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SUPERIOR COURT OF THE STATE OF CALIFORNIA
FOR THE COUNTY OF LOS ANGELES

THE PEOPLE OF THE STATE OF CALIFORNIA, Plaintiff, v. ROGER KNIGHT, Defendant.	No. LA067366 MOTION TO EXCLUDE AND/OR LIMIT CONCLUSIONS OF FIREARM EXAMINER

TO STEVE COOLEY, DISTRICT ATTORNEY FOR THE COUNTY OF LOS ANGELES, AND/OR HIS REPRESENTATIVE:

PLEASE TAKE NOTICE that on April 27, 2012, in Department S of the above-entitled court, at 8:30 a.m., or as soon thereafter as counsel can be heard, Defendant ROGER KNIGHT, by and through his counsel, respectfully moves this Court to limit the conclusions admitted in the course of the testimony of Los Angeles Police Department ("LAPD") Firearms Examiner W. Moore (#E8199), pursuant to the Due Process Clause of the Fifth

Amendment and the rule of *People v. Kelly* (1976) 17 Cal. 3d 24, and *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923).

Dated: April 16, 2012

Respectfully submitted,

RONALD L. BROWN, PUBLIC DEFENDER

By _____
HARRY J. McKEE
Deputy Public Defender

INTRODUCTION

Firearms Examiner W. Moore has concluded that the markings he observed on a single discharged cartridge casing purportedly recovered from an apartment where the defendant was residing was "discharged in the same firearm" as discharged cartridge casings recovered at the scene of the shooting. (See attached Lab Report dated April 21, 2011). Mr. Moore reached this conclusion without having analyzed any actual firearm. (See generally attached Arrest Report). Mr. Moore also opined that bullets recovered from the right rear passenger door of the complaining witness' vehicle and a bullet recovered from the front door at 10812 ½ Magnolia were "fired through the barrel of the same firearm". (See attached Lab Report dated August 30, 2011; see also attached Property Report dated March 30, 2011; see also attached Property Report dated March 30, 2011; see also attached Property Report dated July 19, 2011).

The defense objects to this language because it communicates to the fact finder a proposition not generally accepted in the relevant scientific community[1]: that the examiner was able to determine based on a single side-by-side comparison that these cartridges were

[1] This is the standard for admissibility under Kelly-Frye.

"discharged from the same firearm" to the exclusion of all others. The defense seeks to exclude such testimony.

This Motion explains why the proposition that one particular firearm can be singled out based on markings observed on a piece of ammunition is controversial in the relevant scientific community, why identification opinions are not generally accepted and thus violate Kelly/Frye, and why the defense's proposed exclusion on Mr. Moore's testimony is generally accepted.

POINTS AND AUTHORITIES

I. THE FUNDAMENTAL ASSUMPTIONS UNDERLYING FIREARM AND TOOLMARKS EXAMINATIONS, UNIQUENESS AND REPRODUCIBILITY, ARE NOT GENERALLY ACCEPTED IN THE SCIENTIFIC COMMUNITY

A. Fundamental Assumptions of Uniqueness and Reproducibility

Firearm-related toolmark (FATM) identification rests on two fundamental assumptions: (1) uniqueness (that certain marks are unique to a particular firearm); and (2) reproducibility (that marks unique to a firearm can be reproduced on different cartridges/bullets). Striated and impression toolmarks fall into three categories: (1) class characteristics; (2) sub-class characteristics; and (3) individual characteristics.

B. Class, Sub-class and Individual Characteristics

Class characteristics are *intentional, designed* features of tools created in the manufacturing process, such as the rifling impression on a bullet reflecting the number, width and direction of twist of the lands and grooves in the type of barrel that fired it. Sub-class characteristics are *unintentional* features of *batches* of tools created in the manufacturing process with similarities in appearance, size, or surface finish distinguishing them from other tools of the same type.

Finally, individual characteristics are toolmarks which are believed to be *unique* to a single tool and *reproducible* from a single tool so that individual marks reproduced on different fired cartridges can be used to show that these cartridges were all fired by the same firearm. The theory as to their creation is that they originate from random imperfections in the manufacturing process or subsequent use, corrosion or damage. However, these two fundamental assumptions of uniqueness and reproducibility of individual marks are not accepted even within the community of firearm examiners. (See attached Affidavit of Alicia Carriquiry, Ph.D).

