INVESTIGATION OF THE ASSASSINATION OF PRESIDENT JOHN F. KENNEDY

APPENDIX TO HEARINGS

BEFORE THE

SELECT COMMITTEE ON ASSASSINATIONS

OF THE

U.S. HOUSE OF REPRESENTATIVES

NINETY-FIFTH CONGRESS

SECOND SESSION

VOLUME VII

MEDICAL AND FIREARMS EVIDENCE

MARCH 1979

Printed for the use of the Select Committee on Assassinations

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MEDICAL EVIDENCE AND RELATED ISSUES PERTAINING TO THE ASSASSINATION OF PRESIDENT JOHN F. KENNEDY

Select Committee on Assassinations
U.S. House of Representatives
Ninety-fifth Congress
Second Session

March 1979

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PREFACE*

This section of the appendix to the hearings deals with the medical evidence relating to the assassination of President John F. Kennedy and the wounding of Governor John B. Connally of Texas. Section 1, introduction, presents a historical overview of the material, lists the issues addressed, outlines the investigative procedure of the committee, and briefly summarizes the content of the remaining four sections. These sections are: Performance of the autopsy (sec. 2); chain of custody of the materials acquired during the autopsy (sec. 3); authenticity of the autopsy photographs and X-rays (sec. 4); and the report of the forensic pathology panel (sec. 5).

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* Materials submitted for this report by the committee's forensic pathology panel were compiled by HSCA staff members Donald A. Purdy, Jr. and T. Mark Flanagan.

SECTION I. INTRODUCTION

(1)* John F. Kennedy was the fourth American President to be assassinated, the first in 60 years. In each case, pathologists performed an autopsy to determine the cause of death and the nature of the injuries. It is quite remarkable that despite major advances in medical technology, the autopsy of President Kennedy created more controversy than that of any of the others.

(2) In the case of the autopsy of Abraham Lincoln in 1865, physicians conducted the examination in the White House within several hours following the President's death. Those in attendance included several of the physicians who regularly treated the President. While a major dispute arose during the autopsy concerning the path of the missile through the President's head, the matter was finally settled. The pathologists forwarded an official autopsy report in a letter to the Surgeon General of the United States. The X-ray technology that could have assisted in resolving the dispute had not yet been invented.

(3) The autopsy of James Garfield in 1881 did not trigger any controversies. The autopsy surgeons, who likewise included several of the President's regular physicians, preserved certain physical specimens for later examination and issued a report, which included sketches to document the location of the wounds.

(4) The autopsy of William McKinley in 1901 was controversial. The problems began when his wife successfully halted the autopsy after 4 hours, even though the surgeons had not located the missile. The autopsy report indicated that this intervention prevented the physicians from removing all the portions of tissue necessary for proper examination. Interestingly, although Thomas Edison made available his newly invented X-ray machine the physicians refused to use it. After the autopsy a dispute arose over the path of the missile and gained so much momentum that the pathologists had to issue a statement in an effort to quell rumors.

(5) The autopsy of President Kennedy has been the most controversial. For example, it is the only one in which the physicians who normally provided medical treatment to the President were not in attendance.

(6) The handling of the emergency medical treatment and the autopsy of President Kennedy by the various physicians, the Warren Commission, and the President's family not only has generated more controversy than any other Presidential autopsy, it has also raised many questions regarding the assassination overall, more so than any other factor.

---

* Arabic numerals in parentheses at the beginning of paragraphs indicate the paragraph number for purposes of citation and referencing; italic numerals in parentheses in the middle or at the end of sentences indicate references which can be found at the end of each report or section.

(7) Confusion and speculation over the nature of the injuries to the President surfaced immediately in the wake of his emergency treatment on November 22, 1963, at Parkland Memorial Hospital, Dallas, Tex., and his autopsy later that evening at Bethesda Naval Hospital, Bethesda, Md. The following summaries of news accounts from the New York Times in the first days after the assassination demonstrate the confusion:

> November 24, 1963—the President suffered an entrance wound in the Adam's apple and a massive head wound in the head.
>
> December 17, 1963—the FBI concluded that one bullet had struck the President in the right temple and another had hit where the right shoulder joins the neck.
>
> December 19, 1963—the pathologists had determined that a bullet had lodged in the back, a second had struck the right rear of the head.

(8) While the newspapers continued to chase rumors, the FBI compiled a report on the assassination, which Director of the FBI, J. Edgar Hoover submitted to the Warren Commission on December 19, 1963. A supplemental report was also sent to the Commission on January 13, 1964. This report reflected the observations made by the FBI agents who attended the autopsy.

(9) By early February 1964, the single bullet theory—the theory that one bullet traversed the upper back and neck of President Kennedy and then caused all the wounds to Governor Connally—began to emerge. During the next several months of 1964, the Warren Commission questioned most of the doctors associated with the medical evidence pertaining to President Kennedy and Governor Connally. There was no evidence that any members of the Warren Commission or its staff ever viewed any of the autopsy photographs or X-rays of President Kennedy. Nevertheless, in the fall of 1964, the Warren Commission concluded in its final report that President Kennedy had been struck by two missiles, as reflected in the autopsy report, and that the missile that exited the President's neck also caused all of Governor Connally's wounds. The Warren Commission also concluded that the missile that struck both the President and the Governor was the one discovered at Parkland Hospital.

(10) The next significant event regarding the autopsy occurred on April 22, 1965, when Robert F. Kennedy, then the Attorney General, authorized Dr. George Burkley, the White House physician, to transfer materials derived from the autopsy—autopsy photographs, autopsy X-rays, microscopic tissue slides and physical specimens such as the brain, which had been stored at the White House since the autopsy—to Mrs. Evelyn Lincoln, the former personal secretary to President Kennedy, who then had an office in the National Archives. On April 26, Robert I. Bouck, the head of the Protective Research Division of the U.S. Secret Service, where the autopsy materials were stored in the White House, and Dr. Burkley prepared an inventory list and transferred the materials. The photographs and X-rays from the autopsy, as well as the microscopic slides and other gross material, allegedly including the brain, were transferred at that time.

(11) Although Mrs. Lincoln had an office in the Archives, she was not an employee. Consequently, when the materials were transferred, they were not technically given to the National Archives.
(12) Over the next few years various critics continued to question the autopsy conclusions. In 1966, Edward Jay Epstein, in his book inquest, related that, although the FBI had had access to the autopsy report of Dr. Humes, in its report of December 9, 1963, it had stated that the missile entering the President's upper back did not exist. Epstein concluded that this discrepancy cast serious doubts on the accuracy of the entire investigation of the Commission.
(13) In 1966, Mark Lane, an attorney from New York, also published a book, entitled "Rush to Judgement," which was critical of the Warren Commission. Lane questioned the theory that a lone assassin shot the President from the rear. He cited the initial comments of several Parkland Hospital doctors who characterized the throat wound as one of entrance. He theorized that if the President had been shot from the front, then more than one assassin had to have been involved. Lane also criticized vehemently the single-bullet theory, contending that the Warren Commission devised it in order to explain how one assassin could have inflicted all the wounds to the President and the Governor by firing three shots in the requisite time interval. Lane argued that the single-bullet theory was not possible and that consequently only one alternative existed: more than one assassin shot at the President.
(14) In November 1966, the autopsy pathologists reviewed the autopsy X-rays and photographs now in the custody of the National Archives. They did so at the request of the Department of Justice, which wanted to determine their consistency with the autopsy report.
(15) The pathologists had never seen the photographs previously. They agreed that the photographs and X-rays corroborated their autopsy report.
(16) These photographs and X-rays had become the property of the U.S. Government as a result of a deed of gift from the Kennedy family to the National Archives on October 31, 1966. All materials listed in the 1965 transfer from the White House to Evelyn Lincoln were to be included in this transaction, but the microscopic slides and the gross material, including the brain, were found to be missing. The disposition of these "missing" materials was not documented at this or any other time.
(17) As more persons published books critical of the Warren Commission, more issues emerged concerning the autopsy. In 1967, Josiah Thompson published "Six Seconds in Dallas," in which he proposed the theory that President Kennedy was struck in the head simultaneously by two shots: One from the rear and one from the front. Thompson based this on the rear head motion visible in the Zapruder film, the reports from the Parkland and Bethesda surgeons, and eyewitness accounts. This theory necessarily involves two assassins. Sylvia Meagher also published a voluminous work in 1967, entitled "Accessories After the Fact"; she further criticized the Warren Commission findings and advanced alternative theories.
(18) By 1968, as a result of criticisms and allegations surrounding the Warren Commission's conclusions, then-Acting Attorney General

Ramsey Clark convened a panel of medical experts, commonly referred to as the Clark panel, for the first independent review of the autopsy photographs and X-rays. Although the panel confirmed the autopsy pathologists' findings regarding the number of shots that struck the President and their general direction through the body, it stated that the entrance wound on the President's head was actually 10 centimeters (about 4 inches higher) than indicated in the autopsy report. This conclusion generated even more confusion and doubt concerning the validity of the autopsy.

