Touch DNA: Extracting and Analyzing Genetic Material from Ballistic Evidence

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The Joyce Foundation

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Questions about this report can be addressed to info@joycefdn.org.

For more information about this report, or to access the underlying data analyzed, please visit: www.joycefdn.org/CrimeGunIntelligence.

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Introduction

INTRODUCTION

In the early morning hours of December 26, 2019, two armed, masked men walked into a Denny's restaurant in Manassas, Virginia and demanded customers hand over their wallets, phones, and valuables.[1] Amidst the chaos, the restaurant's manager was able to escape the restaurant and call 911.[2] As the perpetrators fled the scene, they shot two men, including DoorDash delivery driver and father of two Yusuf Ozgur, who eventually died of the gunshot wound.[3] At the time, "touch DNA" analysis of ballistic evidence–a method for obtaining DNA profiles from trace amounts of biological evidence left on objects–was a relatively new technology.[4] But a Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) agent on the scene knew that this analysis was available, and collected the shell casings (also known as cartridge casings) for DNA testing. Within days, the ATF Laboratory had matched DNA collected from the shell casings to existing DNA profiles, leading to the identification and arrest of the two perpetrators.[5] Both men were eventually found guilty of felony murder and numerous other charges.[6]

Touch DNA analysis of ballistic evidence is a powerful, relatively new tool that complements traditional crime gun intelligence methods, such as crime gun tracing through eTrace, and ballistic imaging and correlation through the National Integrated Ballistic Information Network (NIBIN). By capturing trace biological material left on firearms or shell casings, touch DNA allows investigators to directly connect individuals to specific criminal acts. Despite growth in touch DNA analysis of ballistic evidence, there remains a massive gap to comprehensive adoption and usage, largely driven by a lack of resources and capacity.

"Despite growth in touch DNA analysis of ballistic evidence, there remains a massive gap to comprehensive adoption and usage, largely driven by a lack of resources and capacity."

[1] Julie Carey and Andrea Swalec, "Man Convicted of Murder for Deadly Shooting Inside Virginia Denny's," *NBC News 4 Washington*, September 27, 2022.

[2] Cher Muzyk, "Denny's manager recounts chaotic, Christmas night robbery as trial begins for gunman charged in 2019 fatal shooting of DoorDash delivery man," *Prince Williams Times*, January 8, 2024.

[3] Jill Palermo, "Fund tops $132,000 for Yusuf Ozgur, remembered as hard-working father, helpful neighbor," *Prince Williams Times*, January 8, 2024.

[4] Paul Wagner, "ATF Device Helps Analyze Shell Casings for DNA," *NBC News 5 Dallas Fort Worth*, June 18, 2021; Francesco Sessa, Monica Salerno, Giuseppe Bertozzi, et al. "Touch DNA: Impact of Handling Time on Touch Deposit and Evaluation of Different Recovery Techniques: An Experimental Study," *Scientific Reports*, July 2, 2019.

[5] Paul Wagner, "ATF Device Helps Analyze Shell Casings for DNA," *NBC News 5 Dallas Fort Worth*, June 18, 2021.

[6] Alanea Cremen, "Man sentenced to 50 years, 2 life sentences for deadly robbery, judge suspends all but 17 years depending on good behavior," *WUSA9*, January 8, 2024.

What is “Touch DNA” Analysis?

WHAT IS "TOUCH DNA ANALYSIS"

DNA evidence is a cornerstone of modern criminal investigation. Testing of biological evidence–such as blood, semen, saliva, and hair–can identify and connect individuals to crime scenes, link crimes to one another, generate investigative leads, and exonerate the innocent.[7] The introduction of the FBI's Combined DNA Index System (CODIS) in the late 1990s significantly enhanced the use of DNA to solve crimes.[8] CODIS stores DNA profiles from known offenders and from crime scene evidence, allowing for cross-jurisdictional comparisons. As of July 2025, CODIS contains over 18 million offender profiles and has assisted in more than 700,000 investigations.[9]

Recent advancements in DNA technology include the development of "touch DNA," a method for obtaining DNA profiles from trace amounts of biological evidence left on objects.[10] While Touch DNA analysis has been used in criminal investigations for more than two decades, its application to ballistic evidence (such as recovered firearms and fired shell casings) has become feasible only recently due to the difficulty of recovering DNA from metal surfaces.[11]

"Recent advancements in DNA technology include the development of 'touch DNA,' a method for obtaining DNA profiles from trace amounts of biological evidence left on objects."