C. Assumptions are Not Accepted Even Within the Firearms Examiner Community

In the Association of Firearm and Toolmark Examiners [*hereinafter* "AFTE"] journal in Spring of 2000, FATM examiner Jerry Miller carried out thousands of comparisons of bullets of different calibers of known matches and known non-matches. See Jerry Miller *Criteria for Identification of Toolmarks Part II Single Land Impression Comparisons* AFTE Journal Spring 2000. Mr. Miller's objective was to establish that the least subjective methodology used by firearm examiners, known as CMS, produces few false positive identifications and that its performance does not depend on caliber. In his research, Mr. Miller obtained the distribution of the percentages of land impression matches (minimum, average,

maximum) over the thousands of comparisons for known matches (KM) and known non-matches (KNM) samples. His results are striking in that they put into question whether an examiner who is only counting matching land impressions can accurately declare that two samples match. Instead, Mr. Miller's results suggest that there is a similar distribution of matching impressions among bullets that are known to be matches as there are among bullets known to be non-matches. Given that with both known matches and known non-matches, the percentages of matching landmarks were similar, it is clear that simply by counting the number of matching markings between two samples, it is not possible to accurately declare a match between the two samples. See Jerry Miller *Criteria for Identification of Toolmarks*, supra.

For example, with regard to the data obtained by Miller for 9mm ammunition using two-dimensional images, the range in the number of matching striae was 2 to 9 in KNM and 1 to 27 in KM. The corresponding average numbers were 5 and 7. Now while the maximum number of matching striae appears to be much higher in KM (27 versus 9 in KNM), the relatively low average of 7 indicates that much of the distribution of the number of matching impressions was actually concentrated around the lower values. Therefore, given two samples with anywhere between two and ten matching impressions, it would be equally likely for them to be a "true" match or a "true" non-match. See

Jerry Miller *Criteria for Identification of Toolmarks*, supra.

Miller's results call into question the reliability of FATM examinations in generating a match. For most calibers and for both two and three-dimensional images, experimental data suggests that the overlap between the distribution in numbers, and percentages, of matching impressions in KMs and KNMs is too high to allow for separating a match from a non-match. See Jerry Miller *Criteria for Identification of Toolmarks*, supra.

Additionally, the community of FATM practitioners has ignored those in their own circles who have expressed concern that "[a]s the techniques of firearms manufacture have evolved, following mostly commercial rather than forensic arguments, this hypothesis [of uniqueness] needs to be verified on a regular basis." See M.S. Bonfanti & J. De Kinder, *The Influence of Manufacturing Processes on the Identification of Bullets and Cartridge Cases - A Review of the Literature*, 39 Sci. & Justice 4 (1999). In other words, because the aim of firearm manufacturers is to make as many firearms as similar as possible, and because techniques of mass production have facilitated this goal, the assumption of uniqueness needs to be verified on a continuing basis as manufacturing techniques change. See United States v. Mouzone, Crim. No. WDQ-08-086, *reprinted in and adopted by* United States v. Willock, 696 F.Supp.2d 536, 574 (D. Md. 2010).

D. National Academy of Sciences Questioning the Validity of Assumptions

From 2004 to 2007, Dr. Carriquiry served on a Committee of the National Academy of Sciences, charged with assessing the technical feasibility of a national ballistics database. The project was sponsored by the National Institute of Justice (NIJ), the Office of Justica Programs and the US Department of Justice. This study culminated with an exhaustive 322 page treatise on the feasibility of a national ballistics database entitled "Ballistics Imaging" (2008) which can be found at: http://www.nap.edu/openbook.php?record_id=12162&page=197

Underlying the specific tasks with which the committee was charged was the assumption of uniqueness of firearms-related marks: ie. whether a particular set of toolmarks can be shown to come from one weapon to the exclusion of all others. The committee determined that **the validity of the fundamental assumptions of uniqueness and reproducibility of firearms-related toolmarks has not yet been fully demonstrated.** The committee further found that a significant amount of research would be needed to **scientifically determine the degree to which firearms-related toolmarks are unique or even to quantitatively characterize the probability of uniqueness.** The Committee stated that **"[c]onclusions drawn in firearms identification should not be made to imply the presence of a firm statistical basis when none has been demonstrated."**

Id. at 82. Further, it stated that **"additional general research on the uniqueness and reproducibility of firearms-related toolmarks would have to be done if the basic premises of firearms identifications are to be put on a more sold scientific footing."** *Id.*

In 2009,the National Academy of Sciences released a second report entitled *Strengthening Forensic Science in the United States: A Path Forward* (2009) which further addressed and underscored the substantial debate within the scientific community regarding the validity of firearms toolmark identification.