(19) In 1975, in the midst of mounting criticism, the Rockefeller Commission convened a group of medical and firearms experts to review the evidence. They concurred with the opinions of the Clark panel. Both the Clark and Rockefeller panels, however, conclusions were presented without supporting material. Doubts and rumors persisted.

(20) In 1976, the House passed a resolution establishing the committee and empowered it to conduct a full and complete investigation into the circumstances surrounding the death of President Kennedy. The committee determined that it should examine, among other things, the major issues that had arisen over the years in connection with the autopsy of the President and related medical evidence. These issues included:

1. How many missiles struck President Kennedy and Governor Connally, specifically, whether President Kennedy could have been struck in the head from behind and from the front simultaneously and whether the backward motion of the President's head, visible in the Zapruder film, is consistent with the conclusion that the President was struck only from behind;
2. The feasibility that one missile entered President Kennedy's back, exited his neck, and then caused all of Governor Connally's wounds, with little damage to the missile;
3. The origin and trajectories of the missiles;
4. The number of wounds President Kennedy and Governor Connally received, their respective locations, whether they were entrance or exit wounds, and the reasons for those characterizations;
5. Whether the nature of the wounds to President Kennedy and Governor Connally was consistent with the damage that would be caused by 6.5 millimeter caliber Mannlicher-Carcano ammunition and in particular a single bullet traversing two bodies;
6. The accuracy of the opinions of the Parkland Hospital doctors concerning the location of President Kennedy's wounds and reasons for those opinions;
7. The discrepancies in various reports about wound locations, especially those between the official autopsy report and the findings of the Clark panel and the Rockefeller Commission panel concerning the location of the rear head wound;
8. The thoroughness, competence, and accuracy of the autopsy with respect to both the medical aspects and those bearing on possible future litigation in court;
9. The location and fate of the microscopic tissue slides and gross materials, including the brain, which the pathologists retained for future study and which are now unaccounted for;

10. The possibility that at some time the autopsy photographs and X-rays were doctored or that they were false or incomplete;
11. Whether the autopsy was performed within the proper jurisdiction;
12. What chain of custody was followed for the various items of evidence; and
13. Whether other procedures should have been followed and what procedures should be followed in the event of other assassinations.

(21) In addressing these issues, the committee decided to analyze some issues itself and to retain experts to examine others. Specifically, the committee prepared a report on issues relating to the performance of the autopsy and thoroughly traced the chain of custody of the "missing" autopsy materials.

(22) The committee consulted experts in the fields of forensic odontology, radiology, chemical engineering, and photography in examining the authenticity of the autopsy photographs and X-rays.

(23) Finally, the committee convened a panel of forensic pathologists to address the medical issues relating to the death of President Kennedy and the wounding of Governor Connally and to recommend procedures to be followed in the event of future assassinations.

(24) The panel of forensic pathologists consisted of two subpanels: One of members who had not previously reviewed the autopsy photographs, X-rays, and related material, the other of those who had.

Panel members who had not previously reviewed the evidence were:

John I. Coe, M.D., chief medical examiner of Hennepin County, Minn.

Joseph H. Davis, M.D., chief medical examiner of Dade County, Miami, Fla.

George S. Loquvam, M.D., director of the Institute of Forensic Sciences, Oakland, Calif.

Charles S. Petty, M.D., chief medical examiner, Dallas County, Dallas, Tex.

Earl Rose, M.D., LL.B., professor of pathology, University of Iowa, Iowa City, Iowa.

Panel members who had previously reviewed the evidence were:

Werner V. Spitz, M.D., medical examiner of Detroit, Mich.

Cyril H. Wecht, M.D., J.D., coroner of Allegheny County, Pa.

James T. Weston, M.D., chief medical investigator, University of New Mexico School of Medicine, Albuquerque, N. Mex.

The chairman of the panel was Michael M. Baden, M.D., chief medical examiner of New York City.

(25) The committee asked that the two subpanels present their views in a single report, with the stipulation that any member could submit a dissenting opinion that would be included with the report.

(26) The remainder of this volume contains the evidence developed by the committee and the findings and conclusions of the forensic pathology panel. It is divided into three sections: An analysis of the performance of the autopsy of President John F. Kennedy (sec. 2); a presentation of the efforts of the committee to trace the chain of custody of the materials acquired during the autopsy (sec. 3); and, finally, the report of the panel on forensic pathology (sec. 4). Each section includes a statement of the issues addressed, the evidence considered, and the conclusions reached.

SECTION II.—PERFORMANCE OF AUTOPSY

PART I. INTRODUCTION

(27) Throughout the last 15 years, many critics have questioned the competency and validity of the autopsy of President Kennedy. The efforts of the U.S. Department of the Navy and other Government sources to insure privacy with respect to the autopsy procedures and other events that took place at Bethesda Naval Hospital have contributed in part to much of the uncertainty and skepticism. Included in these efforts was an order of silence issued to the participants in the autopsy.(*1*)

(28) Because of this skepticism and in accordance with its mandate to conduct a full and complete investigation into the circumstances surrounding the death of President Kennedy, the committee decided to investigate the performance of the autopsy. The focus was to be on the following issues:

1. The possibility that someone ordered or otherwise strongly suggested that the autopsy doctors perform a limited or incomplete autopsy;
2. The question of the competency and validity of the autopsy; and
3. The documentation of the events that occurred, how they occurred, and when they occurred.

(29) The committee conducted a review of all documentary evidence and contacted almost all persons still alive who had attended the autopsy. The Department of the Navy agreed to rescind the orders of silence issued to the autopsy personnel.

(30) The following material relates the issues and corresponding facts chronologically (part II) and then presents the conclusions of the committee.

(31) The evidence indicates that while the pathologists were given authority to perform a complete autopsy, the autopsy was not complete according to established medicolegal standards.

PART II. FACTS AND ISSUES

Background

(32) At 1:30 p.m., eastern standard time (e.s.t.), on November 22, 1963, President Kennedy and Governor Connally were shot while riding in a Presidential motorcade through the streets of Dallas, Tex. The driver of the Presidential limousine, Secret Service Agent William Grier, immediately drove the limousine at high speed to Parkland Memorial Hospital, Dallas, Tex., arriving at approximately 1:35 p.m., e.s.t.(*2*) Having been alerted to the emergency by radio, Parkland Hospital personnel quickly escorted the wounded President and Governor into the emergency treatment facilities.

