AFFIDAVIT OF JOHN NIXON

I, JOHN NIXON, declare as follows:

Executive Summary

1. In 1974, FBI firearms/toolmarks examiner, Special Agent Robert Sibert, examined four discharged cartridge case exhibits recovered at a crime scene and concluded that they were all fired in the same firearm. His opinion was based upon firing pin and breech face marks left on the ammunition exhibits.

2. Mr. Sibert was also asked to examine a 1911A1 pistol owned by Petitioner Macumber. Mr. Sibert test fired the Macumber pistol and found that the breech face and firing pin markings left on the discharged cartridge cases were different to those on the cartridge case exhibits from the crime scene. Mr. Sibert opined that the ejector markings on three of the four crime scene cartridge cases were the same as the ones left by the Macumber pistol. Mr. Sibert then opined that the breech face and firing pin markings were different because they had been changed or altered.

3. Mr. Sibert offered little to illustrate his observations and support his subjective opinions. He provided very few photomicrographs, no notes, and a single, “idealized” depiction of a cartridge case during his testimony. There is no evidence that Mr. Sibert had his work verified by a colleague. While his protocol was considered normal practice at that time, it falls far short of modern crime laboratory protocols, which typically must be documented or verified by sketches, extensive photomicrographs, or a second examination by a colleague. Even current laboratory protocols were condemned as unvalidated and subjective in the 2009 National Academy of Sciences (NAS) Report.

4. The ejector mark on a 45 ACP cartridge case represents a mere 1.5% of the total area of the rear of that cartridge case. In comparison, the breech face and firing pin marks cover the remaining 98.5% of the rear of the cartridge case. It is generally accepted that the firing pin and breech face marks are more repeatable and reliable than the ejector marks.

5. Dismissing the extensive exculpatory breech face and firing pin marks produced by the Macumber pistol because those components may have been changed or altered, and relying upon the minimal and less reliable ejector mark for an identification, is not good practice. It is akin to selecting a man off the street at random and concluding that he robbed a bank last year even though his face looks completely different to that of the suspect in the security camera photograph - he has similar blue eyes, but the rest of his face is different, and therefore must have been altered by plastic surgery.

6. It is this author’s opinion that the same evidence examined in a forensic laboratory today would lead the examiner to **eliminate** the Macumber pistol as the one that fired the cartridge case exhibits recovered at the crime scene.

Expertise

7. I am originally from the United Kingdom, where I worked as a scientist and professional engineer for the UK government, conducting weapons systems research, design, development, performance testing, mid-life improvement, reverse engineering, and forensic examinations, including firearms. I am a professional engineer with a first class honors degree in mechanical engineering (recognized as equivalent to a 4yr US degree under the terms of the Washington Accord) and a Masters degree in business administration. I am a Fellow of the Institution of Mechanical Engineers, a Member of the American Academy of Forensic Sciences, and a member of several other technical/professional societies. I completed a 4-year engineering apprenticeship that covered mechanical and production (industrial) engineering. My apprenticeship involved both college study / examinations, and extensive practical workshop training in the use of both hand tools and machine tools. I am an NRA certified pistol/personal protection instructor and range safety officer. I qualified as a factory certified SIG firearms law enforcement armorer with 100% test scores.[1] I am currently a consultant with Athena Research & Consulting LLC in Bippus, Indiana, specializing in technical and forensic consulting in the areas of firearms, ballistics, munitions, and explosives. I have conducted extensive forensic engineering research and have been responsible for numerous innovations in guns and munitions design. I have published numerous research papers and technical articles, including items on firearm identification and toolmark analysis. I have presented training seminars to numerous groups of investigators, attorneys, engineers, law enforcement personnel, medical professionals, and students. Clients include insurance companies, attorneys, defense contractors, federal, state, and municipal governments. In addition to testifying in UK courts, I have testified as an expert in numerous US Federal Courts, and many state courts, including Indiana, Minnesota, Illinois, Iowa, Kansas, New York, Maryland, Florida, Ohio, and Kentucky. I have worked for both defense and plaintiff/prosecution. A copy of my *curriculum vitae* is attached to this affidavit as Exhibit A.

8. My engineering apprenticeship included extensive education and practical training in the manufacture of machined components from metals, and other materials. I was required to pass proficiency tests in the manufacture of components using both hand tools and machine tools, including drills, boring machines, vertical & horizontal milling machines, shaping machines, slotting machines, lathes, surface grinding machines and bench grinders. My education and training included additional component manufacturing methods, such as casting, forging, welding etc. These are the same processes and techniques used in the manufacture of firearms and ammunition.

