

It is my opinion that the two photographs are forgeries, composites manufactured to eliminate evidence of an exit wound in the rear of the President's head. The only method I am aware of that could have been used to create these composites is known as "soft edge matte insertion." (See attachment 1.)

The question of the authenticity of these particular photographs is crucial because of the large volume of evidence indicating that at least one shot struck the President in the head from the front, causing an exit wound at the rear of the skull. The problem is that this wound, seen by so many in Dallas, does not appear in the autopsy photographs and X-rays.

The most reliable descriptions were those from the Parkland doctors on the day of the murder. Doctors Clark, Jones, Perry, Baxter, Akin, McClelland, and Nurses Hutton, Bowron, and several others all describe that same wound in great detail, and all place it at the same point in the rear of the President's head in the area of the occipital bone. Many said cerebellar tissue protruded from a large avulsive exit wound. This too indicates a lower rear head exit wound. A partial list of the many eyewitnesses who describe this wound is included as attachment 2 to this memo. It seems highly improbable that all these witnesses were mistaken.

Furthermore, the descriptions of the eyewitnesses who saw Kennedy's head wound at Parkland are corroborated by those who saw the bullet impact upon the head in Dealey Plaza.

Secret Service Agent Clint Hill saw a piece of the President's skull fly from the President's head and travel toward the rear-left of the car. Mrs. Kennedy attempted to pick up this piece (and indeed from a recently declassified portion of her Warren Commission testimony we can see that she may have picked up a section of skull) and tried to hold it onto the rear of her husband's head.

The next day Billy Harper found a piece of bone in Dealey Plaza. Originally, the "Harper" fragment was identified by a qualified pathologist as a section of occipital bone.

In addition, there is photographic evidence of a shot exiting from the rear of the President's head.

Zapruder film frames No. 335 and No. 337 clearly show the result of the head shot. They are the clearest two frames showing the President after the head explosion.

I have examined and measured the contours of the President's head on Zapruder film frames 335 and 337. The rear of the President's head, in these frames, shows his hair pushed upward and away from the scalp. That indicates the bones underneath were avulsed outward. This matches the description of the wound provided by Dr. McClelland who said the bones at the rear of the head were "sprung open." (See attachment 2 for full quote and other descriptions of this wound.)

Conclusions

The Dallas observations indicating a rear exit hole cannot be easily dismissed. These accounts were provided by trained medical personnel. It defies belief that so many people, viewing the President from different angles at different times, should all describe the same wound condition and position. My own examination of the autopsy photographs of the rear of the head shows a sharp contrast buildup along an irregular line at the rear of President Kennedy's head. This contrast buildup could be the result of a photocompositing process whereby another photograph was superimposed on the back of President Kennedy's head, thus

eliminating evidence of that exit wound. Based upon my observation of that contrast buildup, and the Dallas medical observations indicating there was a wound there, it is my opinion, as a photo-consultant to the House Select Committee, that these photographs are forgeries.

2. LEFT TEMPORAL WOUND

There are at least two Parkland Hospital doctors who noted a wound of entry in the President's left temple (Dr. Robert N. McClelland and Dr. Marion T. Jenkins).

Dr. McClelland, in his official statement regarding the assassination filled out at 4:45 p.m. on November 22, wrote: "The cause of death was due to massive head and brain injury from a gunshot wound to the left temple." (ER, p. 527.) Dr. Jenkins, in his testimony to the Warren Commission on March 25, 1964, stated that, ". . . I thought there was a wound on the left temporal area, right in the hairline and right above the zygomatic process." (H6, p. 48.) When informed that no one else had noted such an entrance wound, Dr. Jenkins stated that it might have been blood from some other point.

My examination of this area on autopsy photograph No. 29 leads me to believe that Dr. Jenkins was correct on his initial opinion.

Close inspection of the left temporal area on the original transparency (but not on any of the later generation duplicates) reveals the presence of a faint but distinct circular hole which I estimate to be approximately 5 or 6 mm in size in the left sideburn approximately 25 to 30 mm above the bottom of the sideburn, and 10 to 15 mm in front of the foremost ear line. (Photos 30 and 31 show much the same area but because of different exposure and clarity of the film, the hole is not as evident.)

The other photographic and medical panel members who inspected the autopsy items were not familiar with the Kennedy case and the question of a left temporal wound prior to and at the time of their examination of these items and so were probably not looking in that area for any damage.

I must point out that on transparency No. 29, the "hole" is visibly very faint with no blood to highlight it to the casual observer. Indeed, if one did not know to look for evidence of this wound, it would simply remain unnoticed.

To facilitate future study, I have made a single 8"x10" glossy print of this area which is at the Archives stored with the original collection. (I made two such photographs: One was not clear because the transparency moved while in the enlarger.)

On July 19, 1978, while Dr. Michael Baden was at the Archives examining the X-rays and photographs, and I was attending a meeting of the photo panel, I telephoned Dr. Baden and informed him of the existence of this evidence of a left temporal bullet wound. While still on the telephone with me, Dr. Baden examined the photographs. He said he could locate no wound in the left temple, and that what I was seeing was "a small spot of blood." From this conversation, I could have concluded that either: (a) Dr. Baden was looking at a blood spot at another point close to the "hole"; or (b) Baden and I both saw the same thing in the left temporal area, but simply disagree as to what it meant.

On October 27, I had another opportunity to examine the X-rays and photographs and, on that occasion, I noted again that there was no blood visually related to this wound, raising

further question of Dr. Baden's diagnosis. At that time I also discovered that the skull X-rays contained data which seem to indicate a hole in the left temple.

On lateral X-rays of the skull, there is a gray spot at the same location as the "hole" on photo No. 29. There is, however, no evidence of radiating fracture marks on the skull from this point.

Conclusion

There is photographic and X-ray evidence supporting the observations of the Dallas doctors - McClelland and Jenkins - that there was a left temporal entrance wound.

I feel it is the committee's obligation to have the medical panel re-examine the X-rays and photographs in the area I have pinpointed, and, if they disagree with my conclusion, explain what this circle represents, if not a bullet hole; and also explain the corresponding image on the X-rays.

VIII. RECOVERED BULLET DURING JFK AUTOPSY

Although there is a great deal of evidence that a bullet was recovered from President Kennedy's body at the time of the autopsy, none of the evidence of this bullet was ever mentioned in the public hearings.

To recap, Warren Commission document No. 371 reveals "one receipt from the FBI for a missile removed during the examination of the body." An examination of the receipt shows that a bullet was removed from the body of President Kennedy during the autopsy in the evening of November 22, 1963. This bullet was handed over to and signed for by FBI agents Francis X. O'Neill and James W. Sibert.

The January 4, 1964 issue of the Journal of the American Medical Association (vol. 187, no. 1) stated on page 15 that the bullet was recovered during the autopsy.

The Washington Post of December 18, 1963, after checking the report with the FBI before publication, stated that a bullet was recovered from deep within the President's shoulder. This was again confirmed in the Post on May 29, 1966.

The fact of the recovery of this bullet fully destroys the myth of the "single bullet," and that evidence of an additional gunshot during the assassination was suppressed.

Commander Humes removed this bullet but there is no indication from which direction the bullet came. If it was from the front, there had to be at least two assassins. If the bullet came from behind and as the best evidence show, did not exit the President's body. Considering the number and timing of the shots in any combination, there had to be more than one assassin.

The issue has been raised that the bullet or missile may have been a fragment of a bullet or missile. This seems highly unlikely since Sibert and O'Neill were professional enough to know the difference between an entire bullet and small fragment. In addition to this, the FBI itself did not confirm to the Washington Post that it was "a bullet" and not just a fragment.

It should be noted that this entire area of discussion occurred many months before the single bullet theory was invented to try to prove the "lone assassin theory."

Endnotes

¹Richard Sprague, "Computers and Automation," The Assassination of President John F. Kennedy: The Application of Computers to the Photographic Evidence, May 1970, p. 34.

²See, for example, Mark Lane, Rush to Judgment (New York: Dell Publishing Co., 1976), pp. 344-356; Sylvia Meagher, Accessories After the Fact (New York: Vintage Books, 1976), pp. 3-35; F. Peter Model and Robert J. Groden, JFK: The Case for Conspiracy (New York: Manor Books, Inc., 1977), pp. 124-165, 186-189; J. Gary Shaw, Cover-Up: The Governmental Conspiracy To Conceal the Facts About the Public Execution of John Kennedy (published by the author, 1976), pp. 32-39; Richard Sprague, see ref. 1, pp. 29-60; Josiah Thompson, Six Seconds in Dallas (New York: Bernard Geis Associates, 1967); Harold Weisberg, Whitewash II: The FBI-Secret Service Cover-Up (published by the author 1967), pp. 128-249; Harold Weisberg, Photographic Whitewash: Suppressed Kennedy Assassination Pictures (published by the author, 1967).

³J. C. Dainty and R. Shaw, Image Science (New York: Academic Press, 1976), pp. 116-150.

⁴See, for example, Harry Andrews and Bob R. Hunt, Digital Image Restoration (Englewood, N.J.: Prentice-Hall, Inc., 1977).

¹²Report of the President's Commission on the Assassination of President Kennedy (Washington, D.C.: U.S. Government Printing Office, 1964), p. 19 (hereinafter cited as the Warren Report).

¹³Ibid.

¹⁴Ibid., p. 111.

¹⁵Ibid., p. 115.

¹⁶Ibid.

¹⁷Ibid., p. 117.

¹⁸Ibid., p. 106.

¹⁹Ibid.

²⁰See ref. 2, Model and Groden, pp. 124-157, and Thompson, pp. 59-79.

²¹Ibid.; see also Lane, ref. 2, pp. 69-80, and Meagher, pp. 27-35.

²²See ref. 2, Thompson, pp. 216-18.

²³Testimony of Lyndal L. Shaneyfelt, May 6, 1964. Hearings before the President's Commission on the Assassination of President Kennedy (Washington, D.C.: U.S. Government Printing Office, 1964), vol. 5, p. 153 (hereinafter 5 Warren Commission Hearings, 153).

²⁵See ref. 23, Testimony of Lyndal L. Shaneyfelt, p. 153.

²⁶"Scientific Report of the Kennedy Assassination Forensic Pathology Panel," Appendix to The hearings before the Select Committee on Assassinations, U.S. House of Representatives, 95th Congress, 2nd session (Washington, D.C.: U.S. Government Printing Office, 1979), vol. VII, pars. 294-343 (hereinafter "J.F.K. Forensic Pathology Panel Report," HSCA-JFK Hearings, VII); see also pars. 127-141 of this report, the "Photographic Evidence Panel Report."

²⁷See fig. II-10 (J.F.K. Exhibit F-133).

²⁸Scientific Report of the Kennedy Assassination Firearms Panel," Appendix to The hearings before the Select Committee on Assassinations, U.S. House of Representatives, 95th Congress, 2nd session (Washington, D.C.: U.S. Government Printing Office, 1979), vol. VII (hereinafter "J.F.K. Firearms Panel Report VII," HSCA-JFK Hearings).

²⁹An Analysis of Recorded Sounds Relating to the Assassination of President John F. Kennedy, a report prepared for the House Select Committee on Assassinations, by Mark R. Weiss and Ernest Aschkenasy, February 1979, vol. VIII, sec. 4.2.3. (hereinafter Weiss and Aschkenasy report).

³⁰See pp. 69-70 of this Report of the Photographic Evidence Panel.

⁴⁰The Harper Encyclopedia of Science (New York: Harper & Row, 1963), vol. 4, p. 1196.

⁴¹Encyclopedia Britannica (Chicago: Wm. Benton Publishers, 1970), p. 533.

⁴²Ibid.

⁴³Photogrammetric Analysis of Zapruder and Nix Movie Film, a report prepared for the House Select Committee on Assassinations by the U.S. Geological Survey, November 1978 (hereinafter USGS Report) (J.F.K. Document No. 013633).

⁴⁴Warren Report, pp. 92-117.

⁶⁵Warren Report, p. 19.

⁶⁶Ibid., pp. 122-129.

⁶⁷Testimony of Jack D. White, Sept. 14, 1978, II House Select Committee on Assassinations - J.F.K. Hearings, 341-344; letter and photographic analysis comments from Fred

Newcomb to the House Select Committee on Assassinations, Mar. 7, 1977 (J.F.K. Document No. 00913).

⁶⁸F. Jenkins and H. White, Fundamentals of Optics (New York: McGraw-Hill, 2nd ed., 1950), sec. 3.4, p. 39.

⁷⁹See ref. 2.

⁸⁰See refs. 3 and 4.

⁸¹See paras. 33-34 and 39-41 of this report of the Photographic Evidence Panel.

⁸²Warren Report, pp. 18-19.

⁸³Testimony of Tom C. Dillard, Apr. 1, 1964, 6 Warren Commission Hearings, 164.

⁸⁴Staff interview of James W. Powell, Jan. 12, 1978, House Select Committee on Assassinations (J.F.K. Document No. 004644).

⁸⁵FBI interview of Robert J. E. Hughes, Nov. 30, 1963; CE 2591, 25 Warren Commission Hearings, 873.

⁸⁶See ref. 83, Dillard testimony.

⁸⁷See ref. 84, Powell interview.

⁸⁸Letter from Dr. P. G. Roetling to the House Select Committee on Assassinations, July 31, 1978 (J.F.K. Document No. 010433).

⁸⁹"Photographic Image Production and Analysis," a report prepared by the Rochester Institute of Technology (RIT) for the House Select Committee on Assassinations' Photographic Evidence Panel, July 16, 1978, pp. 33-34 (J.F.K. Document No. 0014322).

⁹⁰Letter from Stanford Research Institute International to the House Select Committee on Assassinations, Autoradiographic Intensification of Photographic Evidence, July 14, 1978, P.O. 65466 (J.F.K. Document No. 010025).