(33) Drs. Malcolm Perry and Charles J. Carrico were two of the first doctors to attend the President. In addition to a massive head wound,

both observed a small, circular wound situated in the region of the neck below the adam's apple, which they susequently characterized as an entry wound.(*3*) To combat the President's failure to breathe, Dr. Perry decided to perform a tracheotomy.(*4*) In doing so, he cut through the small, circular neck wound, making it difficult to identify the missile wound.(*5*)

(34) With respect to the head wound, Dr. Robert McClelland, another of the doctors who attended the President, said in his testimony before the Warren Commission, that the right posterior section of the skull had been blasted.(*6*) Dr. Kemp Clark, who also assisted with the President, similarly described the wound as being in the back of the President's head—in the right posterior part.(*7*)

(35) The Parkland doctors soon realized their efforts to save President Kennedy were fruitless. Dr. Clark pronounced him dead at 2 p.m., e.s.t.(*8*)

(36) The total time that the doctors had observed or treated the President was approximately 20 minutes. They had been concerned only with administering emergency treatment. Their primary concern was to restore the breathing and stop the bleeding. None examined the President's back—and so did not discover any wound there. Further, none observed any wound to the head other than the one massive wound. Nor was their job to measure precisely the location of the wounds or to examine the body for all possible wounds. When the President died, the Parkland doctors' functions also ended.(*9*)

(37) Drs. Robert Shaw, Charles Gregory, and George Shires treated the wounds of Governor Connally.(*10*) In their medical reports, they described wounds to his chest, wrist, and thigh.

(38) Soon after Dr. Kemp Clark of Parkland Hospital, Dallas, Tex., pronounced the President dead, the Secret Service and other personnel proceeded to transport the body from Texas to Washington, D.C. While in flight, Mrs. Kennedy chose Bethesda Naval Hospital in Bethesda, Md., as the site for the autopsy, since the President had served in the Navy.(*11*)

(39) The Secret Service and the Navy Department made arrangements for the performance of the autopsy.(*12*) The surgeon general of the Navy and the commanding officer of the Naval Medical School advised Comdr. James J. Humes, the director of laboratories of the National Medical School,(*13*) Naval Medical Center, Bethesda, Md., that the Secret Service was transporting the body of the President to Bethesda and that he was to ascertain the cause of death.(*14*)

(40) The FBI authorities contacted their Baltimore field office and advised that arrangements should be made for Bureau agents to proceed to Andrews Air Force Base, Camp Springs, Md., to meet Air Force One and to handle any matters that would fall within FBI jurisdiction.(*15*) Consequently, Special Agents Francis X. O'Neill, Jr., and James W. Sibert proceeded to Andrews Air Force Base. Their specific instructions were to accompany the body at all times, ride in the motorcade to Bethesda Naval Hospital, witness the autopsy, preserve the chain of custody of any evidentiary material, and transport any bullets that might be recovered to the FBI Laboratory.(*16*)

(41) On arrival at Andrews Air Force Base, a motorcade transported the body of the President to the Bethesda Naval Hospital, (*17*) with Special Agents Sibert and O'Neill traveling in the third car. (*18*) At

Bethesda, the ambulance first stopped at the main entrance; Mrs. Jacqueline Kennedy and Attorney General Robert F. Kennedy got out (*19*) and joined other members of the Kennedy family on the 17th floor of the hospital to await the conclusion of the autopsy. (*20*) The ambulance then proceeded to the rear of the building, arriving at approximately 7:35 p.m. (*21*). Personnel carried the body into the hospital. (*22*)

(42) Dr. Humes chose J. Thornton Boswell, M.D., chief of pathology at Bethesda, (*23*) and Pierre A. Finck, M.D., chief of the military environmental pathology division and chief of the wound ballistics pathology branch at the Armed Forces Institute of Pathology at Walter Reed Medical Center, (*24*) to assist him in performing the autopsy. During the autopsy, Special Agents Sibert and O'Neill recorded the names of what they believed were all the persons in attendance at any time. (*25*) In a report they submitted subsequent to the autopsy, they included: (*26*)

1. Adm. Calvin B. Galloway, commanding officer of the U.N. National Naval Medical Center;
2. Adm. George C. Burkley, White House physician to the President;
3. Comdr. James J. Humes, director of the laboratories of the National Medical School, Naval Medical Center, Bethesda, Md.;
4. Capt. James H. Stover, Jr., commanding officer of the Naval Medical School;
5. John Thomas Stringer, Jr., medical photographer;
6. James H. Ebersole, assistant chief radiologist at the Bethesda Naval Medical Center;
7. Floyd Albert Riebe, medical photographer;
8. J. Thornton Boswell, chief of pathology at Bethesda;
9. Jan Gail Rudnicki, laboratory technologist, assisting Dr. Boswell;
10. Pierre A. Finck, M.D., chief of the military environmental pathology division and chief of the wound ballistics pathology branch at Walter Reed Medical Center; (*27*)
11. Paul K. O'Conner, laboratory technologist;
12. Jerrol F. Custer, X-ray technician;
13. James Curtis Jenkins, laboratory technologist;
14. Edward F. Reed, X-ray technician;
15. James E. Metzler, hospital corpsman third-class;
16. Capt. David Osborne, chief of surgery;
17. Brig. Gen. Godfrey McHugh, Air Force aide to the President;
18. Lt. Comdr. Gregory H. Cross, resident in surgery;
19. Gen. Philip C. Wehle, commanding officer of the U.S. Military District, Washington, D.C.;
20. Chester H. Boyers, chief petty officer in charge of the pathology division;
21. Dr. George Bakeman, U.S. Navy (the committee could not locate this person);
22. Secret Service Agent Roy Kellerman;
23. Secret Service Agent William Greer; and
24. Secret Service Agent John J. O'Leary. (*28*)

(43) Through its own investigation, the committee determined that the following persons also attended the autopsy:

1. Richard A. Lipsey, personal aide to General Wehle;(*29*) and
2. Samuel Bird,(*30*) in 1963, a lieutenant stationed at the ceremonial duties office, Fort Myers, Va., 3d Infantry Division.

(44) Additionally, Sibert and O'Neill reported that, following the autopsy, four persons from Gawler's Funeral Home in Washington, D.C., entered the autopsy room to prepare the President's body for burial. They were:

1. John Van Haeson;
2. Edwin Stroble;
3. Thomas Robinson; and
4. Mr. Hagen.(*31*)

(45) These persons, together with Sibert and O'Neill, were the only ones present at any time in the autopsy room with the body of the President.

(46) In their report, Sibert and O'Neill noted that the body of the President was removed from the casket in which it arrived and placed on the autopsy table.(*32*) They said that a sheet covered the entire body; an additional wrapping, saturated in blood, surrounded the head.(*33*)

(47) Dr. Humes had testified previously to the Warren Commission that the body was received in a casket, was wrapped in a sheet, and was unclothed.(*34*) James Jenkins, a student laboratory technician, whose normal duties included admitting a body to the morgue and conducting an initial examination, likewise stated that the body of the President was unclothed and that it may have been wrapped in a sheet.(*35*)

(48) A major issue in the initial stages of the autopsy was whether Dr. Humes had authority to perform a full or partial autopsy.*

(49) The belief that Dr. Humes had authority for only a partial autopsy derived from several factors. Special Agent O'Neill told the committee that he recalled that Mrs. Kennedy had given permission for a partial autopsy and that Dr. Burkley, the President's physician, reiterated her remarks in the autopsy room.(*36*) He believed there was no question that Dr. Burkley was conveying the wishes of the Kennedy family regarding a full-versus-partial autopsy.(*37*) Special Agent Sibert told the committee that he, too, had the impression the Kennedy family was somehow transmitting step-by-step clearances to the pathologists.(*38*)

(50) John Stringer, the medical photographer, likewise recalled some discussion at the beginning of the autopsy concerning the scope of the autopsy. He said he believed Dr. Burkley played a central role in the discussions and seemed to be acting on behalf of the Kennedy family.(*39*) He specifically recalled Dr. Burkley indicating to the doctors that they should not conduct a full autopsy, saying, "* * * (you) shouldn't do a complete one if (you) don't have to."(*40*)

(51) Adm. David Osborne (then captain) stated that at the beginning of the autopsy there was tremendous pressure to perform a "quick post" and to leave the hospital.(*41*)

(52) The evidence supports the above recollections. They reflect the general nature of the initial stages of the autopsy: somewhat confused at the beginning with discussions concerning the extent and nature of

*The scope of Dr. Humes' authority and the scope of the performance are two distinct issues. Dr. Humes may have had authority to perform a full or complete autopsy, but may have performed a partial one.

the autopsy to be performed. The evidence also indicates, however, that these observations do not reflect the total picture and that Dr. Humes ultimately received permission to perform a complete autopsy. The following memorandum is a primary source:

DATE: NOVEMBER 26, 1963.

