

COMMONWEALTH OF MASSACHUSETTS

SUFFOLK, SS.

SUPERIOR COURT DEPARTMENT

SUCR2014-10417

SUCR2015-10384

COMMONWEALTH

v.

AARON HERNANDEZ

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**COMMONWEALTH’S OPPOSITION TO THE DEFENDANT’S MOTION  
IN LIMINE TO EXCLUDE FIREARMS ANALYSIS TESTIMONY**

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Now comes the Commonwealth in the above-captioned matters and respectfully requests this Honorable Court deny the defendant’s motion to exclude the firearms analysis testimony. The evidence challenged by the defendant has already been found to be reliable and admissible. The “PCAST Report” does not contradict or undermine the validity of firearms and tool mark comparison testimony.

What is more, as of December 2, 2016, PCAST has invited submission of additional scientific reports and literature, and “PCAST plans to review the findings of its Report in light of the additional relevant information.” (*See* attached letter authored by Eric Lander, Co-Chair of PCAST). Indeed, the litany of academic and peer-reviewed research unequivocally supports the validity of firearm and tool mark comparison and forensic evidence. A list of these publications compiled by the Association of Firearm and Tool Mark Examiners (“AFTE”) is attached as Appendix A, and available at: <https://afte.org/resources/swggun-ark/testability-of-the-scientific-principle>.

Based on this comprehensive research and the controlling precedent established in *Commonwealth v. Heang*, 458 Mass. 827 (2011), this Court should also deny the defendant’s request that the Commonwealth “prove with independent black box studies the validity of any firearms analysis and its studies in this case in a *Daubert* hearing”

(D. Memo at p. 21). Likewise, there is no question of unsettled law to be reported to the Appeals Court, pursuant to Mass. R. Crim. P. 34. Accordingly, this Court should deny the defendant's motion, and upon proper foundation and within the constraints of *Heang*, allow the Commonwealth to present firearms analysis and tool mark comparison testimony.

### **PROCEDURAL HISTORY AND RELEVANT FACTS**

#### **I. The Homicides of Daniel Abreu and Safiro Furtado in Boston**

On July 16, 2012, around 2:30 a.m., the defendant shot and killed two men and injured a third as the victims were stopped at the intersection of Shawmut Avenue and Herald Street in Boston. The driver, 29-year-old Daniel de Abreu, suffered fatal gunshot wounds to the chest. The front seat passenger, 28-year-old Safiro Furtado, suffered fatal gunshot wounds to the head. Two backseat passengers escaped without injury, and a third backseat passenger, Aquilino Freire, suffered a non-life threatening gunshot wound to his arm. The two deceased victims were pronounced at the scene, and Freire was transported to Tufts Medical Center.

The following ballistic evidence was recovered from the scene, victims' bodies during the autopsy, Tufts, and the victims' BMW:

- Item (5) - bullet from BMW
- Item (7) - bullet jacket from BMW
- Item (9) - bullet fragment from BMW
- Item (15) - bullet from Furtado
- Item (16) - bullet fragments from Furtado
- Item (27) - bullet from Freire
- Item (52) - bullet fragments from Abreu

On August 6, 2012, Detective Tyrone Camper determined that the four recovered bullets (Items 5, 7, 15, and 27) were fired from the same firearm based on sufficient agreement of class and individual characteristics of the land impression marks.

## **II. The .38 Caliber Revolver is Recovered in Longmeadow**

On June 21, 2013, the Massachusetts State Police responded to a radio call for a motor vehicle accident on I-91 in Longmeadow, Massachusetts. One vehicle involved in the accident was a red 2012 Toyota Camry, operated by Jailene Diaz-Ramos. The vehicle was towed and, pursuant to an inventory search, the State Police located an unlocked briefcase in the trunk that contained an unloaded Smith & Wesson .38 caliber special revolver and loose rounds of .38 caliber ammunition.

Diaz-Ramos was close friends with John Alcorn (aka “Chicago”) who was a semi-professional football player. Chicago’s cousin was T.L. Singleton who was married to the defendant’s cousin, Tanya Cummings-Singleton.<sup>1</sup> The silver 2006 Toyota 4-Runner, a promotional vehicle that was leased to the defendant and used the night of the homicides, was recovered in June 2013 at the Singletons’ residence at 114 Lake Avenue, in Bristol, Connecticut.

## **III. The Firearms Analysis and Comparisons**

On June 28, 2013, Boston Police homicide detectives obtained the .38 caliber revolver and ammunition, and projectiles that the State Police had test-fired from the weapon. That same day, Detective Tyrone Camper utilized a comparison microscope and compared one test-fired projectile with one bullet recovered from the homicide (Item 5). Detective Camper determined that the two projectiles had been fired from the same weapon.

Thereafter, in March 2015, Detective Camper test-fired the .38 caliber revolver and conducted further comparison analysis. He compared the four recovered bullets (Items 5, 7, 15, and 27) with his test-fires and determined that all of the projectiles were fired from the .38 caliber revolver.

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<sup>1</sup> T.L. Singleton and Tanya Cummings-Singleton are both deceased.

## **ARGUMENT**

### **I. THE PCAST REPORT DOES NOT AFFECT THE ADMISSIBILITY OF BALLISTIC EVIDENCE IN THE COMMONWEALTH.**

Forensic ballistics testimony has long been deemed admissible in the Commonwealth. *Commonwealth v. Heang*, 458 Mass. 827, 845 (2011), citing *Commonwealth v. Giacomazza*, 311 Mass. 456, 471 (1942); *Commonwealth v. Millen*, 289 Mass. 441, 483 (1935). *See also Commonwealth v. Best*, 180 Mass. 492, 495-496 (1902) (decision by Chief Justice Oliver Wendell Holmes was “the first in the nation to uphold the admissibility of forensic ballistic evidence in the form of expert testimony and comparison photographs”); *Commonwealth v. Meeks*, SUCR2002-10961, (Brassard, J., dated September 28, 2006) (following a ten-day evidentiary hearing, the Court concluded “[t]he theory and process of firearms identification are generally accepted and reliable, and the process [had] been reliably applied in these cases”).

First, the PCAST Report -- by its own admission -- does not preclude admission of ballistic and tool mark comparison evidence. The PCAST Report states:

Whether firearms analysis should be deemed admissible based on current evidence is a decision that belongs to the courts. If firearms analysis is allowed in court, the scientific criteria for validity as applied should be understood to require clearly reporting the error rates seen in appropriately designed black-box studies (estimated at 1 in 66, with a 95 percent confidence limit of 1 in 46, in the one such study to date).

PCAST Report at p. 12, 112.

Second, the PCAST Report does not present any new findings or criticisms of forensic ballistic evidence. The defendant’s claim (D. Memo. at p. 5) that “PCAST has concluded that there are no validity studies behind this long accepted firearm testimony” is wholly false. The PCAST Report heavily relied on two National Research Council Reports: (1) National Research Council, *Ballistic Imaging* (2008) (“NRC Report, 2008”); and (2) National Research Council, *Strengthening Forensic Science in the United States: A Path Forward* (2009) (“NRC Report, 2009”). These studies challenged the accuracy

and reliability of forensic ballistic evidence. The PCAST Report echoes those concerns, but does not bring to light any new studies or data. The Supreme Judicial Court recognized and discussed both NRC Reports in the *Heang* decision -- and determined that forensic ballistic testimony satisfied the *Daubert-Lanigan* factors. *See Heang*, 458 Mass. at 837-839, 842-844. The SJC found:

Although the [2008] NRC report called into question the exactitude with which a forensic ballistics expert could declare a ‘match,’ there was no evidence before the judge suggesting that firearms examiners could not assist the jury by using their technical expertise to observe and compare toolmarks found on projectiles and cartridge cases.

*Id.* at 845.

The PCAST Report cites the “Ames Laboratory Study” as an appropriate “black-box” study. *Id.* at pp. 110-111. This study supports the validity and reliability of forensic ballistic comparison evidence – and reported an error rate of 1.5%. Again, PCAST does not challenge the principle that ballistic evidence can be compared, rather it calls for additional studies. Similarly, the PCAST Report acknowledged “examiners can, under some circumstances, associate ammunition with the gun from which it was fired” (p. 111). *See United States v. Chester*, Docket No. 1:13-CR-00774 (N.D. Ill. 2016) (“[T]he report does not dispute the accuracy or acceptance of firearm tool mark analysis within the courts. Rather, the report laments the lack of scientifically rigorous ‘black-box’ studies needed to demonstrate the reproducibility of results, which is critical to cementing the accuracy of the method”). As this Court recently held in *Commonwealth v. Legore*, SUCR2015-10363, “Ruling and Order on Defendant’s Motion for Daubert/Lanigan Hearing on Admissibility of Firearms” (Locke, J., dated Nov. 16, 2016), the PCAST Report does not provide grounds “to disturb settled law permitting a properly qualified firearms expert from offering opinion evidence under Mass. G. Evid. § 702.”<sup>2</sup>

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<sup>2</sup> A copy of these decisions are included at Appendix B.

Third, the PCAST group did not include practitioners or “adequately consider the numerous research studies that support the validity of firearm and tool mark forensics, including one of the most recent research studies on the topic.” *See* Bureau of Alcohol, Tobacco, Firearms and Explosives Official Statement, ATF Response to the PCAST Report (Sept. 21, 2016); *see also* American Congress of Forensic Science Laboratories (ACFSL), Position Statement re The 2016 PCAST Report (Sept. 21, 2016); American Society of Crime Laboratory Directors, Inc. (ASCLD), Statement on September 20, 2016 PCAST Report on Forensic Science (Sept. 30, 2016); Association of Firearm and Tool Mark Examiners (AFTE), Response to PCAST Report on Forensic Science (Oct. 31, 2016).<sup>3</sup> The PCAST Report also improperly discounted one recent study: Smith, T.P., Smith, G.A., and J.B. Snipes, “A validation study of bullet and cartridge case comparisons using samples representative of actual casework,” *Journal of Forensic Sciences*, Vol. 61, No. 4 (2016): pp. 939-946, was designed to produce a usable error rate based on casework. This study also attempted to quantify whether there was any relationship between an examiner’s years of experience and performance in identification. The PCAST Report is critical of this study because it was a “within-set” study, not a “black-box” study. *See* PCAST Report at p. 111-112, n.335.

