QUEEN'S UNIVERSITY
DEPARTMENT OF CLASSICS
KINGSTON, ONTARIO

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Harold:

Here is the report that I sent to Oser and Alford today via air mail.

I'll write in a day or two about other matters; I wanted you to have this right away.

I hope Alcock can use it, for I would like to see him chew Frazier's ass off.

This is not a matter that has been brought to light before, and I doubt whether Frazier would anticipate questioning about this.

Dick

Bernabei

R. BERNABEI
DEPT. OF CLASSICS
QUEEN'S UNIV.
KINGSTON, ONTARIO

THE DEFECTIVE SIGHTING ARRANGEMENT OF THE MANNLICHER-CARCANO RIFLE

References ↓

The burden of this report.

This report concerns matters related to the sighting arrangement of the Mannlicher-Carcano, caliber 6.5 mm, rifle which allegedly was used in the assassination of President Kennedy. The examination results in the conclusion that certain statements made by J. Edgar Hoover, by FBI firearms expert Robert Frazier, and by the Warren Report falsely indicate that the rifle was easily capable of causing the President's wounds.

This report should not be construed as necessarily bearing on questions related to conditions that might have prevailed at the time of the assassination. It merely indicates that the relevant statements of Hoover, Frazier, and the Warren Report are false and lead to the unwarranted conclusion that the rifle could easily have accomplished the assassination of the President.

The background of the issue to be discussed.

On 27 November 1963, at the FBI firing range in Washington, FBI agents Robert Frazier, Cortland Cunningham, and Charles Killion first test-fired the rifle by firing three shots each at targets located 15 yards from the firing line. The target fired by Frazier and Cunningham was introduced as CE 548; Killion's target is CE 549. The six bullets fired by Frazier and Cunningham struck approximately 4 inches high and 1 inch to the right of the point of aim; Killion's three shots struck approximately 2½ inches high and 1 inch to the right of the point of aim. (copy attached). (pp. 402-404)*

Later, on the same day, Frazier fired six shots at 25 yards into the target that was subsequently introduced as CE 550. Five of the six shots grouped 4 to 5 inches high and 1 to 2 inches to the right of the point of aim. A sixth shot struck low and well outside the 5-shot group. (p. 404)

On 16 March 1964, Frazier alone fired a third series of targets on the FBI range at Quantico, Virginia; Frazier fired these targets at 100 yards. Four 100-yard targets were introduced as CE's 551-554. Before firing this series, Frazier unsuccessfully attempted to lower the sights so that the bullets would strike where the scope was aimed. The internal adjusting mechanism of the scope was unstable, and Frazier could not properly align the sight, but for the purposes of his test he was satisfied when the bullets struck 100-yard targets approximately 5 inches high and 3 to 4 inches to the right of the point of aim. (pp. 404-405)

* Unless otherwise noted, page references are for volume 3 of the Commission's "Hearings".

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The issue in question.

Regarding the sighting arrangement which caused shots to strike high and right of the point of aim, the Warren Report states: (WR p. 104)

> Although all of the shots were a few inches high and to the right of the target, this was because of a defect in the scope which was recognized by the FBI agents and which they could have compensated for if they were aiming to hit the bull's-eye... Moreover, the defect was one which would have assisted the assassin aiming at a target which was moving away. Frazier said,"The fact that the cross-hairs are set high would actually compensate for any lead which had to be taken. So that if you aimed this weapon as it was actually received at the laboratory, it would not be necessary to take any lead whatsoever in order to hit the intended object. The scope would accomplish the lead for you." Frazier added that the scope would cause a slight miss to the right. It should be noted, however, that the President's car was curving slightly to the right when the third shot was fired.

The opposite is true, as I shall demonstrate below. If the sighting arrangement which existed when Frazier first received the rifle also existed at the time of the assassination, it is extremely unlikely that bullets fired from the rifle would strike their intended target, for the rifle that Frazier received was sighted-in on a very high trajectory.

On 26 March 1964, J. Edgar Hoover wrote to J. Lee Rankin a letter (CE2724) dealing with various ballistic data. Part of the letter concerns the defective sighting arrangement. Hoover correctly notes:

> ...there is no way of determining whether the present condition of the telescopic sight is the same as at the time of the assassination.

