breech face:** The flat, vertical surface that forms the rear of the firing chamber of a firearm.

**Cartridge:** A unit of firearm ammunition containing four components: primer, powder, bullet, and cartridge case.

**Cartridge case:** The component of firearm ammunition, usually made of brass, that holds the primer, powder, and bullet.

**Clearance rate:** The percentage of all homicide cases where an arrest was made or the police have evidence to make an arrest, but cannot because of exceptional circumstances, such as the suspect's death.

**Firing pin:** A narrow rod which, when released by pulling the trigger, springs forward and strikes the primer of a chambered cartridge, causing the cartridge to discharge.

**Microstamp:** A microscopic array of characters etched into the interior surfaces of a firearm during manufacturing; these characters are transferred to the cartridge case when the cartridge is discharged.

**NIBIN:** National Integrated Ballistic Information Network, operated by the Bureau of Alcohol, Tobacco, Firearms and Explosives and the Federal Bureau of Investigation. NIBIN allows firearms investigators to capture and compare ballistic images from cartridge cases and bullets recovered at crime scenes.

**Primer:** A percussion-sensitive chemical mixture contained in the base of a cartridge. The primer explodes when struck by the firing pin, igniting the powder.

**Toolmarks:** Unintentional markings or impressions left on the firing pin and breech face during manufacture and then transferred to the cartridge or projectile when the gun is discharged. Toolmark examiners work to establish a link between the mark left on the cartridge and the firearm.

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