Fourth, the defendant claims (without reference to any authority) that firearms comparison evidence “may not be admitted into evidence before a jury until and unless its scientific reliability in this matter has been independently validated by third parties in black box studies, published and properly submitted to the scientific rigors of true scientific disciplines” (D. Memo. at p. 15). Yet, this is not the well-established standard for admissibility of expert opinion testimony set forth in *Daubert*, *Lanigan* and their progeny. The PCAST Report does not -- and cannot -- set a new legal standard for admissibility. As this Court recently found, “The Report recommends, however, that if

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<sup>3</sup> A copy of these publications and statements are included at Appendix C.

such evidence is admitted, it should be accompanied by testimony regarding the known error rates as found in the Ames Laboratory's 'black-box' study." *Legore*, at p. 4. Thus, the Commonwealth will elicit this testimony on direct examination -- and, of course, the criticisms that the PCAST Report acknowledged (subjectivity and lack of peer-reviewed, black box studies) are fodder for cross-examination.

Accordingly, the PCAST Report does not affect the admissibility of forensic ballistic evidence in the Commonwealth. This evidence satisfies the *Daubert-Lanigan* requirements and is admissible at trial pursuant to the guidelines set out in *Heang*. The Commonwealth respectfully requests this Honorable Court deny the defendant's motion *in limine* to exclude the ballistic comparison evidence, deny the request for a *Daubert-Lanigan* hearing as such evidentiary hearing is unnecessary, and decline to report any questions to the Appeals Court, as there are no unsettled questions of law.

Respectfully Submitted  
For the Commonwealth,

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Dated: December 2, 2016

Dear National District Attorneys Association,

In September 2016, the President's Council of Advisors on Science and Technology (PCAST) released its Report to the President on "*Forensic Science in the Criminal Courts: Ensuring Scientific Validity Of Feature-Comparison Methods.*" See [https://www.whitehouse.gov/sites/default/files/microsites/ostp/PCAST/pcast\\_for\\_ensic\\_science\\_report\\_final.pdf](https://www.whitehouse.gov/sites/default/files/microsites/ostp/PCAST/pcast_for_ensic_science_report_final.pdf).

As a follow-up to this work, PCAST invites you to reply by Wednesday, December 14 to the following request:

(1) Please identify any relevant scientific reports that (i) have been published in the scientific literature, (ii) were not mentioned in the PCAST report; and (iii) describe appropriately designed, research studies that provide empirical evidence establishing the foundational validity and estimating the accuracy of any of the following forensic feature-comparison methods, as they are currently practiced:

- (a) DNA analysis of mixed samples with three or more contributors, in which the contributor in question represents less than 20% of the sample.
- (b) Bitemark analysis.
- (c) Firearms analysis to associate ammunition with an individual gun (as opposed to analysis to identify class characteristics).
- (d) Footwear analysis to associate an impression with an individual item of footwear (as opposed to analysis to identify class characteristics).
- (e) Hair analysis.

(2) Please indicate how the scientific reports establish foundational validity and estimate the accuracy of the relevant method.

PCAST plans to review the findings of its Report in light of the additional relevant information.

Please send replies to [pcast@ostp.eop.gov](mailto:pcast@ostp.eop.gov) by December 14, 2016.

Sincerely,

Eric Lander  
Co-Chair, PCAST



**APPENDIX A: List of Published Studies, with brief summary, available at**  
**<https://afte.org/resources/swggun-ark/testability-of-the-scientific-principle>**

(The studies are categorized and listed alphabetically, with the studies published after the NAS Report on February 18, 2009, **highlighted in bold**)

## **FIREARM IDENTIFICATION - BULLETS**

Bachrach, B., "Development of a 3D-Based Automated Firearms Evidence Comparison System", *Journal of Forensic Sciences*, Vol. 47(6), November 2002, pp. 1253-1264.

This study reports on a computerized system that calculates correlation coefficients for comparisons of bullet striation patterns using generated 3-D maps of bullet surfaces. Was validated using known matches (KMs) and known non-matches (KNMs), so therefore the system arrives at a conclusion of identification (or not), with an associated probability of error. Highly relevant to our work, because shows conclusively that an objective observer (a machine) detects significant visual differences between KNMs and KMs.

Biasotti, A. A., "A Statistical Study of the Individual Characteristics of Fired Bullets", *Journal of Forensic Sciences*, Vol. 4(1), January 1959, pp. 34-50.

Validity study in which no more than three consecutively matching striations (CMS) were found on lead bullets fired from different guns and no more than four CMS were found on jacketed bullets fired from different guns.

Brown, C., Bryant, W., "Consecutively Rifled Gun Barrels Present in Most Crime Labs", *AFTE Journal*, Vol. 27, No. 3, July 1995, pp. 254-258.

Study of multi-barreled derringers in which it was assumed that barrels were rifled consecutively. One set of derringer test fires showed some good correspondence in the groove impressions (gross marks), but showed little correspondence in the land impressions.

Brundage, D. J. "The Identification of Consecutively Rifled Gun Barrels", *AFTE Journal*, vol. 30(3), Summer, 1998, pp. 438-444.

Validation study in which ten consecutively broach rifled pistol barrels produced by Ruger were used to test the fundamental claim that qualified examiners will rarely, if ever, commit false identifications or false eliminations. Thirty examiners were given the test nationwide and no misidentifications were made.

Bunch, S. G. "Consecutive Matching Striation Criteria: A General Critique", *Journal of Forensic Sciences*, vol. 45 (5), Sept. 2000, pp. 955-962.

This paper critiques the Consecutive Matching Striation (CMS) approach to toolmark identification. The author discusses the practical and theoretical weaknesses of the approach, argues that it demands a statistical/probabilistic treatment of results - such as the use of Bayesian likelihood ratios - and also suggests much additional research is needed.

**Chu, et al, "Automatic Identification of Bullet Signatures Based on Consecutive Matching Striae (CMS) Criteria", Forensic Science International, 231, 2013, Pp. 137-141.**

**Study of fired bullet markings from ten consecutively manufactured firearm barrels by an automated 3D signature analytic method. This study used 3D topography image capture technology with acquisitions that were cross correlated to existing firearm Consecutive Matching Striae (CMS) identification criteria. Results provided a fairly objective test that demonstrated support for these firearm CMS criteria.**

**Chu, Tong and Song, "Validation Tests for the Congruent Matching Cells (CMC) Method Using Cartridge Cases Fired with Consecutively Manufactured Pistol Slides", AFTE Journal, Volume 45, Number 4, Fall 2013, pp. 361-366.**

**Study of ten consecutively manufactured slides using 3D topography technology with correlations of paired breech marking correlation cells to establish firearm identifications. Test results showed significant separation between KM and KNM distributions without any false positive or false negative identification.**

**DeFrance, C. S., VanArsdale, M., "Validation Study of Electrochemical Rifling", AFTE Journal, vol. 35 (1), Winter, 2003, pp. 35-37.**

**Validation study in which nine examiners participated in the comparison of bullets from electrochemically rifled barrels produced by Smith & Wesson. No misidentifications were made.**

**Fadul, T. G., "An Empirical Study to Evaluate the Repeatability and Uniqueness of Striations/Impressions Imparted on Consecutively Manufactured Glock EBIS Gun Barrels", AFTE Journal, Volume 43, Number 1, Winter 2011, Pp. 37-44.**

**An empirical study of ten consecutively manufactured Glock barrels containing the Enhanced Bullet Identification System (EBIS). Study consisted of test sets sent to 238 examiners from 150 laboratories in 44 states and 9 countries that were designed to test the examiner's ability to correctly identify fired bullets to the barrel that fired them. The results from 183 of these examiners produced an error rate of 0.4%. This study validated the repeatability and uniqueness of striated markings in gun barrels, as well as the ability of a competent examiner to reliably identify fired bullets to the barrels that marked them.**

Freeman, R. A., "Consecutively Rifled Polygon Barrels", AFTE Journal, vol.10 (2), June 1978, pp.40-42.

This study documents the comparison of bullets fired through three consecutively manufactured polygon barrels produced by H&K for the Model P9S pistol. It was found that the bullets fired from these barrels could easily be identified to the correct barrel. Additionally, these barrels possessed a fluted chamber. Marks from the fluted chambers were visible on the bullets and could also be used for identification.

Hall, E. "Bullet Markings from Consecutively Rifled Shilen DGA Barrels", AFTE Journal, vol. 15(1), Jan., 1983, pp. 33-53.

Study of consecutively button rifled polygonal style barrels. Conclusion implies that there should be no risk of misidentification.

**Hamby J. E., Brundage D. J. , Thorpe J. W., "The Identification of Bullets Fired from 10 Consecutively Rifled 9mm Ruger Pistol Barrels: A Research Project Involving 507 Participants from 20 Countries", AFTE Journal, Volume 41, Number 2, Spring 2009, pp. 99-110.**

**Bullets fired from ten (10) consecutively manufactured barrels were correctly identified to the respective barrel that fired them by five hundred-seven (507) firearm examiners from twenty (20) countries. This study validates the underlying theory that: 1) there are identifiable features imparted by a gun on the surfaces of fired bullets that 2) enable a competent firearms examiner to accurately and reliably link them to the barrel that fired them.**

**Intelligent Automation, Incorporated, "A Statistical Validation of the Individuality of Guns Using High Resolution Topographical Images of Bullets", National Institute of Justice Grant #2006-DN-BX-K030, October, 2010**

**Study of marks on fired bullets by a topography based (3D) automated system. This study continued the analysis of a previous 2005 NIJ bullet study and validated the original premise of Firearm/Toolmark ID. This study also concluded that 1) the ability to determine that a given bullet was fired from a specific barrel depends on the individual barrel itself and not only on the brand of its manufacture, and 2) the performance of the automated analysis system used in this study is not representative of that of a trained firearms examiner as humans have a remarkable ability to perform pattern matching that is difficult to be replicated in any automated system.**

Lomoro, V. J., "Class Characteristics of 32 SWL, FIE Titanic Revolvers", AFTE Journal, vol. 6 (2), 1974, pp. 18-21.