It is regretable that Hoover did not let the matter rest with that assertion, for the next paragraph of the letter comprises statements that involve him--and subsequently Frazier and the Warren Report-- in the unwarranted claim that the defective sighting arrangement might have increased the chances of the marksman hitting his intended target. He states:

> It is to be noted that at the time of firing these tests, the telescopic sight could not be properly aligned with the target since the sight reached the limit of its adjustment before reaching accurate alignment. The present error in alignment, if it did exist at the time of the assassination, would be in favor of the shooter since the weapon is presently grouping high and to the right with respect to the point of aim, and would have tended to reduce the need for "leading" a moving target in aiming the rifle. (CE 2724)

Hoover's statements regarding the defective sighting arrangement undoubtedly derive from Frazier's analysis, for Frazier is is the FBI expert who conducted the tests and evaluated the results. The Warren Report, however, depends directly on the testimony of Frazier.

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In his testimony of 31 March 1964 Frazier describes principles which apply to the technique of leading a moving target. Referring specificly to the situation which was supposed to have prevailed at the time of the assassination, Frazier asserts that almost no lead is required for a person firing down upon the President from the easternmost window on the sixth floor of the Texas School Book Depository. About 6 inches over the intended target would suffice, he said, for if the target were the midpoint of the President's head, 6 inches above that point would be about 2 inches above the top of the head. Frazier himself would not have allowed any lead if he were shooting under those conditions. (pp. 408-410)

Frazier is asked a hypothetical question; his answer is the erroneous statement quoted by the Warren Report in the passage cited above:

> Mr. EISENBERG. Mr. Frazier, turning back to the scope, if the elevation crosshair was defective at the time of the assassination, in the same manner it is now, and no compensation was made for this defect, how would this have interacted with the amount of lead which needed to be given to the target?
>
> Mr. FRAZIER. Well, may I say this first. I do not consider the crosshair as being defective, but only the adjusting mechanism does not have enough tolerance to bring the crosshair to the point of impact of the bullet. As to how that would affect the lead-- the gun, when we first received it in the laboratory and fired these targets, shot high and slightly to the right.
>
> If you were shooting at a moving target from a high elevation, relatively high elevation, moving away from you, it would be necessary for you to shoot over that object in order for the bullet to strike your intended target, because the object during the flight of the bullet would move a certain distance.
>
> The fact that the crosshairs are set high would actually compensate for any lead which had to be taken. So that if you aimed with this weapon as it actually was received at the laboratory, it would be necessary to take no lead whatsoever in order to hit the intended object. The scope would accomplish the lead for you.
>
> I might also say that it also shot slightly to the right, which would tend to cause you to miss your target slightly to the right. (p. 411)

Examination of ballistic data will disclose that when Frazier first received the rifle, it was sighted-in on a much higher trajectory than his statements imply. In fact, the trajectory was so high that it would have been a considerable detriment for a person firing under the conditions that were supposed to have prevailed at the time of the assassination.

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Examination of ballistic data.

The three main factors which affect the calculation of bullet trajectory are the caliber, weight, and velocity of the bullet in question. The Mannlicher-Carcano rifle fires caliber 6.5 mm bullets of 160 grains weight. Frazier measured the muzzle velocity of seven bullets fired from the Mannlicher-Carcano rifle, and determined that the average muzzle velocity of all the shots was 2165 feet per second. (p.412) (p.400)

Because a Mannlicher-Carcano rifle and 6.5 x 52 mm Mannlicher-Carcano cartridges which it fires were not available, the calculations described below relate specificly to the 6.5 mm bullet used in the cartridge designated as 6.5 x 53 mm Mannlicher-Schoenauer. The Mannlicher-Schoenauer fires 6.5 mm bullets of 160 grains weight at a muzzle velocity of 2160 feet per second. However, the calculations apply generally to any 6.5 mm bullet of 160 grains weight with a muzzle velocity of about 2160 feet per second. The difference between the two cartridges in question is insignificantly small; the results of calculations and tests based on the Mannlicher-Schoenauer are equally valid for the Mannlicher-Carcano. (*see note below)

The location of the scope sight with respect to the rifle bore must also be considered in determining the trajectory of bullets fired under the circumstances of the defective sighting arrangement of the Mannlicher-Carcano rifle that Frazier used. Measurement of an exact replica of the scope-mounted Mannlicher-Carcano rifle disclosed that the midline of the sight was 1½ inches above and ¼ inch to the left of the midline of the bore. In the test described below, the scope was mounted 1½ inches directly above the bore. The verticle trajectory of bullets could therefore be determined both by calculation and by actual test-firing, but the lateral trajectory can be determined only by calculation.