As such, touch DNA represents a new tool in the crime gun intelligence toolkit. Now, if a law enforcement agency recovers a gun connected with a homicide, for example, the agency can trace that gun through eTrace to identify its first retail purchaser; test fire the gun for entry into NIBIN; and swab the gun for touch DNA analysis.

This ability to test ballistic evidence for trace amounts of DNA is especially meaningful given low clearance rates for gun homicides. As detailed in The Joyce Foundation's 2024 report *Optimizing Crime Gun Intelligence*, only 46% of all firearm murders are cleared (solved) each year, as

[7] National Institute of Justice, "Overview of Steps in Analyzing DNA Evidence," August 8, 2012.

[8] Federal Bureau of Investigation, "Frequently Asked Questions on CODIS and NDIS," accessed July 7, 2025.

[9] Federal Bureau of Investigation, "CODIS-NDIS Statistics," accessed July 7, 2025.

[10] Francesco Sessa, Monica Salerno, Giuseppe Bertozzi, et al. "Touch DNA: Impact of Handling Time on Touch Deposit and Evaluation of Different Recovery Techniques: An Experimental Study," *Scientific Reports*, July 2, 2019.

[11] Bonsu, Dan Osei Mensah, Denice Higgins, and Jeremy J. Austin. "Forensic touch DNA recovery from metal surfaces – a review." *Science & Justice*, January 30, 2020; Ann Givens, "A New Method of DNA Testing Could Solve More Shootings," *The Trace* & *Wired* (co-publication), March 6, 2019.

compared to 75% of murders committed with other weapons.[12]

While there is no comprehensive data source for the use and impact of touch DNA analysis nationwide, reports from individual law enforcement agencies suggests that the practice is growing, and driving important investigative results, including:

- In San Diego, California, the San Diego Police Department analyzed DNA from 19 shell casings to identify two suspects in a fatal shooting at a family party. The results matched two individuals with samples in state and local DNA databases, and both men were convicted for the killing.[13]
- In Chicago, Illinois, prosecutors used DNA evidence recovered from the front slide of a firearm to help convict an individual for the murder of Chicago Police Officer Ella French.[14]
- In New Haven, Connecticut, the Connecticut State Police analyzed DNA they obtained from the handle of a gun discarded while an individual was fleeing a traffic stop for false license plates. The DNA matched the profile of a convicted felon, who was charged with manufacturing a firearm without a serial number (a "ghost gun"), the illegal sale of a large capacity-magazine, criminal possession of a firearm, and carrying without a permit.[15]

Adding touch DNA analysis to the available suite of crime gun intelligence tools can further strengthen law enforcement investigations of gun crimes, yet growth in the use of touch DNA has been limited by a lack of resources, and thus far its use has been limited to a relatively small number of cases.

[12] Sarah Ryley, Jeremy Singer-Vine, and Sean Campbell, "5 Things to Know About Cities' Failure to Arrest Shooters," *The Trace*, January 24, 2019.

[13] Ann Givens, "A New Method of DNA Testing Could Solve More Shootings," *The Trace*, March 6, 2019.

[14] Leah Hope, "Firearms, DNA experts testify in trial of Emonte Morgan, charged in CPD Officer Ella French's murder," *ABC7 Chicago*, March 1, 2024; Darius Johnson, Shardaa Gray, and Marissa Perlman, "Man gets life without parole for murder of Chicago Police Officer Ella French," *CBS News Chicago*, September 11, 2024.

