

I believe that our findings demonstrate the wisdom of Professor Blakey's strategy, and, furthermore, that they illustrate a potentially useful way to apply scientific procedures in forensic proceedings.

Thank you.

Chairman STOKES. Thank you very much, Dr. Barger, and I know you spent a great deal of time on this project, and a great deal of time with both the staff and committee, and we appreciate very much your testimony here today.

The Chair recognizes Professor Blakey.

**FINAL COMMENTS BY PROF. G. ROBERT BLAKEY, CHIEF
COUNSEL AND STAFF DIRECTOR**

Mr. BLAKEY. Thank you, Mr. Chairman.

Mr. Chairman, it may be appropriate at this time to review for the committee and those who are following our proceedings the results of the committee's various scientific projects, making an effort to relate them to the acoustics results, and seeing what light, taken together, they shed on the events in Dealey Plaza on November 22, 1963.

According to the acoustical analysis conducted by the committee, four shots, over a total period of 7.91 seconds, were fired at the Presidential limousine. The first, second and fourth came from the depository; the third came from the grassy knoll. In evaluating the acoustics project, it is relevant to ask to what degree its results are consistent with data obtained in other scientific analyses. Similarly, other scientific disciplines may be evaluated comparing them with the acoustics results.

Following the Warren Commission's analysis that found only three shots, one of which missed, it had been generally assumed that the final shot fired at President Kennedy was the one that is vividly depicted at Zapruder frame 313, although the Commission itself acknowledged that the last shot might have missed. Using frame 312—when the bullet would actually have struck the President—as the point of reference, it can be determined that the four shots would have been heard by the limousine occupants at Zapruder frames 166, 196, 296, and 312.

A review of the Zapruder film indicates that a shot fired in the vicinity of frame 166 did not strike any limousine occupants, so it must have missed. The committee's photographic panel, while unable specifically to conclude that a shot was fired at this point, noted that Governor Connally's hand moved from left to right at a rate of 540° per second during frames 162 through 164 and 166 through 167, followed by a more gradual shift of his torso to the right. The panel concluded these movements may have been a reaction to a severe external stimulus. The panel considered these actions to be particularly significant because they were consistent with the Governor's Warren Commission testimony that he had turned in response to having heard the first shot and was struck almost immediately afterward. It is also consistent, of course, with the Governor's testimony before this committee and with the testimony of eyewitnesses.

Some of those statements were incorporated in the record this morning. The relationship between the panel's observations con-

cerning Governor Connally and the acoustics analysis is, however, unclear, because Governor Connally appears to have initiated his rapid body movement prior to frame 166, at the time when the acoustics data suggest that the first shot would have been heard in the limousine.

The relationship between the film and the recording is, however, only approximate. It reflects the adjusted real-time characteristics of the recording and the average running time of the film—18.3 frames per second. It was possible to determine the real-time characteristics of the recording because of the knowledge that the recorder was powered by a 60-cycle-per-second electrical current. Since prints of this 60-cycle-per-second current actually appear on the tape, the corrected running time can be determined by comparing these prints with a clocking of the running of the tape.

The 18.3-frame-per-second average rate of the Zapruder film was, on the other hand, determined by the FBI under laboratory conditions in which the camera was set and run in the manner that Zapruder described he had used it at the time of the assassination. In relating this film to the acoustics results, it is important to understand that given the 18.3-frame-per-second average running speed of the film, a differential, for example, of only six frames is actually a differential of less than a third of a second.

For this reason, absolute correlation between the acoustics recording and the film should not be expected. What is significant is that there is an approximate correlation in rough time between the events on the film and the tape. Each, therefore, corroborates or substantiates the other.

The photographic panel's observations were also relevant to acoustics data that indicated the second shot both impacted and was heard by the limousine occupants at Zapruder frame 196. Specifically, the panel noted that at Zapruder frame 192 the President's movements suddenly froze, as his right hand seemed to stop abruptly in the midst of a waving motion. Then during frames 200 to 202 his head moved rapidly to the left. The sudden interruption of the President's hand-waving motion, coupled with his rapid head movements, was considered by the photographic panel as evidence of President Kennedy's reaction to some "severe external stimulus."

Finally, the panel observed that Governor Connally's actions at frame 224, as he is seen emerging from behind the sign that obstructed Mr. Zapruder's view, indicated he was also reacting to some "severe external stimulus." Based upon this observation and upon the positions of President Kennedy and Governor Connally within the limousine, the panel concluded that the relative alignment of the two men was consistent with the theory that they had just been struck by the same bullet.

