# MEMORANDUM

To: Jeremy Gunn
From: Phil Golrick
Date: April 5, 1995
Re: Ballistics Evidence

This memorandum summarizes the Warren Commission testimony of Robert A. Frazier on March 31, 1964. Frazier was an FBI firearms expert, who worked in the FBI Laboratory in Washington, D.C. III WC 390-91.

## Who Mounted the Scope?

The FBI asked Klein's Sporting Goods to mount a scope on a comparison rifle (CE 542) of the same model as CE 139 (alleged assassination rifle) in the way that they normally prepare such weapons to be shipped to customers, after specifying that "the scope should be in approximately [the same] position on the frame of the weapon" as it is on CE 139. The mount on the comparison rifle had two "enlarged holes" of the same size, with similar threads, as CE 139, with the same type of screws as CE 139. III WC 396-97. This comparison was made "in an attempt to determine . . . whether the scope was mounted on Exhibit 139 by the firm which is thought to have sold Exhibit 139," but Frazier stated: "I could not deduce from . . . the way the scope is mounted -- who mounted it. I can only say that the two are mounted in identical fashion. And it is possible that the same person or persons mounted the two scopes." III WC 396-97.

## The Sling

The sling on CE 139 was apparently home-made "from some carrying case, camera bag, musical-instrument strap, or something of that nature." III WC 397. The sling was so short that it was "very difficult" to use in shooting at all; however, using that sling would have provided steadier aim than using no sling at all, and "would assist more in offhand than any other type of shooting." III WC 397.

## The Ammunition Clip

The clip holds six rounds, although it will function if loaded with fewer rounds. The most common type of rifle ammunition clip, such as is used with Mausers, holds five rounds, but clips for the 6.5 mm Mannlicher-Carcano hold six rounds. Ammunition for this kind of rifle is usually not sold in clips, but rather in 20-shot boxes. III WC 398. CE 139 "does not have the box magazine commonly found in most military weapons which holds the cartridges and can be reloaded one at a time, but they must remain in the clip, or they will malfunction. The follower in the weapon will throw the cartridges right back out of the gun." III WC 441. Most other rifles can be loaded with

or without the clip, the clip making loading more convenient. However, CE 139 will malfunction if loaded without a clip. III WC 441.

Cartridges

Frazier identified CE 141 as "a 6.5 mm. Mannlicher-Carcano cartridge, manufactured by the Western Cartridge Co., at East Alton, Ill." It was "submitted to me as a cartridge removed from the rifle at the time it was recovered." The bullets for this type of cartridge weigh "160 to 161 grains." III WC 399.

Frazier identified CE 543, 544, and 545 -- which, counsel stated for the record, were spent cartridge cases found on the sixth floor of the TSBD -- as of the same type and manufacture as CE 141. Frazier had "received these cartridge cases on two different occasions for examination in the laboratory, and comparison with the rifle." III WC 399.

Muzzle Velocity

On 12/3/63, at the Naval Research Laboratory in Washington, D.C., cartridges of the same type and manufacture were fired from CE 139, and the muzzle velocity of each shot was measured. The average velocity was 2,165 feet per second, with individual variations "well within the manufacturer's accepted standards of velocity variations," which is "40-foot-per-second, plus or minus." This average velocity yields a calculated energy of 1,676 foot-pounds. This latter figure is "merely a term used to compare one bullet against another rather than for any practical purposes . . . because of the bullet's extremely light weight. The bullet's velocity and weight, and gravity enter into the determination of its energy in foot-pounds." III WC 400.

Quality of Ammunition

He describes this type of ammunition as "very accurate," having "fairly reasonable accuracy." III WC 400. Out of approximately 60 rounds fired in tests of this type of ammunition from CE 139, there were no misfires. III WC 437. Frazier noted that "[t]here is other ammunition on the market available for this particular rifle in this caliber, which in my opinion is undependable or would be a very poor quality of ammunition." He thought that any reports that 6.5 mm Mannlicher-Carcano ammunition from The Western Cartridge Co. is of poor quality "may have been a confusion between that other ammunition of the same caliber and this Western ammunition." III WC 437-38.