[15] Rob Polansky, "DNA on Discarded "Ghost Gun" Leads to New Haven Man's Arrest," *Eyewitness News 3*, December 20, 2024.

Use of Touch DNA Analysis in Gun Crime Investigations

USE OF TOUCH DNA ANALYSIS IN GUN CRIME INVESTIGATIONS

DNA can be found on the surfaces of a firearm, its ammunition, and on shell casings. By cross-referencing DNA profiles extracted from ballistic evidence with federal, state, and/or local databases, law enforcement may be able to identify a person or persons associated with that ballistic evidence. Policing experts, like the International Association of Chiefs of Police Law Enforcement Policy Center, recommend incorporating the collection and testing of DNA from crime scene ballistics evidence into law enforcement investigation protocols.[16]

There is no uniform national protocol for when and how to integrate DNA swabbing into the broader processing of ballistic evidence, which may also include gun tracing and/or NIBIN submission. However, experts suggest that swabbing should occur as soon as possible, given the tendency of genetic material to degrade over time, especially when in contact with certain metals.[17] At the Denver Crime Gun Intelligence Center (CGIC)–recognized as a national leader in the application of touch DNA–recovered firearms are swabbed immediately for cellular material, before they are test fired for entry into NIBIN. The CGIC is able to conduct all of this evidence collection and produce initial intelligence packages within 24-48 hours, with full reports completed within an average of ten days.[18]

While there is no comprehensive nationwide data available on how often touch DNA analysis is applied to ballistic evidence, reports from individual law enforcement agencies suggest that usage of the technology is growing. The San Diego Police Department began using touch DNA analysis in 2014, and funded its own study of the practice, which was published in the *Forensic Science Journal* in 2015. Over the next three years, police sent the San Diego Police Department's lab more than 1,000 shell casings for DNA testing.[19] Between 2019-2021, the laboratory at Denver's CGIC–an inter-agency partnership between the Denver Police Department, ATF, and other agencies–tested over 350 firearms for DNA.[20] And the Illinois State Police tested over 650 fired shell casings for DNA

[16] IACP, "Firearms Recovery," March 2023.

[17] Paul Wagner, "ATF Device Helps Analyze Shell Casings for DNA," *NBC News 5 Dallas Fort Worth*, June 18, 2021.

[18] Interview with Denver CGIC staff, June 25, 2025.

[19] Ann Givens, "A New Method of DNA Testing Could Solve More Shootings," The Trace, March 6, 2019.

[20] Interview with Denver CGIC staff, June 25, 2025.

between 2022-2025.[21]

For agencies that do not have the ability to perform touch DNA analysis on ballistic evidence within their own labs, the ATF Laboratory is a crucial resource. According to information the ATF shared

with the Joyce Foundation, from fiscal years 2020 through 2024, law enforcement agencies submitted 986 firearms and 9,020 shell casings to ATF's laboratory for DNA analysis:[22]