⁹¹Reports prepared for the House Select Committee on Assassinations' Photographic Evidence Panel: (1) University of Southern California Image Processing Institute (USCIPI), "Computer Processing of Kennedy Assassination Photographic Evidence," July 1978, pp. 7-10 (J.F.K. Document No. 009716); (2) The Aerospace Corp., Digital Image Processing Analysis of Photographic Evidence Relating to the John F. Kennedy Assassination, December 1, 1978, pp. 19-21 (J.F.K. Document No. 013712).

⁹²See ref. 91, Aerospace report, pp. 22-32.

⁹³Letter from The Aerospace Corp. to the House Select Committee on Assassinations, December 11, 1978 (J.F.K. Document No. 014205); letter from the House Select Committee on Assassinations to the U.S. Attorney General, January 8, 1979 (J.F.K. Document No. 014710).

⁹⁴Statement of Special Agent Paul E. Landis, Jr., November 30, 1963, CE 1024, 18 Warren Commission Hearings, 753; see ref. 2, Thompson, Six Seconds in Dallas, pp. 23-26.

⁹⁵See for example, Model and Groden, ref. 2; and Sprague, ref. 2.

⁹⁶Testimony of Phillip L. Willis, July 22, 1964, 7 Warren Commission Hearings, 493.

⁹⁷FBI Interview of M. A. Moorman, November 23, 1963 (CE 1426), 22 Warren Commission Hearings, 838-39.

⁹⁸Testimony of Leo J. Gauthier, May 6, 1964, Warren Commission Hearings, 137.

⁹⁹Ibid.; see ref. 96, Willis testimony, pp. 493-94.

¹⁰⁰See ref. 91, USCIPI Report, part II, "The Black Dog Debate" (J.F.K. Document No. 009716).

¹⁰¹See ref. 4, Andrews and Hunt, pp. 126-46.

¹⁰²See ref. 91, Aerospace report and USCIPI Report.

¹⁰³Ibid.

¹⁰⁴See for example, Model and Groden, ref. 2; and Thompson, ref. 91.

¹⁰⁵See ref. 36, Bolt Beranek & Newman.

¹⁰⁶See ref. 89, RIT report, p. 35.

¹⁰⁷See ref. 91, Aerospace report.

¹⁰⁸See ref. 2, Model and Groden.

¹⁰⁹See ref. 91, Aerospace report; letter from Los Alamos Scientific Laboratory to the House Select Committee on Assassinations, August 14, 1978 (J.F.K. Document No. 010855).

¹¹⁰See ref. 4, Andrews and Hunt, pp. 126-146.

¹¹¹See ref. 91, Aerospace report.

¹¹²See ref. 4, Andrews and Hunt, pp. 193-98; see ref. 109, letter from Los Alamos Scientific Laboratory.

¹¹³W. K. Pratt, Digital Image Processing (New York: Wiley & Sons, 1978), P. 641.

¹¹⁴Nix Film Analysis, Itek Corp., Lexington, Mass. (1967).

¹¹⁵Ibid.

¹¹⁶See ref. 2, Model and Groden.

¹¹⁷Letter and report from the University of California Los Alamos Scientific Laboratory to the House Select Committee on Assassinations, June 27, 1978 (J.F.K. Document No. 009636).

¹¹⁸See ref. 43, USGS report.

¹¹⁹See ref. 117, letter and report from the University of California Los Alamos Scientific Laboratory.

¹²⁰Sears and Zemansky, University Physics, Addison Wesley (1957).

¹²¹Letter from the University of California Los Alamos Scientific Laboratory to B. Hunt, August 7, 1978, on the "Man-in-Bushes questions" (J.F.K. Document No. 014487).

¹²²See ref. 113.

¹²³Ibid.

¹²⁴See ref. 121, letter from the University of California Los Alamos Scientific Laboratory.

¹²⁵Testimony of R. S. Stovall, April 3, 1964, 7 Warren Commission Hearings, 193.

¹²⁶Testimony of Guy F. Rose, April 8, 1964, 7 Warren Commission Hearings, 231.

¹²⁷Testimony of Lyndal L. Shaneyfelt, September 1, 1963, 15 Warren Commission Hearings, 693; but see also Rose testimony, ref. 126 (Dallas police found two negative that showed Oswald holding a rifle in his hand, wearing a pistol at his hip); executive session testimony of R. L. Studebaker, October 5, 1978, House Select Committee on Assassinations (J.F.K. Document No. 014695); executive session testimony of John Grizzaffi, October 5, 1978, House Select Committee on Assassinations (J.F.K. Document No. 014699).

¹²⁸"Report of Captain Fritz: Interrogation of Lee Harvey Oswald, November 23, 1963," Warren Report, pp. 608-09; see ref. 126, Rose testimony.

¹²⁹"FBI interview of Mrs. Lee Harvey Oswald, December 3, 1963" (CE 1401), 22 Warren Commission Hearings, 751.

¹³⁰Ibid.

¹³¹"Testimony of Mrs. Lee Harvey Oswald, February 3, 1964," 1 Warren Commission Hearings, 15.

¹³²"FBI interview of Mrs. Lee Harvey Oswald, Feb. 22, 1964" (CE 1404), 22 Warren Commission Hearings, 785.

¹³³"Testimony of W. J. Waldman, May 20, 1964," 7 Warren Commission Hearings, 365; Warren Report, p. 128.

¹³⁴See ref. 127, Shaneyfelt testimony, p. 692.

¹³⁵See ref. 131, Mrs. Oswald testimony, pp. 15-16, 118.

¹³⁶Warren Report, p. 128.

¹³⁷"Testimony of Mrs. Lee Harvey Oswald, June 11, 1964," 5 Warren Commission Hearings, 405.

¹³⁸"Testimony of Lyndal L. Shaneyfelt, April 23, 1964," 4 Warren Commission Hearings, 284.

¹³⁹Warren Report, pp. 127, 592-597; see ref. 138, Shaneyfelt testimony, pp. 288-89.

¹⁴⁰Ibid.

¹⁴¹See Shaneyfelt exhibits 2-18, 21 Warren Commission Hearings, 443.

¹⁴²See ref. 138, Shaneyfelt testimony, pp. 290-94.

¹⁴³Ibid., pp. 281-82.

¹⁴⁴See ref. 2, Lane pp. 356-362; Model and Groden, pp. 190-92; Meagher, pp. 200-09; Shaw, pp. 47-50; testimony of Jack D. White, Sept. 14, 1978, 9 House Select Committee on Assassinations - J.F.K. hearings, 322-40.

¹⁴⁵Syndicast Services videotape interview with Malcolm Thompson, as seen in BBC-TV film, "The Assassination of President Kennedy . . . What Do We Know Now That We Didn't Know Then," March 7, 1978 (J.F.K. Document No. 006039).

¹⁴⁶Ibid.

¹⁴⁷See ref. 129.

¹⁴⁸See ref. 131, Mrs. Oswald testimony, p. 16.

¹⁴⁹"Testimony of Mrs. Marguerite Oswald, Feb. 10, 1964," I Warren Commission Hearings, 146-48.

¹⁵⁰Staff summary of interview with Mrs. G. Dees, Jan. 5, 1977, House Select Committee on Assassinations (J.F.K. Document 004030).

¹⁵¹Receipt of subpoenaed photograph, Apr. 5, 1977 (J.F.K. Document No. 001145).

¹⁵²Coy of manuscript, Apr. 7, 1977 (J.F.K. Document No. 007503).

¹⁵³Outside contact report with Richard S. Stovall, Apr. 14, 1978 (J.F.K. Document No. 007503).

¹⁵⁴See ref. 125.

¹⁵⁵See ref. 151.

¹⁵⁶See ref. 150.

¹⁵⁷See ref. 153; see ref. 127, Studebaker testimony.

¹⁵⁸See para. 39-41, Scientific Report of the Photographic Evidence Panel.

¹⁵⁹See ref. 127.

¹⁶⁰See ref. 138, Shaneyfelt testimony.

¹⁶¹H. C. McKay, Three-Dimensional Photography, Principles of Stereoscopy (New York: American Photographic Publishing Co., 1953), pp. 1-11.

¹⁶²Testimony of C. S. McCamy, Sept. 15, 1978, II, House Select Committee on Assassinations - J.F.K. hearings, 397-98; Manual of Photogrammetry, vols. I and II (3d ed., 1966), American Society of Photogrammetry.

¹⁹⁵These discrepancies are discussed in Thompson, Six Seconds in Dallas, ref. 2, pp. 40-58, 99-114, and 196-213; See Warren Report, pp. 59-60 and 85-95.

¹⁹⁶Clark Panel Review of Photographs, X-Ray Films, Documents and Other Evidence to the Fatal Wounding of President John F. Kennedy (1968) (J.F.K. Document 002430).

¹⁹⁷See ref. 26, "J.F.K. Forensic Pathology Panel Report," House Select Committee on Assassinations - J.F.K. Hearings, para 151-61.

²⁰²Testimony of James W. Altgens, July 22, 1964, Warren Commission Hearings, 517.

²⁰³Weisberg, Harold, "The Milteer Documents," citation to a report in Harold Weisberg, Oswald in New Orleans (Cannon Books, 1967), p. 383; and P. Scott, P. Hoch, and R. Stetler, eds., The Assassinations (New York: Vantage Books, 1976).

²⁰⁴*Ibid.*; see also ref. Model and Groden, p. 11.

²⁰⁵This informant was identified as Willie A. Somersett in Dan Christensen, "J.F.K., King: The Dade County Links," Miami Magazine, vol. 27, no. 11, September 1976, p. 25; and Robert Groden, "The J.F.K. Evidence That Nobody Wanted To Reveal," Argosy, vol. 386, no. 1, August 1977, p. 34.

²⁰⁶FBI interview of unnamed source, November 26, 1963, Commission Document No. 1347, FBI report by Special Agent R. P. Gemberling, July 16, 1964, Bureau No. 62-109060, Field Office File No. 89-43, pp. 120-24.

²⁰⁷FBI interview of Joseph Milteer, Nov. 27, 1963, Commission Document No. 20, FBI report by Special Agents K. A. Williams and D. A. Adams, December 1, 1963, Bureau No. 62-109060, Field Office File No. AT 105-3193, pp. 24-25.

²⁰⁸See ref. 203, Weisberg, p. 118.

²⁰⁹See ref. 2, Groden, p. 33, but also see Secret Service Report, No. 27, 1963, S.S. File No. CO-2-33, 915 X-3-11-3363-8 (J.F.K. Document 01439).

(During check of potentially dangerous persons Nov. 22-25, 1963, the FBI agent at Thomasville, Georgia, ascertained that Milteer was in Quitman, Georgia, at the time of the assassination.)

²¹⁰Digital Image Processing Analysis of Photographic Evidence Relating to the John F. Kennedy Assassination, a report prepared for the House Select Committee on Assassinations, by Robert Chiralo, The Aerospace Corporation, Dec. 1, 1978, pp. 4348 (J.F.K. Document 013712); see also Photographic Image Production and Analysis, prepared for House Select Committee on Assassinations by professors at the Rochester Institute of Technology, July 16, 1978, p. 37 (J.F.K. Document 013712).

²²²Report to the President by the Committee on CIA Activities Within the United States (1975), p. 255 [hereinafter Rockefeller Commission Report].

²²³*Ibid.*; but see also M. Canfield and A. Weberman, Coup d'Etat in America (New York: The Third Press, 1975), p. 224, alleging the boxcar was originally parked closer to the knoll area and the Texas School Book Depository.

²²⁴See ref. 222, Rockefeller Commission Report, p. 256; see ref. 223, Canfield and Weberman, p. 60.

²²⁵See ref. 222, Rockefeller Commission Report, p. 357.

²²⁶*Ibid.*, pp. 251-52; see ref. 223, Canfield and Weberman, pp. 71-93.

²²⁷See ref. 222, Rockefeller Commission Report, p. 251.

²²⁸*Ibid.*, pp. 256-57.

²²⁹FBI report, Apr. 21, 1975 (J.F.K. Document 014520).

²³⁰Report excerpt prepared for the House Select Committee on Assassinations, July 18, 1978 (J.F.K. Document 010005).

²³¹See ref. 223, Canfield and Weberman, p. 124.

²³²See, e.g., Michael Eddowes, The Oswald File (General Publishing Co., 1977); letter and analysis from Jack D. White to the House Select Committee on Assassinations, Aug. 24, 1978 (J.F.K. Document 011086).

²³³L. S. Penrose, "Distance, Size and Shape," Annals of eugenics (18:337-343), 1953-54; see also Eugene Giles and Hermann K. Bleibtreu, "Cranial Evidence in Archaeological Reconstruction: A Trial of Multivariate Techniques for the Southwest," American Anthropologist (63:48-61), 1961; Jacques Gomila, The Use of Penrose's C_H^2 For an Intra-Population and Inter-Population analysis to the House Select Committee on Assassinations, Aug. 24, 1978 (J.F.K. Document - J. S. Weiner and L. Huizinga, eds. (Oxford: Clarendon Press, 1972), pp. 115-136.

²³⁴See ref. 232, Eddowes, pp. 211-22; letter and analysis from Jack D. White to the House Select Committee on Assassinations, Aug. 24, 1978 (J.F.K. Document 011086).

²³⁵See ref. 232, Eddowes.

²³⁶See ref. 234, White.

²³⁷Ibid.

²⁴³Testimony of James W. Altgens, July 22, 1964, 7 Warren Commission Hearings, 517; the photographic evidence panel correlated the Altgens photograph in time to Zapruder frame 255.

²⁴⁴Warren Report, p. 644.

²⁴⁵"Testimony of Billy Nolan Lovelady, Apr. 7, 1964," 6 Warren Commission Hearings, 338-39.

²⁴⁶"Testimony of William H. Shelley, Apr. 7, 1964," 6 Warren Commission Hearings, 328; "Statement of Buell W. Frazier, Mar. 18, 1964" (CE 1381), 22 Warren Commission Hearings, 647; "Statement of Sarah D. Stanton, Mar. 18, 1968" (CE 1381), 22 Warren Commission Hearings, 675.

²⁴⁷See ref. 2, Lane, pp. 354-356; Shaw, pp. 39-42.