To: SAC, Baltimore.
From: SA's James W. Sibert and Francis X. O'Neill, Jr.
Subject: Assassination of President John F. Kennedy.

Following arrival at the Naval Medical Center and preparation of the President's body for inspection and autopsy, to be performed by Dr. Humes, chief pathologist and commander, U.S. Navy, Admiral Burkley, the President's personal physician advised that Mrs. Kennedy had granted permission for a limited autopsy and he questioned any feasibility for a complete autopsy to obtain the bullet which had entered the President's back.

At this point, it will be noted Dr. Humes, as the physician conducting the autopsy, stated it was his opinion that the bullet was still in the President's body and could only be extracted through a complete autopsy, which he proposed to do.

Special Agent Roy Kellerman, Secret Service, in conference with Special Agents Sibert and O'Neill, from an investigative and protective standpoint, advised Admiral Burkley that it was felt the bullet should be located.

At this point, Adm. C. B. Galloway, Commanding Officer of the National Naval Medical Center, Bethesda, Md., told Commander Humes to perform a complete autopsy.

(53) Special Agent O'Neill corroborated the information in this memorandum in an affidavit and in his interview with the committee.(*42*) In addition, Admiral Osborne (the Captain) stated in a committee interview that Dr. Humes was successful in resisting pressure to perform an incomplete autopsy and that no one issued any orders limiting it.(*43*) Admiral Galloway also stated that no one transmitted any orders to limit the autopsy in any manner and that this memorandum was consistent with his recollections.(*44*)

(54) For these reasons, it may be concluded that Dr. Humes possessed authority to perform a complete autopsy.

(55) During the initial stages of the autopsy, when the discussion over a full-versus-partial autopsy occurred, the pathologists conducted an examination of the exterior of the body and took photographs and X-rays before making any incisions.(*45*) This is when the pathologists observed that a tracheostomy had been performed on the President.(*46*)

(56) Stringer(*47*) and Riebe(*48*) took the autopsy photographs under the direction of Dr. Humes. Stringer told the committee that his equipment included a 4- by 5-inch graphic view camera that had a standard lens and used film holders which contained one segment of film on each side.(*49*) He also stated that as he photographed the body, he would give the film to a Secret Service agent standing adjacent to him who later signed a receipt to Captain Stover to obtain formal custody of the film.(*50*) Such a receipt—from Capt. J. H. Stover, Jr., commanding officer of the U.S. Naval Medical School to Roy H. Kellerman, assistant special agent in charge, U.S. Secret Service—does exist.(*51*)

(57) Stringer also stated that a Federal agent took a camera from Riebe and exposed the film.(*52*) This apparently occurred because the agent felt Stringer was the only person authorized to photograph the body and that Riebe was only to assist Stringer and not take photographs on his own initiative.

(58) Special Agents Sibert and O'Neill confirmed that the pathologists had X-rays taken before and after making incisions.(*53*) Dr. Ebersole, the acting chief of the radiology department that evening, stated in a deposition to the committee that prior to commencing the autopsy he took several X-rays of the skull, chest and trunk of the body.(*54*) He stated that he used portable X-ray equipment (*55*) and did not take X-rays of the hands and feet.(*56*) Dr. Ebersole further told the committee that he hand carried these films in their cassettes to the fourth floor of the hospital, where a darkroom technician developed them and then returned them to him. Ebersole then hand carried them back to the autopsy room.(*57*)

(59) After completion of the autopsy, before releasing the X-rays, Dr. Ebersole received a receipt from Roy H. Kellerman acknowledging possession of them.(*58*)

(60) Sibert and O'Neill observed that, on the basis of the preliminary X-rays, the pathologists concluded that:

> * * * no complete bullet of any size could be located in the brain area and likewise no bullet could be located in the back or any other area of the body as determined by total body X-rays.(*59*)

(61) At approximately 8:15 p.m., e.s.t, Dr. Humes made the first incision.(*60*) In his Warren Commission testimony, he stated that he used a routine incision:

> Which is a Y-shaped incision from the shoulders over the lower portion of the breastbone and over to the opposite shoulder and reflected the skin and tissues from the interior portion of the chest.(*61*)

(62) Dr. Humes then began examining the missile wounds. Sibert and O'Neill noted that he located the track of a missile that appeared to enter the rear of the head and progress forward.(*62*) The X-rays of the skull revealed numerous minute fragments widely distributed throughout the skull, as well as two larger fragments. The pathologists commented that this indicated the missile had fragmented on passing through the skull.(*63*)

(63) Dr. Humes located the entrance of the missile track in the head as approximately 2.5 centimeters laterally to the right and slightly above the external occipital protuberance.(*64*)

(64) In the autopsy report, Dr. Humes described the exist as:

> A large irregular defect of the scalp and skull on the right involving chiefly the parietal bone but extending somewhat into the temporal and occipital regions.(*65*)

He further stated that:

> [i]n this region there is an actual absence of scalp and bone producing a defect which measures approximately 13 centimeters in greatest diameter.(*66*).

(65) Sibert and O'Neill observed that Dr. Humes removed two fragments from the right side of the skull; one 7 by 2 millimeters in size, the other 1 by 3 millimeters.(*67*) Special Agents Sibert and O'Neill signed a receipt for custody of these fragments and immedi-

ately following the autopsy transported them to Special Agent Kurt Frazier at the FBI Laboratory.(*68*)

(66) The receipt for the fragments has been a continuing source of controversy. It states that Bureau agents received a "missile,"(*69*) as opposed to two fragments. Chester H. Boyers, the corpsman who typed the receipt,(*70*) submitted an affidavit to the committee which stated that the receipt was for two fragments that Dr. Humes removed from the skull, despite the receipt's caption of "a missile."(*71*) Boyers emphasized that he gave Sibert and O'Neill only missile fragments.(*72*) In affidavits and committee interviews, Sibert and O'Neill also stated that Dr. Humes had retrieved two fragments and that they received these fragments and not a missile.(*73*)

(67) The evidence indicates that the receipt was in error and that Boyers transferred only fragments to Sibert and O'Neill.

(68) Sibert and O'Neill next observed in their report that Dr. Humes examined a wound situated below the shoulders and 2 inches to the right of the middle line of the spinal column.(*74*) In the autopsy report, Dr. Humes characterized this wound as an entrance wound and located it 14 centimeters from the tip of the right acromion process and 14 centimeters below the tip of the right mastoid process.(*75*) Dr. Humes probed this wound with his finger and concluded that the missile had only traveled a short distance because he could feel the end of the track with his finger.(*76*) During the autopsy, Dr. Humes stated that he and his colleagues opened the chest cavity and carefully examined the lining of the chest cavity and both lungs.(*77*) Admiral Galloway told the committee that the pathologists examined the brain and all of the internal organs and structures. These included the liver, heart, lungs, spleen, kidneys, and adrenal glands.(*78*) The autopsy protocol and supplemental report state that the doctors examined the chest cavity, lungs, heart, abdominal cavity, skeletal system, liver, spleen, kidneys, and brain, but did not list the adrenal glands.(*79*)

(69) In regard to the examination of the chest cavity, Dr. Humes told the Warren Commission and the committee that he specifically remembered the photographers taking Kodachrome photographs of the interior of the President's chest.(*80*) Stringer, one of the photographers, stated that he also thought he had taken some interior photographs of the President's chest.(*81*) Dr. Burkley, however, told the committee that no one took any photographs of the interior of the chest.(*82*) There is no evidence that such photographs exist.