A 6.5 mm Mannlicher-Schoenauer rifle with a scope mounted 1½ inches above the bore was sighted so that bullets struck 4 inches high when fired at an aiming point on a target 15 yards away. This sighting arrangement corresponds precisely with the sighting arrangement of the Mannlicher-Carcano rifle when Frazier and Cunningham fired CE 548, the first target that Frazier introduced as a Commission Exhibit. The computed point of impact for bullets fired under the designated conditions is 29 inches high at 100 yards. Test-firing tends to verify the computation; bullets fired at targets 100 yards distant from the muzzle of the Mannlicher-Schoenauer rifle struck 28½ inches high of the point of aim. (Exhibit [illegible])

Computation of the lateral trajectory is based on the location of the scope ¼ inch to the left of the bore, and a sighting arrangement that causes bullets to strike 1 inch to the right of the point of aim at 15 yards. The computed point of impact for bullets fired under those conditions is 5½ inches to the right of the point of aim at 100 yards. This computation was not verified by test-firing. (Exhibit attached)

* Frazier, p.412:"I have taken calculations for similar weight and velocity bullets from ballistic tables, which bullets approximate the velocity of the 6.5 mm bullet and the weight of that bullet as fired from" the Mannlicher-Carcano rifle.

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The figures designated above refer only to conditions that existed when Frazier fired bullets into a trajectory that was more or less parallel to the ground. The point of impact would shift somewhat if, using the same defective sighting arrangement, bullets were fired downward from an elevation.

Under conditions similar to those that are supposed to have existed at the time of the assassination, the computed point of impact for bullets fired downward is about 25 inches above the point of aim at 90 yards, the approximate distance between the President and the easternmost window on the sixth floor of the Texas School Book Depository. This computation was not verified by test-firing.

Limitations on the scope of this report.

I wish to reiterate that the data set forth in this report do not necessarily bear on the question whether the Mannlicher-Carcano was used in the assassination, for it is not possible definitely to know whether the defective sighting arrangement existed at the time of the assassination.

However, this report bears considerably on Frazier's analysis concerning the effect of the unusual sighting arrangement; the Warren Report uses that erroneous analysis in order to foster the notion that the defective sighting arrangement would appreciably simplify the task of an assassin who used the rifle in that condition. In fact, that sighting arrangement would have been severely detrimental to accurate shooting.

Frazier's knowledge of the high trajectory,
a) in Washington: 27 November 1963.

It is possible that when Frazier first fired the rifle at targets 15 yards away, he accurately guessed that the bullets would strike unusually high of the point of aim on more distant targets. Indications of this assertion are superficial and would be unworthy of mention except in the light of Frazier's subsequent activity on the range at Quantico.

The assertion that Frazier might accurately have guessed the long range trajectory rests mainly on an estimate of the quality and extent of his knowledge regarding principles that govern the trajectory of scope-sighted rifles. Frazier discloses his accurate and full knowledge of those principles at the lower half of 3H412 and the upper half of 3H 413. By any definition that a reasonable person would apply to the word "expert", Frazier unquestionably is an expert on firearms.

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It is difficult to suppose that a man of Frazier's knowledge and experience failed to perceive that the bullets which struck target CE 548 four inches above the point of aim were moving upward in an unusually steep trajectory; a properly sighted rifle would cause bullets to strike slightly below the line of sight at 15 yards as they move very gradually upward through this point in their trajectory.

Target CE 550, fired at 25 yards, renders that supposition almost inconceivable; on this target the group of shots occurs slightly higher than on Frazier's 15-yard target. The two targets together offer a clear and measurable indication that the bullets were moving steeply upward in their trajectory. A properly sighted rifle would cause bullets to strike almost on the point of aim at 25 yards.

Frazier's knowledge of the high trajectory,
b) on the range at Quantico; 16 March 1964.

In the course of his testimony, Frazier introduced CE's 551-554, the targets resulting from his third series of test-firing the Mannlicher-Carcano rifle. Fired on the 100-yard range at Quantico, the shots that struck these targets grouped about 5 inches high and 5 inches to the right of the point of aim at 100 yards. (pp. 404-405

The lateral trajectory corresponds with the computed 100-yard trajectory for bullets fired under the conditions imposed by the defective sighting arrangement that existed when Frazier fired the rifle in Washington. That is, bullets which passed 1 inch to the right of the point of aim at 15 yards should strike about 5 inches to the right of the point of aim at 100 yards.