²⁴⁸See ref. 2, Meagher, p. 362.

²⁴⁹CE 1408, May 24, 1964, New York Herald-Tribune story, 22 Warren Commission Hearings, 793-94; see ref. 2, Model and Groden, pp. 147-49; Meagher, p. 363; and Thompson, pp. 225-27.

²⁵⁰Ibid.

²⁵¹Letter from FBI Director J. Edgar Hoover to J. Lee Rankin, Mar. 9, 1964, Commission document 457.

²⁵²See ref. 2, Thompson, p. 227; outside contact report with Billy Nolan Lovelady, July 5, 1978 House Select Committee on Assassinations (J.F.K. Document 009727).

²⁵³Memorandum from Robert Groden to the House Select Committee on Assassinations, July 21, 1978 (J.F.K. Document 010209).

²⁵⁴See ref. 210, RIT report, p. 36.

Itek Corporation Reports

Nix Film Analysis: May 18, 1967, Conducted by Itek Corporation

SUMMARY

Exhaustive studies performed by Itek Corporation on segments of one of the three known Kennedy assassination films failed to turn up any new evidence. These studies were performed to determine the contents of the 8-millimeter film taken by Orville Nix during the assassination of President Kennedy in Dallas.

The film is the only one of the three known films of the assassination that provides significant photographic coverage of the grassy knoll area from where some eyewitnesses reported the shots were fired. The film is owned by United Press International and the studies were undertaken on a public service basis by Itek at the request of UPI.

The quality of the film content was improved by utilizing advanced photographic image enhancement methods. Precise measurements were made of a number of significant objects in the photographs to ensure proper identification of the objects and to determine whether or not the fatal shot could have been fired from certain points.

Several objects on and behind the grassy knoll were unclear in the original film. Some of those who have viewed the Nix film have claimed to see a man on an elevated object aiming a rifle. "The man with the rifle," however, was found to be nothing more than tree shadows on the wall of Shelter 3 of Pergola 2 on Dealey Plaza. The elevated object visible on the photographs was determined to be some 20 feet beyond these shadows in a parking lot. The object appeared to be a vehicle, but positive identification was not possible due to the quality of the photographs.

The following conclusions were drawn from the studies:

1. The object previously claimed to be a person by some of the viewers of the Nix film was found to be shadows on the wall of Shelter 3.
2. A "vehicle-like" object was identified in the parking lot behind the knoll. A rifleman at this location would have had to fire the fatal shot from 9 feet above the ground to clear existing horizontal obstructions. Moreover, from this point, a line of sight and line of fire to President Kennedy could have existed only for less than 1/30 second before the fatal round because of permanent vertical obstructions. No person was visible on the roof of the "vehicle" in the enhanced photographs.
3. The area known as the "grassy knoll," which is bordered by the picket fence, the concrete wall, and Shelter 3, was carefully examined. No person was visible in the Nix film in this area.
4. In the vicinity of the assassination point, President Kennedy's car traveled at essentially uniform speed.

1. INTRODUCTION

Itek Corporation has, as a public service, conducted various detailed investigations and research on the content of the film "The Assassination of President Kennedy," taken by photographer Orville O. Nix. The film, owned by United Press International, is a 31-foot-long, 8-millimeter color motion picture taken just prior to, during and immediately after the fatal shot on November 22, 1963. Selected frames of this film were used by the Warren Commission in verifying the "time and positioning" of critical frames in the Abraham Zapruder film. Very little duplication, investigation, or publicity, other than the Warren Report, has been concerned with the Nix film.

1.1 BASIC OBJECTIVE

The basic objective of the studies was to perform a detailed analysis on the total content of the Nix film. Where the quality of the film or conditions of exposure did not permit visual investigation, no deductive analysis was made.

1.2 PRIMARY OBJECTIVES

The primary objectives were:

1. To investigate an unidentified "shape" in the vicinity of Shelter 3 of Pergola 2 in Dealey Plaza (see Fig. 1-1). Pergola 2 is located adjacent to the area referred to as the "grassy knoll" (see Fig. 1-2).
2. To investigate a "vehicle-like" object near Shelter 3 (see Fig. 1-3).
3. To investigate the "area" bounded by the wall at the crest of the knoll, the picket fence, and Shelter 3 of Pergola 2 (see Fig. 1-4).
4. To determine whether or not lines of sight and lines of fire were possible from the unidentified "shape," from the "vehicle-like" object, and from the "area" to a point a calculated height above road grade on Elm Street, identified as Point 313 (see Fig. 1-5).

1.3 COLLATERAL INFORMATION CONCERNING THE NIX FILM

The following collateral information is pertinent to the Nix film:

1. Date and time of photograph - The film was taken on November 22, 1963, at 12:30 p.m. CST.
2. Conditions during photography - There was bright sunlight (with heavy shadows) and the wind was from the west at 15 mph.
3. Type of camera - The camera was a Keystone 8-millimeter movie camera with zoom lens. The average frame rate was 18 frames per second.
4. Type of film - The film was identified as Kodachrome II, Tungsten (i.e., artificial light). No filter was used.

5. Location of photographer - Orville Nix, estimated to be approximately 6.5 feet tall, was located on Main Street approximately 300 feet southeast of Pergola 2. This places him approximately 200 feet from the centerline of Elm Street at Point 313. Nix moved approximately 8 feet toward Elm Street and 35 feet west on Main Street during the photographic sequence (see Fig. 1-5).

6. Coverage of photography - The zoom setting at the time of exposure provided total angular coverage of 11 degrees, allowing the photographic recording of approximately 75 feet of the knoll area (see Fig. 1-5).

1.4 PHOTOGRAPHIC SOURCE DATA

Photographic source data used in the investigation comprise:

1. The original Nix 8-millimeter color motion picture.
2. Black and white 13^x enlarged negatives made from all color frames of the original Nix film.
3. Black and white 13^x enlarged paper prints made from the above negatives.
4. Color transparencies selected frames of the original film enlarged 13^x.

5. A black and white 16-millimeter motion picture of the knoll area taken by a representative of UPI immediately after 12:30 p.m. CST.

6. A black and white vertical aerial photograph of the Dealey Plaza (scale 1 inch = 88 feet) taken by Bruce and Gunn, Inc., of Dallas on July 15, 1963 (see Fig. 1-6).

7. Black and white ground photographs of critical objects and areas taken by a representative of UPI on February 24, 1967.

1.5 COLLATERAL SOURCE MATERIAL

1. Dealey Plaza grade plan (scale 1 inch = 20 feet) drawn March 30, 1940 (see Fig. 1-5).
2. Dealey Plaza landscape plan (scale 1 inch = 20 feet) drawn March 30, 1940.
3. Warren Commission survey plan (scale 1 inch = 10 feet) drawn May 31, 1964 (see Fig. 1-7).
4. Critical ground and object measurements (for examples, see Figs. 1-8 and 1-9).

4. CONCLUSIONS

4.1 ANALYSIS OF UNIDENTIFIED "SHAPE"

The unidentified "shape" in the vicinity of Shelter 3 of Pergola 2 in Dealey Plaza was found to be shadow and highlight details created by the sun casting shadows of tree branches on the wall of Shelter 3.

4.2 ANALYSIS OF "VEHICLE-LIKE" OBJECT

Analysis showed that an object with the appearance and size was located a minimum of 4 feet beyond the end of the picket fence in an area normally used for parking vehicles. Fig. 1-6 shows a vehicle at approximately the same location (vehicle closest to Shelter 3).

No person was observed on or near the vehicle.

4.3 ANALYSIS OF THE "AREA"

Analysis of the area bounded by the wall at the crest of the knoll, the picket fence, and Shelter 3 showed that no persons or definable objects were visible in the subject area.

4.4 POSSIBLE LINES OF SIGHT AND LINES OF FIRE

Possible lines of sight and lines of fire to a point 4.5 feet directly above point 313 on Elm Street existed from both the "area" and the "vehicle-like" object.

In the "area" bounded by the wall, the picket fence, and the southwest corner of Shelter 3, the possible line of fire would have to originate from a position 6.5 to 7 feet above grade. However, as previously mentioned, detailed analysis of this "area" did not reveal any persons or definable objects.

A line of sight and possible line of fire existed from the "vehicle-like" object from a position at least 9 feet above grade. However, from the average position determined for the "vehicle-like" object, only a very narrow field of view existed to point 313 and to the northeast, i.e., the direction from where the motorcade came. This narrow field of view permitted visual observation of not more than 1 foot to the northeast of point 313 along Elm Street. Calculations using the average vehicle speed, as previously discussed, show a line of sight and line of fire existed for less than 1/30 second because of the permanent vertical obstruction created by the walls of Shelter 3.

4.5 SPEED OF PRESIDENTIAL CAR

In the vicinity of point 313, President Kennedy's car was found to have traveled with essentially speed.

Life-Itek: Kennedy Assassination Film Analysis, Conducted by Itek Corporation - November 20, 1967

Itek Corporation at the request of Life magazine has, as a public service, conducted certain investigations of the content of selected frame photographs and movie sequences taken on or about the time of the assassination of President John F. Kennedy on November 22, 1963. The photographic materials were supplied by Time Inc., and the studies performed by Itek were defined by Life and were intended to augment those undertaken by staff members of Life magazine.

The movie sequences analyzed did not include the film taken by Orville O. Nix, although collateral information was drawn from Itek's Nix film analysis report where pertinent. The Nix film, property of United Press International, was analyzed by Itek early in 1967 and was reported on in the document "Nix Film Analysis," dated 18 May 1967.

1.1 PHOTOGRAPHIC AND REFERENCE MATERIALS

The photographic materials supplied by Time Inc. are as follows:

1. Original 8-millimeter color movie taken by Robert J. E. Hughes. This film is reported to have been exposed approximately 10 seconds before the assassination. The sequence studies shows the Texas School Book Depository Building.
2. Original 8-millimeter color movie taken by Mr. Bell. The sequence studies also shows the Texas School Book Depository Building, but this film was exposed a considerable time after the assassination. The film was employed as a "fixed" data reference (see task D, subtask b).
3. Original size 127 black and white negative taken by Hugh W. Betzner, Jr. This photograph shows the presidential limousine and background data just prior to the assassination.
4. Original 35-millimeter color transparency taken by Philip L. Willis. This picture, referred to as Willis no. 5, was taken just prior to the assassination and generally shows the same scene as Betzner's photograph.
5. A 35-millimeter color transparency enlargement of frame 188 from the 8-millimeter movie taken by Abraham Zapruder. The frame shows the presidential limousine with photographers Willis and Betzner in the background.
6. Original 35-millimeter color transparency taken by W. Bond. This frame shows the grassy knoll after the assassination. The grassy knoll is located adjacent to Pergola 2 (see Fig. 2-3).
7. A duplicate of a black and white Polaroid print taken by Mary Moorman. This print shows the limousine immediately after point 313 (the frame number on the Zapruder film which shows the impact of the fatal bullet) (see Fig. 2-2).
8. A black and white enlarged duplicate of a 13-millimeter color transparency taken by P. L. Willis. This picture, referred to as Willis no. 6, shows the motorcade on Elm Street after the assassination.
9. Two original 35-millimeter black and white film strips taken by Thomas Dillard. The strips include narrow angle and wide angle scenes of the Texas School Book Depository immediately after the assassination.

Other material used in Itek's study included:

- A copy of the Warren Commission Dealey Plaza Map.
- Miscellaneous copies and enlargements of the above-mentioned photographic materials.

- Selected copies of Warren Commission exhibits.

1.2 STUDY OBJECTIVES

1. Task A - Investigate a "facelike" image above the fence and wall at the top of the grassy knoll.

Background. A tonal change resembling the head and neck of a person appears approximately 15 feet north of the southeast corner of the picket fence on the grassy knoll. The same image appears on five different photographic records analyzed. The study was started under the assumption that the "facelike" object might be located immediately behind the wall, between the wall and the fence, or behind the fence.

2. Task B - Determine which frame, the Betzner (127 black and white) or the Willis no. 5 (35-millimeter color), was exposed first.

Background. Both Willis and Betzner were located on the southeast corner of Houston Street and Elm Street. The Zapruder frame shows both photographers and the presidential car at approximately the time that they took the pictures being analyzed.

3. Task C - Determine position versus time of the "person" appearing at the south end of the wall (on the grassy knoll) on the Betzner and Willis no. 5 images.

Background. In the Willis and Betzner pictures analyzed in task B a "person" in dark clothing can be seen at the south end of the wall on the knoll. The "person" can only be seen above the wall, indicating that he is probably on the upper landing of the steps between the wall and the fence. The location of this "person" at the time the presidential car was at point 313 is of interest.

4. Task D - Determine what can be observed and measured at the sixth floor window of the Texas School Book Depository Building. This task was divided into subtasks as follows:

- a. Time lapse viewing of Hughes and Bell images under high magnification.
- b. Stereo viewing of Hughes and Bell images with respect to a tree shadow (tree located approximately 90 feet from the corner of Houston and Elm Streets) barely discernible in the foreground of both pictures.

2.3 TASK C

The objective of task C was to determine position versus time of the "person" appearing at the south end of the wall (on the grassy knoll) on the Betzner and Willis no. 5 images.

Because of the chronological sequence of the event being analyzed, collateral information and imagery from the Itek study of the UPI owned Nix film was employed in this task. This film provided key reference data near the assassination point (point 313). Materials used for the study were (1) before point 313, Betzner and Willis no. 5, no. 6, Hughes, Bond, and the Nix study.

No special photographic operations were required, since materials prepared for the previous tasks were used. Optical screening and viewing equipment was matched to the particular image being analyzed.

Stereophotogrammetric viewing and measurement of the Betzner and Willis no. 5 images verified that the size of the "person" is commensurate with that of an adult human. Scale factors for this conclusion were based on physically measured values of the height of the wall and distance from ground level at the upper landing to the top of the wall at the south end. The stereoscopic base provided by the distance between photographers Betzner and Willis was sufficient to determine that the "person" is immediately behind the wall. The instrument used for stereo viewing and measurement was a Wild ST-3 stereoscope with stereometer.