(70) By this point in the autopsy, the pathologists had closely examined the body and had still not located any missile, particularly the one which entered the back. They could not explain why they could not find any bullets.(*83*) They then began speculating about bullets which fragment. Special Agent Sibert decided to call Special Agent Charles L. Killion at the firearms section of the FBI laboratory to inquire about fragmenting bullets.(*84*) On receiving this call, Killion informed Sibert that Secret Service Agent Richard Johnson had forwarded to the laboratory a bullet which reportedly had been found on a stretcher in the emergency room of Parkland Memorial Hospital in Dallas, Tex.(*85*) Killion described the bullet as a 6.5-millimeter rifle missile with a copper-alloy full jacket.(*86*)

(71) Sibert and O'Neill stated in their report that during the autopsy Dr. Humes, concluded on the basis of this information and knowing that the Parkland doctors had performed cardiac massage that they may have forced the bullet out of the President's back.(*87*) This theory would account for a missile track with no bullet.

(72) During the latter stages of the autopsy, authorities sent from Dallas three separate fragments of skull bone(*88*) found in the Presidential limousine. There is no evidence to show who sent these fragments to Bethesda. The pathologists concluded they were from the skull. Dr. Humes directed the X-raying of these fragments(*89*) and observed that one of the fragments contained minute metallic fragments along a line which corresponded with the large defect in the skull of the President.(*90*) This particular bone fragment alone exhibited bevelling of the outer table which Pierre Finck said indicated that a missile existed at that point.(*91*) Both Dr. Humes and Dr. Burkley informed the committee that these fragments were placed back in the skull of the President.(*92*)

(73) By the termination of the autopsy at approximately 11 p.m., (*93*) the pathologist had formulated the following general conclusions:

1. One missile entered in the rear of the skull of the President and exited in the front of the skull; and
2. One missile entered the back of the President and was apparently dislodged during cardiac massage at Parkland Hospital.(*94*)

(74) Admiral Galloway corroborated these statements before the committee, saying that an assassin or assassins shot the President from behind with two shots.(*95*)

(75) After completing the autopsy, Dr. Humes remained to assist the morticians in preparing the President's body.(*96*) Secret Service Agent Kellerman said that after the morticians had prepared the body, the Secret Service agents and the Kennedy family left the hospital at 3:56 a.m. and went to the White House.(*97*)

Additional issues arising from the performance of the autopsy

(76) Although Dr. Humes had authority to perform a complete autopsy, the committee still had to resolve the issue of the actual scope of the autopsy. Specifically, Dr. Humes may have decided on his own initiative to limit the autopsy in certain respects or, despite the initial grant of authority, some factors may possibly have surfaced during the course of the autopsy which may have impinged on the independent decisionmaking of Dr. Humes.

(77) Dr. Pierre Finck, one of the pathologists, asserted in a sworn statement to the committee that he believed the autopsy was incomplete:

> Because of the restrictions I suggested or said I felt it was not complete, but Dr. Humes then said that the autopsy had accomplished the purposes as stated—the number of wounds, the direction of the projectiles and the cause of death—so I was actually satisfied.(*98*)

Dr. Finck later stated that restrictions from the family (were)the

reason for limiting our actions.(*99*) Specifically, Dr. Finck contends that someone ordered them (the pathologists) not to dissect the missile track that began in the upper back and progressed forward into the neck region. When questioned about the source of this order, Dr. Finck stated:

> I cannot say that it was this army general, I can't recall that precisely. I remember the prosecutors and Admiral Galloway. As far as saying now so and so told me that or didn't tell me that, it is extremely difficult. There was an army general in that room and I cannot readily pinpoint the origin of those instructions to comply with those family wishes.(*100*)

(78) The committee determined that it was Dr. Humes and not any army general or other person who made the decision not to dissect the back entry wound. The following exchange between one of the medical consultants for the committee and Dr. Humes supports this conclusion:

> Dr. BADEN. Now, for example, not exploring the wound from the back to the neck, that was not done. I mean, cutting it open completely. That wasn't done specifically; was that because somebody said, "Don't do it"?
>
> Dr. HUMES. Now wait a minute, that wound was excised.
>
> Dr. BADEN. The back wound?
>
> Dr. HUMES. Yes, sir. The back of the neck, and there are microscopic slides of that wound.
>
> Dr. BADEN. I see. The skin was taken out. And then was it——
>
> Dr. HUMES. It was probed.
>
> Dr. BADEN. Was it opened up?
>
> Dr. HUMES. It was not laid open.
>
> Dr. BADEN. Now that was your decision as opposed to somebody else's decision?
>
> Dr. HUMES. Yes. It was mine.(*101*)

(79) The committee also investigated the possibility that the Kennedy family may have unduly influenced the pathologists once the autopsy began, possibly by transmitting messages by telephone into the autopsy room.* Brig. Gen. Godfrey McHugh, then an Air Force military aide to the President, informed the committee that Attorney General Robert F. Kennedy and Kenneth O'Donnell, a presidential aide, frequently telephoned him during the autopsy from the 17th floor suite.(*102*) McHugh said that on all occasions, Kennedy and O'Donnell asked only to speak with him.(*103*) They inquired about the results, why the autopsy was consuming so much time, and the need for speed and efficiency, while still performing the required examinations.(*104*) McHugh said he forwarded this information to the pathologists, never stating or implying that the doctors should limit the autopsy in any manner, but merely reminding them to work as efficiently and quickly as possible.(*105*)

(80) While General McHugh or others may not have stated or implied that the doctors should limit the autopsy, their remarks no doubt caused consternation, although they may not have substantively affected the autopsy. The following passage explains this view:

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* There was a telephone in the autopsy room.

(81) Dr. HUMES. There were no questions but we were being urged to expedite this examination as quickly as possible, that members of the President's family were in the building, that they refused to leave the premises until the President's body was ready to be moved; and similar remarks of the vein which we made every effort to put aside and approach the investigation in as scientific a manner as we could. But did it harass us and cause difficulty—of course it did, how could it not!

Dr. BOSWELL. I don't think it interfered with the manner in which we did the autopsy.

Dr. HUMES. I don't either. (*106*)

(82) Dr. Boswell further stated that there were no constraints. (*107*) Dr. Ebersole, the radiologist, likewise informed the committee that "[t]o the best of my knowledge there were absolutely no restrictions and it was Dr. Humes' decision as to the extent of the autopsy." (*108*) Stringer, one of the medical photographers, also could not recall anyone issuing any orders. (*109*) He stated specifically that while McHugh manifested a great deal of emotion, he did not issue any orders. (*110*)

(83) This evidence indicates that:

1. Commander Humes had full authority to perform a complete autopsy, and indeed, that Admiral Galloway told him to do so;
2. Commander Humes, not anyone else, made any decision that resulted in a deviation from a complete forensic autopsy; and
3. The remarks of others to expedite the autopsy were probably the reason for the decision to perform a less than complete autopsy.

(84) In a committee telephone interview with Admiral Osborne, another issue arose. He stated that he thought he recalled seeing an intact slug roll out from the clothing of President Kennedy and onto the autopsy table when personnel opened the casket and removed the clothing from the body of the President. (*111*)

(85) The committee reviewed thoroughly all documents and recontacted those persons who moved the body of the President from the casket onto the autopsy table and then prepared the body for examination. Paul K. O'Connor, who along with James Jenkins, had the duty of preparing the body for the autopsy, said the body had arrived at about 8 p.m. and was wrapped in a body bag, the head in a sheet. (*112*) O'Connor said he assisted in unwrapping the sheet (*113*) and could not recall any foreign object, specifically a missile, being discovered during the autopsy or while unwrapping the sheets. (*114*)

(86) Jenkins likewise said he could not recall any foreign objects being discovered or discussed and specifically could not recall any missile or fragments of a missile falling out onto the autopsy table or floor. (*115*)

(87) Throughout the committee's investigation, no one had ever mentioned the discovery of a missile in Bethesda Naval Hospital. The only bullet recovered was the one discovered at Parkland Memorial Hospital.