This paper points out the pitfalls of basing an identification on the groove impressions on bullets fired from F.I.E. Titanic Revolvers. Bullets from three different guns were shown to have agreement in the groove impressions, but were found to differ significantly in the land impressions.

Lutz, M., "Consecutive Revolver Barrels", AFTE Newsletter #9, Aug., 1970, pp.24-28.

Reported results of the comparison of jacketed and lead bullets fired from two consecutively rifled barrels and that the markings on the bullets were identifiable and unique to the barrel that fired them.

Matty, W., "A Comparison of Three Individual Barrels Produced from One Button-Rifled Barrel Blank", AFTE Journal, vol. 17(3), July, 1985, pp. 64-69.

Study of the uniqueness of marks produced on bullets fired from three barrels that were produced from the same rifled barrel blank. Subclass characteristics noted in the groove impressions, but not in the land impressions. Study also notes that over the first few firings that the striations on the bullets change significantly.

Miller, J., "An Examination of Two Consecutively Rifled Barrels and a Review of the Literature", AFTE Journal, vol. 32 (3), Summer, 2000, pp.259-270.

Study in which bullets were pushed through two consecutively broached .44 caliber barrels and were examined using Biasotti/Murdock conservative CMS criteria for identifications. No misidentifications.

Miller, J., "Criteria for Identification of Toolmarks, Part II: Single Land Impression Comparisons", AFTE Journal, vol. 32 (2), Spring, 2000, pp. 116-131.

This study compares bullets fired by Raven 25 Auto, Lorcin 380 Auto, and Stallard Arms 9mm pistols to specimens in the NIBIN database. This study supports the Biasotti/Murdock conservative criteria.

Miller, J., "An Examination of the Application of the Conservative Criteria for Identification of Striated Toolmarks Using Bullets Fired from Ten Consecutively Rifled Barrels", AFTE Journal, vol. 33 (2), Spring, 2001, pp. 125-132.

Using the bullets from the Brundage Ruger ten barrel test the author 1) identified some very minor subclass characteristics but not sufficient to cause a misidentification 2) applied the conservative CMS criteria which resulted in no misidentifications.

Miller, J., McLean M., "Criteria for Identification of Toolmarks", AFTE Journal, vol. 30 (1), 1998, pp.15-61.

Using IBIS, the authors compared land impressions of .38 Special jacketed bullets fired from S&W revolvers. Found no CMS counts greater than six (6) for KNMs, using the computer monitor. Using a separate set of testfires and the comparison microscope, no CMS counts greater than four (4) for KNMs were found.

Murdock, J. E., "A General Discussion of Gun Barrel Individuality and an Empirical Assessment of the Individuality of Consecutively Button Rifled .22 Caliber Rifle Barrels", AFTE Journal, vol. 13 (3), 1981, pp. 84-95.

This study discusses rifling methods, including the "new", method of button rifling. Examination of nine barrels (three consecutively rifled barrels from three manufacturers) and test fired bullets from each indicated no subclass characteristics. First two bullets fired from each barrel could not be identified to each other which is indicative of rapid change in barrel interior, which in turn confirms individuality of barrels.

Skolrood, R. W., "Comparison of Bullets fired from Consecutively Rifled Cooney .22 calibre Barrels", Canadian Society of Forensic Science, vol. 8(2), 1975, pp. 49-52.

This paper discusses the potential for broaches to produce reproducible gross marks and that examiners should be wary of these gross marks.

Smith, E., "Cartridge Case and Bullet Comparison Validation Study with Firearms Submitted in Casework", AFTE Journal, vol. 37 (2), Spring 2005, pp. 130-135.

This validation study was designed to test the accuracy of examinations by trained firearms examiners who use pattern recognition as a method for identification. Eight FBI examiners took the test which consisted of both bullets and cartridge cases. No false positives or false negatives were reported.

Tulleners, F., Guisto M., "Striae Reproducibility on Sectional Cuts of One Thompson Contender Barrel", AFTE Journal, vol. 30(1), 1998, pp. 62-81.

For this study, a Thompson Center Contender button rifled barrel was sectioned one inch at a time after each test firing. A total of six sections were removed from the barrel. Each sections bullets were compared each other to see how much the CMS count had changed. Striae on the bullets were found to be significantly altered from one barrel section to the next. The results obtained from adjacent barrel sections were apparently comparable to the results Biasotti obtained from different, uncut barrels.

Tulleners, F., Hamiel J., "Sub Class Characteristics of Sequentially Rifled .38 Special S&W Revolver Barrels", AFTE Journal, vol. 31 (2), 1999, pp. 117-222.

This article discusses the potential for sub-class characteristics in S&W revolver barrels. The article points out that, examiners should be careful when examining the groove impressions on fired bullets from broach rifled barrels.

## **FIREARM IDENTIFICATION - CARTRIDGE CASES**

**Hamby, J., Norris, S., and Petraco, N., "Evaluation of GLOCK 9 mm Firing Pin Aperture Shear Mark Individuality Based on 1,632 Different Pistols by Traditional Pattern Matching and IBIS Pattern Recognition", Journal of Forensic Science, Volume 61, #1, January 2016, pp. 170-176.**

**Expanded cartridge case comparison study, combining previous research (see Hamby and Thorpe, 2009) with newly examined cartridge cases, involving a total of 1,632 different 9 mm Glock pistols. There were no misidentifications with use of conventional pattern comparison (optical microscopy) nor with electronic imaging technology. These empirical findings were used to establish a Bayesian probability model, estimating that the random chance of two different Glock 9mm pistols creating the same aperture shear mark is less than .0001%. These results further validate the premise of individualization and support the hypothetical proposition that a competent firearm and toolmark examiner can correctly distinguish the firearm that fired an ammunition component.**

**Baldwin, D.P., Bajic, S.J., Morris, M., and Zamrow, D., "A Study of False-Positive and False-Negative Error Rates in Cartridge Case Comparisons", Ames Laboratory, USDOE Technical Report #IS-5207, April 7, 2014.**

**Conducted empirical study on fired cartridge cases designed to measure individual examiner false identifications and false eliminations when comparing an unknown specimen to a collection of three known fired cartridge cases. These comparison results were not subjected to respective laboratory QA verification or peer review processes. Two hundred eighteen (218) firearm examiners, the majority of whom who were AFTE members or worked at accredited forensic laboratories, responded to this study with the following results using a 95% confidence interval:**

**False Positives= 1.01% (Note: 20 of 22 false identifications were made by the same five examiners)**

**False negatives= 0.367% (Note: 2 of 4 false negatives were made by a single examiner; 215 of 218 examiners made no false elimination calls)**

**Maximum Likelihood Estimator= 0.939%.**

**Results reflect averaged error rates of individual participants, and did not include QA/QC checks employed by many laboratories that may have reduced published error rates. The study revealed that the majority of participating examiners did not make false identification or elimination calls. Inconclusive results were not treated as errors.**



Bunch, S. G., Murphy D., "A Comprehensive Validity Study for the Forensic Examination of Cartridge Cases", AFTE Journal, vol. 35 (2), Spring 2003, pp. 201-203.

This validity study used 10 consecutively manufactured Glock slides to test the proposition that qualified examiners rarely or never commit false positive or false negative errors in cartridge cased exams. FBI examiners participated in this blind study. False positive and false negative rates were 0%.

Coffman, B. C., " Computer Numerical Control (CNC) Production Tooling and Repeatable Characteristics on Ten Remington Model 870 Production Run Breech Bolts", AFTE Journal, Volume 35, Number 1, Winter 2003, pp. 49-54.

Ten shotgun bolt faces, consecutively produced by the same CNC manufacturing machine tool, were examined and compared for the presence subclass and individual characteristics. Results of these comparisons found that the manufacturing process used to fabricate these bolts produced subclass characteristics and sufficient individual characteristics to provide uniqueness.

Coody, A. C., "Consecutively Manufactured Ruger P-89 Slides", AFTE Journal, Volume 35, Number 2, Spring 2003, pp. 157-160.

Ten consecutively produced pistol slide breechfaces were examined and compared for the presence subclass and individual characteristics. Results of these comparisons found that the manufacturing processes used to fabricate these breechfaces produced subclass characteristics and sufficient individual characteristics to provide uniqueness.

**Fadul, et al, "An Empirical Study to Improve the Scientific Foundation of Forensic Firearm and Tool Mark Identification Utilizing Ten (10) Consecutively Manufactured Slides", AFTE Journal, Volume 45, Number 4, Fall 2013, pp. 376-389. Reprint- See next citation for original publication.**

**Empirical study of marks produced from 10 consecutively Ruger brand manufactured pistol slides by 217 firearm examiners from 46 states and the District of Columbia. Results of this study established an error rate of less than 0.1%, and validated toolmark durability as these slides maintained their individual signature after multiple firings.**

**Fadul, T. G., et al, "An Empirical Study to Evaluate the Repeatability and Uniqueness of Striations / Impressions in Fired Cartridge Casings Fired in 10 Consecutively Manufactured Slides", National Institute of Justice, Office of Justice Programs, US Department of Justice Project Award No. 2009-DN-BX-K230.**

**Empirical study designed to improve the understanding of the accuracy, reliability, and measurement validity in the firearms and toolmark discipline of forensic science.**

**158 test sets of cartridge cases fired in ten consecutively made Ruger slides were distributed to 281 examiners in 46 states including the District of Columbia. The test sets were designed to determine an examiner's ability to correctly identify the source of the fired cartridge cases.**

**217 examiners participated in this study and their results in this empirical study established an error rate of less than 0.1%.**

Gouwe J., Hamby J. E., Norris, S., "Comparison of 10,000 Consecutively Fired Cartridge Cases from a Model 22 Glock .40 S&W Caliber Semiautomatic Pistol", AFTE Journal, Volume 40, Number 1, Winter 2008, pp. 57-63.

Ten thousand (10,000) .40 S&W caliber cartridge cases fired from a Glock, model 22, pistol were compared. All 10,000 fired cases could be identified to each other. This study validates previous durability studies that showed identifiable markings from a tool could persist for a long period of time.

Grooss, K. D., "The 'Hammer-Murderer'", AFTE Journal, vol. 27 (1), 1995, pp. 27-30.