Cartridge Ejection Pattern

Frazier made two sets of tests in which shells were ejected from CE 139. He testified that the arrangement of shells by the TSBD sixth-floor window depicted in photographs CE 510, 511, and 512 was "consistent with" the test results. III WC 402.

Defect in Scope

When CE 139 was test-fired on 11/27/63, its scope exhibited a defect that caused the weapon to fire high and to the right of the aiming point. This defect disappears after several shots are fired and the mount stabilizes. Frazier could not offer an opinion as to when this defect came into being. III WC 405-06.

Testing for Speed and Accuracy

On 11/27/63, Frazier and other marksmen subjected CE 139 to a series of test firings at stationary targets at 15 and 25 yards. On 3/16/64, the rifle was fired at stationary targets at 100 yards. From one series of shots at 100 yards, "the three shots landed approximately 5 inches high and within a 3-1/2-inch circle, almost on a line horizontally across the target. . . . These three shots were fired in 5.9 seconds." In the second series at that distance, "three shots fired in 6.2 seconds . . . landed in approximately a 4-1/2 to 5-inch circle located 4 inches high and 3 or 4 inches to the right of the aiming point." In the third series from 100 yards, "three shots . . . landed in a 3-inch circle located about 2-1/2 inches high and 2 inches to the right of the aiming point . . . [and had been] fired in 5.6 seconds." The final series from 100 yards resulted in "three shots fired in 6.5 seconds, which landed approximately 5 inches high and 5 inches to the right of the aiming point, all within a 3-1/2-inch circle." III WC 404-05.[1] These tests were performed with the first cartridge already loaded in the chamber, and were "timed from the time of this first shot until the last shot." They were not "offhand," but "with a rest, . . . with one arm resting on a bench or a table." III WC 410.

These tests

[1]The shorter-range tests on 11/27/63 resulted longer firing times -- up to 9 seconds. III WC 403-04, 420.

> "were for the purposes of determining whether we could fire this gun accurately in a limited amount of time, and specifically to determine whether it could be fired accurately in 6 seconds. Now, we assumed the 6 seconds empirically -- that is, we had not been furnished with any particular time interval. Later we were furnished with a time interval of 5.5 seconds.[2] . . . we merely fired it to demonstrate the results from rapidly firing the weapon, reloading the gun and so on, in a limited time."

No other tests were performed to determine the accuracy of the rifle. III WC 410-111.

When asked, "Based on your experience with the weapon, do you think three shots could be fired accurately within 5-1/2 seconds if no rest was utilized?," Frazier replied, "That would depend on the accuracy which was necessary or needed or which you desired. I think you could fire the shots in that length of time, but whether you could place them, say, in a 3- or 4-inch circle without either resting or possibly using the sling as a support -- I doubt that you could accomplish that." III WC 407.

When asked how firing at a moving target from 100 yards would have affected his time, Frazier replied it "would have slowed down the shooting" by "[a]pproximately 1 second. It would depend on how fast the target was moving, and whether it was moving away from you or towards you or at right angles." Frazier stated that, with further practice, he could improve his performance with the weapon to the point of firing three shots within a 6-inch "relative circle" from 100 yards within 4.8 to 5.0 seconds. III WC 407.

Frazier concluded that CE 139 "is a very accurate weapon . . . the weapon will, even under rapid-fire conditions, group closely -- that is, one shot with the next." III WC 411.

Difficulty of Shot from Sixth Floor TSBD Window

Frazier said that the purported shots at the President from the sixth floor window were not difficult "under the circumstances -- a relatively slow-moving target, and very short distance, and a telescopic sight . . . [W]hen you shoot at 175 feet or 260 feet, . . . with a telescopic sight, you should not have any difficulty in hitting your target." Expert marksmanship would not be required, because "the marksmanship is accomplished by the telescopic sight." He noted, however, that "you would have to be very familiar with the weapon to fire it rapidly, and . . . hit this target at those ranges." III WC 413.