Analysis of the other imagery was aided by high magnification binocular viewers and film screening devices. The photographic analysis of the location of the "person" was correlated with the relative time interval between exposures.

Conclusions

Measurement of the size of the "person" on the Betzner and Willis no. 5 images verified that it could be an adult person. These photographs were taken when the limousine was approximately 100 feet from point 313. At point 313 the edge of the Moorman picture cuts through the groups of persons on the steps, showing only one of the group. The Nix frames immediately after point 313 show a dark clothed man running up the steps away from the motorcade. Films after point 313 provide no clear indication of where the "person" is located.

- c. Three-image photointegration of Hughes and Bell images.
- d. Visual integration of Hughes and Bell images.
- e. Dodging and low gamma processing of Dillard photographs of Texas School Book Depository Building.
- f. Improved print of Hughes frame.
- g. Photogrammetric analysis of Dillard image.

Background. Films of the motorcade when it was still on Houston Street show periodic sequences of the Texas School Book Depository Building. Films taken of the building immediately after the assassination provide collateral data. Combinations of these images plus advance photographic techniques might bring out additional information on occurrences at the sixth floor window and its immediate vicinity.

2. MATERIAL PREPARATION, IMAGE ANALYSIS, AND CONCLUSIONS

2.1 TASK A

Task A involved the investigation of the "facelike" image appearing above the fence and the wall at the top of the grassy knoll. The Moorman photograph shows the image of interest. Fig. 2-1, a photograph taken in 1967, shows the same area for reference purposes. The

photographic materials⁵² used in this study (identified by their respective photographers) were Moorman, Bond, Willis no. 5, Willis no. 6, Betzner, and Hughes. The Hughes movie, primarily intended for study of the Texas School Book Depository Building, showed in its later sequences the grassy knoll area and therefore was used in task A.

For this task, all but the Moorman and Hughes pictures were enlarged and printed as black and white transparencies to enable direct tonal comparison of the image in question. In all photographic duplication, the materials were processed with low gamma techniques and Itek G-4 chemistry. Appendix A contains a discussion of this procedure and its purpose.

In all but the Betzner picture, the "facelike" image was observed. (In the Betzner picture, the image was obscured by a tree and a road sign.) It was analyzed for tonal and shape similarity in the remaining five records and measured for comparative size and distance from the end of the fence. Measurements of distance confirmed the same location of the image in all five photographs. After corrections for distance variations created by camera perspective angle, the measurements of image location correlated to within 5 to 8 percent.

Conclusions

In the Moorman picture, the "facelike" image could be interpreted as being behind the wall. Two analysis factors refute this observation: (1) The apparent size of the object scaled to known dimensions resulted in a top to bottom head size of 5 inches (obviously too small for an adult human). (2) The remaining frames analyzed show the object only above the picket fence.

The Bond picture clearly shows the object to be a shrub separation with no "body" between the object and the top of the picket fence. Autos in the parking area behind the fence can be seen between the top of the fence and the lower edge of the shrubs at the location of the object.

2.2 TASK B

The objective of task B was to determine which frame, the Betzner (127 black and white) or the Willis no. 5 (35-millimeter color), was exposed first. The materials used in the study were Betzner, Willis no. 5, Zapruder 188, and the Dealey Plaza Map.

A duplicate negative of each of the frames under study was produced, using phosphor quench dodging and low gamma processing. Enlarged paper prints were produced to permit graphic resection and feature plotting. (Dodging and low gamma processing are explained in Appendix A.)

Through graphic resection, the photographers' positions, the principal axes of the cameras, and the positions of the presidential limousine were determined and plotted on a map overlay (see Fig. 2-2). Through photographic analysis the position of the car with respect to lane lines and tree shadow was used to confirm general exposure time sequencing.

⁵²Materials are listed in order of pertinence.

Conclusions

The location of the presidential limousine in the resected Betzner picture and in the resected Willis picture showed that Betzner exposed first and Willis exposed when the car was approximately 5 feet farther along Elm Street. Assuming an approximate average vehicle speed of 16.4 feet per second, this would correspond to 0.3 second. The sequencing was verified by location of the car with respect to lane lines.

Photographic evidence indicates that the "person" appearing in the Willis no. 5 and Betzner pictures joined two other persons on the steps by the time the car was at point 313. Since the distance the car traveled was approximately 100 feet between the early pictures at point 313, the "person" would have had from 6 to 7 seconds to walk approximately 20 feet.

2.4 TASK D

The object of task D was to determine what could be observed and measured at the sixth floor window of the Texas School Book Depository Building. The photographic materials used in this task were Hughes, Bell, Dillard, and miscellaneous contact prints of pertinent Warren Report pictures.

Both the Hughes and Bell films were contact duplicated using phosphor quench dodging and low gamma processing techniques. The Dillard strip was dodged, duplicated, and processed in the same way.

Selected frames of the Hughes and Bell films were color separated. The procedure and purpose of color separation are explained in Appendix A.

Three successive frames from each of the Hughes and Bell films were integrated (referenced to the sixth floor window) photographically on the Itek ACVP (see Appendix A).

The duplicate films and the Dillard strip were photographically enlarged for some of the analyses.

The image, grain structure, and film base of the Dillard picture (Warren Commission Dillard Exhibit C) were analyzed under very high magnification for possible imperfections.

Subtask a - Time Lapse Viewing of Hughes and Bell Images Under High Magnification. The sixth floor window was repeatedly viewed on the Hughes (before assassination) film. Note was made of the tone and shape of the object(s) and changes thereof appearing in the window. This procedure was repeated on the Bell film.

Subtask b - Stereo Viewing of Hughes and Bell Images. Hughes took his film from a point on Houston Street at road level. Bell took his film from an elevated position adjacent to Houston Street near the Hughes location. The images of the window were brought to the same scale and viewed stereoscopically with a vertical stereo base.

Subtask c - Three-Image Photographic Integration of Hughes and Bell Images. These images were used to repeat subtasks a and b. The resulting imagery was of higher contrast, but no additional information was found.

Subtask d - Visual Integration. This technique was used primarily in the stereo viewing and provided a high resolution stereo view. Two successive frames of the Hughes film were overlaid and placed in one stereo channel, and two successive frames of the Bell film were

overlayed and placed in the second stereo channel. A definite improvement in contrast and depth perception resulted.

Subtask e - Dodging and Low Gamma Processing of Dillard Exhibit C. (Closeup of Texas School Book Depository, sixth floor.) Additional information was brought out and analyzed. A pattern of highlight tonal features resembling a face can be observed slightly above and to the right of a box on the windowsill.

Subtask f - Improved Color Print of Hughes Film. The new print showed features (boxes, etc.) not visible in the original copy print.

Subtask g - Photogrammetric Analysis of Dillard Exhibit C. After careful photogrammetric analysis, which took into account the photographer's location, camera perspective, scale relations, and window and room dimensions, it was determined that the "facelike" pattern was too small by a factor of two to be a face located along the camera line of sight and still be located in the sixth floor room. The imaged pattern was consistent with patterns on an open box of books located directly behind the point determined to be the assassin's location (see Fig. 2-3).

Conclusions

Subtask a. A rectangular shape with the long dimension vertical can be seen (on both the Hughes and Bell images) slightly to the right of center in half open, right-hand window of the Texas School Book Depository Building. In the Hughes sequence, the shape appears to change in size as the car approaches the corner of Houston and Elm Streets. It seems to decrease in size from left to right and from top to bottom.

Subtask b. The rectangular shape is definitely recessed from the window and would appear to be a stack of boxes. No parallax measurement was made owing to the lack of the necessary numerical data.

Subtasks c and d. The results of these subtasks supported observations in subtasks a and b.

Subtask e. Physical analysis of the Dillard film showed a blemish in the base material near the point of the "facelike" pattern. This blemish was considered too small (5 to 6 microns) to cause the pattern.

Subtasks f and g. The results of these subtasks are discussed above.

John F. Kennedy Assassination Film Analysis, Conducted by Itek Corporation - May 2, 1976

CBS News approached Itek Corporation in the Summer of 1975 with a request for a new analysis of the major photographic films of the assassination of President John F. Kennedy. At that time, CBS News was preparing a Special Report on this subject and wished to include in it an updated and detailed analysis of the films which showed the major events of the assassination. The initial request by CBS to Itek was essentially as follows: By utilizing relatively new and sophisticated techniques of image analysis, e.g., digital image processing, which have not or could not have been applied in the past to these films; can you tell us anything more about what the films might reveal relative to the assassination? Specifically, Itek was

asked to study the Zapruder Film in the area surrounding frame 313, and to study the Hughes Film which shows some of the Texas School Book Depository (TSBD) windows and the presidential limousine several seconds before the shots.

The primary reason for the request by CBS to Itek was that Itek had performed two previous studies of some of the assassination films in 1967 for UPI and Time-Life. Summaries of these studies are contained in appendices A and B of this report. Another reason is that Itek is expert in the field of image analysis, and has resources for such study.

Itek undertook this study at a research project in the public interest as were the previous studies.

The initial request by CBS was relatively unbounded, so the first phase of this effort was designed to determine the most fruitful areas of study in order that the analytical work could be concentrated in areas where useful results were most likely to be found. Study into the background of this assassination, and preliminary study of the films, permitted the general request of CBS to be reformulated as series of specific questions. These questions, listed below, were addressed in part by CBS on the Special Report.

From the film which shows the sixth floor corner window and other windows of the Texas School Book Depository Building, can any objects be detected or recognized? Can we see what is happening there? Is there any evidence of a shot being fired around frame 186? Do frames 210 to 240 give us any evidence of when Governor Connally was struck? Can we see any evidence of when his wrist was struck? In what direction did Connally move? What can we tell from Zapruder frames 313 and 314 about the motion of the particles ejected from the President's head? Does the movement of the particles tell us anything about the direction of the shot? What can we discover from frames 308 to 317 about the movement of the President's head and body? How much forward movement was there? For how long? What can you tell us about Mrs. Kennedy's movement in the car? What is its relationship to President Kennedy's movements? In frame 414 can we discern any person or persons in the shrubbery Mr. Zapruder had then in front of his camera?

The study was not restricted to answering the above questions, however, the majority of the results reported here are related to the information produced in dealing with them. It is the purpose of this report to provide a complete description of all the work performed on this project and to present the results and conclusion derived from the study.

This program employed the services of over a dozen technical specialists. These people were called upon to contribute in his or her area of expertise as the research progressed. People with training and expertise in the following disciplines participated in the program: physics, photographic science, special photographic processing, photo interpretation, image analysis, coherent optical image processing, photogrammetry, and digital image processing.

We presented here the results of a technical research program, and do not attempt to draw conclusions beyond the capability of the analysis to support them. All of our efforts are described including those from which no firm conclusion could be drawn, but from which some useful data resulted in the pursuit of a particular objective. We are aware of the controversy and uncertainties go beyond the realm of photographic analysis and thus beyond the scope of this report. This work had produced a detailed assessment of the major photographic evidence of the assassination and we believe it has produced answers to some of the most significant questions raised over the years about those events which took place in Dealey Plaza.

2.0 SUMMARY AND CONCLUSIONS

This study of some of the major films of the Kennedy assassination in Dallas, November 22, 1963, has produced the following results and conclusions.

- Motion of an object or person was detected in the sixth floor corner window of the Texas School Depository.
- Identification of this (object) was not possible despite enhancement techniques applied to the imagery. No other motions or evidence indicating the presence of a person(s) in other sixth floor windows visible in the Hughes film were found.
- No evidence could be found which would indicate that President Kennedy was struck before the Stemmons Freeway sign blocked Zapruder's view.
- President Kennedy was first wounded most probably after frame 212 and before frame 223.
- The positions of President Kennedy and Governor Connally in the car at about 1 and 3/4 seconds before (i.e., frame 218 vicinity), and the locations of their wounds are consistent with the hypothesis that both were struck by a single bullet traveling on a trajectory from the sixth floor window of the TSBD.
- Governor Connally begins a rapid and seemingly involuntary change in physical appearance at about Zapruder frame 225. Part of this change (hand and arm movement) to a wound which reaction is first observable at frame 224. Governor Connally's hand movement lags President Kennedy's by about 2 frames or about 1/9th of a second.
- All major particles ejected from the President's head at frame 313 travel in a forward direction and his head moves forward about 2.3 inches between frames 312-313 under the impact of the blow.
- The motions of Mrs. Kennedy and the President in the time immediately after frame 313 indicate that Mrs. Kennedy contributed to or caused the backward motion of the President after 313.
- No evidence of gunmen purported to be either on the grassy knoll or behind the stockade fence was found. Explanations, more consistent with the physical data (film images) than gunman theories, of the observable are offered in the text.

The Nelson Rockefeller Report to the President
By the Commission on CIA Activities

Chapter 19

Allegations Concerning the Assassination of President Kennedy

Allegations have been made that the CIA participated in the assassination of President John F. Kennedy in Dallas, Texas, on November 22, 1963. Two different theories have been advanced in support of those allegations. One theory is that E. Howard Hunt and Frank Sturgis, on behalf of the CIA, personally participated in the assassination. The other is that the CIA had connections with Lee Harvey Oswald or Jack Ruby, or both of them, and that those connections somehow led to the assassination. The Commission staff has investigated these allegations.

Neither the staff nor the Commission undertook a full review of the Report of the Warren Commission. Such a task would have been outside the scope of the Executive Order establishing this Commission, and would have diverted the time of the Commission from its proper function. The investigation was limited to determining whether there was any credible evidence pointing to CIA involvement in the assassination of President Kennedy.

**A. The Theory That Hunt and Sturgis Participated in the
Assassination**

The first of the theories involves charges that E. Howard Hunt and Frank Sturgis, both convicted of burglarizing the Democratic National Committee headquarters at the Watergate in 1972, were CIA employees or agents at the time of the assassination of the President in 1963. It is further alleged that they were together in Dallas on the day of the assassination and that shortly after the assassination they were found in a railroad boxcar situated behind the "grassy knoll," an area located to the right front of the presidential car at the time of the assassination.