An actual murder case in Germany that in effect comprised a blind test of both examiner skill and theoretical validity for cartridge case comparisons. A police officer was suspected of murder, but the lack of clues led to all Walther P5 pistols issued to police in Germany being test fired and compared to the evidence cartridge cases at the BKA lab. An identification occurred with a test-fired cartridge case from the 3704th pistol. Almost simultaneous events elsewhere proved this conclusion to be accurate. No false identifications occurred.

**Hamby J., and Thorpe J., "The Examination, Evaluation and Identification of 9mm Cartridge Cases Fired from 617 Different GLOCK Model 17 & 10 Semiautomatic Pistols", AFTE Journal, Volume 41(4), Fall 2009, Pp. 310-324.**

**Study of cartridge cases fired from 617 different Glock pistols were conducted utilizing conventional comparative optical microscopy and electronic imaging technology to test the premise of individualization in FA/TM ID. Results of this study validated not only the premise of individualization but also the hypothetical proposition that a competent firearm and toolmark examiner can correctly identify the firearm that fired an ammunition component without committing a misidentification.**

Kennington, R., "Identification of Cartridge Cases Fired in Different Firearms: "Pre-Identified Cartridges"", AFTE Journal, vol. 31(1), 1999, pp. 15-19.

This research discusses the pitfall that toolmarks produced during the manufacturing process of ammunition components pose and that one should be mindful that these marks exist.

**LaPorte, D., "An Empirical Validation Study of Breechface Marks on .380 ACP Caliber Cartridge Cases Fired from Ten Consecutively Finished Hi-Point Model C9 Pistols", AFTE Journal, Volume 43, Number 4, Fall 2011.**

**Empirical and validation studies of ten consecutively manufactured Hi-Point pistol breechfaces determined that the manufacturing process imparted individual characteristics that enable a competent firearms examiner to reliably identify a questioned cartridge case to the firearm in which it was fired.**

Lardizabal, P., "Cartridge Case Study of the HK USP", AFTE Journal, vol. 27 (1), Jan., 1995, pp. 49-51.

This study examined two consecutively manufactured H&K 40 S&W caliber USP breechfaces along. Subclass characteristics were identified on the breechface impressions. Test fired bullets from three H&K barrels were also examined and little correspondence was found between signatures from bullets fired from different barrels.

Lopez, L., Grew S., "Consecutively Machined Ruger Bolt Faces", AFTE Journal, vol. 32 (1), 2000, pp. 19-24.

This study warns that one should be careful with microscopic marks from a boltface machined with an end mill. Misidentification possible unless ID on wear or machining "chatter" marks.

**Lyons, D. J., "The Identification of Consecutively Manufactured Extractors", AFTE Journal, Volume 41, Number 3, Summer, 2009, pp.246-256.**

**Study conducted on ten consecutively manufactured firearm extractors. Firearm and toolmark examiners from different laboratories were given ten sets of cartridge cases marked by these extractors to attempt to make the correct associations between the known and unknown cases. Each examiner also received twelve unknown marked cases in addition to the standards for the ten consecutively manufactured cartridge cases, with each known specimen having at least one unknown specimen associated with it.**

**Study showed that extractors could be distinguished from each other despite that they were consecutively manufactured.**

Matty, W., "Raven .25 Automatic Pistol Breech Face Tool Marks", AFTE Journal, vol. 16 (3), 1984, pp. 57-60.

For this study, three consecutively made breechfaces from Raven pistols were compared. The concentric toolmarks on the breechfaces were found to be individual and not subclass.

Matty, W., Johnson T., "A Comparison of Manufacturing Marks on Smith & Wesson Firing Pins", AFTE Journal vol. 16 (3), 1984, pp. 51-56.

This study examined the concentric marks produced by Smith & Wesson firing pins. Subclass characteristics were found. These subclass marks are a result of the lathe mounted cutter being much harder than the firing pins and thus marks can be reproduced; however, using the areas of the firing pins that show wear can be used for identification.

**Mayland and Tucker, "Validation of Obturation Marks in consecutively Reamed Chambers", AFTE Journal, Volume 44, No. 2, Spring, 2012, pp.167-169.**

**Study of fired cartridge cases from ten consecutively manufactured firearms was conducted to determine the reproducibility and reliability of obturation marks from reamed chambers for identification purposes. Results of this empirical study, which consisted of sixty-four (64) participants from nineteen (19) national laboratory systems, effected a sensitivity rating of 0.927.**

**These results demonstrate that obturation markings imparted on fired cartridge cases can be used as a reliable means of identification to the firearm that marked them.**

**Petraco D. K., et al, "Application of Machine Learning to Toolmarks: Statistically Based Methods for Impression Pattern Comparisons", NIJ/NCJRS Document #239048, Award #2009-DN-BX-K041, July 2012**

**Statistical study using 3D quantitative surface topographies of toolmarks, consisting of fired cartridge cases, screwdriver and chisel striations, by confocal microscopy. Principal component and canonical variate analysis, as well as support vector machine methodology, was used to objectively associate these toolmarks with the tools that produced them. Estimated toolmark identification error rates were approximately 1% using these algorithmic methods. The findings of this objective and quantitative scientific research support the general conclusions codified in the AFTE Theory of Identification.**

Rosati, C., "Examination of Four Consecutively Manufactured Bunter Tools", AFTE Journal, vol. 32 (1), 2000, pp. 49-50.

For this study, four bunters produced by Electrical Discharge Machining (EDM) used by Remington for .45 Auto cartridge case manufacture were used to determine if this process was random in nature. Confirms random nature of marks from EDM process on headstamp characters.

**Saribey, A. Y., Hannam A. G., Tarimci C., "An Investigation into Whether or Not the Class and Individual Characteristics of Five Turkish Manufactured Pistols Change During Extensive Firing", Journal of Forensic Sciences, Volume 54, Number (5), September 2009, Pp.1068-1072.**

**Conducted statistical durability study of fired cartridge cases from five different pistols. Each pistol had at least 1000 cartridge cases fired in them with every 250th case compared to the first fired case. Although there were noted changes in individual and some class characteristics, these wear changes were not statistically significant based on standard deviation measurements. This study statistically validated previous durability studies.**

**Stroman, A., "Empirically Determined Frequency of Error in Cartridge Case Examinations Using a Declared Double-Blind Format", AFTE Journal, Vol. 46, No. 2, Spring 2014, Pp. 157-175.**

**No gun empirical study of fired cartridge cases to determine the frequency of error in firearms identification using a declared double-blind testing format; i.e., a declared test containing blind elements. Seventy-four of seventy-five examiners accurately identified the questioned fired cartridge cases to the respective known specimens with no false positives. This study also demonstrated that examiners were able to accurately evaluate breechface markings avoiding misidentifications from substantial subclass marks contained cartridge cases.**

Thompson, E., "Phoenix Arms (Raven) Breechface Toolmarks", AFTE Journal, vol. 26 (2), 1994, pp. 134-135.

This is a follow-up study of the Matty article on Raven breechfaces. Four breechfaces from Phoenix pistols (formerly Raven) were compared to determine the nature of their marks. As in the Matty article the breechfaces were found to possess unique identifying marks.

Thompson, E., "False Breechface ID's", AFTE Journal, vol. 28 (2), April, 1996, pp. 95-96.

This study examines the manufacturing process of Lorcin pistol breechfaces. Of noteworthiness is the fact that Lorcin breechfaces are stamped and then painted over not machined. False identifications could be possible if the only marks considered are from the breechface. Also noted was the fact that paint on breechfaces has a tendency to chip off and that one should not solely rely on the breechface impression as a means for identification.

**Thompson, R., Song J., Zheng A., and Yen J. "Cartridge Case Signature Identification Using Topography Measurements and Correlations: Unification of Microscopy and Objective Statistical Methods", National Institute of Standards and Technology, Presented at the 18th European Network of Forensic Science Institutes (ENFSI) Conference, Lisbon, Portugal, October, 2011**

**A comparison microscope employing the standard optical comparison method and confocal microscopy, with subsequent cross correlation topography analysis, were used to correctly identify cartridge cases fired from ten consecutively made pistol slides.**

**Subsequent cross correlation function analysis and statistical analysis of match and non-match scores correctly identified the fired cartridge cases back to their respective known slide source in 19 of 20 occasions with one inconclusive result. Results of the mathematical determination of slide source were compared to the validated results from the microscopic comparisons.**

Uchiyama, T., "Similarity among Breech Face Marks Fired from Guns with Close Serial Numbers", AFTE Journal, vol. 18 (3), 1986, pp. 15-52.

This study examined the breechface marks produced by Browning Baby, Raven P-25 and Titan pistols. Subclass characteristic were found to be significant on the breechface of each of these pistol models and examiners should use caution when encountered.

**Weller, T. J., et al, "Confocal Microscopy Analysis of Breech Face Marks on Fired Cartridge Cases from 10 Consecutively Manufactured Pistol Slides", Journal of Forensic Sciences, Volume 57, Number 4, July 2012, pp. 912-917.**

**Microscopic study of 90 test fired cartridge case specimens from ten consecutively manufactured pistol slides. A total of 8010 comparisons were conducted by using confocal microscopy with a 3D cross-correlation analysis logarithm. The average match scores were 0.82 with the average non-match scores 0.20. There was no overlap of scores between matching and non-matching test scores. This study provided objective data that supports the AFTE Theory of Identification.**

## **FIREARM AND TOOLMARK IDENTIFICATION - THEORETICAL**

Brackett, J. W. "A Study of Idealized Striated Marks and their Comparisons using Models", Journal of the Forensic Science Society, vol. 10 (1), January, 1970, pp. 27-56.

Comparison of various proposed probability models for striated marks, with an eye toward the development of an automated system. CMS model tended to support empirical work of Biasotti.

Collins, E. R., "How Unique Are Impressed Toolmarks? An Empirical Study of 20 Worn Hammer Faces", AFTE Journal, vol. 37 (4), Fall 2005, pp. 252-295.

This study utilizes 20 worn hammer faces to determine if Stone's (2003) theoretical types of toolmark characteristics model "accurately and consistently represents the occurrence of individualizing effects", This study includes an addendum by Stone which outlines refinements to his original model. The refinements to the original model continue to provide probabilities that are astronomical.