(88) Following this investigation, the committee recontacted Admiral Osborne and informed him that the body of the President had not arrived in any clothes, but was wrapped in sheets, (*116*) and that no one else recalled anything about the discovery of a missile. (*117*)

Admiral Osborne then said that he could not be sure he actually did see a missile and that it was possible the FBI and Secret Service only spoke about the discovery of a missile. He did say he was positive only one bullet was ever recovered, whether it was discovered at Bethesda Hospital or Parkland Hospital. (*118*)

Post-autopsy events

(89) On Saturday morning, November 23, Dr. Humes informed the committee that he fulfilled a religious commitment and then met with the other two autopsy pathologists in the late morning (*119*) to discuss the preparation of the autopsy report. Dr. Humes said he then called Parkland Memorial Hospital in Dallas to speak with the doctors who had administered emergency treatment to President Kennedy. (*120*) Dr. Perry, one of the first physicians to see and treat the President, told the committee that Dr. Humes called him twice, separated by about a 30-minute interval. (*121*) During the first call, Dr. Perry told Dr. Humes that due to the President's failure to breathe, he had determined a tracheostomy was necessary, then or never, and therefore made a transverse incision straight throught the bullet wound in the anterior aspect of the neck at approximately the second or third tracheal ring. (*122*) The second call involved a discussion of the chest incisions made on the President at Parkland. (*123*)

(90) As a result of these telephone calls, Dr. Humes concluded that the missile which had entered the upper back had traversed the body and exited in the anterior portion of the neck, (*124*) although he had not observed the remains of any such hole during his examination of the body.

(91) Following the telephone calls with Dr. Perry, Dr. Humes went home and rested until late that afternoon and then proceeded to write the autopsy protocol (autopsy report). (*125*) He told the committee that after writing the report he destroyed the original notes because they were stained with the blood of the President and he felt it would be "inappropriate to retain [them] to turn in to anyone in that condition." (*126*)

(92) In preparing the autopsy protocol, Dr. Humes did not have access to the autopsy photographs or X-rays. (*127*) (This was also the case with respect to his Warren Commission testimony.)

(93) After completion of the autopsy protocol (*128*). Dr. Humes hand-carried the document to the Office of the White House Physician at approximately 6 p.m. that evening. (*129*) The general conclusions were that:

1. One missile entered in the rear of the skull of the President and exited in the front of the skull; and
2. One missile entered the back of the President and exited in the front of the neck. (*130*)

(94) The pathologists completed a supplementary report approximately 1½ weeks later and delivered it to the White House Physician on December 6, 1963. (*131*)

Part III. Conclusions

(95) The two major issues connected with the autopsy are its scope—full versus partial—and the competency with which the prosectors

performed it. Despite allegations that the Kennedy family or other authorities ordered a partial or limited autopsy, evidence shows that the pathologists were given authority to perform a complete autopsy. The autopsy was not complete, however, according to established medicolegal standards. A combination of strong Kennedy family desires to finish the autopsy quickly, a military environment that hindered independent action, a lack of experience in forensic pathology among the prosectors, and a lack of established jurisdictional and procedural guidelines all contributed to the pathologists' failure to take certain measures essential to the completion of a thorough medicolegal autopsy and to competently perform the autopsy.

(96) The measures essential to a thorough medicolegal autopsy that the pathologists failed to take are:

1. Conducting the autopsy in an atmosphere free from the presence of individuals not necessary to any medical or investigative aspects of the autopsy. Aside from the Secret Service and FBI agents, it was not necessary for other military personnel to be in the autopsy room who were not performing a medical function.
2. Consulting the Parkland Hospital doctors who administered emergency treatment to the President before initiating the autopsy. According to the medical panel of the committee, such consultation is normal procedure.
3. Acquiring the assistance of an experienced pathologist engaged in the full-time practice of forensic pathology, as opposed to the consulting capacity Dr. Finck possessed. Such experienced assistance might have prevented several errors.
4. Recording precisely the locations of the wounds according to anatomical landmarks routinely used in forensic pathology. The medical panel of the committee stated that the reference points used to document the location of the wound in the upper back—the mastoid process and the acromion—are movable points and should not have been used.
5. Dissecting the wound that traversed the upper back of the President. The medical panel stated that probing a wound with a finger is hardly sufficient; to ascertain the actual track, the wound must be dissected.
6. Examining all organs and documenting the results of such examinations. Although the pathologists did examine most organs, they made no reference to the adrenal glands, part of the anatomy routinely examined during the autopsy.
7. Sectioning the brain coronally. Such documentation could have provided additional insight into the destructive impact of the missile in the brain.

(97) The committee recognizes that the inadequacies of the autopsy originated in part from the unique and hectic circumstances surrounding the death of the President, and not with any one source. Whatever the cause, however, these inadequacies have continued to feed the confusion and mistrust so long associated with the autopsy of President Kennedy and have reduced the effectiveness of the committee's review of the medical evidence. These problems reinforce the necessity for establishing substantive and procedural guidelines to be followed in the

performance of any autopsy stemming from the assassination of a national political official.

REFERENCES

(1) Letter from Capt. H. P. Miller, Medical Service Corps, U.S. Navy, Director, Administrative Services, to the House Select Committee on Assassinations, Sept. 22, 1977 (JFK Document No. 002590).

(2) Report of the President's Commission on the Assassination of President Kennedy (Washington, D.C: U.S. Government Printing Office, 1964), p. 53 (hereinafter "Warren Report").

(3) Id. at p. 54.

(4) Ibid.

(5) Interview of Malcolm O. Perry, Jan. 11, 1978, House Select Committee on Assassinations, p. 2 (JFK Document No. 006186). See addendum I of sec. V of this volume for this document.

(6) Testimony of Robert Nelson McClelland, Hearings before the President's Commission on the Assassination of President Kennedy (Washington, D.C.: U.S. Government Printing Office, 1964), vol. VI, p. 33 (hereinafter McClelland testimony, VI Warren Commission hearings, p. 33).

(7) Testimony of William Kemp Clark, VI Warren Commission hearings, p. 20.

(8) Warren Report, p. 55.

(9) The Parkland doctors were providing emergency treatment to the President. Once the President died, their functions ceased. Further, after the President died, they believed it was beyond the scope of their duties to conduct any further action. (Warren Report, pp. 55–56).

(10) Id at p. 56.

(11) Warren Report, p. 59.

(12) FBI report, Bureau No. BA 89–30, Nov. 26, 1963, p. 3 (JFK Document No. 013618) (hereinafter cited as Sibert and O'Neill).

(13) Testimony of Dr. James J. Humes, Sept. 7, 1978, hearings before the Select Committee on Assassinations, U.S. House of Representatives, 95th Cong., 2d Sess. (Washington, D.C.: U.S. Government Printing Office, 1979), vol. I, p. 323ff (hereinafter Humes testimony, Sept. 7, 1978, I HSCA–JFK hearings, 323ff).

(14) Id. at p. 324.

(15) Sibert and O'Neill, p. 1. See also staff interview of James W. Sibert, Aug. 29, 1977, House Select Committee on Assassinations, p. 1 (JFK Document No. 002191).

(16) Ibid., Sibert interview.

(17) Sibert and O'Neill, p. 1.

(18) Ibid.

(19) Ibid.

(20) Warren Report, p. 59.

(21) Ibid. See also Humes testimony, II Warren Commission hearings, p. 349.

(22) Sibert and O'Neill, p. 1.

(23) Staff interview of J. Thornton Boswell, Aug. 16, 1977, House Select Committee on Assassinations, p. 1 (JFK document No. 002071).

(24) Deposition of Pierre A. Finck, Mar. 11, 1978, House Select Committee on Assassinations, pp. 70–71 (JFK Document No. 013617).

(25) Sibert and O'Neill, p. 3.

(26) Id. at p. 2.

(27) The Sibert and O'Neill report documented that Finck arrived after the autopsy had begun. Sibert and O'Neill, p. 2.

(28) The Sibert and O'Neill report documented that O'Leary only remained in the autopsy room for a short time. Sibert and O'Neill, p. 2.

(29) Staff interview of Richard A. Lipsey, Jan. 18, 1978, House Select Committee on Assassinations (JFK Document No. 014469).