9. I was required to manufacture test specimens to specified tolerances and surface finishes. In order to manufacture a component to a specified surface finish one needs knowledge of toolmarks - how they are created, what they look like, and how to reduce them to acceptable levels.

[1] An armorer is someone who is certified to inspect, assess, and repair problems with firearms.

10. I have extensive knowledge and/or experience in the design of components, and manufacturing techniques, of precision investment casting, polymer injection molding, metal matrix composites, polymer/glass/carbon/Kevlar composites, forging, and metal injection molding (MIM).

11. Many firearms and toolmark examiners in the US are members of the Association of Firearms and Tool Mark Examiners (AFTE). AFTE is a trade association, and membership of the organization is neither a requirement for employment as a firearms/toolmarks examiner, nor a requirement to be a court qualified expert in the discipline.

12. AFTE has no specified level of education, nor do they have a required educational discipline for admission to membership. During my casework I have encountered AFTE members with no degrees, associates degrees, and bachelor's degrees in an array of disciplines, including English literature, psychology, sociology, anthropology, nursing, history, government & politics, criminal justice, agriculture, communications, and others.

13. AFTE members frequently cite brief tours of firearms and ammunition manufacturing facilities as proof of their expertise in firearms, ammunition, machining, manufacturing, and toolmarks. This is analogous to touring a hospital and claiming to have acquired the expertise to be a medical doctor.

14. Instead, AFTE members' expertise in toolmarks is essentially in comparing patterns of lines and features, and this "expertise" comes from on the job training and experience. And yet, AFTE's "Theory of Identification" and Procedures Manual, which were formulated without input from independent scientists & engineers with relevant education and expertise, are the only guidance in the field, and are relied upon by most firearm and toolmark examiners to make the leap from their observance of corresponding patterns to their identification of a particular firearm to a high degree of certainty - or even absolute certainty. Along the same lines, studies often cited as "validation studies" for the field of firearms and toolmark identification were conducted by AFTE members, "peer-reviewed" by AFTE members, and published through the AFTE Journal. Many, if not all, of these studies are flawed and would likely not have made it through the peer-review process required by legitimate scientific journals with more rigorous standards and reviewers with knowledge of proper experimental design and a lack of vested interest in the study results.

Documents Reviewed

15. I reviewed the following documents, provided by the Arizona Justice Project, in preparing this affidavit:

a. Transcript of December 20, 1976, testimony of Robert W. Sibert (misspelled as "Siber" throughout transcript), FBI Laboratory firearms/toolmarks examiner;

b. Transcript of January 3 and 4, 1977, closing arguments in Petitioner's trial;
c. September 18, 1974, Report by Robert W. Sibert of his examination of the firearms evidence in Petitioner's case;
d. Transcript of phone call between Robert W. Sibert and Bedford Douglas, Public Defender for Petitioner during trial;
e. September 9, 1974 Maricopa County Sheriffs Office Departmental Report, and attached cable from FBI.

Technical Background to Firearms & Toolmark Identification

16. Firearms identifications are concerned with linking fired (expended/discharged) ammunition components to the firearm from which they were discharged. Occasionally, the process may be applied to unfired ammunition that has been cycled through a suspect firearm. This is accomplished by toolmark comparison - a subjective visual process. Toolmarks fall into two categories - stria and impressions.

17. Stria are scratch marks that are generated when one surface moves relative to another - the harder surface typically leaving scratch marks on the softer one.

18. Impressions are formed when one object impacts another object - the harder object typically leaving its reverse image on the softer object.

19. With regard to firearms and ammunition evidence, both striated and impressed toolmarks are divided into three broad categories - class characteristics, individual characteristics, and sub-class characteristics.

20. **Class characteristics** are shared by every firearm, or firearm component, of a particular class, and typically include the number and direction of twist of the lands and grooves in the barrel, the type of breech face marks (circular, vertical etc), the shape of the firing pin (hemispherical, elliptical etc) and the relative locations of the extractor and ejector (described in reference to a clock face). For example, every Ithaca 1911A1 pistol (and most other brands) is manufactured with six sets of lands and grooves in its barrel, and these have a left twist in order to impart spin to the bullet. These lands and grooves, and their direction of twist, are class characteristics.