The committee's forensic pathology panel based its examination on duly authenticated Kennedy autopsy materials and its personal examination of Governor Connally. It concluded that the first bullet to hit President Kennedy entered his back at approximately 5 centimeters below the shoulder and three centimeters to the right of the midline of the back, and it exited by the front of his neck near the third tracheal cartilage.

The forensic pathological panel, with one member in dissent, stated that the medical evidence was consistent with the hypothesis that this same bullet proceeded to inflict Governor Connally's torso, wrist, and thigh wounds.

A trajectory analysis by the committee was based on the location of the limousine at Zapruder frame 197, the positions of President Kennedy and Governor Connally at that point, and the bullet's course as it could be determined from their wounds. When President Kennedy's entry and exit wounds were used as reference points for the trajectory line, it intersected the Texas School Book Depository within a 13-foot radius of a point approximately 14 feet west of the building's southeast corner and almost level with the sills of the sixth floor windows.

When President Kennedy's exit wound and Governor Connally's entrance wound were used as the reference points for the trajectory line, it intersected the Texas School Book Depository within a 7-foot radius of a point approximately 4 feet west of the southeast corner and 12 feet above the sixth floor windowsills.

Neutron activation analysis performed by the committee on bullet fragments that had been removed from Governor Connally's wrist indicated a high probability that they were from a bullet that had been recovered from a stretcher at Parkland Hospital.

Committee ballistics tests also indicated that this bullet had been fired from Oswald's Mannlicher-Carcano rifle, which had been found on the sixth floor of the Texas School Book Depository. In addition, ballistics tests established that three cartridges found on the sixth floor of the Texas School Book Depository had been fired in Oswald's rifle.

In contrast with evidence thus available for evaluating the acoustics data with respect to the first two shots, there is no other scientific evidence for a shot that would have been heard by the limousine occupants at Zapruder frame 296, that is, no scientific evidence other than the acoustics.

There is also no indication on the Zapruder film that a shot struck any of the limousine occupants at this point.

As for the shot that struck the President at Zapruder frame 312, there is again scientific evidence that may be used to evaluate the acoustics results.

With one panel member dissenting, the forensic pathological panel's view of the autopsy materials established that only one bullet, fired from behind, struck President Kennedy's head, entering near the cowlick portion of his hair part and exiting near the top front area of the right side of his skull. When these wound locations were used as the reference points for a trajectory analysis, given the President's body orientation and the location of the limousine at Zapruder frame 312, the trajectory intersected the TSBD within a 23-foot radius of a point 16 feet west of the southeast corner of the building approximately 15 feet above the sixth floor windowsills.

In addition, neutron activation analysis indicted a high probability that bullet fragments found on the limousine floor came from the same bullet as fragments that had been removed from President Kennedy's brain. According to neutron activation analysis, these fragments did not match the bullet found on the stretcher at

Parkland Hospital, indicating that two bullets struck either the limousine or its occupants.

Finally, ballistics tests confirmed that bullet fragments found in the limousine had been fired by Oswald's Mannlicher-Carcano. Neutron activation and ballistics evidence do not indicate that a third bullet struck the limousine or its occupants.

This summary of the scientific evidence is, of course, based upon the proposition that the fourth and final shot fired at the limousine struck President Kennedy at Zapruder frame 312. If Zapruder frame 312 actually reflects the time of the third shot rather than the fourth, the timing of the first, second and fourth shots would then correspond respectively with Zapruder frames 182, 212, and 327.

The possibility that the fourth shot occurred at Zapruder frame 327 would require a finding, in light of the neutron activation analysis, the ballistics test and the medical testimony, that both the third and the fourth shots hit President Kennedy in the head.

Taken together, both the neutron activation analysis and the ballistics test performed by the committee indicate that only two shots fired by Oswald's Mannlicher-Carcano struck the limousine and its occupants.

The findings of the forensic pathological panel and the results of the trajectory analysis establish that these two shots were fired from behind the Presidential limousine. While the evidence seemingly points to the fourth shot as the head shot, a possibility that the third shot may have hit President Kennedy in the head must nevertheless be closely examined.

After the acoustical data had been reviewed, the committee decided to synchronize the sounds recorded in the reconstruction in Dealey Plaza in August 1978, with the best copy of the Zapruder film available, one in the possession of the Secret Service.

With your permission, Mr. Chairman, I would like now to show to the committee each of two versions of that synchronization.

Will you hold the lights for a minute?

The second version synchronizes shot four from the Depository with Zapruder frame 312. The committee can determine for itself which version is visually more appropriate.

Let me refocus everyone's attention.