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[2]Frazier testified that the 5.5-second interval had been specified by Warren Commission staff, "based on examination, as I understood it, of a movie taken at the scene, and measurements taken at the scene," and that the FBI didn't "know what the time actually was." III WC 420-21.

Recoil and Power

The 6.5 mm Mannlicher-Carcano rifle has "[c]onsiderably less," "nominal" recoil as compared to the average military rifle, "because it has a very low velocity and pressure, and just an average-size bullet weight." This lesser recoil would make it easier to shoot accurately "[u]nder rapid-fire conditions." Other military rifles, for the same reasons, have greater "killing power," but the 6.5 mm Mannlicher-Carcano "has very adequate killing power with reference to humans." III WC 414.

The Three Spent Rifle Hulls

Frazier received CE 543 and CE 544 from Agent Drain on 11/23/63. He tested them that same day and concluded that they had been fired out of CE 139. He received CE 545 from Agents Drain and De Brueys on 11/27/63, tested that cartridge case the same day, and concluded that it also had been fired out of CE 139. III WC 414-15.

He described this testing as follows:

> "The first step was to fire test cartridge cases in this rifle to pick up the miscroscopic marks which are left on all cartridge cases fired in this weapon by the face of the bolt. Then those test cartridge cases were mounted on a comparison microscope, . . . [next to] one of the three submitted cartridge cases, so that you could magnify the surfaces of the test and the evidence and compare the marks left on the cartridge cases by the bolt face and the firing pin of the rifle."

Two test cartridges were used in this comparison. Frazier explained that, as a weapon is manufactured,

> "machining and grinding and filing operations will mark the metal with very fine scratches or turning marks and grinding marks in such a way that there will be developed on the surface of the metal a characteristic pattern. This pattern, because it is made by these accidental machine-type operations, will be characteristic of that particular weapon, and will not be reproduced on separate weapons."

III WC 415. "As a result of comparing the pattern of microscopic markings on the test cartridge cases and those marks on Exhibits 543, 544, and 545, both of the face of the bolt and the firing pin, I concluded that these three had been fired in this particular weapon." III WC 416.

Frazier emphasized that this comparison is made by eyeballing, through the microscope, the test cartridge and the evidence cartridge, and not by examining photographs of the cartridges taken through a microscope: "your eyes will record depths and shapes to a much greater extent than can be shown in a photograph. . . The photograph is taken primarily to illustrate the types of marks found and their location, relatively, on the specimen." III WC 419. Even by direct microscopic examination, a layman would not be qualified to determine whether two cartridges had been fired by the same rifle. III WC 421-22.

On these spent shells, Frazier "did not make any comparisons of either extractor or ejector marks or chambering marks, since the purpose of my examination was primarily to determine whether they were filed in this rifle. . . They were not necessary because they would have indicated only that it may have been loaded into and extracted from the weapon, whereas the marks which I found served to identify it as having been fired in the weapon." III WC 437.

The Stretcher Bullet (CE 399)

Frazier received CE 399 from FBI agent Elmer Todd in the FBI lab on 11/22/63. He did not clean or "alter" it in any way (other than put his mark on it), because it "was clean and it was not necessary to change it in any way." When asked if there was "blood or similar material on the bullet" when he received it, he replied: "Not any which would interfere with the examination, no, sir. Now there may have been slight traces which could have been removed just in ordinary handling, but it wasn't necessary to actually clean blood or tissue off of the bullet." III WC 428-29.

Frazier's examination determined that CE 399 had been fired from CE 139, to the exclusion of all other weapons. He explained: "A bullet when it is fired picks up the marks of the barrel of the weapon. These marks consist of rifling marks of the lands and the grooves, the spiral grooves in the barrel, and, in addition, the abrasion marks or rubbing marks which the bullet picks up due to the friction between the barrel and the surface of the copper jacket on the bullet, or if it is a lead bullet, with the lead." III WC 429. Such marks on a barrel occur during manufacture, use, and cleaning, and as a result of corrosion. III WC 429.