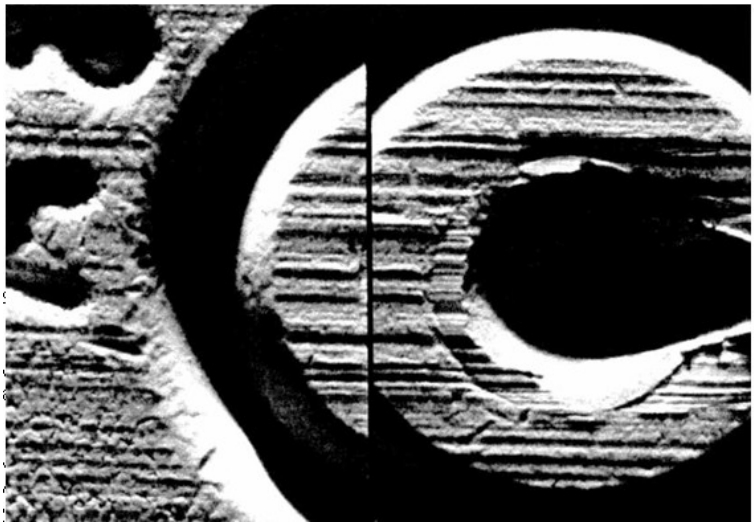
21. **Individual characteristics** are those characteristics that are claimed to be unique to a given firearm (or firearm component) due to assumed random imperfections generated during the manufacture process, during use (wear), or due to damage from neglect and/or abuse.

22. **Sub-class characteristics** are those characteristics which typically result from an imperfection in the tool used to manufacture the firearm component under consideration. All of the components manufactured with that tool will exhibit the same imperfection, but once the tool is replaced subsequent batches of components will be somewhat different in appearance. This batch of components is said to have sub-class characteristics. An example of a sub-class characteristic would be a batch of ejectors manufactured by a single stamping tool that had a defect in form. Interest in sub-class characteristics has increased in recent years, because the phenomenon has increasingly been acknowledged by firearms/toolmarks examiners and researchers.

23. The issue of sub-class characteristics is a persistent problem for the firearm and toolmarks discipline. Sub-class characteristics are features accidentally imparted as part of the tool/firearm manufacturing process – typically a group of imperfections – and are common to an entire batch of manufactured components (e.g. ejectors) produced by an imperfect manufacturing tool. By definition, these characteristics are unpredictable and appear on components of unknown batch size. Because the manufactured components may be installed in many firearms, perhaps several brands and/or models of firearms, it is extremely difficult, and potentially impossible, to determine either the size of a given batch of components that have sub-class characteristics, or their distribution in the population of firearms in circulation. This makes systematic scientific study and evaluation of the phenomenon all the more important. However, independent systematic scientific study and evaluation has not been attempted to date. The AFTE Theory of Identification and the AFTE Procedures Manual make no mention of sub-class characteristics. Sub-class characteristics are briefly described/defined on pages 153 & 175 of the 5th Edition of the AFTE Glossary, but this document does not explain what kind of sub-class characteristics might be associated with different tools/firearms, or different tool/firearm manufacturing techniques.

24. Despite this, many firearms/toolmarks examiners claim that they are constantly vigilant for the presence of sub-class characteristics in their casework. However, the only way to determine that observed marks are sub-class versus individual in nature is to examine other firearms with components from the same batch as the suspect firearm; this would enable the firearms/toolmarks examiner to distinguish and filter out marks that are common to the suspect weapon and the other firearms/components from the same batch, or other brands/models of firearms incorporating components from the same batch. This is not how firearms/toolmarks examinations are conducted, however. Rather, firearms/toolmarks examinations are conducted as a side-by-side comparison between a questioned bullet or cartridge case and a bullet or cartridge case test-fired from a suspect firearm. Often, questioned fired ammunition exhibits are merely compared to one another in the absence of any suspect firearm. Without examining firearms with components from the same batch, the examiner will never know for sure if the observed characteristics are individual or sub-class – and will almost certainly assume they are individual. This is even more likely to happen if the sub-class characteristics are prominent as compared to any individual characteristics. For an example, see the picture below, which shows a microscopic comparison of breech face marks on cartridge cases fired from two different

Smith & Wesson pistols, showing "an alarming example of sub-class characteristics that could be mistaken for individual characteristics."



> G. Rivera, *Subclass Characteristics in Smith & Wesson SW40VE Sigma Pistols*, AFTE Journal, Vol 39, No. 3, pgs. 247 and 251 (2007). If we were to screen out all of the marks that appear to be sub-class in nature (the marks that appear on both of these cartridge cases, fired from two different firearms), we would be left with practically no "individual" marks. Likely, a firearms/toolmarks examiner who encounters these marks in casework would presume that all of the marks are "individual" in nature and use them as the basis for a "match."