As the committee will recall, there has been considerable controversy over the source of the shot that hit the President's head. While it has been suggested that it came from the grassy knoll, medical testimony taken by the committee last September indicated the President was struck twice from behind and that no shots hit from the front. One member of the medical panel did insist, however, that it was possible for a shot to have come from the right front. These two alternatives are depicted by these two versions of the Zapruder film synchronized with the firing test recording.

In viewing each version, the committee should look for, in sequence, two things: First, the committee should watch Governor Connally to see if he turns in response to the first shot. When Governor Connally testified before the committee in September he said he did, in fact, hear the first shot, turn his head to look, and was then hit by the second shot.

Second, the committee should try to detect the point at which President Kennedy and Governor Connally are hit by the second bullet and determine if the reactions of each man are visually appropriate in each film or whether one version—the first or the second—seems to be visually more appropriate.

Let me repeat, this is not a sound film of the actual assassination. The sound that has been dubbed onto the Zapruder film is the sound that was recorded in August as part of Dr. Barger's recording in Dealey Plaza.

In the first version of the film, the hit to President Kennedy's head is keyed to the shot from the grassy knoll.

Let me repeat, in the first version of the film, the hit to President Kennedy's head is keyed to the shot from the grassy knoll. In the second version of the film, the second one you will see, the hit to the head is keyed to the shot from the Texas School Book Depository.

Mr. Chairman, before this film is shown—and I might say the staff considered and discussed with the committee at some length as to whether this film should be shown—I would remind the committee as well as those who are following these proceedings on television or are present in this room that certain segments of this film may be offensive to people of special sensitivity. They are, in fact, offensive to me. Those who might fit in this category might wish not to watch this film.

I would also like to indicate that the film was put together by Robert Groden, a consultant to the committee, and his help is gratefully acknowledged.

Could I have the lights off, please.

[Film presentation.]

Mr. BLAKEY. May I have the light please?

Mr. Chairman, may we have the film just shown entered as JFK F-666?

Chairman STOKES. Without objection, so ordered.

Mr. BLAKEY. Mr. Chairman, in light of the refined acoustics evidence, the committee obviously has weighed the possible implications of a fourth shot fired from the grassy knoll. It goes without saying that this shot would be of particular significance if it could be determined that it inflicted wounds to President Kennedy and contributed to, or actually caused, his death.

The committee has available to it this afternoon, for the purpose of lending an expert opinion to this endeavor, the moderator of its forensic pathological panel, Dr. Michael Baden, the Chief Medical Examiner of New York. In light of the time factor, however, I will summarize what his testimony would have been.

Dr. Baden reexamined the materials in light of the additional information given to him by the acoustics panel. He went back to the original film, to the original X-rays and to the other materials. His conclusion remains as it was: There is no medical evidence that President Kennedy was hit from the front and to the right. There is no medical evidence to indicate that he was not shot at from the front and to the right. The forensic pathological panel simply says that if he was shot at from the front and to the right, the shot missed.

The medical testimony apparently indicated that if the third shot occurred, it did not hit President Kennedy. There is no evidence that anyone else in Dealey Plaza was struck by a bullet from behind the picket fence on the grassy knoll.

Testimony already presented to the committee indicates that one or more persons reported seeing bullets hit in or around the Presidential limousine.

In an effort to complete its investigation of where the third shot, assuming it occurred, might have hit, the committee turned to the Presidential limousine itself, which is now in the possession of the Ford Motor Co. in Dearborn, Mich.

The committee contacted Major Louis Smith of the Michigan State Police and requested that an experienced crime-scene team examine the car to determine if there is any evidence that it was struck by a bullet fired from the picket fence on the grassy knoll.

Major Smith expressed a belief that such an examination would prove futile, since extensive refurbishing and rebuilding had been performed on the limousine since the assassination. He did, nonetheless, make his men available to the committee, and an examination was conducted in the past week.

The examination was conducted by laboratory specialist James Bergen and laboratory specialist Michael Arrowood. The committee expresses its appreciation to them for their effort.

Major Smith reports that there is no evidence that a bullet from the grassy knoll struck the Presidential limousine.

To look further at the question of the direction from which the wound-inflicting bullets came, the committee had available to it—again, this afternoon—its engineering analysis and consultant for the head-shot trajectory. The purpose of Mr. Canning's testimony was to determine if any conclusions of the committee's expert consultant might have been changed by the refinement of the acoustical data. He would have addressed this afternoon the question, Could the fourth shot have occurred at Zapruder frame 327 and have come, as it must have in light of the other evidence, from the depository? His conclusion, based on rough figures, is that it is highly unlikely that a bullet fired from the depository could have struck the President as number four at frame 327.