Deinet, W., "Studies of Models of Striated Marks Generated by Random Processes", Journal of Forensic Sciences, vol. 26 (1), Jan., 1981, pp. 35-50.

Computer-aided studies of the degree of similarity of striated marks are described. Digitized image data on 40 grinding marks were fed into a minicomputer, and the position values of the lines were determined semiautomatically. Idealized models were defined for an objective comparison of striated marks and then applied to the grinding mark data. Necessary conditions of the models were tested by comparing them with actual, measured properties of the marks. Results of the model calculations are presented and the properties of the models discussed.

Hatcher, J. S., Jury, F. J., Weller, J., "Firearm Investigation Identification and Evidence", The Stackpole Company, 1957 P. 389 P.380

Calculated, in a restricted example, that the possibility of the same set of identifiable marks appearing on another tool is approximately 1 in 432,000,000,000 (trillion).

Heard, B. J., "Handbook of Firearms and Ballistics", Wiley & Sons, 1997, pp. 136-141

Calculated, in a restricted example, that the possibility of the same mark(s) appearing on another tool is approximately 1 in 52,860,000,000 (billion).

Howitt D., Tulleners F., "A Calculation of the Theoretical Significance of Matched Bullets", Journal of Forensic Sciences, Volume 53, Number 4, July 2008, Pp.868-875.

Study that calculated random occurrence probability for the correspondence of impression marks on a subject bullet to a random distribution of similar marks on a suspect bullet of the same type. These calculations produced values that supported previous reported empirical probabilities on consecutive matching bullet striae and also indicate that larger consecutive matching sequences are extremely unlikely to occur.

May L., "Identification of Knives, Tools and Instruments", Journal of Police Science (no volume or number listed) 1930, pp. 247-248.

Conducted pioneering study on striated type toolmarks on numerous cutting tools, especially knives, with working edges containing some type of grinded finish.

Also, conducted first attempt at a statistical validation in Toolmark Identification; in which, it was calculated that the possibility of the same identifying mark(s) appearing on another tool is approximately 100,000 X 650 quadrillion.

Neel M., and Wells M., "A Comprehensive Statistical Analysis of Striated Tool Mark Examinations Part I: Comparing Known Matches and Known Non-Matches", AFTE Journal, Volume 39, (4), Summer 2007, pp. 176-198.

Study of 4000 striated toolmark comparisons concluded that known matches (KM) and known non-matches (KNM's) can be statistically distinguished from one another with 3D toolmarks containing a 1 in 802,919 and 2D toolmarks containing a 1 in 12,090,164 likelihood ratio.

**Petraco, D. K., et al, "Addressing the National Academy of Sciences Challenge: A Method for Statistical Pattern Comparison of Striated Tool Marks", Journal of Forensic Sciences, Volume 57, Number 4, July 2012, pp. 900-911.**

**Toolmark test specimens from nine slotted screwdrivers were encoded into high-dimensional feature vectors and analyzed by multiple statistical pattern recognition methods. The statistical methods used, which are widely known and accepted in academic applications, rely on few assumptions of the data's underlying distribution, can be accompanied by standard confidence levels and are falsifiable. Correct classification rates of at least 97% were achieved.**



Stone, Rocky, "How Unique are Impressed Marks", AFTE Journal, vol. 35 (4), Fall 2003, pp. 376-383.

This study outlines several theoretical types of impressed toolmark characteristics (point, line, curve, enclosure and three-dimensional) and applies mathematical probability estimates in an attempt to quantify them. It was found that marks of "reasonable complexity", that the odds of the same marks being repeated on another tool to be astronomical.

## **EMERGING RESEARCH**

**Chu, W., et al, "Selecting Valid Correlation Areas for Automated Bullet Identification System Based on Striation Detection", Journal of Research of the National Institute of Standards and Technology, Volume 116, Number 3, May-June 2011.**

**Study on fired bullet markings using automated bullet identification systems that employ an edge detection algorithm and selection process that locates the edge points of significant toolmark features was conducted. Results of this study validate the differentiation ability of individual characteristics if a proper striation threshold length can be established.**

**Riva, F. and Champod C., "Automatic Comparison and Evaluation of Impressions Left by a Firearm on Fired Cartridge Cases", Journal of Forensic Sciences, Vol. 59, No. 3, May 2014, Pp. 637-647.**

**Automated study of marks contained on fired cartridge cases from seventy-nine 9mm Luger caliber pistols were conducted using 3D surface topography analysis and coupled to a bivariate evaluative model to assign likelihood ratios. The purpose of this analytic system was to conduct an objective comparative analysis with a robust statistical evaluation basis to the results.**

**The system reflected a very high discriminating ability between the known and non-known specimens. This study also reflected very low rates of misleading evidence depending on the firearm considered.**

**Song, J., et al, "Development of Ballistics Identification- from Image Comparison to Topography Measurement in Surface Metrology", Measurement Science and Technology, Volume 23, Number 054010, March, 2012.**

**Systematic study of direct measurement and correlation of surface topography on fired bullet markings was employed. Based on this on this system, a prototype for bullet signature measurement and correlation was developed that has demonstrated superior correlation results for bullet signature identifications.**

**Zhang, S. and Chumbley, L.S., "Manipulative Virtual Tools for Tool Mark Characterization", NCJRS Document #241443, Award # 2009-DN-R-119, March 2013.**

**Research on the development of virtual toolmarks by a 3-D computer simulation that would allow for the development of highly predictable toolmark characterizations. Initial study involved the production of test**

**toolmarks by six screwdriver tips that were then compared by a previously developed statistical algorithm.**

**Preliminary experimental results indicate that the use of a manipulative, virtual tool could provide quantitative data for the characterization of tool marked surfaces that would improve the scientific basis of toolmark identification.**

## **APPENDIX B: Cases**

- *United States v. Chester*, Docket No. 1:13-CR-00774, Order: Denying defendants' second joint renewed motion to exclude expert testimony regarding firearm toolmark analysis (Tharp, Jr., J., dated Oct. 7, 2016).
- *Commonwealth v. Legore*, SUCR2015-10363, "Ruling and Order on Defendant's Motion for Daubert/Lanigan Hearing on Admissibility of Firearms" (Locke, J., dated Nov. 16, 2016).

**IN THE UNITED STATES DISTRICT COURT  
FOR THE NORTHERN DISTRICT OF ILLINOIS  
EASTERN DIVISION**

UNITED STATES OF AMERICA,	)	
	)	
Plaintiff,	)	
	)	
v.	)	
	)	
GREGORY CHESTER,	)	No. 13 CR 00774
ARNOLD COUNCIL,	)	
PARIS POE,	)	Judge John J. Tharp, Jr.
GABRIEL BUSH,	)	
WILLIAM FORD, and	)	
DERRICK VAUGHN,	)	
	)	
Defendants.	)	

**ORDER**

For the reasons stated below, defendants’ second joint renewed motion to exclude expert testimony regarding firearm toolmark analysis [838] is denied. The related motion in limine [837] is also denied.

**STATEMENT**

**I. Renewed *Daubert* Motion [838]**

Defendants renew their motions to exclude toolmark analysis<sup>1</sup> in light of the September 20, 2016 release of the President’s Council of Advisors on Science and Technology’s (“PCAST”) report entitled “Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature Comparison Methods.” Def. Mot. 2, ECF No. 838. The report “discusses the role of scientific validity within the legal system; explains the criteria by which the scientific validity of forensic feature-comparison methods can be judged; applies those criteria to six such methods in detail . . . and offers recommendations on Federal actions that could be taken to strengthen forensic science and promote its more rigorous use in the courtroom.” Ex. A. at 2.<sup>2</sup> Firearm toolmark analysis, which the government’s experts used, is one of the six methods discussed in the report. The report is clear that “[j]udges’ decisions about the admissibility of scientific evidence rest solely on legal standards; they are exclusively the province of the courts and PCAST does not opine on them.” *Id.* at 4. Rather, the report provides foundational scientific background and recommendations for further study.

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<sup>1</sup> See Motions to Exclude, ECF Nos. 333, 699; Orders, ECF Nos. 464, 781.

<sup>2</sup> Page numbers refer to the internal numbering of the pages of the report, not ECF page numbers.

As such, the report does not dispute the accuracy or acceptance of firearm toolmark analysis within the courts. Rather, the report laments the lack of scientifically rigorous “black-box” studies needed to demonstrate the reproducibility of results, which is critical to cementing the accuracy of the method. *Id.* at 11. The report gives detailed explanations of how such studies should be conducted in the future, and the Court hopes researchers will in fact conduct such studies. *See id.* at 106. However, PCAST did find one scientific study that met its requirements (in addition to a number of other studies with less predictive power as a result of their designs). That study, the “Ames Laboratory study,” found that toolmark analysis has a false positive rate between 1 in 66 and 1 in 46. *Id.* at 110. The next most reliable study, the “Miami-Dade Study” found a false positive rate between 1 in 49 and 1 in 21. Thus, the defendants’ submission places the error rate at roughly 2%.<sup>3</sup> The Court finds that this is a sufficiently low error rate to weigh in favor of allowing expert testimony. *See Daubert v. Merrell Dow Pharms.*, 509 U.S. 579, 594 (1993) (“the court ordinarily should consider the known or potential rate of error”); *United States v. Ashburn*, 88 F. Supp. 3d 239, 246 (E.D.N.Y. 2015) (finding error rates between 0.9 and 1.5% to favor admission of expert testimony); *United States v. Otero*, 849 F. Supp. 2d 425, 434 (D.N.J. 2012) (error rate that “hovered around 1 to 2%” was “low” and supported admitting expert testimony). The other factors remain unchanged from this Court’s earlier ruling on toolmark analysis. *See* ECF No. 781.

This order does not, of course, prevent the defendants from cross-examining the government’s experts regarding the error rate of toolmark analysis, and the PCAST report may provide them with fodder for cross-examination. The defendants may, for example, inquire whether the government’s experts have complied with other best practices for firearm and toolmark analysis described in the PCAST report, such as the expert having “undergone rigorous proficiency testing” and whether the examiner “was aware of any other facts of the case” when he or she performed the analysis. *See* Ex. A. at 113. For its part, the government may bring out other best practices its experts have engaged in, such as independent secondary review of the examiner’s results. *See* Resp. at 2.