25. The breech face marks depicted in the above picture appear identical, but were in fact produced by two different weapons. The seemingly identical marks – which many, if not all, examiners would conclude had been produced in the same weapon – are an example of the difficulty of discerning sub-class characteristics from individual characteristics, and the ease with which examiners can erroneously identify a weapon.

26. Aside from the fact that many manufacturing techniques can produce sub-class characteristics, the mere determination that a manufacturing technique can produce sub-class characteristics is of no value to a firearms/toolmarks examiner who is examining fired components under a microscope. The examiner needs to know not only that a manufacturing process is capable of imparting sub-class characteristics on batches of firearm components, but also what the sub-class characteristics specific to a particular batch look like. This is because sub-class characteristics can vary from batch to batch, even if the same manufacturing technique is used; after all, sub-class characteristics come from imperfections in the individual tools used in manufacturing. The only way a firearms/toolmarks examiner can discriminate between sub-class and individual marks given the current state of the science (i.e. without systematic, scientific studies of batches of firearm components) is by examining at least two firearms, or firearms with components, from the same sub-class (batch). It should be noted that Mr. Sibert did not

compare two firearms from the same batch, nor two ejectors from the same batch. Accordingly, Mr. Sibert had no basis for concluding that the marks he examined came from Mr. Macumber's weapon "to the exclusion of all others in the world."

27. As an analogy, I am aware that 6 correct numbers on a lottery ticket could win me a lot of money, and I am aware of the 6 numbers that were on last Saturday's winning ticket; but just because I am aware of those facts does not give me the ability to determine if the 6 numbers on the ticket in front of me on Thursday will win the lottery drawn on the upcoming Saturday. This is essentially what is being said with respect to awareness of the possible presence of sub-class characteristics – just because you're aware that a given brand of firearm exhibited particular sub-class characteristics in the past, gives you zero ability to identify future sub-class characteristics on the same brand and model of firearm, because they will, in all likelihood, be different in appearance.

Background Information on the 1911 / 1911A1 Pistol

28. The 1911 pistol was one of the first viable semi-automatic pistol designs to be mass produced and is probably the most commercially successful handgun design to date. As its name suggests, the 1911 pistol was officially adopted by the US military in 1911, and was quickly embraced by many law enforcement agencies, and civilian shooters. In 1924, the 1911 received several very minor cosmetic and ergonomic changes that did not alter function or manufacturing processes, and was re-designated as the 1911A1. The 1911/1911A1 military contract pistols were characterized by relatively loose production tolerances, resulting in a relatively loose fitting pistol - a characteristic that is often touted to improve reliability, at the cost of accuracy. These loose tolerances may also manifest themselves in the variability of the toolmarks produced by the 1911/1911A1 from shot to shot. The pistol at issue in the Macumber case is a military contract 1911A1.

29. The 1911 pistol was initially manufactured by Colt's Firearms, and has since been manufactured by many other companies. The particular 1911A1 at issue in this case – serial number 1844237 – was manufactured by Ithaca under military contact during World War II. Due to the 1911/1911A1 pistol's perceived superior features, and its consequent popularity, at least 2.7 million have been produced. It is estimated that approximately 400,000 1911A1 pistols were produced by Ithaca for their wartime contract. It is not known if Ithaca manufactured all the components, or purchased some smaller components (such as ejectors, extractors, and firing pins) from third party suppliers - a practice that is common today. If an ejector manufacturer sold ejectors from one batch to several 1911A1 pistol manufacturers, then some non-Ithaca pistols could conceivably be fitted with ejectors that have the same sub-class characteristics as some Ithaca pistols.

30. The 1911A1 pistol is comprised of three main sub-assemblies, the frame (or receiver), the slide, and the barrel. All other parts are attached to either the slide or the frame. The pistol frame is the only component considered to be a firearm (the component that incorporates the serial number). 1911A1 pistols are very popular with gun collectors

and competition shooters today, but were more frequently carried and used at the time of the incident in 1962.

31. In the context of this case it should be noted that the breech face is an integral, non-removable part of the slide; and the extractor and firing pin are component parts of the slide. The ejector is a component part of the frame.