(30) Outside contact report, Samuel Bird, Feb. 17, 1978, House Select Committee on Assassinations (JFK Document No. 005541).

(31) Sibert and O'Neill, p. 3.

(32) Sibert and O'Neill, p. 1.

(33) Ibid.

(34) Humes testimony, II Warren Commission hearings, 349.

(35) Outside contact report, James Curtiss Jenkins, June 27, 1978, House Select Committee on Assassinations, p. 1 (JFK Document No. 009526).

(36) Staff interview of Francis X. O'Neill, Jan. 10, 1978, House Select Committee on Assassination, p. 3 (JFK Document 006185).

(37) Ibid.
(38) See reference 15, Sibert interview, p. 5.
(39) Outside contact report, John Thomas Stringer, Aug. 17, 1977, House Select Committee on Assassinations, p. 13 (JFK Document No. 003070).
(40) Staff interview of John Thomas Stringer, Aug. 17, 1977, House Select Committee on Assassinations, p. 17 (JFK Document No. 002070). See also affidavit of Dr. George C. Burkley, Nov. 28, 1978, House Select Committee on Assassinations, p. 2, in which Dr. Burkley said that the autopsy was to be a complete autopsy, with no limitations.
(41) Outside contact report, Capt. David Osborne, June 20, 1978, House Select Committee on Assassinations (JFK Document No. 013623).
(42) Affidavit of Francis X. O'Neill, Nov. 8, 1978, House Select Committee on Assassinations, p. 4 (JFK Document No. 013073). See reference 36, O'Neill interview, p. 3 (JFK Document No. 006185). See also p. 7, O'Neill affidavit, where he stated that he prepared this memorandum.
(43) See reference 41.
(44) Staff interview of Adm. Calvin B. Galloway, May 17, 1978, House Select Committee on Assassinations, p. 1 (JFK Document No. 009409).
(45) Humes testimony, I HSCA–JFK hearings, p. 324.
(46) Sibert and O'Neill, p. 3.
(47) See reference 40, Stringer interview.
(48) Outside contact report, Floyd Albert Riebe, Apr. 20, 1978, House Select Committee on Assassinations (JFK Document No. 007339).
(49) See reference 40, Stringer interview, p. 10.
(50) Id. at p. 11. Also blank letterhead memorandum, Nov. 22, 1963 (JFK Document No. 002504).
(51) The original number of film exposures listed on the receipt was in error and was changed by crossing out the typed notation and writing in the correct number. See U.S. Secret Service document, Dec. 5, 1963, which reflects this change.
(52) See reference 40, Stringer interview, p. 10.
(53) Sibert and O'Neill, p. 3.
(54) Deposition of James H. Ebersole, Mar. 11, 1978, House Select Committee on Assassinations, p. 4 (JFK Document No. 013617).
(55) Ibid.
(56) Id. at p. 9.
(57) Ibid.
(58) Receipt from Comdr. John H. Ebersole, MC, USN, acting chief of radiology, USNH, National Naval Medical Center, Bethesda, Md., to Roy H. Kellerman, agent, U.S. Secret Service, Nov. 22, 1963 (JFK Document No. 002504).
(59) Sibert and O'Neill, p. 4.
(60) Ibid., p. 3.
(61) Humes testimony, II Warren Commission hearings, 363.
(62) Sibert and O'Neill, p. 3. In their report, Sibert and O'Neill also stated that surgery had been performed on the head area prior to the arrival of the body at Bethesda Naval Hospital. The committee concludes that this report was in error. In an affidavit to the committee, Sibert acknowledged that the statement that head surgery was performed was determined "not to be correct following detailed inspection." See affidavit of James Sibert, Oct. 24, 1978, House Select Committee on Assassinations (JFK Document No. 012806).
(63) Sibert and O'Neill, p. 3.
(64) Autopsy protocol of President John F. Kennedy, Naval Medical School, Bethesda, Md., autopsy No. A63–272, Nov. 22, 1963, p. 4 (hereinafter cited as autopsy protocol).
(65) Id. at p. 3.
(66) Ibid.
(67) Sibert and O'Neill, p. 3.
(68) Ibid., p. 5.
(69) See a copy of the receipt which is attached to the affidavit of Chester H. Boyers, Dec. 4, 1978, House Select Committee on Assassinations (JFK Document No. 014834).
(70) Ibid., Boyers affidavit, p. 3. See also staff interview of Chester H. Boyers, April 25, 1978, House Select Committee on Assassinations (JFK Documents Nos. 013614 and 014462).
(71) Ibid.

(72) Ibid.
(73) See reference 42, O'Neill affidavit, p. 5, and reference 62, Sibert interview, p. 5. See also reference 36, p. 5; and reference 38, Sibert interview, p. 4.
(74) Sibert and O'Neill, p. 4.
(75) Autopsy protocol, p. 3.
(76) Sibert and O'Neill, p. 4.
(77) Humes testimony, II Warren Commission hearings, 363.
(78) See reference 44, p. 2.
(79) Autopsy protocol; supplemental autopsy report of President John F. Kennedy, Dec. 6, 1963 (hereinafter cited as supplemental autopsy report).
(80) Humes testimony, II Warren Commission hearings, 363. See also interview of Dr. James J. Humes, Aug. 17, 1977, House Select Committee on Assassinations, p. 7 (JFK Document No. 003070).
(81) See reference 40, Stringer interview, p. 40.
(82) Interview of Dr. George C. Burkley, Aug. 17, 1977, House Select Committee on Assassinations, p. 4 (JFK Document No. 003070).
(83) Sibert and O'Neill, p. 4.
(84) See reference 62, Sibert affidavit, p. 4; and reference 15, Sibert interview, p. 4.
(85) Sibert and O'Neill, p. 4.
(86) Ibid.
(87) Id. at p. 5.
(88) Autopsy protocol, p. 4.
(89) Deposition of John H. Ebersole, Mar. 11, 1978, House Select Committee on Assassinations, p. 5 (JFK Document No. 013617).
(90) Autopsy protocol, p. 4.
(91) Ibid.; Letter from Pierre A. Finck to Brig. Gen. J. M. Blumberg, MC, USA, director, Armed Forces Institute of Pathology, Feb. 1, 1965, p. 2.
(92) See reference 80, Humes interview, p. 7; and Burkley interview, p. 4.
(93) Humes testimony, II Warren Commission hearings, 349.
(94) Dr. Humes emphasized in his open session testimony before the committee that there was one and only one bullet wound to the back of the President's head that it entered in the rear and that it exited in the front. Humes testimony, Sept. 7, 1978. I HSCA JFK hearings. See also Sibert and O'Neill, p. 5.
(95) See reference 44, Galloway interview, p. 2. But see staff interview with Richard A. Lipsey, Jan. 18, 1978, House Select Committee on Assassinations (JFK Document No. 014469), in which Lipsey stated that he recalled the doctors concluding that three missiles struck the President from behind. Lipsey said that one bullet entered the upper back of the President and did not exit; one entered in the rear of the head and exited the throat; and one entered and exited in the right, top portion of the head, causing a massive head wound.

The committee agreed that President Kennedy suffered a wound in the upper back, a wound in the rear of the head, a massive wound in the top, right side of the head, and a wound in the throat. Lipsey was wrong, however, in concluding that three shots struck the President and mistaken if he believed the pathologists reached such a conclusion. Only two shots struck the President: One entered the upper back and exited the throat. Another entered the rear of the head and exited on the top, right side of the head, causing the massive defect.

Lipsey apparently formulated his conclusions based on observations and not on the conclusions of the doctors. In this regard, he believed the massive defect in the head represented an entrance and exit when it was only an exit. He also concluded that the entrance in the rear of the head corresponded to an exit in the neck. This conclusion could not have originated with the doctors, because during the autopsy they believed the neck defect only represented a tracheostomy incision. Lipsey did properly relate the preliminary conclusion of the doctors during the autopsy that the entrance wound in the upper back had no exit. The doctors later determined that this missile had exited through the throat. Thus, although Lipsey's recollection of the number of defects to the body and the corresponding locations are correct, his conclusions are wrong and are not supported by any other evidence.