Mr. Chairman, this concludes the presentation of the staff to the committee.

At this point I wonder, though, if I might be permitted to make an observation?

Chairman STOKES. The Chair recognizes Professor Blakey.

Mr. BLAKEY. Mr. Chairman, I would like to express my appreciation, as I have not in a personal way previously, to the committee, on the public record, for the support that it has given this staff in pursuing its investigation.

May I be blunt and say that not every congressional committee acts without politics. This one did. This staff appreciates being free from that particular affliction.

In addition, let me say that it is not true of every investigation that it goes the last mile. As you may be aware, I went to Notre Dame where I at least learned one thing. Put in terms of football analogy, it would go something like this: When you are ahead, don't let up, and when you are behind, don't give up. Translated

into this investigation, it means that we should have made every effort we could as long as we could.

I want to thank you, particularly and personally, for extending to this committee staff the opportunity to continue to pursue this investigation for the last yard.

As you know, and as I am sure some other people here present know, the staff has over the last several weeks begun going on vacations, well deserved, and to other jobs. Nevertheless, I hope history writes that this staff worked until the last possible minute.

Last, I would like to say what I have not said publicly to the staff as a whole, both those who are here now and those who may be watching this on the outside, that I deeply appreciate the professionalism that you showed, and the hard work, far in excess of what I had any reason to expect, that you gave me. Thank you.

Chairman STOKES. Thank you, Professor Blakey. I am sure that our entire committee would concur with me that you have done an outstanding job as the director of the staff and as chief counsel for this committee. You have done it with the highest form of professionalism, and we are indebted to you for that.

Additionally, we are very proud of the type of a staff that you did assemble—very bright young people, who served this country so well and in such a dedicated way.

I might acknowledge also that deputy chief counsel Ken Klein and our senior staff counsel, Michael Goldsmith, were prepared to examine fully the two other witnesses whom we are not going to call on in light of time constraints.

At this time I would like to announce the committee will meet in executive session immediately after we have adjourned the full session of this committee, and I have some closing remarks.

If anyone wants to be recognized before I give those remarks—

Mr. DODD. Mr. Chairman, I just wanted to raise a question that I would have asked of a couple of the witnesses coming, and possibly for the purpose of the record I could direct them to Mr. Blakey, to see if we can't shed some light on them at this point. One has to do with the question, in light of the implications of the acoustical evidence, with regard to a fragment found, a bullet fragment found in the limousine that for some time has not been easily identifiable as a result of neutron activation tests.

I wonder, Mr. Blakey, if you might just comment on that. There has been some question raised about that particular fragment and I wonder if there are others as well, or just that one that raised that question?

Mr. BLAKEY. I am not really prepared to respond to that, Mr. Dodd, and I probably have done in this record what I should not have on several occasions, and that is, speak from memory.

I think perhaps I will have to discuss that with you later, when I can get a briefing on the details of that and not misstate, or misstate myself.

Mr. DODD. In light of that, I won't ask the other ones then. I don't want to rely on people's memories. I will reserve the questions until afterward, Mr. Chairman.

Mr. EDGAR. Mr. Chairman—

Chairman STOKES. Mr. Edgar?

Mr. EDGAR. I just wanted to say, on behalf of this member, and I think I speak for the others, how deeply indebted we are to you for taking up the chairmanship of this particular committee over the last year and a half and providing the leadership that this committee so desperately needed. You came on at a tough time, and I think you deserve our deep gratitude for your efforts as chairman. I just want to say thank you.

CLOSING REMARKS BY CHAIRMAN LOUIS STOKES

Chairman STOKES. Thank you very much. It has been for me a great experience.

I guess one of the things I am most proud of is that in the 10 years I have been in the Congress I have never seen a congressional committee work as harmoniously, in such a nonpartisan way, as this committee has, and it has been a real honor to have chaired this committee.

I am very proud of the type of support I have gotten from the ranking minority member, Mr. Sam Devine of Ohio, who has been staunch in his support of this committee in every respect and has been tireless in his efforts on behalf of this committee, along with the other members of the minority side; and, of course, our two distinguished subcommittee chairmen, Judge Richardson Preyer, who chaired the Kennedy investigation, and Congressman Fauntroy, who chaired the King investigation, and both of whom worked tirelessly, many, many hours in executive session and in the full sessions, and all of you gentlemen—Mr. Dodd, Mr. Edgar, Mr. Fithian—who I know attended those executive sessions and worked long hours while you tried to do your other congressional work, many times at a very personal sacrifice—I think the country is indebted to all of you. Thank you.

[Additional material included at the request of Congressman Richardson Preyer:]