The verticle trajectory, however, does not correspond. By computation and by test-firing it was found that bullets which pass 4 inches above the point of aim at 15 yards should strike about 29 inches above the point of aim at 100 yards.

CE's 551-554 are not the first targets that Frazier fired at the 100-yard range. Before firing these, Frazier fired other targets which did not come into evidence. The first of the targets that he fired at 100 yards undoubtedly would have shown the precise trajectory at that distance, for after Frazier fired his first target he tried unsuccessfully to adjust the sights to a point where the bullets would strike where the sight was aimed. He managed only to adjust the sights sufficiently to cause the bullets to strike about 5 inches above the point of aim. (pp. [illegible])

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The knowledge that Frazier fired 100-yard targets under the conditions of a defective sighting arrangement that at least approximated the conditions that existed when he fired the rifle in Washington comes from his testimony on 3H405. Asked why the shots on CE's 551-554 were striking high and to the right, Frazier replies:

> When we attempted to sight in this rifle at Quantico, we found that the elevation adjustment in the telescopic sight was not sufficient to bring the point of impact to the aiming point. In attempting to adjust and sight-in the rifle, etc...

It is evident that Frazier test-fired the rifle before attempting properly to align the sight. Even if the high trajectory escaped his notice at the short range in Washington, Frazier cannot have avoided knowing that at 100 yards the bullets were on a trajectory about 29 inches high of the point of aim; he must have observed that on the first target that he fired. Only his knowledge of the exceedingly high trajectory would impell him to adjust the scope.

A little later in his testimony Frazier says: (p.406)

> We sighted the scope in relatively close,

but it is clear from the question that he was asked and from the context of the passage that he means close to the point of aim on the target, not close to the target itself. Nothing in Frazier's testimony or elsewhere suggests that any firing at Quantico was done at a range less than 100 yards.

The loose scope mount.

Shortly after testifying that the defective sighting arrangement, if it had existed at the time of the assassination, "would actually compensate for any lead which had to be taken", and thereby would render the shooting easier, Frazier discloses that the mount which supports the scope was loosely attached to the rifle when he received it:

> ... this mount was loose on the rifle when we received it. And apparently the scope had even been taken off the rifle, in searching for fingerprints on the rifle. (p.411)

Frazier himself then draws a most relevant conclusion from that disclosure:

> So that actually the way it was sighted-in when we got it does not necessarily mean it was sighted in that way when it was abandoned.

That information makes moot all other discussion concerning the condition of the sighting arrangement at the time of the shooting. There should have been no further reference to the sighting arrangement.

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Conclusion

This report does not examine the assassination of the President; it examines the analysis and the analysers of the ballistic data which led the Warren Report to purvey the false and unwarranted assertion that "the defect (in the sighting arrangement) was one which would have assisted the assassin, etc."

That assertion was developed from material which ought not to have been applied to questions about the actual conditions of the assassination. The scope mount was loosely attached to the rifle when Frazier received it, and apparently it had been removed before test-firing. Now and even at that time, no reasonable conjecture can be made concerning the alignment of the scope at the time of the assassination.

Not only is the unwarranted assertion false, it is precisely the opposite of the truth.

Moreover, it is highly probable the Robert Frazier knew that his statement, "it would be necessary to take no lead whatsoever in order to hit the intended object", is false.

Exhibits

The following exhibits are attached:

1) Graph illustrating the vertical trajectory of bullets fired under the conditions of the defective sighting arrangement (includes ballistic data relevant to the 6.5 x 53 mm Mannlicher-Schoenauer cartridge).
2) Graph illustrating the lateral trajectory of bullets fired under the conditions of the defective sighting arrangement.
3) A copy of target CE 548 (actual size).