32. The 1911A1 is a semi-automatic pistol, meaning that a single round is discharged, and the next round automatically loaded, with each pull of the trigger. As this process occurs, a number of firearm components will leave toolmarks on the ammunition components that they come in contact with. With regard to the 1911A1 the following processes typically occur:

i. The cartridge case is fed from a magazine that is housed in the grip of the frame, and it may have magazine lip striation marks imparted to it. These small marks are used relatively rarely in identifications.

ii. As it is being fed from the magazine, the rear of the cartridge case slides up the breech face and its rim is engaged by a spring steel extractor (a steel claw-like component typically located at approximately the 3 o'clock position). The slide of the pistol continues moving forward and the ammunition is fed into the chamber end of the barrel, ready for firing.

iii. When the operator pulls the trigger the firing pin is driven forward and impacts the primer that is centrally located in the rear of the ammunition. This firing pin impression is frequently used as a means of identification.

iv. As the propellant in the cartridge case ignites & combusts it generates significant gas pressure. This gas pressure forces the bullet down the barrel, and at the same time the cartridge case is pushed rearward into the breech face of the pistol. Any toolmarks on the breach face leave their reverse impression on the head of the cartridge case and primer. These impressed toolmarks are frequently used as a means of identification. It should be noted that the breech face is a component that (in most firearms, including the 1911A1 in this case) both cannot be replaced, and offers a relatively large surface area in contact with the entire rear of the cartridge case, thereby improving the statistical probability that a given cartridge case can be identified as having been fired while in contact with that breach face.

v. At the same time that the gas pressure forces the cartridge case against the breech face, it forces the bullet (projectile) down the barrel of the pistol. The barrel leaves a reverse image of the rifling on the bullet. The barrel also leaves scratches (stria) on the fired bullet, and these are frequently used to link a fired bullet to the barrel that fired it.

vi. As the pistol's slide moves rearward due to the forces generated by the firing process, the empty cartridge case moves rearward from the chamber due to the force generated by the propelling gases and/or the pulling action of the extractor claw. The extractor holds the case against the breech face (with some movement being possible) and when the slide is almost at its fully rearward position the ejector impacts the cartridge case. The ejector typically impacts the rear of the cartridge case in the 7 to 8 o'clock range. Because the extractor holds the case at the 3 o'clock position and the ejector impacts the case at the 7 to 8 o'clock position, the empty case pivots about the extractor and is thrown clear of the pistol - typically upward and rearward.

33. Key pistol components and the previously described operational sequence are depicted in the series of photographs attached hereto as Exhibit B.

34. The result of these actions is that the extractor may leave a combination of scratch marks and impressed/scratch marks on the edge of the rim, and under the rim, of the cartridge case. The ejector leaves an impact impression on the rear surface of the cartridge case head.

35. **Extractor** marks are less consistent in nature than the previously discussed firing pin and breech face markings because the operational process allows significant scope for relative movement and/or clearance between the extractor claw and the cartridge case.

36. Shot to shot variability between **ejector** marks tends to be greater than the other marks discussed, with the possible exception of extractor marks, because, among other things, the cartridge case has significant opportunity for movement between leaving the chamber and impacting the ejector. 1911A1 ejector marks typically represent a mere 1.5% of the viewable surface area on the rear of the cartridge case - the remaining 98.5% containing breech face marks and the firing pin impression. Clearly, it would be unsafe to base any claimed absolute identification on such a small percentage of the overall area available for comparison. Additionally, different ammunition loadings and cartridge case materials frequently result in some variability in terms of location, depth, and reproducibility of markings.

37. It should be noted that these firearm components may be manufactured by a wide variety of techniques, including stamping, machining, casting, metal injection molding, and forging. These components may receive surface finish refinements (polishing, plating, etc) and heat treatment. These finishing processes reduce the number of individual characteristic marks, and may reduce the potential for the components to acquire in-service individual characteristics by wear, abuse, or corrosion.

38. Some firearms/toolmarks examiners are comfortable making identifications based upon extractor and ejector markings alone, but this is increasingly unpopular, and in this author's opinion offers a much lower statistical probability of an accurate and reliable identification due to the much smaller marked areas, and the inherent variability within those small areas. Ejector markings in particular can be both small and variable, and are often obscured, partially obscured, or altered by the presence of head stamp identification markings (also known as bunter tool impressions). Examples of 1911A1 ejector marks are attached to this Affidavit as Exhibit C.