Under this theory, Hunt and Sturgis were allegedly in Dallas on November 22, 1963, and were taken into custody by the police, but were mysteriously released without being booked, photographed or fingerprinted by the police - although they were allegedly photographed by press photographers while they were being accompanied to the Dallas County Sheriff's office.

It is further contended that the persons shown in these press photographs bear "striking resemblances" to photographs taken of Hunt and Sturgis in 1972. Portions of two amateur motion pictures films of the assassination (Zapruder and Nix) are alleged to reveal the presence of several riflemen in the area of the grassy knoll.

The Hunt-Sturgis theory also rests on the assumption that at least one of the shots that struck President Kennedy was fired from the area of the grassy knoll, where Hunt and Sturgis were alleged to have been present. The direction from which the shots came is claimed to be shown by the backward and leftward movement of President Kennedy's body almost immediately after being struck by that bullet. Taken together, these purported facts are cited as the basis for a possible conclusion that CIA personnel participated in the assassination of President Kennedy, and, at least inferentially, that the CIA itself was involved.

The Commission staff investigated the several elements of this theory to the extent deemed necessary to assess fairly the allegations of CIA participation in the assassination. The findings of that investigation follow.

Findings

1. The Allegation that Hunt and Sturgis Were CIA Employees or Agents in 1963

E. Howard Hunt was an employee of the CIA in November 1963. He had been an employee of the CIA for many years before that, and he continued to be associated with the CIA until his retirement in 1970. Throughout 1963 he was assigned to duty in Washington, D.C., performing work relating to propaganda operations in foreign countries. His duties included travel to several other cities in the United States, but not to any place in the South or Southwest. He lived with his family in the Washington, D.C. metropolitan area throughout that year, and his children attended school there.

Frank Sturgis was not an employee or agent of the CIA either in 1963 or at any other time. He so testified under oath himself, and a search of CIA records failed to discover any evidence that he had ever been employed by the CIA or had ever served it as an agent, informant or other operative. Sturgis testified that he had been engaged in various "adventures" relating to Cuba which he believed to have been organized by the CIA. He testified that he had given information, directly and indirectly, to federal government officials, who, he believed, were acting for the CIA. He further testified, however, that at no time did he engage in any activity having to do with the assassination of President Kennedy, on behalf of the CIA or otherwise.

2. The Allegations That Hunt and Sturgis Were Together in Dallas on the Day of the Assassination

Hunt and Sturgis testified under oath to members of the Commission staff. They both denied that they were in Dallas on the day of the assassination. Hunt testified that he was in the Washington, D.C. metropolitan area throughout that day, and his testimony was supported by two of his children⁵³ and a former domestic employee of the Hunt family. Sturgis testified that he was in Miami, Florida, throughout the day of the assassination, and his testimony was supported by that of his wife and a nephew of his wife. The nephew, who was then living with the Sturgis family, is now a practicing attorney in the Midwest.

With the exception of the domestic employee of the Hunt family, all witnesses directly supporting the presence of Hunt and Sturgis in Washington, D.C., and Miami, Florida, on the day of the assassination are family members or relatives. Less weight can be assigned to the testimony of such interested witnesses if there is substantial evidence to the contrary. In the

⁵³A son who was nine years old at the time could not recall whether his parents were present or absent that day; the fourth (and youngest) Hunt was not born then. Mrs. Hunt is now deceased.

absence of substantial conflicting evidence, however, the testimony of family members cannot be disregarded.

Hunt testified that he had never met Frank Sturgis before they were introduced by Bernard Barker in Miami in 1972. Sturgis testified to the same effect, except that he did not recall whether the introduction had taken place in late 1971 or early 1972. Sturgis further testified that while he had often heard of "Eduardo," a CIA political officer who had been active in the work of the Cuban Revolutionary Council in Miami prior to the Bay of Pigs operation in April 1961, he had never met him and did not know until 1971 or 1972 that "Eduardo" was E. Howard Hunt. Sturgis had also been active in anti-Castro groups in the Miami area before, during and after Hunt's assignment on the political aspects of the Bay of Pigs project in 1960 and early 1961.

Other testimony linked Hunt to Sturgis at a date earlier than 1971. One witness asserted that Sturgis is a pseudonym; that his name is Frank Fiorini; and that he took the name of Sturgis from a fictional character (Hank Sturgis) in a novel written by Hunt in 1949 (Bimini Run). Sturgis testified that his name at birth was Frank Angelo Fiorini; that his mother's maiden name was Mary Vona; that his father's name was Angelo Anthony Fiorini; that his parents were divorced when he was a child; that his mother subsequently remarried a man named Ralph Sturgis; and that at his mother's urging he legally changed his name in Norfolk, Virginia, sometime in the 1950's, to take the last name of his stepfather.

A search of the relevant court records disclosed that a petition was filed on September 23, 1952, in the Circuit Court of the City of Norfolk (Virginia) pursuant to which a Frank Angelo Fiorino petitioned to change his name to Frank Anthony Sturgis. The petition recited that his mother had divorced his father about 15 years previously and had married one Ralph Sturgis, that he had been living with his mother all of his life, that his mother was known as Mary Sturgis, and that his stepfather also desired him to change his name to Sturgis. An order of the Court was entered on September 23, 1952 (the same date as the petition) changing his name to Frank Anthony Sturgis. The order appears in the records of the Circuit Court of the City of Norfolk, Virginia. In the petition and the order relating to the change of name, Fiorini was misspelled as Fiorino.

In the light of this documentary evidence, no weight can be given to the claim that Sturgis took his present name from a character in a Hunt novel - or that his name change was associated in any way with Sturgis's knowing Hunt before 1971 or 1972.

The personnel, payroll and travel records of the CIA were checked with respect to E. Howard Hunt. Daily attendance records for the period are no longer available because they are destroyed in the ordinary course of the Agency's records disposal system three years after completion of the audit for each year. What records remain, including annual leave, sick leave, and travel records, disclose that Hunt had no out-of-town travel associated with his employment in the month of November 1963. He used no annual leave and eleven hours of sick leave in the two-week pay period ending November 23, 1963. The exact date or dates on which the sick leave was taken could not be ascertained. There is some indication, however, that some of these eleven hours of sick leave may have been taken by Hunt on November 22, 1963. He testified that, on the afternoon of that day, he was in the company of his wife and family in the Washington, D.C. area, rather than at his employment duties. That was a Friday, and therefore

a working day for employees at the CIA. Hunt could not recall whether he was on duty with the CIA on the morning of that day.

Because Sturgis was never an agent or employee of the CIA, the Agency has no personnel, payroll, leave or travel records relating to him.

In examining the charge that Hunt and Sturgis were together in Dallas on the day of the assassination, the investigators were handicapped by the fact that the allegation was first made in 1974, more than ten years after the assassination. Evidence which might have been available at an earlier time was no longer available. Contacts with relatives, friends, neighbors or fellow employees (who might have known of the whereabouts of Hunt and Sturgis on that particular day) could not be recalled. Some of these persons are now dead. Finally, records which might have been the source of relevant information no longer exist.

It cannot be determined with certainty where Hunt and Sturgis actually were on the day of the assassination. However, no credible evidence was found which would contradict their testimony that they were in Washington, D.C., and Miami, Florida, respectively.

3. The Allegation That Hunt and Sturgis Were Found Near the Scene of the Assassination and Taken to the Dallas County Sheriff's Office

This allegation is based upon a purported resemblance between Hunt and Sturgis, on the one hand, two persons who were briefly taken into custody in Dallas following the assassination.

The shooting of President Kennedy occurred at about 12:30 p.m., Dallas time, on November 22, 1963, while the presidential motorcade was passing Dealey Plaza as it headed generally westward on Elm Street. Witnesses to the shooting gave the police varying accounts of where they thought the shots had come from. On the basis of the sound of the shots, some believed that they had come from the Texas School Book Depository Building (TSBD), which was behind and slightly to the right of President Kennedy when he was hit. Law enforcement officials understandably conducted a widespread search for evidence relating to the assassination.

Several hours after the shooting, officers of the Dallas Police Department checked all railroad freight cars situated on tracks anywhere in the vicinity of Dealey Plaza. About six or eight persons, referred to as "derelicts," were found in or near the freight cars. These persons were taken either to the nearby Dallas County Sheriff's office, or to the Dallas Police Department, for questioning. All were released without any arrest record being made, or any fingerprinting or photographing being done by the authorities.

Among the six or eight "derelicts" found in the vicinity of the freight cars were three men who, according to the arresting officers, were found in a boxcar about one-half mile south of the scene of the assassination. They were taken to the Sheriff's office by the Dallas police officers, who walked northward along the railroad tracks to a point west of the Texas School Book Depository, then north to Houston Street and back south to the Sheriff's office. This somewhat circuitous route was actually the most convenient one available, according to the Dallas policemen. As the police and the "derelicts" passed the TSBD Building and headed for the Sheriff's office, they were photographed by several press photographers on the scene. Copies of five of the photographs showing the "derelicts" were submitted to the Commission's staff as evidence.

A witness who volunteered his testimony stated on the basis of hearsay that the three "derelicts" in question were found in a boxcar situated to the near northwest of the assassination scene, which would have been to the right from the presidential car at the time of the shooting. Between the area in which the boxcar was claimed by this witness to be located and that part of Elm Street where the assassination occurred was a "grassy knoll."

It was alleged by other witnesses (who were associated with the first witness and who also volunteered testimony) that a bullet fired from the area of the "grassy knoll" struck President Kennedy in the head. It was also claimed by the same witnesses that one of the three photographed "derelicts" bears a "striking" facial resemblance to E. Howard Hunt and that another of them bears a "striking" facial resemblance to Frank Sturgis. Finally, it was alleged that if those two "derelicts" were, in fact, Hunt and Sturgis, and if the President was in fact struck by a bullet fired from his right front, the CIA would be shown to be implicated in the killing of President Kennedy.

The photographs of the "derelicts" in Dallas have been compared with numerous known photographs of Hunt and Sturgis taken both before and after November 22, 1963. Even to non-experts it appeared that there was, at best, only a superficial resemblance between the Dallas "derelicts" and Hunt and Sturgis. The "derelict" allegedly resembling Hunt appeared to be substantially older and smaller than Hunt. The "derelict" allegedly resembling Sturgis appeared to be thinner than Sturgis and to have facial features and hair markedly different from those of Sturgis.

The witnesses who testified to the "striking resemblance" between the "derelicts" and Hunt and Sturgis were not shown to have any qualifications in photo identification beyond that possessed by the average layman. Their testimony appears to have been based on a comparison of the 1963 photographs of the "derelicts" with a single 1972 photograph of Sturgis and two 1972 photographs of Hunt.

Over fifty photographs taken of Hunt and Sturgis both before and after November 22, 1963, were submitted to the FBI photographic laboratory for a comparison with all known photographs of the "derelicts." (The FBI assembled a completed set of all photographs of the "derelicts" taken by the three photographers known to have photographed them.) The comparison was made by FBI Agent Lyndal L. Shaneyfelt, a nationally recognized expert in photo identification and photo analysis.

The report of Agent Shaneyfelt, embodied in a Report of the FBI Laboratory, dated April 21, 1975, and signed by Clarence M. Kelley, Director of the FBI, concluded that "neither E. Howard Hunt nor Frank Sturgis appear as any of the three 'derelicts' arrested in Dallas, Texas, as shown in the photographs submitted."

With respect to Hunt, it was found that he had a much younger appearance, a smooth and tightly contoured chin, and a more angular or pointed chin, compared with the "derelict" in question. The latter was much older, had a chin with protruding pouches and a more bulbous nose.

With respect to Sturgis, even more distinguishing characteristics were observed. Sturgis looked like a Latin, whereas the "derelict" had the general appearance of a Nordic. Sturgis had very black, wavy hair - and the "derelict" had an oval face with more rounded chin. Sturgis and the "derelict" had markedly different ratios between the length of their noses and the height of their foreheads. They also had different ear and nose contours.

Hunt is approximately five feet nine inches tall, and Sturgis is approximately five feet eleven inches tall. The FBI laboratory made an on-site study in Dallas, using the cameras with which the photographs of the "derelicts" were originally taken; it was concluded from the study that the "derelict" allegedly resembling Hunt was above five feet, seven inches tall, and that the "derelict" resembling Sturgis was about six feet two inches tall, with one inch margin for error in each direction. The difference between the height of the two "derelicts" was therefore about seven inches, while the difference between Hunt's height and that of Sturgis is only about two inches.

The photographs of the "derelicts" in Dallas have been displayed in various newspapers in the United States, on national television programs, and in the April 28, 1975, issue of Newsweek magazine. But no witnesses have provided testimony that either of the "derelicts" was personally known to be Hunt or Sturgis - and no qualified expert has offered to make such an identification.

4. The Allegation That President Kennedy Was Struck in the Head by a Bullet Fired From His Right Front

The witnesses who presented evidence they believed sufficient to implicate the CIA in the assassination of President Kennedy placed much stress upon the movements of the President's body associated with the head wound that killed the President. Particular attention was called to the Zapruder film, and especially frame 312 and the succeeding frames of that film. It was urged that the movements of the President's head and body immediately following the head wound evidence in frame 313 established that the President was struck by a bullet fired from the right front of the presidential car - the direction of the grassy knoll and the freight car in which "Hunt" and "Sturgis" were allegedly found.

By frame 312 of the Zapruder film, President Kennedy had already been wounded by a bullet which had struck him in the region of his neck. His body is shown to be facing generally toward the front of the presidential car. He is leaning toward the left. His head is turned somewhat toward the left front, and it is facing downward toward the floor in the rear portion of the car. His chin appears to be close to his chest.