End

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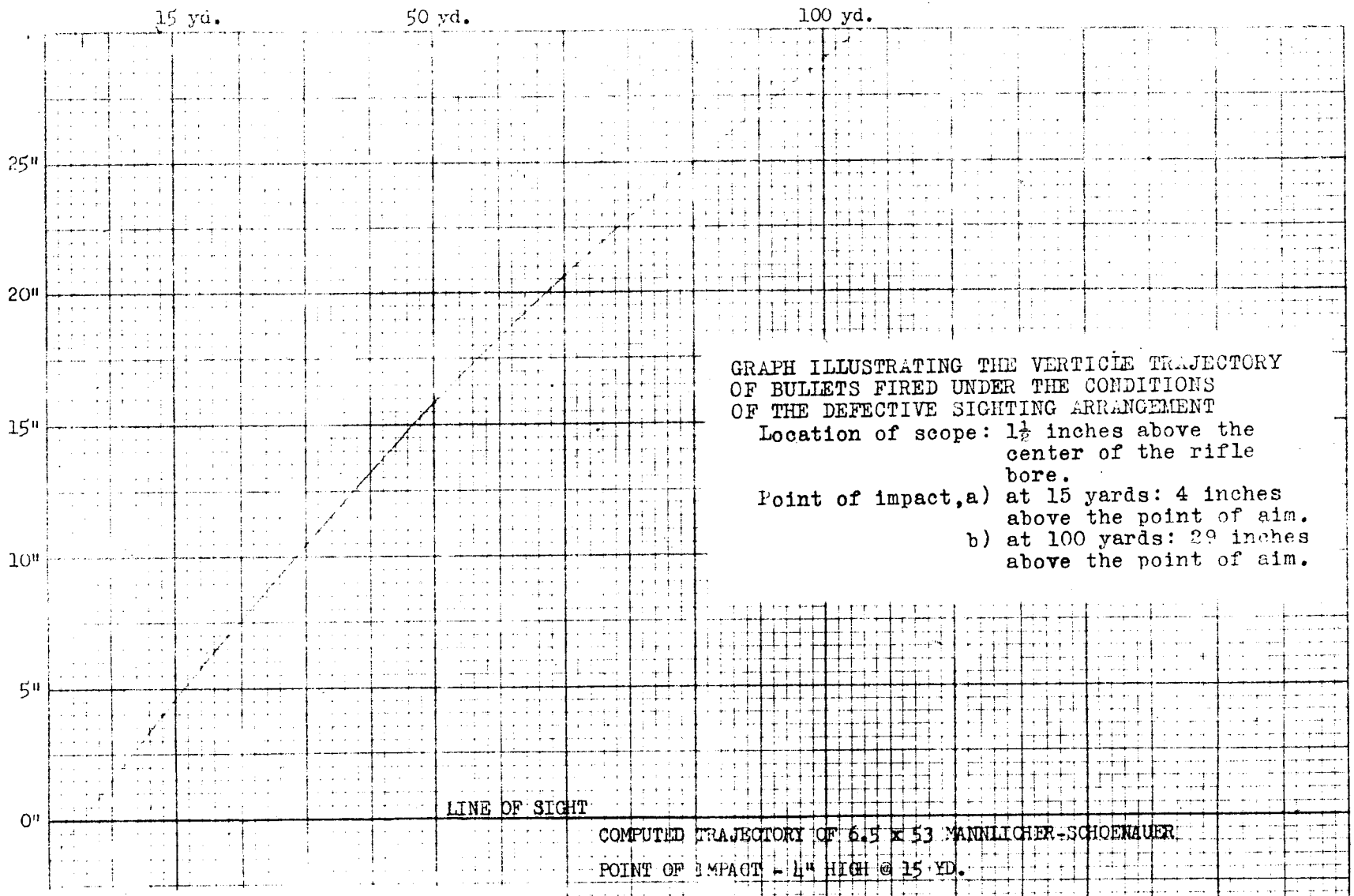


GRAPH ILLUSTRATING THE VERTICLE TRAJECTORY OF BULLETS FIRED UNDER THE CONDITIONS OF THE DEFECTIVE SIGHTING ARRANGEMENT

Location of scope: 1½ inches above the center of the rifle bore.

Point of impact, a) at 15 yards: 4 inches above the point of aim.
b) at 100 yards: 29 inches above the point of aim.

COMPUTED TRAJECTORY OF 6.5 x 53 MANNLICHER-SCHOENAUER

POINT OF IMPACT - 4" HIGH @ 15 YD.