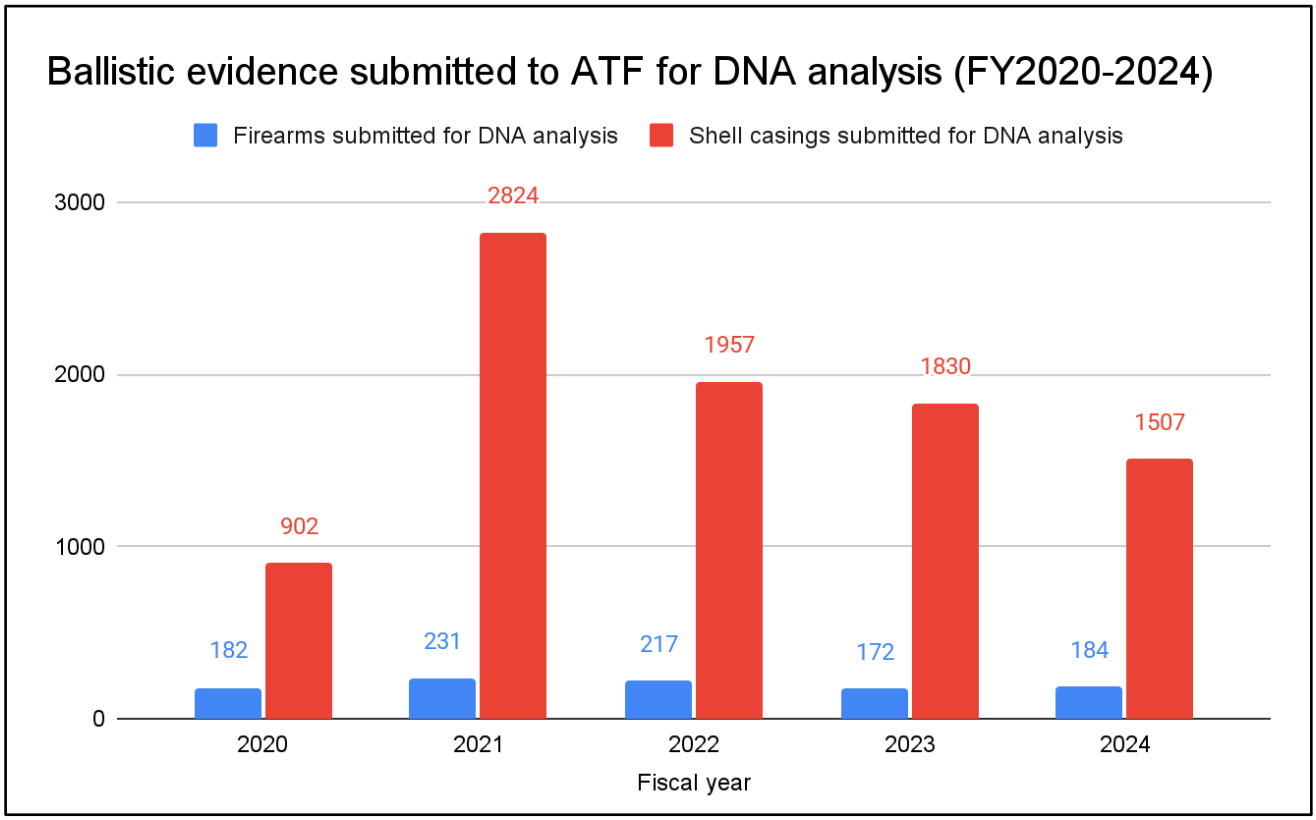

Chart data comes from a March 2025 ATF response to data request.

At the time of publication, ATF had not responded to the Joyce Foundation's formal request for an interview about this data. Interviewees at other agencies suggested that the spike in ATF's DNA testing of ballistic evidence in 2021 may have been connected to the national spike in gun violence, with the national gun homicide rate reaching a 25-year-high in 2021.[23] The subsequent decrease in DNA testing of ballistic evidence in 2022-2024 may then be correlated with decreases in gun

[21] Interview with Illinois State Police staff, July 10, 2025.

[22] ATF touch DNA data provided in March 2025.

[23] Interview with Denver CGIC staff, June 25, 2025; CDC WONDER, National Gun Homicide Rate, 1999-2023.

violence since the 2021 peak.

Despite evidence of growth in the touch DNA analysis of ballistic evidence, there remains a massive gap to comprehensive adoption and implementation, largely driven by a lack of resources and capacity. In fiscal year 2024, ATF received nearly 640,000 trace requests for recovered firearms, but only 1,507 of these firearms (less than 1%) were analyzed for DNA by ATF.[24] The share of recovered shell casings analyzed for DNA is even lower than this. Even among agencies at the leading edge of

touch DNA analysis, comprehensive usage is not yet feasible. For example, the Denver CGIC will only submit a recovered firearm for DNA analysis if there is a NIBIN hit. As such, of 2,726 recovered firearms swabbed for cellular material between 2019-2021, only 352 (13%) were ultimately submitted for DNA analysis. “The bottom line is we have to triage things,” said a senior staff member with the Denver Police Department’s Forensics and Evidence Division, “if we had unlimited staff and funding, we should be able to run that [DNA] analysis on every case.”