After reviewing the literature offered by firearms examiners in support of these fundamental assumptions, the National Research Council ["NRC"] concluded that "the scientific knowledge base for toolmark and firearms analysis is fairly limited." (See *Strengthening Forensic Science*, supra at 155). Specifically, the NRC found that the **"validity of the fundamental assumptions of uniqueness and reproducibility of firearms-related toolmarks has not yet been fully demonstrated."** Id. at 154.[1] In other words, the NRC found that the fundamental assumptions underlying the firearm comparison discipline have not been shown to be scientifically sound. Even if one were to assume that there is some validity to the proposition that marks left by a firearm are reproducible - that "firearms-related

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[1] Quoting NRC, *Ballistic Imaging*, supra at 3.

toolmarks are not completely random and volatile; one can find similar marks on bullets and cartridge cases from the same gun" - the NRC was very clear that reproducibility alone is not sufficient to make the leap from a set of marks on a bullet to one particular firearm. Id.

This is because, as the NRC discovered, there is currently no scientific basis for the firearm examiner's assumption of uniqueness. The NRC was unequivocal that a "significant amount of research would be needed" not only to "determine the degree to which firearms-related toolmarks are unique" but even just to "characterize the probability of uniqueness." Id. at 154.

The NRC was critical of the smattering of "studies" that do exist, disapproving of their "heavy reliance on the subjective findings of examiners rather than on the rigorous quantification and analysis of sources of variability [in the production of tool marks]." Id. at 155. This is unacceptable to the broader scientific community, which demands that theoretical assumptions be validated through empirical research before they can be relied upon with any confidence in application. Id. at 112 (describing the essential processes of hypothesis testing, methodical data collection, and developing limits of uncertainty). And yet, firearms examiners not only rely upon these assumptions with confidence, they rely upon them with an unfounded "certainty."

The courts have also recognized that "[t]here is a substantial debate within the scientific community, as well as the Courts, regarding the degree to which firearms toolmark identification evidence passes muster," and "in this debate . . . the latest scientific consensus is as expressed in the NRC Forensic Science Report." See United States v. Mouzone, Crim. No. WDQ-08-086, *reprinted in and adopted by* United States v. Willock, 696 F.Supp.2d 536, 574 (D. Md. 2010).

II. THE FUNDAMENTAL ASSUMPTIONS OF UNIQUENESS AND REPRODUCIBILITY LACK EMPIRICAL SUPPORT

There is a lack of data to determine the probability that two bullets or cartridge cases will match if fired from the same firearm. (See attached Affidavit of Alicia Carriquiry, Ph.D). As discussed earlier, the significance of a match in terms of probative value relies on the assumption that each gun leaves a "unique" mark or impression on all bullets or cartridges fired with it (ie the assumptions of uniqueness and reproducibility). These are unverified assumptions because with the data that exists it is not possible to determine the probability that two bullets or cartridge cases will match if fired from *different guns*. This is known as the coincidental match probability. It is crucial to know if this coincidental match probability is or is not non-negligible

before knowing the probative value of a match.

In the case of DNA evidence, it is known both: (1) the probability that two samples will match if they were deposited by the *same person*; and (2) the probability that 2 samples will match if they were deposited by *different persons*. The ratio of these two probabilities is the *likelihood ratio* and the likelihood ratio is very high for DNA because the first probability is very high and the second probability (coincidental match probability) is very low.

With firearm marks examining, <u>there is no known likelihood ratio</u> because there is insufficient data to know the coincidental match probability: the probability that two samples will match if they originated from <u>different firearms</u>. In order to reliably estimate the coincidental match probability for firearm examining, it is necessary to conduct a *population-wide* study where a representative sample of guns (ie each type of each brand of firearm) with a wide range of ammunition to create a *reference database* as exists in DNA (which has shown that the coincidental match probability in that field is essentially zero).

Just as in its infancy DNA evidence was not supported by a reference database from which a coincidental match could be estimated, firearm marks examining evidence of "matches" should not be allowed

until a reference database is established.