CENTER OF SIGHT 1½" ABOVE CENTER OF BORE

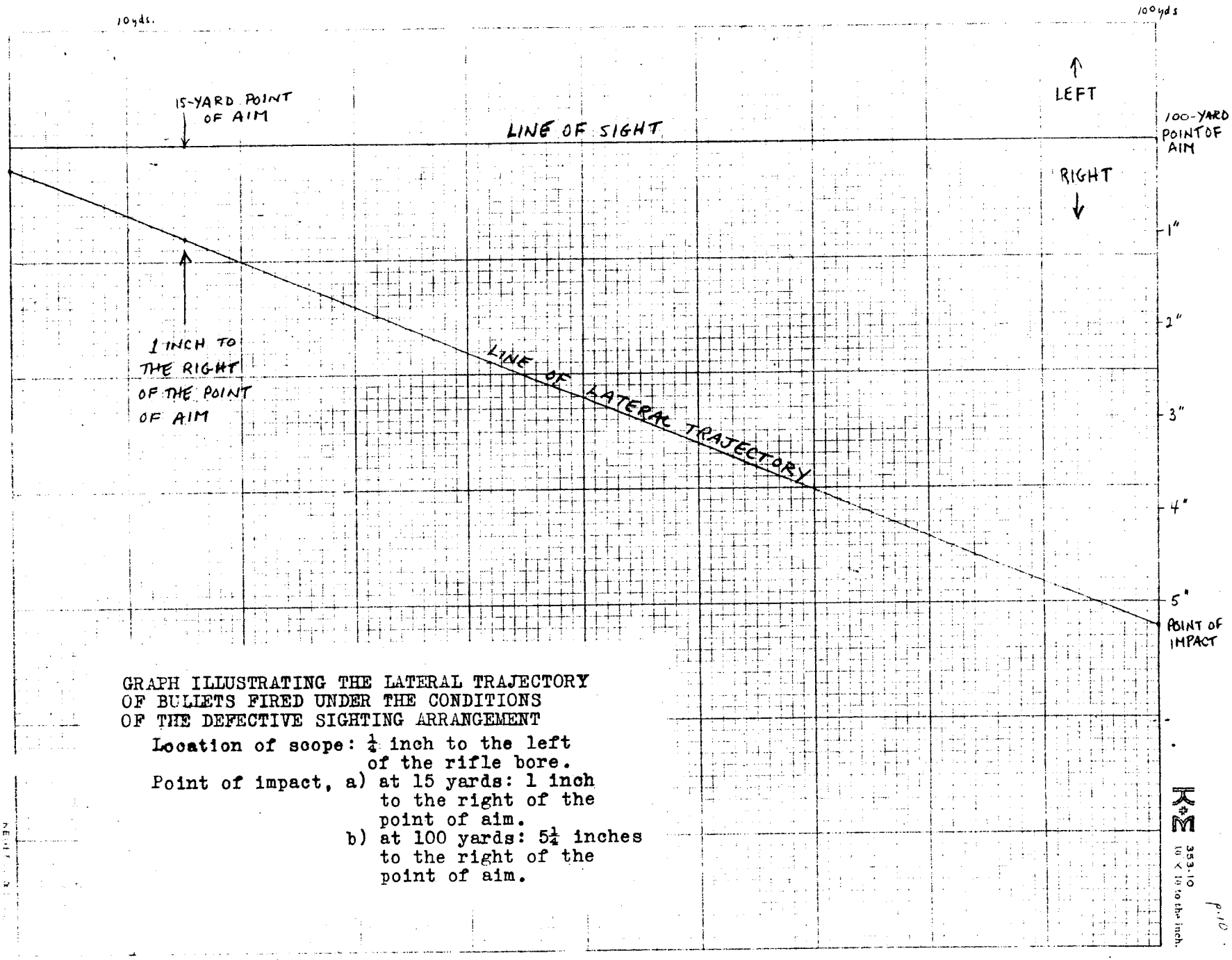
Relevant ballistic data

Caliber: 6.5 x 53 mm Mannlicher-Schoenauer

Weight: 160 grains

Muzzle Velocity: 2160 feet per second

Trajectory for rifle sighted-in at 150 yards (normal for this caliber): bullet crosses the line of sight at 25.5 yards, passes 1.5 inches above the line of sight at 75 yards, crosses the line of sight at 150 yards, passes 4 inches below the line of sight at 200 yards