[24] ATF, “Fact Sheet - eTrace: Internet-Based Firearms Tracing and Analysis,” August 2025.

Efficacy & Impact of Touch DNA Analysis

EFFICACY & IMPACT OF TOUCH DNA ANALYSIS

When ballistic evidence is tested for DNA, the results have been strong, and demonstrate the ongoing improvement of the technology. The ATF Laboratory's DNA Section monitors the success of DNA analysis performed on various types of evidence, including ballistic evidence. Over time, ATF has improved its ability to obtain DNA profiles from ballistic evidence. The ATF Laboratory added DNA analysis to its capabilities in 2007. From 2007-2012, the DNA Section studied a random sample of firearms and found that the laboratory was able to successfully obtain a suitable DNA profile from 28% of firearms. In 2021, when the DNA Section recreated this analysis, the ATF Laboratory's success rate in obtaining a suitable DNA profile was 76%:[25]

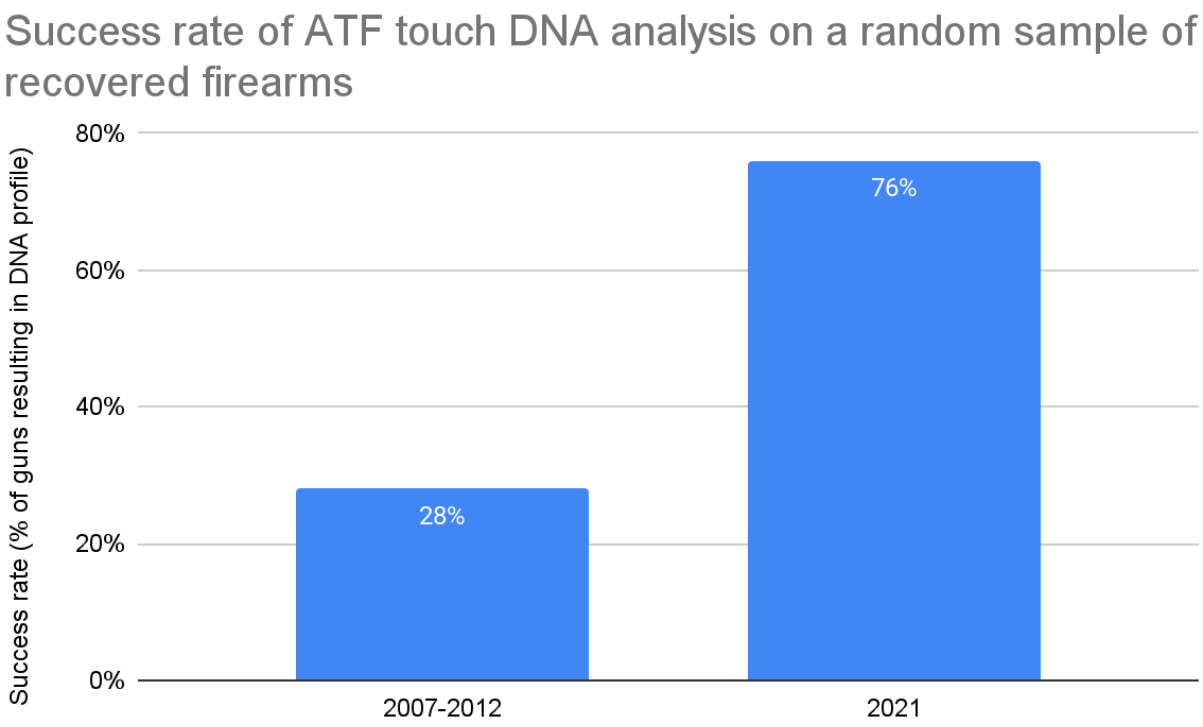

Chart data comes from a March 2025 ATF response to data request.