III. THE *FATM* METHODOLOGY IS FLAWED WITH SUBJECTIVITY AND LACKS VALIDATION

Aside from the lack of acceptance of the fundamental assumptions of uniqueness and reproducibility, scientists do not accept that the Association of Firearm and Toolmark Examiners' (AFTE's) amorphous standards can be used to reliably distinguish unique from non-unique markings and use those markings to narrow the pool of potential sources down to one particular firearm. The NRC examined the AFTE "methodology":

> AFTE has adopted a theory of identification, but it does not provide a specific protocol. It says that an examiner may offer an opinion that a specific tool or firearm was the source of a specific set of toolmarks or a bullet striation pattern when "sufficient agreement" exists in the pattern of two sets of marks. It defines agreement as significant "when it exceeds the best agreement demonstrated between tool marks known to have been produced by different tools and is consistent with the agreement demonstrated by tool marks known to have been produced by the same tool." The meaning of "exceeds the best agreement" and "consistent with" are not

specified, and the examiner is expected to draw on his or her own experience.

See *Strengthening Forensic Science*, supra at 155.

As the NRC points out, AFTE's guidance does not provide a coherent methodology at all, but rather leaves it to the examiner to make a "subjective decision based on unarticulated standards." Id. at 153-55. The AFTE theory asks the firearms examiner to think back to the closest known non-match that he can remember, and see if the correlation he currently sees under the microscope is better than the one in his mind's eye. If so, it is appropriate to opine that the marks came from one specific firearm. That's it. That's the *entirety* of the guidance provided under the AFTE theory of identification. Perhaps not surprisingly even to the layperson, the scientific community finds this "lack of a precisely defined process" to be a "fundamental problem with toolmark and firearm analysis." Id. at 155.

For example, for a firearms examiner to allege that markings left on a bullet or cartridge case came from a particular gun, he must have distinguished "individual" markings from all non-individual markings, including subclass markings, and also must have found enough of these "individual" markings to warrant excluding all other firearms. Subclass markings resemble individual markings - indeed, they are created in the same fashion, by

imperfections in the firearms manufacturing process - but unlike "individual" markings, they will be transferred to bullets and cartridge casings fired from *any* firearm manufactured in the same lot (*i.e.* produced by the same tool).

Examples of problematic subclass characteristics (*i.e.* markings that may appear to be unique but are actually common to a specific make and model of gun) are rife in the literature[2] and are publicly acknowledged to present serious problems for the possibility of making correct identifications.[3] Nevertheless, the AFTE method fails to provide any standards for recognizing or otherwise dealing with subclass markings. "Because not enough is known about the variabilities among individual tools and guns,"[4] and

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[2] *See, e.g.,* Patrick D. Ball, *Toolmarks Which May Lead to False Conclusions*, 32(3) AFTE J. 292 (2000); Evan Thompson, *False Breech Face ID'S*, 28(2) AFTE J. 95 (1996); Richard K. Maruoka, *Guilty Before the Crime? The Potential for a Possible Misidentification or Elimination*, 26(3) AFTE J. 206 (1994); Richard K. Maruoka, *Guilty Before the Crime II?*, 27(1) AFTE J. 20 (1995); *see also* M.S. Bonfanti & J. De Kinder, *The Influence of Manufacturing Processes on the Identification of Bullets and Cartridge Cases - A Review of the Literature*, 39 Sci. & Justice 3, 5 (1999) (reporting that for some handguns "a correct identification of the firearm on the basis of the breech face and firing pin impression, turned out to be hardly possible" and for different guns "it was impossible to identify the tool which generated the subclass characteristics").

[3] *See, e.g.,* Gene C. Rivera, *Subclass Characteristics in Smith & Wesson SW40VE Sigma Pistols*, 39(3) AFTE J. 247 (2007).

[4] *Strengthening Forensic Science,* supra at 154.

because the AFTE theory offers no standards to guide the analysis, "subclass characteristics that could easily be mistaken for individual characteristics, and might lead an examiner to make a false positive identification" are a serious problem.[5]

Not only does the AFTE method fail to provide a defined process (or standards) for firearms examiners to follow, worse, what guidance it does provide has not been submitted to "any meaningful scientific validation, determination of error rates, or reliability testing to explain the limits of the discipline." See *Strengthening Forensic Science*, supra at 107-08 (referring to firearms comparison). Before scientists put a methodology to use, they conduct validation testing to establish whether or not the methodology reliably and consistently produces the purported results. Validation testing also allows scientists to determine the degree of certainty associated with a methodology, *i.e.* the degree of certainty with which a firearms examiner may match markings to one particular firearm, assuming the methodology is executed correctly.