At frame 313 of the Zapruder film, the President has been struck by the bullet that killed him, and his head has moved forward noticeably. At frame 314 (which is about 1/18 of a second later) his head is already moving backward. Succeeding frames of the film show a rapid backward movement of the President's head and upper body, and at the same time his head and body are shown to be turning towards his left. Still later frames show the President's body collapsing onto the back seat of the car.

The evidence presented to the Warren Commission revealed that the speed of the Zapruder motion picture camera was 18.3 frames per second. If the film is projected at that speed, the forward movement of the President's head from frame 312 to frame 313 is not readily perceived. On the other hand, such forward movement is evident upon careful measurement of still projections of relevant frames. It is very short, both in distance and duration. The backward movement and the turning of the President's head toward the left are rapid, pronounced and readily apparent during a running of the film at either normal or slow speed.

It was claimed that the movement of the President's head and body backward and to the left is consistent only with a shot having come from the right front of the presidential car - that is, from the direction of the grassy knoll.

Medical and ballistics experts were consulted. Also considered were (1) the autopsy report on the body of President Kennedy, and (2) the report of a panel of medical experts who, in February 1968, at the request of Attorney General Ramsey Clark, reviewed the autopsy report and the autopsy photographs, X-ray films, motion picture films of the assassination, the clothing worn by President Kennedy and other relevant materials.

The autopsy report of James J. Humes, M.D.; J. Thornton Roswell, M.D.; and Pierre A. Finck, M.D., described the President's head wounds as follows:

The fatal wound entered the skull above and to the right of the external occipital protuberance. A portion of the projectile traversed the cranial cavity in a posterior-anterior direction (see lateral skull roentgenograms) depositing minute particles along its path. A portion of the projectile made its exit through the parietal bone on the right carrying with it portions of the cerebrum, skull and scalp. The two wounds of the skull combined with the force of the missile produced extensive fragmentation of the skull, laceration of the superior sagittal sinus, and of the right cerebral hemisphere.

In February 1968, a panel of physicians met in Washington, D.C., at the request of Attorney General Ramsey Clark, to examine the autopsy report, the autopsy photographs and X-rays, the Zapruder, Nix and Muchmore motion picture films of the assassination, and various other evidence pertaining to the death of President Kennedy. Each of the four physicians constituting the panel had been nominated by a prominent person who was not in the employment of the federal government. They were:

William H. Carnes, M.D., Professor of Pathology, University of Utah, Salt Lake City, Utah; Member of Medical Examiner's Commission, State of Utah. Nominated by Dr. J. E. Wallace Sterling, President of Stanford University.

Russel S. Fisher, M.D., Professor Forensic Pathology, University of Maryland; and Chief Medical Examiner of the State of Maryland, Baltimore, Maryland. Nominated by Dr. Oscar B. Hunter, Jr., President of the College of American Pathologists.

Russel H. Morgan, M.D., Professor of Radiology, School of Medicine, and Professor of Radiological Science, School of Hygiene and Public Health, the Johns Hopkins University, Baltimore, Maryland. Nominated by Dr. Lincoln Gordon, President of the Johns Hopkins University.

Alan R. Moritz, M.D., Professor of Pathology, Case Western Reserve University, Cleveland, Ohio; and former Professor of Medicine, Harvard University. Nominated by Dr. John A. Hannah, President of the Johns Hopkins University.

After reviewing the autopsy photographs, and making their findings concerning them, the Panel said in its report:

"These findings indicated that the back of the head was struck by a single bullet traveling at high velocity, the major portion of which passed through the right cerebral hemisphere, and which produced an explosive type of fragmentation of the skull and laceration of the scalp. The

appearance of the entrance wound in the scalp is consistent with its having produced by a bullet similar to that of Exhibit CE 399."⁵⁴

After review of the autopsy X-rays, the Panel's report states:

"The foregoing observations indicate that the decedent's head was struck from behind by a single projectile. It entered the occipital region 25 mm to the right of the midline and 100 mm above the external occipital protuberance. The projectile fragmented on entering the skull, one major section leaving a trail of the metallic debris as it passed forward and laterally to explosively fracture the right frontal and parietal bones as it emerged from the head."

The Panel discussed its findings as follows:

"The decedent was wounded by two bullets of which entered his body from behind.

"One bullet struck the back of the decedent's head well above the external occipital protuberance. Based upon the observation that he was leaning forward with his head turned obliquely to the left when this bullet struck, the photographs and X-rays indicate that it came from a site above and slightly to his right.

"The absence of metallic fragments in the left cerebral hemisphere or below the level of the frontal fosse on the right side together with the absence of any holes in the skull to the left of the midline or in its base and the absence of any penetrating injury of the left hemisphere eliminate with reasonable certainty the possibility of a projectile having passed through the head in any direction other than from back to front as described in preceding sections of this report."

Certain other evidence relating to the source of the bullets that struck President Kennedy was noted. This included:

a. The bullet fragments found in the presidential car which were large enough to bear ballistics marks were determined by the FBI to have been fired by the Oswald rifle found on the sixth floor of the Texas School Book Depository Building, and not from any other weapon. CE 399 was also fired from that rifle.

b. No physical evidence, such as rifle, shell casing, bullets, or damage to the presidential car, was found which would support a theory that one or more shots were fired from a direction other than from behind and above the President.

c. Most eyewitnesses testified that three shots were fired. Three shell casings were found near the window at the southeast corner of the sixth floor of the Texas School Book Depository Building, and all of them were determined by the FBI to have been fired by the Oswald rifle to the exclusion of any weapon. That window was also the one in which a man firing a rifle was seen by witnesses who testified before the Warren Commission. The Oswald rifle was found on the sixth floor of the TSBD Building within an hour after the assassination.

d. No witness at the scene was found who saw any other assassin, or who saw anyone firing, or disposing of a weapon in any other location, or who heard the bolt of a rifle being operated at any other location. Three TSBD employees testified before the Warren Commission

⁵⁴CE 399 was Warren Commission Exhibit 399, a nearly whole bullet found in Parkland Memorial Hospital in Dallas on the day of the assassination. It was established by ballistics experts as having been fired by the rifle found on the sixth floor of the TSBD building and found by the Warren Commission to have belonged to Lee Harvey Oswald. The Warren Commission determined that the bullet passed through President Kennedy's neck and then struck Governor Connally, who was sitting in front of President Kennedy, and who was taken to Parkland Hospital.

that they had been watching the motorcade from open windows near the southeast corner of the fifth floor of the TSBD Building. One of them testified that he heard not only the three shots, but also the sound above him of a rifle bolt in action and the sound of empty shells hitting the floor. All three of them testified that "debris" fell down from above them at the time of the shots, and that they talked to each other at that time about the shots having come from above them.

e. A shot fired from direct front of the presidential car can be ruled out. Such a bullet would have had to pass through the windshield of the car unless fired from above the overpass just ahead of the presidential car. There were no holes in the windshield, and the overpass was guarded by two policemen in the presence of some fifteen railroad employees. None of them saw or heard any shooting take place from the overpass.

Nonetheless, a re-examination was made of the question whether the movements of the President's head and body following the fatal shot are consistent with the President being struck from (a) the rear, (b) the right front, or (c) both the rear and the right front. The Zapruder, Nix and Muchmore films, a set of all relevant color slides of the Zapruder film, the autopsy photographs and X-rays, the President's clothing and back brace, the bullet and bullet fragments recovered, and various other materials, were reviewed at the request of the Commission staff by a panel of experts consisting of:

Lieutenant Colonel Robert R. McMeekin, MC, USA; Chief, Division of Aerospace Pathology, Armed Forces Institute of Pathology, Washington, D.C.

Richard Lindenberg, M.D., Director of Neuropathology and Legal Medicine, Department of Mental Health, State of Maryland, Baltimore, Maryland.

Werner U. Spitz, M.D., Chief Medical Examiner, Wayne County, Detroit, Michigan.

Fred J. Hodges, III, M.D., Professor of Radiology, the Johns Hopkins School of Medicine, Baltimore, Maryland.

Alfred G. Olivier, V.M.D., Director, Department of Biophysics, Biomedical Laboratories, Edgewood Arsenal, Aberdeen Proving Grounds, Maryland.⁵⁵

⁵⁵Dr. McMeekin, a forensic pathologist who has done extensive studies in the field of accident reconstruction, utilizing computer-assisted analysis of the reactions of human body components to the application of various forces. Dr. Lindenberg is a prominent authority in the field of neuropathology, i.e., the pathology of the brain and nervous system. Dr. Spitz is a forensic pathologist who has had extensive experience with gunshot wounds and is an editor of a textbook on forensic pathology. Dr. Hodges is a specialist in radiology and surgery associated with the brain and nervous system. In 1973-1974 he served as President of the American Society of Neuroradiology. Dr. Olivier had conducted numerous experiments to study the effects on animals and humans of penetrating wounds from high velocity bullets. Drs. Spitz, Lindenberg and Hodges hold faculty positions in the Medical School of Wayne State University, the University of Maryland, and the Johns Hopkins University, respectively.

The Panel members separately submitted their respective conclusions. They were unanimous in finding that the President was struck by only two bullets, both of which were fired from the rear, and that there is no medical evidence to support a contention that the President was struck by any bullet coming from any other direction.

They were also unanimous in finding that the violent backward and leftward motion of the President's upper body following the head shot was not caused by the impact of a bullet coming from the front or right front.

Drs. Spitz, Lindenberg and Hodges reported that such a motion would be caused by a violent straightening and stiffening of the entire body as a result of a seizure-like neuromuscular reaction to major damage inflicted to nerve centers in the brain.

Dr. Olivier reported that experiments which have been conducted at Edgewood Arsenal disclosed that goats shot through the brain evidenced just such a violent neuromuscular reaction. There was a convulsive stiffening and extension of their legs to front and rear, commencing forty milliseconds ($1/25$ of a second) after the bullet entered the brain. In the past two decades, Dr. Olivier and his associates have conducted extensive tests on the effects of high velocity bullets fired into live animals, using high speed photography to record the results.

Dr. Olivier reported that the violent motions of the President's body following the head shot could not possibly have been caused by the impact of the bullet. He attributed the popular misconception on this subject to the dramatic effects employed in television and motion picture productions. The impact of such a bullet, he explained, can cause some immediate movement of the head in the direction of the bullet, but it would not produce any significant movement of the body. He also explained that a head wound such as that sustained by President Kennedy produces an "explosion" of tissue at the area where the bullet exits from the head, causing a "jet effect" which almost instantly moves the head back in the direction from which the bullet came.

Drs. Olivier and McMeekin, utilizing an enlargement of the film and an accurate measuring device, made measurements of the movement of the President's head associated with the head shot. They found that in the interval between Zapruder frames 312 and 313, the President's head moved forward significantly; at frame 314 ($1/18$ of a second later) it was already moving backward and it continued to move backward in the succeeding frames.

Dr. Olivier was of the opinion that the start of the backward movement resulted from both a neuromuscular reaction and a "jet effect" from the explosion at the right front of the head where the bullet exited. Thereafter, the violent backward and leftward movement of the upper body, he believes, was a continuing result of the neuromuscular reaction. Dr. McMeekin's report to the Commission contained no reference to the subject of a "jet effect."

Dr. Olivier credited Dr. Luis Alvarez with originating studies into the "jet effect" produced by high velocity bullets fired into the head. Dr. Alvarez is a Nobel Prize-winning physicist at the Lawrence Berkeley Laboratories, University of California at Berkeley. An article describing his experiments is soon to be published.

Dr. John K. Lattimer of New York and Dr. Cyril H. Wecht of Pittsburgh were also interviewed. Each of them studied in detail the autopsy photographs, X-rays, and other materials, as well as the motion pictures of the assassination, and has published the results of his findings.

Dr. Lattimer testified that there was no medical evidence to support a theory that the President had been hit by a bullet from any direction other than from the rear and above. The medical evidence showed that the President had not been hit from the front or right front. Had a second and nearly simultaneous bullet from the front or right front hit the President's head after frame 313 of the Zapruder film, it would either have encountered no skull (in which case it would have passed through the brain and exited elsewhere) or it would have struck the skull. In either case, it would have left evidence which would be revealed by the autopsy photographs and X-rays.

Dr. Lattimer also testified that he had performed experiments to test both the damage effects of a bullet fired into the rear of the head (in the precise area where the President was hit) and the principle of the "jet effect." He utilized a Mannlicher-Carcano 6.5 millimeter rifle of the same model as the one found by the Warren Commission to belong to Lee Harvey Oswald, and ammunition from the same manufacturer and lot number as that found to have been used by Oswald. The results, he said, confirmed both the head injuries shown in the autopsy photographs and X-rays and the principle of the "jet effect." Dr. Lattimer presented to the Commission staff as evidence a motion picture film and still photographs showing the result of his experiments.

Dr. Wecht testified that the available evidence all points to the President being struck only by two bullets coming from his rear, and that no support can be found for theories which postulate gunmen to the front or right front of the presidential car.

In a 1974 article written by Dr. Wecht and an associate, an article which was made an exhibit to his testimony, Dr. Wecht stated that, "If any other bullet struck the President's head, whether before, after, or simultaneously with the known shot, there is no evidence for it in the available autopsy materials." He testified that on the autopsy photographs of the back of the President's head, there was something above the hairline which he could not identify at all, and he thought it was possible that this was an exit wound. He stated that the other autopsy photographs and the autopsy X-rays provided no support to that possibility, but he thought it was possible that the physicians who performed the autopsy could have missed finding such a wound.

Dr. Wecht said that there was some question about the backward and leftward movement of the President's head and upper body after frame 313, but he also said that a neuromuscular reaction could occur within about one-tenth of a second.

The Commission staff also interviewed by telephone Dr. E. Forrest Chapman of Michigan, the only other physician who is known to have studied the autopsy photographs and X-rays. Dr. Chapman declared that if there were any assassins firing at the President from the grassy knoll, "they must have been very poor shots because they didn't hit anything."

No witness who urged the view that the Zapruder and other motion pictures films proved that President Kennedy was struck by a bullet fired from his right front was shown to possess any professional or other special qualifications on the subject.