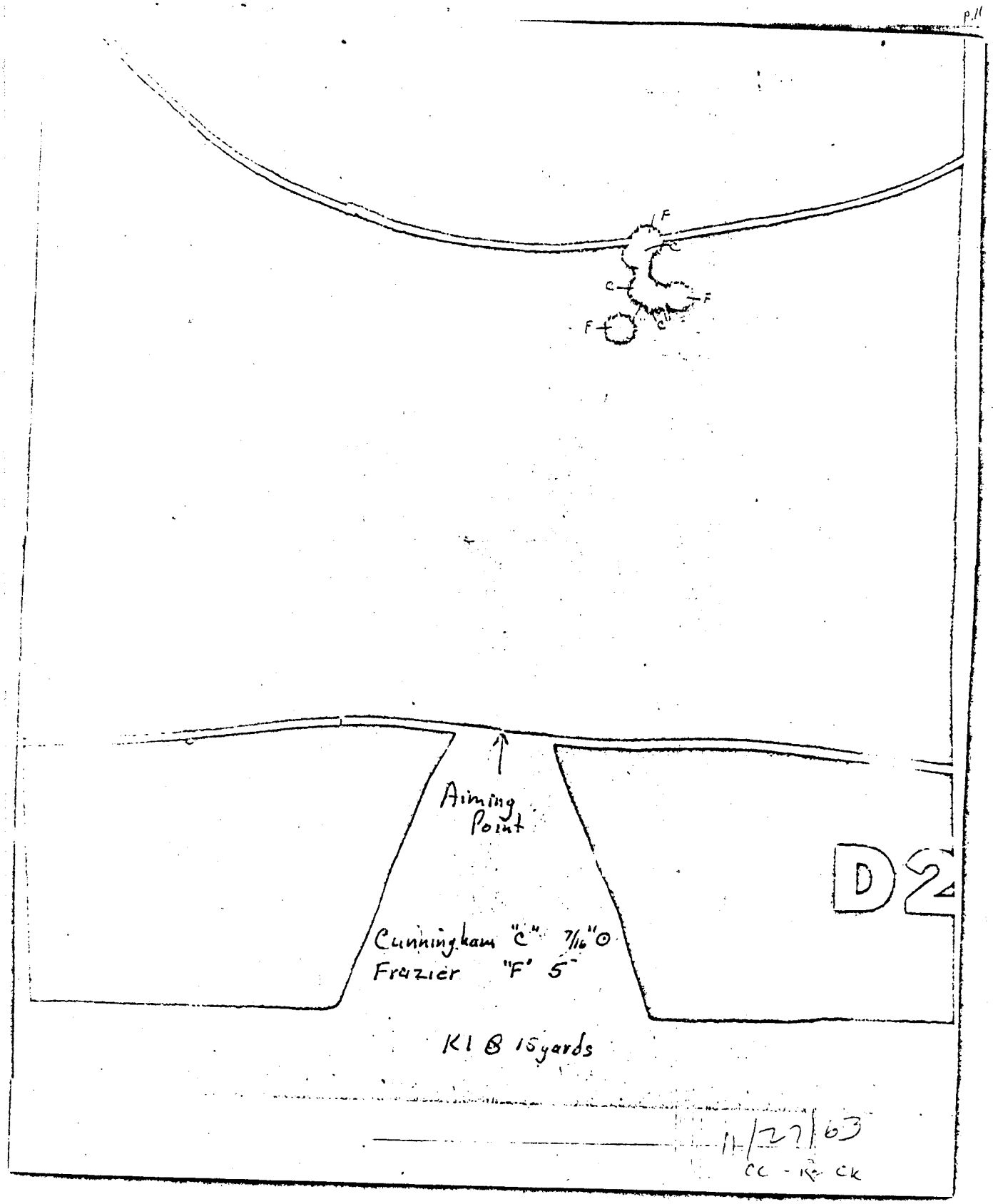
GRAPH ILLUSTRATING THE LATERAL TRAJECTORY OF BULLETS FIRED UNDER THE CONDITIONS OF THE DEFECTIVE SIGHTING ARRANGEMENT

Location of scope: $\frac{1}{4}$ inch to the left of the rifle bore.

Point of impact, a) at 15 yards: 1 inch to the right of the point of aim.

b) at 100 yards: $5\frac{1}{4}$ inches to the right of the point of aim.

K&M 353-10 10 × 10 to the inch.



CE548 (ACTUAL SIZE)