Because the high heat and pressure of firing a gun can degrade biological material, recovering touch DNA from cartridge casings is generally more challenging than from recovered firearms. Touch DNA analysis of fired cartridge casings was not available at the ATF laboratory until 2019. But, a random sample of 968 fired cartridge cases produced by 269 firearms were tested for DNA between 2019-2022, resulting in a suitable DNA profile 58% of the time.[26]

[25] ATF touch DNA data provided in March 2025.

[26] ATF touch DNA data provided in March 2025.

When the Denver CGIC tracked its results from 2019-2021, it found that of the 233 DNA profiles obtained from firearms that it submitted to the CODIS database, nearly 70% returned a CODIS hit

to an offender or crime scene profile in the system. “We got more CODIS hits than we expected,” said a senior staff member with the Denver Police Department’s Forensics and Evidence Division, “we were expecting about 10% to come back with information, so our results were a revelation and justified the work product.”[27] The Denver crime lab tracks every CODIS hit, and sends the hit notifications to the detectives working the cases. According to the Denver Police Department staff, “Adding the DNA hits to our crime gun intelligence tools provides our detectives with a better intelligence package overall. We can give them the name of a possible suspect, someone to talk to, and go from there.”[28]

There is no comprehensive tracking of outcomes in cases where touch DNA analysis is applied to ballistic evidence, but anecdotal examples suggest it has played a meaningful role in solving certain high-profile cases. In May 2023, for instance, Officer Aréanah Preston was shot and killed as she exited her car after returning home from her shift with the Chicago Police Department (CPD).[29] With no eyewitnesses and no clear video image of the suspects, CPD had few immediate leads. ATF offered to test the shell casings recovered from the crime scene for DNA and to expedite the analysis. Within two days, ATF provided CPD with full DNA profiles of several suspects The CPD agreed to ATF’s help, and within 2 days, they had DNA profiles of several suspects, evidence that ultimately contributed to the charging of four individuals for Officer Preston’s murder.[30]

[27] Interview with Denver CGIC staff, June 25, 2025.

[28] Interview with Denver CGIC staff, June 25, 2025.

[29] John Dodge, “Chicago Police Officer Areanah Preston Murder: A Timeline of the Case,” *CBS News Chicago*, May 10, 2023.

[30] Interview with Chicago Police Department staff, June 2, 2025; Chuck Goudie, Michelle Gallardo, Liz Nagy, and Christian Piekos, “Chicago police shooting: 4 charged with murder of Officer Areanah Preston,” May 11, 2023.

Resource Needs & Gaps

RESOURCE NEEDS & GAPS

Despite its demonstrated impact, touch DNA analysis of ballistic evidence remains very rare. The technique is time and resource-intensive, and most crime laboratories reserve it for a small fraction of gun homicide cases–often those with heightened public attention, such as the shooting of law enforcement officers, mass shootings, or other major incidents. While touch DNA analysis can yield crucial leads, resources and capacity remain significant barriers to its adoption and implementation at scale.

For the Denver CGIC to incorporate touch DNA into its processing of crime guns, it hired three new forensic scientists in 2019: two who were cross-trained in firearms, latent prints, and forensic biology; and one who was dedicated exclusively to DNA analysis. These new positions cost approximately $300,000 per year in total, and were initially funded by a grant from the National Institute of Justice's Forensic DNA Laboratory Efficiency Improvement and Capacity Enhancement Program. There are additional costs associated with ATF staff, firearms examiners, and triage detectives who contribute to and use intelligence obtained via touch DNA analysis; many of these costs are currently borne by the City of Denver. Again, the Denver CGIC currently performs touch DNA analysis on about 13% of its recovered crime guns. In order to fully test all recovered firearms, the Denver CGIC estimates it would need at least double or triple its current capacity.[31]