Changes & Issues in the Discipline of Firearms & Toolmark Examination from 1974 to the Present Time

39. Comparison microscopes and pattern matching – as employed by firearms/toolmarks examiners – have been around for a long time, and have enjoyed broad acceptance within the forensic firearms community for decades. However, the fact that firearms/toolmarks examiners compare patterns using microscopes, have been doing so for a long time, and are content with this ambiguous methodology, misses the point of recent debate among scientists. Scientists are not critical of the fact that firearms/toolmarks examiners compare patterns of marks. Rather, they are critical of the comparison of patterns without specified and validated criteria to give meaning to any observed similarity between patterns. In short, modern scientists and statisticians are concerned that the conclusions firearms/toolmarks examiners reach are over-extended, inaccurate, unreliable, and arrived at using non-validated techniques and assumptions.

40. The National Academy of Sciences (NAS) found that the decision of a toolmark examiner is subjective, based upon unarticulated standards and have no statistical foundation for estimation of error rates [1]. Additionally, the National Research Council (NRC) Report, *Ballistic Imaging*, stated that the fundamental assumptions of uniqueness and reproducibility of firearms related toolmarks has yet to be fully demonstrated [2]. It is my opinion that these findings, and the other firearm-related findings and conclusions of the NAS report, are well-informed and legitimate. Until a specific protocol for the examination and categorization of toolmarks on fired ammunition components has been formulated and validated by appropriately qualified scientists, engineers, and statisticians, then the discipline of toolmark analysis must be considered an unproven 'science' at best - and more of a subjective art.

41. In the years prior to the NAS report, law enforcement laboratory firearms and toolmark identification practitioners, in conjunction with their trade association, the Association of Firearm and Tool Mark Examiners (AFTE), developed increasingly stringent examination criteria that have been incorporated into many forensic laboratory protocols & procedure manuals. AFTE published these new criteria in their Theory of Identification (Exhibit D) and their Procedure Manual - the most pertinent sections being FA-IV-13 (Exhibit E) and Appendix 1 (Exhibit F).

AFTE Theory of Identification (Exhibit D*)*

42. The key points made in the document, Ex D, are:

A. Toolmark comparison is a subjective process.

B. Opinions of common origin can be made when the unique surface contours of two tool marks are in "sufficient agreement."

C. Sufficient agreement is defined as

"Agreement is significant when it exceeds the best agreement demonstrated between toolmarks known to have been produced by different tools and is consistent with agreement demonstrated by toolmarks known to have been produced by the same tool."

43. Note that this document assumes that the concept of 'unique' toolmarks has been validated and is universally accepted - something refuted by the 2009 NAS Report [1].

AFTE Procedure Manual Section FA-IV-13 (Exhibit E)

44. This document states:

"6.1.6 The entire unknown should be considered."

45. This statement from Ex E means that the entire cartridge case or bullet should be considered, the inference being that a high probability of an identification should not be called if only part of the exhibit is in agreement, and the rest is not. In the Macumber case, a mere 1.5% of the toolmarks on the case head were claimed to be in agreement, while 98.5% were declared to be in disagreement.

"6.2.2 An insufficient correspondence of individual characteristics but a correspondence of class characteristics will lead the examiner to the conclusion that no identification or elimination could be made with respect to the items examined."

"6.2.5 All identifications must be documented by either:

6.2.5.1 Verification by a second examiner
6.2.5.2 Photomicrograph
6.2.5.3 The identification indexed and extensive notes referencing these indexing marks are taken"

46. There is no evidence in the record to indicate that Mr. Sibert used any of the documentation techniques prescribed by the AFTE Procedures Manual (Ex E) except for minimal photography. The fact that there was no supporting testimony by a second examiner, nor examination by an independent defense expert, seriously diminishes the reliability of the claimed match. In the Macumber case, no sketches or other notes of the claimed match were presented, and only minimal photographic records were provided, thereby further diminishing the reliability and credibility of Mr. Sibert's conclusions. These shortcomings would be totally unacceptable in any modern forensic laboratory.

AFTE Procedure Manual - Appendix 1 (Exhibit F)

> 1.2.3 "The discipline recognizes that an elimination of a firearm by other than class characteristics is possible but that such an elimination is an exceptional situation."

47. Interpretation of Ex F: AFTE realizes that at some point the individual characteristics may be so different that, under the AFTE Theory of Identification, an elimination based upon individual characteristic dissimilarity may be justified. This author disagrees that such an elimination should be considered an "exceptional situation". If sufficient agreement of individual characteristics is considered sufficient justification for an identification, then the corollary surely must be that sufficient disagreement of individual characteristics must be considered as justification for an elimination. In the Macumber case there was more than sufficient disagreement between the cartridge case exhibits recovered at the incident scene, and those test fired in the Macumber pistol; consequently, the Macumber pistol should have been eliminated as the murder weapon.