Frazier weighed CE 399 at 158.6 grains. He also weighed several bullets of the same type for comparison purposes, and they were "all in the vicinity of 161 grains . . . 160.85, 161.5, 161.1 grains." As to CE 399, "There did not necessarily have to be any weight loss to the bullet. There may be a slight amount of lead missing from the base of the bullet, since it is exposed at the base, and the bullet is slightly flattened; there could be a slight weight loss from the end of the bullet, but it would not amount to more than 4 grains, because 158.6 is only a grain and a half less than the normal weight, and at least a 2 grain variation would be allowed. So it would be approximately 3 or 4 grains." III WC 430.

Frazier stated that CE 399 "is distorted by having been slightly flattened or twisted," but this "is hardly visible unless you look at the base of the bullet and notice it is not round." This distortion did not affect his examination to determine whether CE 399 had been fired from CE 139. III WC 430.

Bullet Fragment Q2 (CE 567)

Frazier's mark is on the fragment. He identifies it as "a piece of the jacket portion of a bullet from the nose area and a piece of the lead core from under the jacket." He had weighed it as 44.6 grains. On the basis of his examination, Frazier concluded that CE 567 had been fired from CE 139, to the exclusion of all other weapons. III WC 432. Although the fragment had been mutilated, one-fourth of the surface area of the entire bullet was still available for comparison purposes. "One-fifth to one-sixth would have been sufficient for identification, based on the character of the marks present." III WC 434. Frazier received this fragment "[a]t 11:50 pm, November 22, 1963, from Special Agent Orrin Bartlett, our liaison agent with the Secret Service, in the FBI laboratory." III WC 435.

Bullet Fragment Q3 (CE 569)

Frazier had weighed the fragment at 21.0 grains, and described it as "the base or most rearward portion of the jacket of a metal-jacketed bullet, from which the lead core is missing." Frazier's mark is on the fragment, and he received it "[a]t 11:50 pm, November 22, 1963, from Special Agent Orrin Bartlett, our liaison agent with the Secret Service, in the FBI laboratory." Frazier's examination determined that the fragment had been fired from CE 139, to the exclusion of all other weapons. Frazier could not determine whether CE 569 and CE 567 were fragments of the same bullet or from separate bullets. III WC 435. On this fragment, one-third of the total circumference of the bullet was sufficiently unmutilated to allow comparison testing. III WC 436.

Frazier "wiped off" "a very slight residue of blood or some other material adhering" before examining CE 567 and 569, but there was so little that "it actually would not have been necessary" to do so. III WC 437.

Yaw

In the various test firings, Frazier found "[n]o evidence at all of tumbling or yaw." III WC 438.

Reports of Hearing More Than Three Shots

Witnesses in Dealey Plaza "could very readily have heard other sounds which could be confused with shots. . . . [W]ith any weapon in which the bullet travels faster than the speed of sound, . . . the bullet itself will cause a shock wave or a sound wave, and a person standing in front of that weapon will hear the report of the bullet passing and then subsequently the sound will reach them of the cartridge explosion, which could very easily be confused with two shots." III WC 438.

Walker Bullet (Q-188)

Frazier identified his mark on Q-188, which counsel stated for the record had been recovered from General Walker's home. Frazier had comparison-tested Q-188, but had been unable to determine whether it had been fired from CE 139, "although the bullet could have been fired from the rifle on the basis of its land and groove impressions." The physical characteristics of Q-188 were consistent with its being a 6.5 mm Mannlicher-Carcano cartridge manufactured by Western Cartridge Co., but this could not be conclusively determined either. III WC 438-39. Nor was Frazier able to determine that Q-188 had been fired from a 6.5 mm Mannlicher-Carcano, as opposed to some other type of rifle. III WC 440.

Examiners Involved

Frazier, Charles Killion, and Cortlandt Cunningham, all of the FBI Laboratory, conducted three separate sets of identification tests. They did not compare results until they were all finished. Killion and Cunningham agreed with all of the identification conclusions stated in Frazier's testimony. No one who performed identification tests on these pieces of evidence disagreed with any of these conclusions. III WC 440.