In June 2022, New York City established the nation's first dedicated DNA Gun Crimes Unit within the Office of Chief Medical Examiner (OCME), aiming to expedite the processing of DNA evidence from ballistic evidence.[32] With a $2.5 million investment of city funds, the initiative added 24 forensic scientists and upgraded laboratory technologies, achieving a reduction in testing turnaround times from 60 days to 30 days or less by May 2023. In the first year of its inception, the DNA Gun Crimes Unit performed analysis on about 3,300 guns.[33]

Other departments that rely on ATF for testing have been significantly limited in their ability to use touch DNA in connection to gun crimes, only obtaining the analysis for certain types of high-profile shooting (i.e. a shooting of a police officer or a mass shooting). "In an ideal world, we would use touch DNA on all firearm homicide and non-fatal shootings," said a senior officer in the Chicago

[31] Interview with Denver CGIC staff, June 25, 2025.

[32] Office of the Mayor of New York City, "Mayor Adams, Chief Medical Examiner Dr. Graham Announce Formation of Nation's First DNA Gun Crimes Unit," June 30, 2022.

[33] Michelle Taylor, "NYC Gun Crimes Lab Halves Turnaround Time to 30 Days," *Forensic Magazine*, June 27, 2023.

Police Department. "If we had the training and the tools more available to us, we could quickly shift our protocols to do it [touch DNA analysis] consistently."[34]

Existing resource and capacity limitations are likely to become even more pronounced in the coming years as ATF faces significant cuts to its budget. There is no specific line item for touch DNA analysis or laboratory services in ATF's annal budget requests, so there is no way to isolate and track expenditure on this technology over time.[35] However, ATF's budget request for fiscal year 2022 included $4.3 million for 29 new positions and additional equipment for the "initial development of a high-throughput, rapid-processing unit to analyze DNA from fired cartridge cases."[36] In March 2023, ATF announced plans to build a new $75 million forensic laboratory at Wichita State University, which is designed to expand touch DNA and NIBIN capacity, and is set to launch in early 2026.[37] And ATF's fiscal year 2025 budget requested $13.5 million for 30 new positions and other infrastructure related to expanded touch DNA capacity.[38] However, the Trump White House's 2026 budget proposal and the proposed House appropriations for Commerce, Justice, Science, and Related Agencies call for a steep reduction (approximately 25%) in ATF's operational funding, which would be the agency's lowest budget since 2016.[39] The final budget is still pending at the time of this report's publication, but with these proposed cuts, ATF's ability to staff new facilities for optimal analysis of forensic evidence is at risk.

In addition to its direct processing of touch DNA analysis, ATF has also played a significant thought leadership and technical assistance role in developing, validating, and disseminating methods. ATF has engaged in three main forms of knowledge dissemination: in-person training, scientific presentations and publications, and direct information sharing with requesting agencies. According to data provided to the Joyce Foundation, ATF held 16 in-person training sessions on Touch DNA analysis for law enforcement and forensic professionals across the US between 2016-2024. On average, these trainings reached about 100 attendees per session. Over this period of time, ATF also provided informational support to 18 states and DC when they requested assistance

[34] Interview with Chicago Police Department staff, June 2, 2025.

[35] ATF, "Budget & Performance," accessed October 8, 2025.

[36] ATF, "Fiscal Year 2022 Congressional Budget Submission," May 2021; ATF, "ATF to Establish New Field Office on Wichita State University Campus," November 2025.

[37] Samantha Boring, "ATF to bring new $75M forensic lab to Wichita State," *KSNW*, March 13, 2023.

[38] ATF, "Fiscal Year 2025 Performance Budget CJ/PB Submission," February 2024.

[39] Sarah Lynch, "White House seeks budget cuts for Justice Department law enforcement offices, sources say," *Reuters*, May 2, 2025; US Congress, "Overview of FY2026 Appropriations for Commerce, Justice, Science, and Related Agencies (CJS)," November 2025.

on touch DNA techniques.[40] This vital knowledge-sharing role is also at risk with proposed cuts to ATF's budget.