In short, the PCAST report does not undermine the general reliability of firearm toolmark analysis or require exclusion of the proffered opinions in this case. Questions about the strength of the inferences to be drawn from the analysis of the examiners presented by the government may be addressed on cross-examination. For these reasons, the defendants’ renewed motion to exclude is denied.

## **II. Motion in Limine [837]**

The ruling to allow expert testimony on firearm toolmark analysis necessitates consideration of the defendants’ joint motion to exclude, pursuant to Fed. Rs. Evid. 402 and 403, evidence and testimony about a shooting that occurred on October 25, 2005. That shooting is not charged or referred to in the Superseding Indictment.

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<sup>3</sup> Because the experts will testify as to the likelihood that rounds were fired from the same firearm, the relevant error rate in this case is the false positive rate (that is, the likelihood that an expert’s testimony that two bullets were fired by the same source is in fact incorrect).

The government gave notice of its intent to introduce evidence that bullet casings recovered from the scene of the October 2005 shooting—both 9mm and .40 caliber—were fired from the same two guns as casings from shots fired during (1) the murder of Wilbert Moore in January 2006 (the .40 caliber); and (2) the shooting of Cordell Hampton and Antoine Brooks in April 2006 (the 9mm). In short, the government seeks to prove through expert testimony that one of the firearms from the October 25, 2005, shooting was used in the shooting of Moore and another was used in the shooting of Hampton and Brooks.

The defendants object that the October 25, 2005 shooting is not relevant because it is not probative of any fact needed to meet the government's burden, and further, that the probative value of the evidence is outweighed by a risk of juror confusion and unfair prejudice. As to the relevance question, the defendants assert: "The government has never charged or otherwise alleged any of the defendants as being involved in the October 25, 2005." Mot. 2, ECF No. 837. They argue that the shooting is unrelated to "the government's larger case" in that it is apparently "a shooting unrelated to the Hobos." *Id.* Responding orally, the government argued that the evidence is relevant because it tends to show that firearms connected to two separate alleged Hobos shootings (those of Moore and of Hampton and Brooks) were used together in the same place just months earlier.

The evidence is relevant and the objection based on Rule 402 is not well-founded. The ballistics evidence establishes a connection between the separate shootings of Moore on the one hand and of Hampton and Brooks on the other. A connection between the two events is probative of the government's allegation that the Hobos enterprise operated with a purpose of "preserving and protecting the power, territory, operations, and proceeds of the enterprise through the use of threats, intimidation, destruction of property, and violence, including, but not limited to, acts of murder, attempted murder, assault with a dangerous weapon, and other acts of violence."<sup>4</sup> As the defendants have argued on numerous prior occasions, the government must prove an "agreement" and a "pattern" of racketeering activity; linking two murders by the weapons used is relevant evidence to meet that burden. It is also probative of an association-in-fact between the alleged perpetrators of the two 2006 shootings, whether or not the same individuals were also involved in the 2005 shooting.

The government does not offer this ballistics evidence to prove anything about who participated in the October 25 shooting, or that it was a "Hobos shooting." The ballistics testimony at issue will be used for the sole purpose of supporting the proposition that two 2006 shootings are connected to each other by means of firearms that had a common history. The jury will not hear any testimony regarding the events of October 2005, including about the alleged

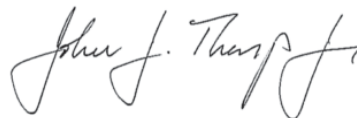
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<sup>4</sup> Count One of the Superseding Indictment also alleges that the Hobos, as part of their illegal agreement, "committed illegal acts, including murder, solicitation to commit murder, attempted murder, aggravated battery, and assault with a dangerous weapon"; that they "obtained, used, carried, possessed, brandished, and discharged firearms in connection with enterprise's illegal activities; and that they "managed the procurement, transfer, use, concealment, and disposal of firearms and dangerous weapons within the enterprise."

perpetrators and alleged victims,<sup>5</sup> and therefore there is a minimal risk that it will be confused or misled by the mere reference to a shooting.

That is also the reason that this evidence is not unduly prejudicial under Rule 403. The only specific prejudice the defendants identify is the risk that “the October 2005 shooting may well be viewed by the jury as a Hobos-related shooting when there is no evidence to support that proposition.” Mot. 2, ECF No. 837. But it is precisely because of this dearth of evidence about the October 2005 shooting that reference to the firearms used is not unfairly prejudicial (in addition to not being confusing, as noted above). The jury would have no basis for making the inference that the defendants fear, and the government has disavowed any intent to argue that inference (and will not be permitted to do so). Moreover, the evidence does not pertain to any particular defendant. It is dry forensic evidence that attempts to prove that the same firearms used in separate murders in 2006 had been used together on a previous occasion, by some unknown individuals. Of the many fertile areas for potential cross examination and argument on this point will be the lack of evidence that the guns were owned or possessed by the same individual(s) in October 2005 and 2006. Indeed, the fact that the guns were used in different shootings in 2006 could support the inference that ownership had changed hands since 2005.

The defendants’ motion in limine is, therefore, denied.

A handwritten signature in cursive script, reading "John J. Tharp, Jr.", written in black ink.

John J. Tharp, Jr.  
United States District Judge

Date: October 7, 2016

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<sup>5</sup> To the extent the defendants seek to preclude any evidence or testimony about the October 25, 2005, shooting *other than* the ballistics match, which is relevant to linking two 2006 shootings, their motion is granted (or mooted because no such evidence is anticipated).



SUFFOLK, ss.

COMMONWEALTH OF MASSACHUSETTS

SUPERIOR COURT  
SUCR 2015-10363

COMMONWEALTH

vs.

JAMARE LEGORE  
Defendant.

**RULING AND ORDER ON DEFENDANT'S  
MOTION FOR DAUBERT/LANIGAN HEARING  
ON ADMISSIBILITY OF FIREARM ANALYSIS**

By motion filed October 22, 2016, the defendant challenges the admissibility of expert testimony comparing ballistics evidence to a recovered firearm. The motion is based on a September, 2016 report by the President's Council of Advisors on Science and Technology ("PCAST"), entitled, *Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods*. The report reviews the scientific validity of forensic feature comparison methods, including firearm toolmark analysis and makes recommendations to Federal courts and authorities regarding further steps to "strengthen forensic science and promote its more rigorous use in the courtroom." *Id.* at 2. For the reasons set forth below, the motion is denied.

Forensic ballistics or firearms identification involves the comparison of bullet and cartridge case evidence to a known firearm, seeking to determine whether the ballistics evidence was likely fired from a particular firearm. Evidence of a ballistics comparison, when performed by a properly trained and qualified analyst following an established methodology, has been

admissible in Massachusetts courts for well over a century. See, e.g., Commonwealth v. Barbosa, 457 Mass. 773,780 (2010); Commonwealth v. Best, 180 Mass. 492, 495-496 (1902). In Commonwealth v. Heang, 458 Mass. 827 (2011), the Supreme Judicial Court considered the admissibility of such evidence in light of a comprehensive legal and scientific review of forensic evidence contained in a report of the National Research Council (an arm of the National Academy of Science) entitled, *Strengthening Forensic Science in the United States: A Path Forward* (2009). After reviewing the scientific underpinnings and methodology applicable to the forensic comparison of ballistics evidence to connect it to a suspect firearm, the Court concluded, "where defense counsel is furnished in discovery with the documentation needed to prepare an effective cross-examination, where a jury are provided with the necessary background regarding the theory and methodology of forensic ballistics, and where an opinion matching a particular firearm to recovered projectiles or cartridge casings is limited to a 'reasonable degree of ballistic certainty', a jury will be assisted in reaching a verdict by having the benefit of the opinion, as well as the information needed to evaluate the limitations of such an opinion and the weight it deserves." Heang, 458 Mass. at 850.

The issue now before this court is whether, based on the recent PCAST report, there are grounds to revisit the SJC decision in Heang. After a non-evidentiary hearing and argument, and upon review of the PCAST report (and in particular, pages 104-114), there is no basis to disturb settled law permitting a properly qualified firearms expert from offering opinion evidence under Mass. G. Evidence § 702 relating to a comparison and match between a bullet recovered from the

alleged victim, and a bullet test-fired from a firearm allegedly associated with the defendant.<sup>1</sup>

The PCAST report echos the concerns articulated by the National Research Council in 2009, regarding the scientific (foundational) validity of comparative ballistics analysis, noting the lack of scientifically rigorous and peer-reviewed studies on the uniqueness of class, sub-class, and individual characteristics imparted on projectiles or cartridge casings when fired from a known firearm, and limitations on the subjective nature of an examination of ballistics evidence. It notes, however, that since the 2009 NRC report, additional studies have been conducted that support the claim that reliable ballistics comparisons can be achieved, including one study by an independent laboratory designed to test the foundational validity of ballistics comparison testing. See Baldwin, D.P., Bajic, S.J., Morris, M., and D. Zamzow. "A study of false-positive and false-negative error rates in cartridge case comparisons." Ames Laboratory, USDOE, Technical Report #IS-5207 (2014); at [afte.org/uploads/documents/swggun-false-positive-false-negative-usdoe.pdf](http://afte.org/uploads/documents/swggun-false-positive-false-negative-usdoe.pdf).

Although the PCAST report is critical of the methodology employed in some of the studies conducted since 2009 and notes that the Ames Laboratory study, while following appropriate scientific protocols, has not been subject to a peer review, nonetheless it acknowledges that no study has undermined the claimed reliability of comparative ballistics evidence.

In short, the PCAST review does not significantly alter the findings and conclusions of the NRC report - indeed, the Council concluded, "[W]hether firearms analysis should be deemed admissible based on current evidence is a decision that belongs to the courts . . . " *Id.* at p. 12.

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<sup>1</sup> The instant motion is based solely on the claim that there is an insufficient scientific foundational validity for ballistics comparison evidence. The defendant is not challenging whether the ballistics analysis here was valid as applied, nor for present purposes is he challenging the qualifications of the firearms examiner.