Competency of the State Expert in this Case

48. Mr. Sibert from the FBI was a relatively well-qualified firearms/toolmarks examiner for the time period under consideration. Mr. Sibert had a degree in mechanical engineering. While the ideal training for a firearms and toolmarks examiner would include a background in gunsmithing, tool making, machining, and bench fitting, it would be very difficult to find one individual with all of these training attributes. Mr. Sibert had undertaken a one-year training program in firearms and toolmarks examination with the FBI laboratory. While this is far from ideal, it was most likely state of the art training in that particular era, and it is unlikely that many firearms and toolmarks examiners at that time would have had better training in terms of both duration and content. This training would, at least in part, offset the lack of training in the four disciplines previously cited. Mr. Sibert testified that he had approximately 2 years experience as a firearms and toolmarks examiner with the FBI at the time he conducted his comparison of the evidence in this case in 1974. Mr. Sibert was also a member of trade association AFTE, and presented his membership in support of his expertise in the Macumber case.

Mr. Sibert's Trial Testimony

49. During trial testimony, Mr. Sibert opined (pages 37 & 38) that the four fired cartridge cases recovered from the murder scene – Exhibits 28 (a & b), 29 and 30 – were all fired in the same weapon, and that he had reached this conclusion based upon comparison of individual characteristics imparted by the firing pin and the breech face. Apparently the firing pin and breech face of the murder weapon was reliably reproducing what Mr Sibert interpreted as unique individual markings.

50. Mr. Sibert further opined that three of the cartridge cases (Ex 28a, 28b and 29) had been fired from Mr. Macumber's Ithaca pistol (Exhibit 34) because he was able to identify and match individual characteristics within the ejector impression marks on the rear of each of the cartridge cases. Mr. Sibert testified that the marks on those three cartridges were produced by the ejector in Mr. Macumber's pistol "to the exclusion of all others in the world."

51. However, the breech face and firing pin markings on these exhibits were different from those produced by Mr. Macumber's pistol. Mr. Sibert speculated that this may have been because the firing pin had been changed and that the individual characteristics on the breech face of Mr. Macumber's pistol had been altered. There were insufficient reproducible individual characteristics imparted by the extractor of Mr. Macumber's pistol to be of any analytical value.

Problems With Mr. Sibert's Testimony

52. To suggest that the individual characteristics in the firing pin impressions left by Mr. Macumber's pistol were different from those on the exhibits because the firing pin was exchanged is a legitimate theory. Mr. Sibert's speculation that the individual characteristics imparted by the breech face of Mr. Macumber's pistol slide were different to those on the recovered cartridge cases because the breech face had in some way been altered is also a legitimate theory. However, it is not legitimate scientific practice to dismiss exculpatory evidence based upon nothing more than speculation that it is different because it may have been altered since the time of the incident. Mr. Sibert did no testing or other investigation to verify his theories; he simply speculated away otherwise exculpatory evidence. This is akin to selecting a man off the street at random and concluding that he robbed a bank last year even though his face looks completely different to that of the suspect in the security camera photograph - he has similar blue eyes, but the rest of his face is different, and therefore must have been altered by plastic surgery. Without objective evidence supporting Mr. Sibert's speculation, the fact that the recovered cartridge cases exhibited different individual characteristics to those produced by Mr. Macumber's pistol should be taken for what it is, at face value - exculpatory evidence.

53. This brings us to Mr. Sibert's other conclusion, that three of the four cartridge cases in evidence (Ex 28a, 28b, & 29) had been fired in Mr. Macumber's pistol (Ex 34) because the individual characteristics imparted by the ejector indicated a match. There are a number of issues to be addressed here:

54. Firstly, the relatively small area of ejector mark under consideration (1.5% of the rear surface area of the cartridge case rear) significantly increases the probability that two apparently similar ejector marks were in fact produced by different firearms. Put simply, the smaller the area, the fewer marks are available for comparison, and the easier it is to erroneously conclude that particular firearm made a mark that was in fact produced by an entirely different firearm.

55. Secondly, even if the ejector individual characteristics (in the subjective judgment of the examiner) were considered sufficiently similar, Mr. Sibert's conclusion that the recovered cartridge cases were fired from Mr. Macumber's pistol "to the exclusion of all others in the world" is grossly exaggerated. Such an opinion expresses a conclusion of identification to an absolute degree of certainty. It is equivalent to a statement of 100% certainty. However, the National Research Council concluded, and I agree, that firearms/toolmars examiners have not established that they can identify to *any* degree of certainty, much less absolute certainty, whether a particular mark was produced by a particular firearm, or component thereof. It is my view that these conclusions give far too much weight and credence to a process that has not yet been scientifically validated.