Threats to federal funding of ATF, the Department of Justice (DOJ), the National Institute of Justice (NIJ), and the Bureau of Justice Assistance (BJA) are stalling growth and even imperiling current levels of touch DNA use. "Right now the [federal] tap is shut off and we have to figure out other ways of handling things," said a senior staff member with the Denver Police Department's Forensics and Evidence Division. This makes state and local funding of touch DNA and other crime gun intelligence initiatives especially critical.

[40] ATF touch DNA data provided in March 2025.

Recommendations

RECOMMENDATIONS

The following recommendations are designed to expand and optimize the use of touch DNA in connection with ballistic evidence, and in concert with other tools in the crime gun intelligence toolkit.

FOR STATE AND LOCAL LAW ENFORCEMENT:

- Develop and implement standardized protocols for integrating touch DNA analysis into gun crime investigations, including:
  - Systematic collection of DNA from recovered firearms and fired shell casings as soon as possible after recovery.
  - Triage and prioritization frameworks that balance case severity, solvability, available capacity, and other factors.
  - Timely submission of DNA profiles to CODIS and other available databases for comparison with known offenders and crime scene profiles.
  - Clear processes for reporting CODIS hits (along with other crime gun intelligence leads) to investigating officers.
- Invest in technical infrastructure and workforce capacity to allow for in-house touch DNA analysis, especially in large agencies with high rates of unsolved gun crimes.
- Track and evaluate outcomes from touch DNA analysis (e.g. CODIS hits, charges filed, case resolutions) to demonstrate investigative value and justify further investment.

FOR FEDERAL POLICYMAKERS:

- Increase overall funding to ATF with specific investments in:
  - Expanded laboratory capacity for DNA analysis of ballistic evidence, with a particular focus on expanding access for agencies without in-house capabilities.
  - Sustained funding for the Wichita laboratory, which could serve as a national hub for both touch DNA and integrated crime gun intelligence.
  - Publication of anonymized aggregate data annually on the number of DNA submissions received, tested, and matched through CODIS to provide transparency and show impact.
- Expand grant programs through NIJ and/or BJA (such as the DNA Capacity Enhancement for Backlog Reduction program), with specific funding available for:
  - Touch DNA analysis of ballistic evidence;
  - Cross-disciplinary forensic training;
  - Capacity building in under-resourced or high-gun-violence jurisdictions.
- Fund research via NIJ that:
  - Rigorously evaluates the impact of touch DNA on gun crime investigations;

        - Develops best practices for integrating touch DNA, NIBIN, and gun tracing into a unified crime gun intelligence protocol.

FOR STATE AND LOCAL POLICYMAKERS:

- Increase direct investment in forensic laboratories (such as those made by the cities of New York and Denver), especially for jurisdictions with high rates of unsolved gun crimes that currently lack in-house capacity for touch DNA analysis. Funding should support:
    - Additional forensic biologists and lab technicians.
    - Updated equipment capable of recovering DNA from challenging surfaces like metals.
- Establish dedicated crime gun intelligence funding streams at the state level to supplement inconsistent federal grants and shield local labs from the volatility of federal appropriations.
- Create regional crime gun intelligence hubs where smaller jurisdictions can access touch DNA services, NIBIN stations, and firearms tracing through centralized resources.

CROSS-CUTTING RECOMMENDATIONS:

- Create a national task force to develop model policies and protocols for the integration of touch DNA into crime gun intelligence workflows.
- Include touch DNA in broader crime gun intelligence awareness and training for law enforcement, forensic professionals, prosecutors, and policymakers to lay the groundwork for increased demand and adoption.

Conclusion

CONCLUSION

Touch DNA analysis of ballistic evidence is another essential tool in the overall crime gun intelligence toolkit. Case examples from across the country demonstrate that this technology can yield critical investigative leads, directly link perpetrators to violent crimes, and contribute to successful prosecutions. Yet despite its demonstrated effectiveness, the widespread adoption and use of touch DNA remain limited by resource and capacity constraints at the federal, state, and local levels. Ensuring that touch DNA can reach its full potential will require sustained investment in forensic personnel, laboratory infrastructure, and standardized protocols for optimal use.

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