On the basis of the investigation conducted by its staff, the Commission believes that there is no evidence to support the claim that President Kennedy was struck by a bullet fired from either the grassy knoll or any other position to his front, right front or right side, and that the motions of the President's head and body, following the shot that struck him in the head, are fully consistent with that shot having come from a point to his rear, above him and slightly to his right.

**5. The Allegation That Assassins (Allegedly Including "Hunt" and "Sturgis")
Are Revealed by the Zapruder and Nix Films To Be Present in
the Area of the Grassy Knoll**

In further support of his contention that shots were fired at President Kennedy from the grassy knoll - and inferentially by "Hunt" and "Sturgis" - a witness called attention to certain frames of the motion pictures films taken at the time of the assassination. He asserted that these frames, including frames 413 and 454-478 of the Zapruder film, reveal the presence of other "assassins" bearing rifles in the area of the grassy knoll.

The Zapruder and Nix films have been carefully reviewed. Frames alleged to reveal the presence of assassins in the area of the grassy knoll have received particularly close attention, together with those frames immediately preceding them and immediately following them. In addition, the Commission has had the benefit of a study of these films by the photographic laboratory of the FBI, and a report on that study.

The Commission staff members who reviewed the films were of the opinion that the images allegedly representing assassins are far too vague to be identifiable even as human beings. For example, Zapruder frames 412, 413, and 414, which have tree foliage in the foreground, show combinations of light and shadow along their lower margins which are varyingly shaped somewhat in the form of a rain hat or a German army helmet of World War II vintage. In frames 411 and 415, however, the contours of the shadows are markedly different and bear no resemblance to a human head - with or without a rain hat or helmet.

Since each frame of the film is only about 1/18 of a second removed in time from its adjacent frame, it was not believed reasonable to postulate that an assassin's head would come into view, and then disappear, directly in front of the Zapruder camera, in the space of about 1/4 of a second (the elapsed time between frames 411 and 415), or that the shape of a head would change so rapidly and markedly.

The conclusion was that the alleged assassin's head was merely the momentary image produced by sunlight, shadows, and leaves within or beyond the foliage. The same was true of the "rifle" allegedly in evidence in frame 413. Even to make out the rough image of a rifle in that frame required imagination - and in the adjacent frames, it is nowhere in evidence.

From the extensive photographic work done in connection with the Warren Commission investigation, the FBI has a substantial library of both its own photographs and copies of the photographs and motion pictures of others taken at the assassination scene.

The place where Abraham Zapruder was standing when he took his famous motion picture has been established. (He was standing on a concrete wall elevated approximately four feet, two inches above the ground to his front.) Based upon an analysis of the direction in which the Zapruder camera was facing at frame 413, the FBI Laboratory was able to identify from other photographs the exact tree shown in that frame. With the aid of reports from the FBI Laboratory, it was concluded that: (1) The tree was between 6 and 6 1/2 feet high; (2) it was barren of any branches or leaves to a height of about 4 feet to 4 1/2 feet above the ground; (3) its foliage was about 2 feet high and 4 feet wide; (4) the near side of its foliage was about five feet directly in from Mr. Zapruder's legs; (5) its trunk was only a few inches in diameter; (6) only the top of the tree came within view of the Zapruder camera; (7) it was the only tree in the immediate vicinity; (8) a human head (even without a helmet) 5 feet in front of Mr. Zapruder

would have occupied about one-half of the total area of frame 413 (many times as much as is occupied by the image of the alleged assassin's head); and (9) it is not reasonable to postulate as assassin in or behind that tree.

An assassin would be unlikely to hide himself behind the barren trunk of a tree only a few inches in diameter, with only his head and shoulders behind the foliage, and with his whole person almost within arm's length in front of a spectator taking movies of the motorcade. Neither would an assassin go unseen and undiscovered, able to make his escape over open ground with a rifle in hand, again unseen by anyone among the numerous motorcade police, spectators and Secret Service personnel present.

A clear photograph of the tree in question, taken on May 24, 1964 (about six months after the assassination), was made a part of the FBI Laboratory Report. It was marked to show the place where Zapruder was standing as he took his motion picture.

The FBI photography laboratory was also able to identify the tree in question on some of the frames of the Nix film, which was also being taken at the time of the assassination. An examination of those frames of the Nix film reveals that there was nobody in or behind that tree. Also made a part of the FBI Laboratory Report was a series of frames from the Nix film, with the tree in question. Mr. Zapruder, and the alleged positions of "assassins" separately marked.

A similar examination was made by the FBI photography laboratory of other frames of the Zapruder and Nix films alleged to reveal assassins in the area of the grassy knoll. Frames 454 through 478 of the Zapruder film were found to reveal no formation "identifiable as a human being or an assassin with a rifle or other weapon." With respect to the Nix film, the FBI reported that "no figure of a human being could be found in the area" of another alleged rifleman, which was determined to be "approximately nineteen feet to the right of where Mr. Zapruder was standing and clearly visible to him." The FBI concluded that the configuration described as a rifleman was actually produced by some "clump type shrubbery" in the background.

On the basis of its staff investigation, the Commission believes that there is no credible basis in fact for the claim that any of the known motion pictures relating to the assassination of President Kennedy reveals the presence of an assassin or assassins in the area of the grassy knoll.

B. The Theory that the CIA Had Relationships with Lee Harvey Oswald and Jack Ruby

The second theory advanced in support of allegations of CIA participation in the assassination of President Kennedy is that various links existed between the CIA, Oswald and Ruby. Lee Harvey Oswald was found by the Warren Commission to be the person who assassinated the President. Jack Ruby shot and killed Oswald two days after the President's assassination.

There is no credible evidence that either Lee Harvey Oswald or Jack Ruby was ever employed by the CIA or ever acted for the CIA in any capacity whatever, either directly or indirectly.

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There is no credible evidence that either Lee Harvey Oswald or Jack Ruby was ever employed by the CIA or ever acted for the CIA in any capacity whatever, either directly or indirectly.

Testimony was offered purporting to show CIA relationship with Oswald and Ruby. It was stated, for example, that E. Howard Hunt, as an employee of the CIA, engaged in political activity with elements of the anti-Castro Cuban community in the United States on behalf of the CIA prior to the Bay of Pigs operation in April 1961. In connection with those duties, it was further alleged that Hunt instrumental in organizing the Cuban Revolutionary Council and that the Cuban Revolutionary Council has an office in New Orleans. Finally, it was claimed that Lee Harvey Oswald lived in New Orleans from April to September 1963, and that a pamphlet prepared and distributed by Oswald on behalf of the Fair Play for Cuba Committee was situated in a building which was also the address of the New Orleans office of the Cuban Revolutionary Council.⁵⁶

It was therefore implied that Hunt could have had contact with Lee Harvey Oswald in New Orleans during the spring or summer of 1963. No evidence was presented that Hunt ever met Oswald, or that he was ever in New Orleans in 1963, or that he had any contact with any New Orleans office of the Cuban Revolutionary Council.

Hunt's employment record with the CIA indicated that he had no duties involving contacts with Cuban exile elements or organizations inside or outside the United States after the early months of 1961. This was more than two years before Oswald went to New Orleans in April 1963 and more than a year before Oswald returned to the United States from the Soviet Union, where he had lived for almost three years.

An example of the testimony relating to an alleged relationship between the CIA and Jack Ruby consisted of a statement that Frank Sturgis was engaged in a series of revolutionary activities among Cuban exiles in the United States in the 1950's and 1960's and that the CIA also sponsored and organized anti-Castro activities among Cuban exiles in the United States in 1959 and the early 1960's.

⁵⁶Each of these statements is substantially true, but many other relevant facts disclosed in the Warren Commission Report are omitted. It is not mentioned for example, that Oswald made up the Fair Play for Cuba Committee pamphlets; that the address he stamped on the pamphlets was never an office of that Committee; that he fabricated a non-existent New Orleans Chapter of the Committee, a non-existent President of that Committee, and a non-existent office for it; that the building in question was a former office, rather than a current office, of an anti-Castro organization when Oswald made up his pamphlets, and that Oswald had tried to infiltrate the anti-Castro organization.

From this group of allegations, the witness inferred that Sturgis and Ruby could have met and known each other - although no actual evidence was presented to show that Ruby or Sturgis ever met each other.

Even if the individual items contained in the foregoing recitations were assumed to be true, it was concluded that the inferences drawn must be considered farfetched speculation insofar as they purport to show a connection between the CIA and either Oswald or Ruby.

Even in the absence of denials by living persons that such connections existed, no weight could be assigned to such testimony. Moreover, Sturgis was never an employee or agent of the CIA.

A witness, a telephone caller, and a mail correspondent tendered additional information of the same nature. None of it was more than a strained effort to draw an inference of conspiracy from facts which would not fairly support the inferences. A CIA involvement in the assassination was implied by the witness, for example, from the fact that the Mayor of Dallas at that time was the brother of a CIA official who had been involved in the planning of the Bay of Pigs operation in Cuba several years previously, and from the fact that President Kennedy reportedly blamed the CIA for the Bay of Pigs failure.

The same witness testified that E. Howard Hunt was Acting Chief of a CIA station in Mexico City on 1963, implying that he could have had contact with Oswald when Oswald visited Mexico City in September 1963. Hunt's service in Mexico City, however, was twelve years earlier - in 1950 and 1951 - and his only other CIA duty in Mexico covered only a few weeks in 1960. At no time was he ever the Chief, or Acting Chief, of a CIA station in Mexico City.

Hunt and Sturgis categorically denied that they had ever met or known Oswald or Ruby. They further denied that they ever had any connection whatever with either Oswald or Ruby.

Conclusions

Numerous allegations have been made that the CIA participated in the assassination of President John F. Kennedy. The Commission staff investigated these allegations. On the basis of the staff's investigation, the Commission concluded there was no credible evidence of any CIA involvement.

National Photographic Interpretation Center (NPIC) Report on the Zapruder Film

Central Intelligence Agency
Office of the Director

14 May 1975

Mr. Robert B. Olsen
Senior Counsel
Commission on CIA Activities
Within the United States

Dear Mr. Olsen:

You recently asked for any textual materials that may have been provided by the Agency to the Secret Service in connection with the NPIC analysis of the Zapruder film.

The only textual material involved is attached. I understand you have had a meeting with NPIC authorities to go into some of the background.

Faithfully yours,

E. H. Knoche
Assistant to the Director

Attachment: a/s

EHKnoche: 5/14/75

Distribution:

Orig - Mr. Olsen w/att

1 - OGC wo/att

1 - IG wo/att

1 - Knoche Chrono wo/att

1 - K Comm Correspondence wo/att

1 - Olsen Oral Request File w/att

1 - Warren Commission File wo/att

1 - ER wo/att

Memorandum on Investigation

Central Intelligence Agency
Office of the Director

7 May 1975

Mr. Robert B. Olsen
Senior Counsel
Commission on CIA Activities
Within the United States

Dear Mr. Olsen:

Attached is an addendum to our comments on the Hoch memorandum. The comments were sent to you on 29 April 1975.

The addendum is keyed to Page 18 of the Hoch memo.

We continue to check on the question raised by Mr. Hoch on his page 24 concerning anti-Castro group meetings in Dallas. We hope to have an answer for you later this week or early next.

Faithfully yours,

E. H. Knoche
Assistant to the Director

Attachment: a/s

EHKnoche: 5/7/75

Distribution:

Orig - Mr. Olsen w/att (Addendum to Hoch Memo

1 - OGC w/o att forwarded on 29 April 1975)

1 - IG w/o att

1 - Knoche Chrono wo/att

1 - K Comm Correspondence wo/att

1 - Olsen Oral Request File, 4/10/75 w/att

1 - Warren Commission wo/att

1 - ER

**Additions to Comments Concerning Paul Hoch's Memorandum on
CIA Activities and the Warren Commission Investigation**

Attached is an addendum to our comments on the Hoch memorandum. As with our original comments, this addendum is keyed to the page in Mr. Hoch's memorandum on which the substance with which it deals appears.

We are continuing our investigation into the question raised on p. 24 of Mr. Hoch's memorandum concerning anti-Castro group meetings in Dallas. We hope to forward our response to that question to the Commission during the week of 5 May 1975.

Central Intelligence Agency
Office of the Director

14 May 1975

Mr. Robert B. Olsen
Senior Counsel
Commission on CIA Activities
Within the United States

Dear Mr. Olsen:

You recently asked for any textual materials that may have been provided by the Agency to the Secret Service in connection with the NPIC analysis of the Zapruder film.

The only textual material involved is attached. I understand you have had a meeting with NPIC - authorities to go into some of the background.

Faithfully yours,

E. H. Knoche
Assistant to the Director

Document Number 1641-450
for FOIA Review on Feb. 1978

Attachment: a/s

EHKnoche: 5/14/75
Distribution:
Orig - Mr. Olsen w/att
1 - OGC w/o att
1 - IG w/o att

- 1 - Knoche Chrono wo/att
- 1 - K Comm Correspondence wo/att
- 1 - Olsen Oral Request File w/att
- 1 - Warren Commission wo/att
- 1 - ER wo/att

**NPIC Analysis of Zapruder Filming
of John F. Kennedy Assassination**

Information was forwarded to the Commission previously on this matter in connection with our comments on the Hoch memorandum. On 8 May 1975, Mr. Olsen asked for copies of any memoranda on other textual information provided to the Secret Service by CIA after NPIC's analysis of the Zapruder film. We have no indication in our records that any such written material was provided to the Secret Service. Attached are copies of the only textual matter in our files pertaining to NPIC's analysis of the Zapruder film. We do not know whether the Secret Service took copies of these notes at the time of the analysis.

Document Number 1641-450
For FOIA Review on Feb. 1978

NATIONAL PHOTOGRAPHIC INTERPRETATION CENTER
Office of the Director

5/13/75

These are xeroxes of the only written or typed papers which we found with the four photo briefing boards made from the Zapruder film of President Kennedy's assassination.

6 sheets attached.