The report recommends, however, that if such evidence is admitted, it should be accompanied by testimony regarding the known error rates as found in Ames Laboratory's "black-box study". Based on the Supreme Judicial Court's comprehensive consideration of the issues relating to comparative ballistics evidence, and the Court's determination that such evidence, properly presented may aid a fact-finder at trial, this Court sees no reason to conduct a formal Daubert/Lanigan hearing based on the report issued by the President's Council.

### ORDER

The Defendant's motion is **DENIED**. The Commonwealth shall be permitted to present expert testimony regard a forensic ballistics examination and comparison, subject to the conditions and limitations outlined in Commonwealth v. Heang, *supra*, and further subject to the requirement that the Commonwealth shall elicit testimony regarding known error rates based on studies identified in the PCAST report. Moreover, nothing herein shall limit defendant's counsel from cross-examining any firearms expert witness based on the findings and content of the PCAST report.

  
Justice of the Superior Court

Dated: November 17, 2016

## **APPENDIX C: Additional Publications and Statements re PCAST Report**

- American Congress of Forensic Science Laboratories (ACFSL), Position Statement re The 2016 PCAST Report (Sept. 21, 2016)
- American Society of Crime Laboratory Directors, Inc. (ASCLD), Statement on September 20, 2016 PCAST Report on Forensic Science (Sept. 30, 2016)
- Association of Firearm and Tool Mark Examiners (AFTE), Response to PCAST Report on Forensic Science (Oct. 31, 2016)
- Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF), Official Statement, ATF Response to the PCAST Report (Sept. 21, 2016)



# THE AMERICAN CONGRESS OF FORENSIC SCIENCE LABORATORIES



The United States Assembly of Forensic Science Laboratory Professionals

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## The American Congress of Forensic Science Laboratories

c/o The Forensic Foundations Group  
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# POSITION STATEMENT

September 21, 2016

## THE 2016 PCAST REPORT

The United States President's Council of Advisors on Science and Technology (PCAST) has released a report that portrays in an unfavorable light specific forensic science disciplines that are in common use today. <sup>1</sup> Drawing the most pointed criticisms were:

- Analysis of complex DNA mixtures
- Bitemark Analysis
- Firearms Analysis
- Footwear Analysis

The PCAST report, in both implicit and explicit terms, calls on the American judiciary to take formal notice of these disciplines as being insufficiently validated and, therefore, inherently unworthy of the respect they have earned in courts of law in over a century of jurisprudence and scientific evaluation. The PCAST report identifies two priorities regarding the future of these disciplines. First, PCAST cites "the need for clarity about the scientific standards for the validity and reliability of forensic methods." Second, it addresses "the need to evaluate specific forensic methods to determine whether they have been scientifically established to be valid and reliable." <sup>2</sup>

These PCAST priorities seem to suggest that perhaps this report should not have been published at all. Unfortunately, it was born of an imbalanced and inexperienced working group whose make-up included no forensic practitioners nor any other professionals with demonstrated experience in the practice of forensic science. The Chair of the

aforementioned working group, Eric Lander, sits on the Board of Directors of the Innocence Project,<sup>3</sup> a legal-activism group that has itself been publicly criticized on numerous occasions (including within peer reviewed literature) for the unfairness of its public statements and the conflicts of interest that have long called into question its motives. In addition, the working group's writer, Tania Simoncelli,<sup>4</sup> has publicly authored previous opinions that DNA database collections violate civil liberties.<sup>5</sup>

Our intent is not to disparage any individuals or their motives. But we have no choice but to recognize the relevance of these biases as we evaluate the legitimacy of the PCAST report. Indeed, forensic science is being judged by such a standard. PCAST should be as well. Yet our greatest concern is that the intellectual exercise of evaluating the reliability of forensic science in the United States is too often ignorant of the ugly realities associated with solving crimes like murder and rape as quickly and accurately as possible. For all the priorities identified by PCAST, none are more important than those that preserve public safety.

Interestingly, the PCAST report comes during a presidential administration that has demonstrated a deep sensitivity to the needs and demands of trial attorneys, criminal defendants, and advocates of sweeping criminal justice reform. Future administrations may take a different approach, tending to champion positions traditionally held by police and prosecutors. We have no opinion in these matters. But these swings in ideological perspective cause commensurate changes in how forensic science and its role in our criminal justice system are perceived. In the current political climate, forensic science is looked upon with far more suspicion and, in some cases, disdain than would be the case in other political circumstances. And because forensic science is both expected and apt to remain independent of these political currents, it is vulnerable to being misrepresented and even bullied in a way that compromises its occupational stability. To truly strengthen forensic science, therefore, it will be necessary to somehow insulate it from the turbulence caused by changes in political winds. PCAST did no favors in this regard.

Nor did PCAST, in our collective opinion, do its due diligence to ensure a reasonable balance of perspectives on these critical issues. It failed to objectively and completely evaluate the overwhelming evidence of strength and reliability in forensic science. Therefore, its report on forensic science will likely go down in history as a political phenomenon, not a scientific one.

Forensic science is an applied science. To argue that it can improve is honorable. To broadly characterize it as lacking scientific validity without proper justification is irresponsible and inaccurate. The work, for example, to add probabilistic studies to our existing validations, to standardize wording for clarity in testimony, to strengthen the communication of uncertainties in conclusions, and to protect against the negative influences of cognitive bias are to be applauded. Yet these are part of an ongoing effort by the forensic science community itself to evolve as all occupations do. And they are ultimately elevating the professionalism with which forensic science is practiced.

Moving forward, however, all forensic science professionals are encouraged to continue doing what they have done for decades – advance the profession with thoughtfulness, self-restraint, introspection, scientific reasoning, quality control, experimentation, and the continuous consideration of new ideas. Let the chips fall where they may. Of course, we must all be open and honest about the uncertainties and variables that exist in forensic science and strive to attach clarity and meaning to those items of evidence with which we are being entrusted. And as unseemly as the ideological battles that are slowly reshaping our criminal justice system may feel at times, they must never distract us from meeting our public responsibilities.

## **References**

- 1 President's Council of Advisors on Science and Technology (PCAST). (2016) *Report to the President. Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature Comparison Methods*. September 2016. Available at:  
[https://www.whitehouse.gov/sites/default/files/microsites/ostp/PCAST/pcast\\_forensic\\_science\\_report\\_final.pdf](https://www.whitehouse.gov/sites/default/files/microsites/ostp/PCAST/pcast_forensic_science_report_final.pdf)
- 2 PCAST: *Report to the President*, See 1. Page x
- 3 Innocence Project Board of Directors. Available at:  
<http://www.innocenceproject.org/disciplines/directors/>
- 4 PCAST: *Report to the President*, See 1. Page vii
- 5 Ms. Simoncelli has authored at least two works on this subject. Available at:  
[https://www.aclu.org/files/images/asset\\_upload\\_file330\\_9567.pdf](https://www.aclu.org/files/images/asset_upload_file330_9567.pdf) and  
<https://www.acslaw.org/publications/issue-briefs/a-new-era-of-dna-collections-at-what-cost-to-civil-liberties>

*The American Congress of Forensic Science Laboratories (ACFSL) is the only membership organization in the United States structured to fully represent and communicate the interests of all professionals employed in the forensic laboratory sciences. Several reputable organizations exist to serve the forensic sciences and particular areas of specialized expertise, but only the ACFSL has membership opportunities for all levels of responsibility and areas of specialty found in American forensic science laboratories. It is our mission, therefore, to unite and represent all current and former professionals employed by United States forensic science laboratories, and to create the conditions necessary for our members to serve the American criminal and civil justice systems with confidence and integrity.*

## **About this Statement**

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The above is a statement by the American Congress of Forensic Science Laboratories (ACFSL). ACFSL publishes position statements strictly as a service to its members and for the benefit of the forensic laboratory sciences. This statement does not necessarily reflect the official position of any person or organization with whom the members of our Executive Board, staff, or volunteers may be affiliated or employed. Information contained in this position statement is neither exhaustive nor exclusive, and its accuracy may be affected by a wide variety of variables, people, and circumstances. ACFSL reserves the right to modify or rescind its position statements at any time. ACFSL may elect to publish, in some circumstances, dissenting opinions by our members or the public at large.





**AMERICAN SOCIETY OF  
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September 30, 2016

**Statement on September 20, 2016 PCAST Report on Forensic Science**

On September 20, 2016, the President's Council of Advisors on Science and Technology (PCAST) issued the report to the President, "***Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods***," which contained seven (7) Scientific Findings and eight (8) Recommendations on the scientific validity of forensic sciences involving feature-comparisons.

The ASCLD Board of Directors has reviewed the official report from PCAST, and finds that while we do agree with some aspects of the PCAST report, we respectfully disagree with many of the Findings and Recommendations including the overarching methodology with which the analysis was performed.

ASCLD strongly agrees that additional financial investment from the Federal government into forensic science is sorely needed. From foundational and applied research funding to investment into operational capacity building and technological advancement, a strong financial investment from the Federal government is critical.

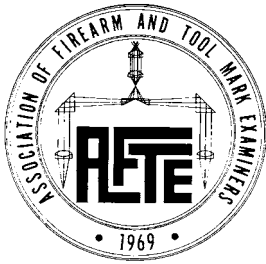
ASCLD also agrees that additional research can always be performed to further demonstrate the appropriate weight that should be afforded to the feature comparison disciplines, both in the capability of the science itself and in the capability of those that conduct examinations. This is how science evolves. PCAST's dismissal, however, of a wealth of existing research because it does not meet an arbitrary criteria of black box studies with an ideal sample size is unhelpful. ASCLD is aware that more than 2,000 post-2009 articles were submitted to PCAST for review during this year-long effort. Additionally, the former OSTP Subcommittee on Forensic Science Interagency Working Groups, AAAS, and several industry working groups either have or are currently developing extensive bibliographies, many of which do not appear to have been reviewed or given credibility.

ASCLD disagrees with discarding these studies as not credible simply for lack of black box studies or ideal sample size. ASCLD concurs that black box and white box studies are significantly important and helpful. Indeed, we sincerely appreciate that the Council highlighted a firearms study in which ASCLD participated. ASCLD does not agree, however, that black box studies are the singular method through which to judge an entire forensic discipline's reliability. ASCLD does not dispute that the proposed methodologies incorporated in the report are highly aspirational and rigorous; however, ASCLD is concerned that a one-size-fits-all approach is not always appropriate due to the specific research needs and unique evidence sample traits of each discipline. These disciplines have previously withstood both scientific and judicial scrutiny, aiding investigators, prosecutors, and defense attorneys throughout the criminal justice system.