Due to these limitations on - and the lack of testing of - their methodology, firearms examiners have not demonstrated that they can reliably identify a particular firearm, nor what would be required to reliably

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[5] *See* Rivera, *supra* n. 18, at 247.

identify a particular firearm. In the wake of the NRC's report, even the president of the American Academy of Forensic Sciences - the most comprehensive and respected of the forensic science organizations (and the organization that publishes the Journal of Forensic Sciences) - agreed that "[t]ool mark analysis . . . can be subject to validation but nevertheless appear[s] never to have been studied for this purpose." See Thomas Bohan, *President's Editorial: Strengthening Forensic Science: A Way Station on the Journey to Justice*, 55(1) J. For. Sci. 2010 at 7. Because the AFTE theory has not been validated, there is no way to assess its "reliability, repeatability, or the number of correlations needed to achieve a given degree of confidence" in a "match." See *Strengthening Forensic Science*, supra at 155.

IV. UNDER THE *KELLY-FRYE* TEST, FATM EXAMINERS SHOULD NOT BE ALLOWED TO TESTIFY TO *IDENTITY* OR *MATCH* OPINIONS

In People v. Kelly (1976) 7 Cal 3d 24, the California Supreme Court reaffirmed that in California, the test for admissibility of expert testimony based on the application of a new scientific technique comported with the federal test set out in Frye v. United States 293 F. 1013, 1014 (D.C. Cir. 1923). The first of the three prongs requires proof that the technique is generally accepted as reliable in the relevant scientific community. A technique which

has enjoyed general acceptance may still be challenged where "new evidence is presented reflecting a change in attitude of the scientific community. See Kelly, supra at 32; see also People v. Bolden (2002) 29 Cal 4th 515, 545.

There is no serious question that there is a debate in the relevant scientific community over the scientific limitations on the firearm and toolmark discipline. On one side of the divide stand independent scientists - experts in the scientific method, proper experimental design, measurements of certainty, and the manufacturing processes employed in firearm production - as well as forensic practitioners and heads of forensic laboratories. After reviewing the firearm and toolmark methodology and supporting literature, they found that the method has not been validated - that the reliability and accuracy of the method is unknown. They found that there is no basis in science for identifying a particular source without matching criteria or objective standards of any sort.

On the other side stand forensic firearm examiners, beholden to the continued public trust in their discipline for their bread and butter. In between the two sides lie members of the firearm toolmark community, like Miller, who have recognized the potential for mistakes and the need for additional research.

The existence of a controversy in the relevant scientific community is the beginning and the end of the

story in a Kelly-Frye jurisdiction such as this one. See United States v. Jenkins, 887 A.2d 1013, 1022 (D.C. 2005). Because there is a controversy as to whether a toolmark examiner can match a bullet or cartridge casing to a particular gun, the examiner cannot testify to such a conclusion.

Recent opinions have heeded the admonitions of the scientific community. For example, after an evidentiary hearing the court in United States. v. St. Gerard (U.S. Army Tr. Judiciary, 5th Judicial Cir. June 7, 2010) found that the examiner could not testify to a match to a particular firearm ***at all***, even if she refrained from discussing her level of "certainty." Id. at 9-21.

Given the current estimation of the toolmarks analysis discipline in the scientific community, a firearms expert should not be permitted to testify to a match to a particular firearm. Such formulations are not generally accepted by the relevant scientific community.

IV. THE DEFENSE PROPOSAL TO EXCLUDE THE EXAMINER'S OPINION IS APPROPRIATE AND GENERALLY ACCEPTED

Accordingly, in the present case, the FATM examiner should not be allowed to render a cavalier identity or match opinion as it is not accepted within the relevant

scientific community. At the very least, any opinion by the examiner should be limited to what is accepted within the relevant scientific community.

CONCLUSION

This Court should hold that, until the "pattern-matching" methodology used by firearms examiners is validated by the scientific community, *Kelly/Frye* precludes the admission of expert testimony concluding that marks on a bullet or casing were left by a particular firearm. This court should exclude such identity testimony entirely.