PANEL I		PANEL II		PANEL III		PANEL IV	
<u>Print No.</u>	<u>Frame No.</u>	<u>Print No.</u>	<u>Frame No.</u>	<u>Print No.</u>	<u>Frame No.</u>	<u>Print No.</u>	<u>Frame No.</u>
1	188	7	225	15	266	21	310
2	198	8	226	16	274	22	311
3	206	9	230	17	289	23	312
4	213	10	239	18	290	24	313
5	217	11	242	19	291	25	314
	222	12	246	20	292	26	322
		13	256			27	334
		14	257			28	384

p. 16

Addendum to comment on Zapruder film:

In late 1963, the Secret Service brought a copy of the Zapruder film to Director McCone and asked to have the film analyzed technically, particularly with regard to anything that could be learned from the film concerning elapsed time between rifle shots. A laboratory at the National Photographic Interpretation Center (NPIC) was made available for the analysis late that same night. The film was analyzed in individual stop frames, and two sets of four briefing boards each were prepared by NPIC. Because the film had been taken in a spring-powered movie camera, it was not possible to determine precise time between shots without access to the camera to time the rate of spring run-down. We assume the Secret Service informed the Warren Commission about anything of value resulting from our technical analysis of the film, but we have no direct knowledge that they did so.

Secret Service representatives were present during the process of analysis and took the film and one set of briefing boards away with them that night. Mr. McCone retained one set of boards. The set was controlled carefully; very few people saw it. It was retired to a CIA record storage facility subsequently. This set has been recalled from storage and can be made available if required.

28 October 1975

MEMORANDUM FOR: Deputy Director

SUBJECT: The "Zapruder Film" of President John F. Kennedy's
Assassination

1. This memorandum is in response to your verbal request for background information about subject 8mm film which is in the Branch inventory.
2. CIA was provided a print of the film by Time, Inc. through the Office of the Assistant at the request of the Office of Training in February 1965. According to Branch records, use of the film was limited to the Office of Training from 1965 to 1969. It was returned to this Branch in April 1969.
3. The film was classified CONFIDENTIAL on the basis of a 10 February 1965 memorandum written by Branch officer after discussion with the then CIA classification control officer.

Document Number 1472-492-BJ

for FOIA Review on Dec. 1977

APPROVED FOR RELEASE

Date: 27 May 82

The Official Warren Commission Report on the Assassination of President John F. Kennedy

CHAPTER III

THE TRAJECTORY

The cumulative evidence of eyewitnesses, firearms and ballistic experts and medical authorities demonstrated that the shots were fired from above and behind President Kennedy and Governor Connally, more particularly, from the sixth floor of the Texas School Book Depository Building. In order to determine the facts with as much precision as possible and to insure that all data were consistent with the shots having been fired from the sixth floor window, the Commission requested additional investigation, including the analysis of motion picture films of the assassination and onsite tests. The facts developed through this investigation by the FBI and Secret Service confirmed the conclusions reached by the Commission regarding the source and trajectory of the shots which hit the President and the Governor. Moreover, these facts enabled the Commission to make certain approximations regarding the location of the Presidential limousine at the time of the shots and the relevant time intervals.

Films and Tests

When the shots rang out the Presidential limousine was moving beyond the Texas School Book Depository Building in a southwesterly direction on Elm Street between Houston Street and the Triple Underpass.²⁶⁰ The general location of the car was described and marked on maps by eyewitnesses as precisely as their observations and recollections permitted.²⁶¹ More exact information was provided by motion pictures taken by Abraham Zapruder, Orville O. Nix and Mary Muchmore, who were spectators at the scene.²⁶² Substantial light has been shed on the assassination sequence by viewing these motion pictures, particularly the Zapruder film, which was the most complete and from which individual 35-millimeter slides were made of each motion picture frame.²⁶³

Examination of the Zapruder motion picture camera by the FBI established that 18.3 pictures or frames were taken each second, and therefore, the timing of certain events could be calculated by allowing 1/18.3 seconds for the action depicted from one frame to the next.²⁶⁴ The films and slides made from individual frames were viewed by Governor and Mrs. Connally, the Governor's doctors, the autopsy surgeons, and the Army wound ballistics scientist in order to apply the knowledge of each to determine the precise course of events.²⁶⁵ Test of the assassin's rifle disclosed that at least 2.3 seconds were required between shots.²⁶⁶ In evaluating the films in the light of these timing guides, it was kept in mind that a victim of a bullet wound may not react immediately and, in some situations, according to experts, the victim may not even know where he has been hit, or when.²⁶⁷

On May 24, 1964, agents of the FBI and Secret Service conducted a series of tests to determine as precisely as possible what happened on November 22, 1963. Since the Presidential limousine was being remodeled and was therefore unavailable, it was simulated by using the Secret Service followup car, which is similar in design.²⁶⁸ Any differences were taken into

account. Two Bureau agents with approximately the same physical characteristics sat in the car in the same relative positions as President Kennedy and Governor Connally had occupied. The back of the stand-in for the President was marked with chalk at the point where the bullet entered. The Governor's model had on the same coat worn by Governor Connally when he was shot, with the hole in the back circled in chalk.²⁶⁹

To simulate the conditions which existed at the assassination scene on November 22, the lower part of the sixth-floor window at the southeast corner of the Depository Building was raised halfway, the cardboard boxes were repositioned, the C2766 Mannlicher-Carcano rifle found on the sixth floor of the Depository was used, and mounted on that rifle was a camera which recorded the view as was seen by the assassin.²⁷⁰ In addition, the Zapruder, Nix, and Muchmore cameras were on hand so that photographs taken by these cameras from the same locations where they were used on November 22, 1963, could be compared with the films of that date.²⁷¹ The agents ascertained that the foliage of an oak tree that came between the gunman and his target along the motorcade route on Elm Street was approximately the same as on the day of the assassination.²⁷²

The First Bullet That Hit

The position of President Kennedy's car when he was struck in the neck was determined with substantial precision from the films and onsite tests. The pictures or frames in the Zapruder film were marked by the agents, with the number "1" given to the first frame where the motorcycles leading the motorcade came into view on Houston Street.²⁷³ The numbers continue in sequence as Zapruder filmed the Presidential limousine as it came around the corner and proceeded down Elm. The President was in clear view of the assassin as he rode up Houston Street and for 100 feet as he proceeded down Elm Street, until he came to a point denoted as frame 166 on the Zapruder film.²⁷⁴ These facts were determined in the test by placing the car and men on Elm Street in the exact spot where they were when each frame of the Zapruder film was photographed. To pinpoint their locations, a man stood at Zapruder's position and directed the automobile and both models to the positions shown on each frame, after which a Bureau photographer crouched at the sixth-floor window and looked through a camera whose lens recorded the view through the telescopic sight of the C2766 Mannlicher-Carcano rifle.²⁷⁵ (See Commission Exhibit No. 887, p. 99.) Each position was measured to determine how far President Kennedy had gone down Elm from a point, which was designated as station C, on a line drawn along the west curblin of Houston Street.²⁷⁶

Based on these calculations, the agents concluded that at frame 166 of the Zapruder film the President passed beneath the foliage of the large oak tree and the point of impact on the President's back disappeared from the gunman's view as seen through the telescopic lens.²⁷⁷ (See Commission Exhibit No. 889, p. 100.) For a fleeting instant the President came back into view in the telescopic lens at frame 186 as he appeared in an opening among the leaves.²⁷⁸ (See Commission Exhibit No. 891, p. 101.) The test revealed that the next point at which the rifleman had a clear view through the telescopic sight of the point where the bullet entered the President's back was when the car emerged from behind the tree at frame 210.²⁷⁹ (See Commission Exhibit No. 893, p. 102.) According to FBI Agent Lyndal L. Shaneyfelt, "There

is no obstruction from the sixth floor window from the time they leave the tree until they disappear down toward the triple overpass."²⁸⁰

As the President rode along Elm Street for a distance of about 140 feet, he was waving to the crowd.²⁸¹ Shaneyfelt testified that the weaving is seen on the Zapruder movie until around frame 205, when a road sign blocked out most of the President's body from Zapruder's view through the lens of his camera. However, the assassin continued to have a clear view of the President as he proceeded down Elm.²⁸² When President Kennedy again came fully into view in the Zapruder film at frame 225, he seemed to be reacting to his neck wound by raising his hands to his throat.²⁸³ (See Commission Exhibit No. 895, p. 103.) According to Shaneyfelt the reaction was "clearly apparent in 226 and barely apparent in 225."²⁸⁴ It is probable that the President was not shot before frame 210, since it is unlikely that the assassin would deliberately have shot at him with a view obstructed by the oak tree when he was about to have a clear opportunity. It is also doubtful that even the most proficient marksman would have hit him through the oak tree. In addition, the President's reaction is "barely apparent" in frame 225, which is 15 frames or approximately eight-tenths second after frame 210, and a shot much before 210 would assume a longer reaction time than was recalled by eyewitnesses at the scene. Thus, the evidence indicated that the President was not hit until at least frame 210 and that he was probably hit by frame 225. The possibility of variations in reaction time in addition to the obstruction of Zapruder's view by the sign precluded a more specific determination than that the President was probably shot through the neck between frames 210 and 225, which marked his position between 138.9 and 153.8 feet west of station C.²⁸⁵

According to Special Agent Robert A. Frazier, who occupied the position of the assassin in the sixth-floor window during the reenactment, it is likely that the bullet which passed through the President's neck, as described previously, then struck the automobile or someone else in the automobile.²⁸⁶ The minute examination by the FBI inspection team, conducted in Washington between 14 and 16 hours after the assassination, revealed no damage indicating that a bullet struck any part of the interior of the Presidential limousine, with the exception of the cracking of the windshield and the dent on the windshield chrome.²⁸⁷ Neither of these points of damage to the car could have been caused by the bullet which exited from the President's neck at a velocity of 1,772 to 1,779 feet per second.²⁸⁸ If the trajectory had permitted the bullet to strike the windshield, the bullet would have penetrated it and traveled a substantial distance down the road unless it struck some other object en route.²⁸⁹ Had that bullet struck the metal framing, which was dented, it would have torn a hole in the chrome and penetrated the framing, both inside and outside the car.²⁹⁰ At that exit velocity, the bullet would have penetrated any other metal or upholstery surface of the interior of the automobile.²⁹¹

The bullet that hit President Kennedy in the back and exited through his throat most likely could not have missed both the automobile and its occupants. Since it did not hit the automobile, Frazier testified that it probably struck Governor Connally.²⁹² The relative positions of President Kennedy and Governor Connally at the time when the President was struck in the neck confirm that the same bullet probably passed through both men. Pictures taken of the President's limousine on November 22, 1963, showed that the Governor sat immediately in front of the President.²⁹³ Even though the precise distance cannot be ascertained, it is apparent that President Kennedy was somewhat to the Governor's right. The President sat on the extreme right, as noted in the films and by eyewitnesses, while the right edge of the jump seat in which

the Governor sat is 6 inches from the right door.²⁹⁴ (See Commission Exhibit No. 697, p. 104.) The President wore a back brace which tended to make him sit up straight, and the Governor also sat erect since the jump seat gave him little leg room.²⁹⁵

Based on his observations during the reenactment and the position of Governor Connally shown in the Zapruder film after the car emerged from behind the sign, Frazier testified that Governor Connally was in a position during the span from frame 207 to frame 225 to receive a bullet which would have caused the wounds he actually suffered.²⁹⁶ Governor Connally viewed the film and testified that he was hit between frames 231 and 234.²⁹⁷ According to Frazier, between frames 235 and 240 the Governor turned sharply to his right, so that by frame 240 he was too far to the right to have received his injuries at that time.²⁹⁸ At some point between 235 and 240, therefore, is the last occasion when Governor Connally could have received his injuries, since in the frames following 240 he remained turned too far to his right.²⁹⁹ If Governor Connally was hit by a separate shot between frames 235 and 240 which followed the shot which hit the President's neck, it would follow that: (1) the assassin's first shot, assuming a minimum firing time of 2.3 seconds (or 42 frames), as fired between frames 193 and 198 when his view was obscured by the oak tree; (2) President Kennedy continued waving to the crowd after he was hit and did not begin to react for about 1 1/2 seconds; and (3) the first shot, although hitting no bones in the President's body, was deflected after its exit from the President's neck in such a way that it failed to hit either the automobile or any other occupants.

Viewed through the telescopic sight of the C2766 Mannlicher-Carcano rifle from the sixth-floor window during the test, the marks that simulated the entry wounds on the stand-ins for the President and the Governor were generally in a straight line. That alinement became obvious to the viewer through the scope as the Governor's model turned slightly to his right and assumed the position which Governor Connally had described as his position when he was struck. Viewing the stand-ins for the President and the Governor in the sight of the C2766 Mannlicher-Carcano rifle at the location depicted in frames 207 and 210, Frazier testified: "They both are in direct alinement with the telescopic sight at the window. The Governor is immediately behind the President in the field of view."³⁰⁰ (See Commission Exhibit No. 893, p. 102.) A surveyor then placed his sighting equipment at the precise point of entry on the back of the President's neck, assuming that the President was struck at frame 210, and measured the angle to the end of the muzzle of the rifle positioned where it was believed to have been held by the assassin.³⁰¹ That angle measured 21°34'.³⁰² From the same points of reference, the angle at frame 225 was measured at 20°11', giving an average angle of 20°52'30" from frame 210 to frame 225.³⁰³ Allowing for a downward street grade of 3°9', the probable angle through the President's body was calculated at 17°43'30", assuming that he was sitting in a vertical position.³⁰⁴

That angle was consistent with the trajectory of a bullet passing through the President's neck and then striking Governor Connally's back, causing the wounds which were discussed above. Shortly after that angle was ascertained, the open car and the stand-ins were taken by the agents to a nearby garage where a photograph was taken to determine through closer study whether the angle of that shot could have accounted for the wounds in the President's neck and the Governor's back.³⁰⁵ A rod was placed at an angle of 17°43'30" next to the stand-ins for the President and the Governor, who were seated in the same relative positions.³⁰⁶ The