56. When I examine and compare fired ammunition I am often inclined to declare that two pieces of ammunition were fired from the same firearm. I must resist this temptation because I realize that I would be making a conclusion based upon 'gut feeling' and/or intuition, rather than a firm science that could be statistically validated and proven.

57. As the 2009 NRC report makes clear, firearms/toolmarks examiners have not demonstrated that their methodology allows them to reliably identify a particular firearm to any level of certainty. To quote the NRC report, the AFTE Theory of Identification "does not even consider, let alone address, questions regarding variability, reliability, repeatability, or the number of correlations needed to achieve a given degree of confidence." [3] "Because not enough is known about the variabilities among individual tools and guns, we are not able to specify how many points of similarity are necessary for a given level of confidence in the result;" [4].

58. Moreover, in my opinion, in the Macumber case the conclusion drawn should have been one of elimination because a mere 1.5% of the cartridge case rear toolmarks were claimed to be in agreement, while 98.5% were admitted to be in disagreement.

Conclusions

59. Toolmark analysis is a subjective visual process that relies upon the judgment of individual practitioners. Many of the assumptions made by firearms/toolmarks examiners have not been statistically validated, particularly those related to the concept of uniqueness. There is no statistical foundation for the estimation of error rates. The existence of sub-class characteristics, and their identification in casework, is a problem. Sub-class characteristics are those toolmarks that are common to a batch of components produced with the same 'imperfect' tooling.

60. Identical sub-class characteristics may be found on firearms components in an unknown number of one model of firearm, or in an unknown number of models of firearms in the overall firearm population. Despite claims to the contrary, it is generally not possible to distinguish sub-class characteristics from individual characteristics unless two firearms, or firearms components, with identical sub-class characteristics are possessed. As such, claims that a particular toolmark was produced by a particular weapon “to the exclusion of all others in the world” cannot be justified statistically.

61. The firing pin impression and breech face marks cover approximately 98.5% of the surface area of the rear of the fired cartridge case. Ejector marks cover approximately 1.5% of the surface area of the rear of the fired cartridge case. Extractor marks cover a very small area of the cartridge case. Extractor and ejector marks tend to be less repeatable than firing pin impressions and breech face marks and, consequently, tend to be less reliable toolmarks on which to base an identification.

62. Despite these known and documented shortcomings of toolmark analysis (firearms identification), in the Macumber case the firearms/toolmarks examiner linked all 4 fired cartridge cases to one another using firing pin impression and breech face markings (that were apparently produced repeatedly from the murder weapon) yet was unable to link them to the Macumber pistol using the same toolmarks. Instead he chose to link 3 of the fired cartridge cases from the murder scene to the Macumber pistol using ejector marks alone.

63. This use of only ejector marks for identification meant that a mere 1.5% of the cartridge case rear toolmarks were claimed to be in agreement, while 98.5% were admitted to be in disagreement. The fact that the recovered cartridge cases exhibited different individual characteristics to those produced by Mr. Macumber’s pistol should have been taken for what it was - exculpatory evidence. It is not legitimate scientific practice to dismiss exculpatory evidence based upon nothing more than speculation that it is different because it may have been altered since the time of the incident.

64. Additionally, The firearms/toolmarks examiner in the Macumber case did not properly document his findings, nor have them confirmed by an independent examiner. Both of these steps are routine in modern labs. The firearms/toolmarks examiner also testified that he had made a positive identification "to the exclusion of all other firearms in the world.” It is this author's opinion that, given the lack of scientifically valid data to

support claims of toolmark uniqueness, and in light of the 2009 NAS Report, conclusions of absolute identification should not be made under any circumstances.

65. It is my opinion that if the same evidence were examined today, a competent and unbiased examiner would **eliminate** Mr. Macumber's pistol as the one that fired the cartridge cases recovered at the murder scene.

References

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[3] National Academy of Sciences, Committee on Applied and Theoretical Sciences, National Research Council, "*Strengthening Forensic Science in the United States: A Path Forward*" pp. 155 (National Academies Press 2009)

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SWORN this 3 day of JANVARY, 2012.

J Nixon

John Nixon

SUBSCRIBED AND SWORN to before me this 3 day of January, 2012.

Notary Signature Julie Crain

Notary Public – County of Huntington, State of Indiana

Print Notary Name Julie Crain

My Commission Expires: 6-8-2013