In addition to the methodology of PCAST's review, ASCLD wishes to express concern over the following:

- **Practitioner involvement.** The report seems to favor that all scientific evaluation activities be performed completely separate from scientists with direct forensic science experience. ASCLD strongly disagrees with the removal of forensic scientists from the evaluation of scientific integrity or technical merit of analyses. ASCLD supports the involvement of academic scientists in the process, but strongly disagrees that these evaluations should be performed in a vacuum devoid of participation by the forensic scientists who can impart an applied knowledge and understanding to the research. Science is not specific or unique to academia or industry. It is the intersection of both that ensures true advancement and the collaboration of both paradigms is paramount to the continued improvement of forensic science.
- **OSAC “independence.”** ASCLD disagrees with the assertion that the NIST OSAC must be staffed with more “independent” scientists. ASCLD believes independence has already been demonstrated by the current OSAC composition, as several existing industry standards have already been referred to standards development organizations for revision in order to incorporate suggested improvements by OSAC units. ASCLD acknowledges there is an important need for input in OSAC from statisticians, metrologists, academic scientists, cognitive behavioral scientists, and legal experts; however, there is no evidence that the current process is broken or needs revision. In fact, ASCLD believes that great success has been shown in OSAC when these resources are engaged early in the process when standards and guidelines are in the development stage at the subcommittee level rather than later in the approval process only.
- **DNA mixture interpretation.** The report determines that, “...the interpretation of complex DNA mixtures with the CPI statistic has been an inadequately specified—and thus inappropriately subjective—method. As such, the method is clearly not foundationally valid.” ASCLD concurs with PCAST to the extent that the principle issue is the subjectivity and variability in the application of mixture interpretation guidelines within the community. ASCLD, however, urges PCAST to consider that the CPI statistic itself: (1) does not interpret complex DNA mixtures and; (2) is a valid statistical tool when properly applied to some DNA mixtures. The use of the CPI statistic is valid and fundamentally sound for use with DNA mixtures where all allelic peaks - after accounting for potential allele stacking and peak height variability - remain above the stochastic threshold. In summary, it is the inappropriate use of the CPI statistic by some practitioners rather than the CPI statistic itself that is not foundationally valid. As the PCAST report correctly acknowledges, new probabilistic software tools have been developed and are being made available to practitioners in an effort to achieve greater consistency in mixture interpretation. The use of new software tools, however, does not necessarily increase the objectivity of the analysis.
- **Simple proficiency tests.** The report indicates that the forensic community prefers proficiency tests not to be too challenging. ASCLD does not agree with this characterization of the entire community, regardless of who made the statement. ASCLD believes the majority of the forensic science community has, and continues, to implement rigorous quality assurance systems that include proficiency testing schemes that resemble the level of difficulty of casework.

While ASCLD has expressed disagreement with a number of aspects of the PCAST report on forensic science, we also wish to convey our desire to work collaboratively with PCAST and other federal agencies on continuing to improve forensic science. ASCLD remains committed to providing excellence in forensic science through leadership and innovation and encouraging the highest standards of practice in the field. The Board of Directors looks forward to continuing to partner with all members of the criminal justice community and any other group with the same interests.



# Association of Firearm and Tool Mark Examiners

## Response to PCAST Report on Forensic Science October 31, 2016

In September, 2016 the President's Council of Advisors on Science and Technology (PCAST) issued a report titled "Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods." As the leading professional organization for practitioners of forensic firearm identification, the Association of Firearm and Tool Mark Examiners (AFTE) acknowledges the challenge faced by the PCAST to understand the scientific field of comparative sciences from their stated brief review of the literature. AFTE strongly agrees with the premise that additional ongoing structured research strengthens the foundational and applied validity of firearm identification, as well as endeavors to reduce the effects of cognitive bias and subjectivity. However, we cannot overstate our disappointment in the PCAST's choice to ignore the research that has been conducted.

Decades of validation and proficiency studies have demonstrated that firearm and toolmark identification is scientifically valid, and that despite the subjective nature of the final comparison stage of analysis, competent examiners employing standard, validated procedures will rarely, if ever, commit false identifications or false eliminations. The foundational literature of the science has been presented to bodies such as the PCAST and the National Academy of Science (NAS) on multiple occasions and can be found at these links on the AFTE website: <https://afte.org/resources/afte-position-documents> , <https://afte.org/resources/swggun-ark>. The PCAST report is highly critical of any research that is not considered a "black box" study; and while this type of research is valuable and should be utilized more going forward, AFTE believes it is not the sole standard by which good science is measured.

The PCAST report references one such black box study conducted in 2014 by the Midwest Forensics Resource Center (MFRC) at the Ames Laboratory, Iowa State University, as the solitary study that can be utilized to accurately determine the error rate for firearm identification. The results of the Ames study were consistent with previous research demonstrating a very low error rate among properly trained examiners. However, the PCAST recommendation that any and all court testimony should refer to this one study as the singular foundational research of firearm and tool mark examination is irresponsible and inaccurate, and suggests a fundamental lack of understanding about the range of analyses done in this forensic discipline. While a global and numerically precise average of accuracy (error rate) would be useful in evaluating the value of an analytical technique, of greater relevance is the performance of the individual examiner as demonstrated by their participation in proficiency testing and similar testing. It should be noted that when foundational black-box type studies have been conducted in the past, the reported errors tend to be clustered among individuals or small groups

of participants rather than generally distributed amongst the population of all examiners participating in the study. Moreover, the technical and quality review processes utilized by laboratories for casework are not applied in these studies.

The PCAST report's assessment of the AFTE Theory of Identification as circular further illustrates the lack of adequate investigation and understanding on the part of the PCAST. First, the Theory of Identification has been in existence since 1992, not 2011 as cited.<sup>(p.59)</sup> Second, the report erroneously defines sufficient agreement as "the examiner being convinced that the items are extremely unlikely to have a different origin."<sup>(p.103)</sup> This characterization is utterly incorrect. The AFTE Theory of Identification clearly defines for the examiner when sufficient agreement does exist and how it is related to the significant duplication of random toolmarks. Only after sufficient agreement has been established does an examiner conclude that the two items are extremely unlikely to have a different origin. It has been consistently demonstrated that when the AFTE Theory of Identification is properly applied, examiners are able to conduct quality, accurate analysis.

Finally, the PCAST insistence on independent inquiry of our field in validation studies and matters of peer review implies a fatal limitation or bias within our community that can only be cured by an outside source. It is true that the majority of past research has been conducted by AFTE members, because while DNA and fingerprints have applications outside of forensics (such as medicine and biometrics), firearm identification has few profit-making applications and does not garner research attention from the private sector. Fortunately, in recent years a great diversity of academics, scientific professionals and agencies have joined in research on firearm and tool mark examination, but they require the input and participation of qualified forensic practitioners. We welcome the attention and ongoing collaboration of such organizations as the National Institute of Standards and Technology (NIST) and the newly-formed Center for Statistics and Applications in Forensic Evidence (CSAFE) in current and future research. Meanwhile, AFTE remains dedicated to the exchange of information, methods and best practices, and the furtherance of research in support of its members world-wide.



## Official Statement

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### **ATF Response to the President's Council of Advisors on Science and Technology Report**

WASHINGTON, D.C. – The Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) has received and reviewed the report entitled *Forensic Science in Federal Criminal Courts: Ensuring Scientific Validity of Pattern Comparison Methods*, issued Sept. 20, 2016, by the President's Council of Advisors on Science and Technology (PCAST). While ATF appreciates the important advisory role of PCAST to the President, and agrees with its goal of strengthening ties between the academic research community and the forensic science community, we join our colleagues at the Department of Justice (DOJ) and the Federal Bureau of Investigation (FBI) in expressing disappointment in the flawed methodology PCAST employed in generating the report, and join them in strong disagreement with PCAST's recommendations regarding the admission of forensic evidence in criminal trials, particularly with respect to firmly established firearm and tool mark forensic evidence.

With respect to the methodology used to generate the report, ATF is particularly disappointed that PCAST failed to consult adequately with expert firearm and tool mark examiners at ATF, FBI, state, and local laboratories. PCAST ignored much of the limited input forensic professionals were allowed to provide. Moreover, in reaching its conclusions regarding firearm and tool mark evidence, PCAST did not adequately consider the numerous research studies that support the validity of firearm and tool mark forensics, including one of the most recent research studies on the topic. ATF and FBI specifically provided the recent research study to PCAST more than a month before the issuance of their report, and provided substantial analysis on how the study further reinforced decades of well documented scientific and legal precedents supporting firearm and tool mark forensics. PCAST, however, chose to relegate its consideration of the study to a footnote without further consultation with DOJ or other experts in the field.

With respect to PCAST's recommendation that courts should restrict the admission of firearm and tool mark evidence, ATF strongly agrees with the DOJ decision not to adopt that recommendation as the existing legal standards regarding the admissibility of firearm and tool mark evidence are based on sound science and sound legal reasoning. Decades of legal precedent—and the underlying scientific research on which the courts have relied—establish that forensic firearm and tool mark evidence is both reliable and of substantial value to juries in determining the facts. Firearm and tool mark evidence not only aids prosecutors and defense attorneys in the courtroom, it also enhances public safety and protects the innocent by providing law enforcement with science-based tools to focus scarce investigative resources on actual perpetrators.

As the agency with primary jurisdiction over the enforcement of federal firearm laws, ATF is deeply committed to the advancement of forensic science in the area of firearms and tool mark analysis—an objective we share with PCAST. ATF’s forensic professionals maintain the highest standards, provide training to law enforcement agencies across the globe, and support the investigative efforts of law enforcement with reliable, science-based leads and expert evidentiary analysis every day. ATF’s National Integrated Ballistics Information Network (NIBIN) is an essential law enforcement tool that regularly provides science-based leads to criminal investigators, helping them to identify, apprehend, and prosecute violent criminals who use firearms to wreak havoc in our communities.

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