(96) Humes testimony, Sept. 7, 1978, I HSCA–JFK hearing.
(97) Testimony of Roy H. Kellerman, II Warren Commission hearings, 100.
(98) Deposition of Pierre A. Finck, Mar. 11, 1978, House Select Committee on Assassinations, p. 110 (JFK Document No. 013617).

(*99*) Id. at p. 128.
(*100*) Id. at p. 76.
(*101*) Interview of James J. Humes, Sept. 16, 1977, HSCA, p. 67 (JFK Document No. 013616), reprinted as part of Addendum I to this report.
(*102*) Interview of Gen. Godfrey McHugh, May 11, 1978, House Select Committee on Assassinations, p. 4.
(*103*) Ibid.
(*104*) Ibid.
(*105*) Ibid.
(*106*) See reference 101, Humes interview, Sept. 16, 1977, p. 66.
(*107*) Id. at p. 73.
(*108*) See reference 89, Ebersole deposition, p. 10.
(*109*) See reference 40, Stringer interview, p. 13.
(*110*) Ibid.
(*111*) See reference 41.
(*112*) Outside contact report, Paul K. O'Connor, June 28, 1978, House Select Committee on Assassinations (JFK Document No. 013613).
(*113*) Ibid.
(*114*) Ibid.
(*115*) See reference 35.
(*116*) Sibert and O'Neill, p. 3; see reference 112; see also reference 35.
(*117*) See reference 41.
(*118*) Ibid.
(*119*) See reference 101, Humes interview, Sept. 16, 1977 p. 49.
(*120*) Ibid.
(*121*) Interview of Dr. Malcolm Perry, Jan. 11, 1978, House Select Committee on Assassinations, p. 8 (JFK Document No. 006370).
(*122*) Id. at p. 2.
(*123*) Id. at p. 8.
(*124*) Autopsy protocol, p. 6.
(*125*) See reference 101, Humes interview, Sept. 16, 1977 p. 51.
(*126*) Ibid. See also Humes testimony, Sept. 7, 1978 I HSCA–JFK hearings. p. 330.
(*127*) Ibid., Humes testimony, p. 331.
(*128*) Admiral Galloway instructed Elsie B. Closson, his secretary, to type the autopsy report and the supplemental report because he believed he needed a typist with a top secret security clearance. See outside contact report, Elsie B. Closson, May 4, 1978, House Select Committee on Assassinations (JFK Document No. 008135).
(*129*) See reference 101, Humes Interview, Sept. 16, 1977, p. 22.
(*130*) Autopsy protocol, p. 16.
(*131*) Supplemental autopsy report.

SECTION III. CHAIN OF CUSTODY OF THE MATERIALS ACQUIRED DURING THE AUTOPSY

Part I. Introduction

(98) Several of the physical materials—microscopic tissue slides, tissue sections of organs, bone fragments, and the brain—that the autopsy pathologists had acquired during the autopsy and retained for future examination, are unaccounted for today. The committee decided a thorough investigation into the medical evidence of the assassination required a diligent effort to locate and obtain these "missing" materials. Consequently, the committee traced the chain of custody of all materials (the "missing" physical items plus other material) derived from the autopsy, contacted all persons directly or indirectly associated with such custody, and investigated other possible theories regarding their fate.

(99) Despite these efforts, the committee was unable to determine precisely what happened to the materials. Circumstantial evidence indicates however, that it is possible that Robert F. Kennedy either destroyed or otherwise rendered them inaccessible.

Part II. Chain of Custody of the Autopsy Materials

(100) The disposition of the autopsy photographs, X-rays, and physical materials immediately following the autopsy was as follows:

1. Photographs and X-rays

(101) At the conclusion of the autopsy on the evening of November 22, 1963, Capt. John H. Stover, Jr., the commanding officer of the U.S. Naval Medical School, gave Secret Service Agent Roy H. Kellerman all the photographic film that the medical photographers had exposed during the autopsy. (*1*) Additionally, Comdr. John H. Ebersole, the acting chief of radiology, gave Kellerman all of the X-ray film.(*2*) In the early morning hours of November 23, Kellerman delivered this material to Robert I. Bouck, Special Agent in Charge of the Protective Research Division, U.S. Secret Service, which is located at the Executive Office Building, Washington, D.C. (the White House).(*3*)

(102) On or about November 27, Bouck instructed James K. Fox of the Secret Service to make arrangements with the Naval Processing Center located in Anacostia, Md. to process both the black and white and the color film.(*4*) Fox, along with Robert L. Knudsen, Mrs. Kennedy's personal photographer, proceeded to Anacostia that same day.(*5*) At the Naval Center, Lt. V. Madonnia of the U.S. Navy processed both black and white negatives and color positives.(*6*) Fox returned the materials to Bouck the same day.(*7*) A few days later, under more instructions from Bouck, Fox made black and white prints from the negatives in the Secret Service laboratory, located at the Protective Research Division, Executive Office Building.(*8*)

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(103) On December 9, Bouck directed Fox to take the color positives back to the Navy photographic laboratory and supervise the processing of enlarged color prints.(*9*) Fox returned all the color prints and positives to Bouck that evening.(*10*)

(104) Bouck and Edith Duncan, his administrative assistant, kept the photographic film and the X-ray films in a combination lock-safe file in the Protective Research Division of the Secret Service in the Executive Office Building, Washington, D.C.(*11*) The combination to the safe was known only to Bouck and Duncan. (*12*) From the early morning of November 23 until the transfer of the materials from the Executive Office Building in April 1965, the Secret Service maintained custody of the X-ray and photographic films.(*13*)

2. Physical specimens retained during the autopsy or discovered at the scene of the assassination

(105) On the day after the assassination, at about 5:30 p.m., William Allen Harper, a student at Texas Christian University, was taking photographs of the Dealey Plaza area.(*14*) when he discovered a piece of bone near the scene of the assassination. Harper informed the FBI that he took the bone to his uncle, Dr. Jack C. Harper, and that they both then went to Dr. A. B. Cairns, chief of pathology at Methodist Hospital, Dallas Tex. (*15*) Dr. Cairns believed the bone to be a piece of human skull.(*16*) William Harper said he then gave the specimen to Special Agent Anderton of the FBI on November 25.(*17*)

(106) Adm. George G. Burkley, the physician to the President, noted in an unaddressed memorandum on Nov. 27, 1963, that at 5:15 p.m. that day he received a small Neiman-Marcus box about 2½ by 3½ inches containing material which "had been discussed previously" with the FBI.(*18*) Dr. Burkley also wrote that this material would be deposited with the commanding officer of the Bethesda Naval Hospital for retention with other materials of a similar nature.(*19*)

(107) The evidence indicates that the Neiman-Marcus box contained the bone fragment William Harper discovered. First, the dimensions of the box and the Harper bone fragment (2¼ by 2½ inches) correspond. Second, the dates when William Harper gave the bone fragment to authorities and when Admiral Burkley referred to the Neiman-Marcus box in his memorandum are just 2 days apart. Third, William Harper gave the fragment to an FBI agent, and Admiral Burkley said the contact for receiving the box was the FBI.(*20*) Fourth, Admiral Burkley referred to the contents of the box as a specimen.(*21*) Consequently, it is logical that the Neiman-Marcus box contained the Harper bone fragment.

(108) In the same memorandum, Dr. Burkley also commented that Bouck had given him a specimen of bone, apparently on the same day, that was allegedly found in the parkway near the scene of the assassination.(*22*) Dr. Burkley noted that both of the above specimens were to be turned over to the Bethesda Naval Hospital for examination, analysis, and retention until other disposition was directed.(*23*) The committee does not know if this occurred.

(109) As mentioned earlier, the pathologists retained various sections of organs as well as the entire brain after the autopsy for subsequent microscopic examination.(*24*) In this regard, Captain Stover informed the committee that the pathologists placed the brain in a formaldehyde

solution in a stainless steel bucket and then deposited this in the closet of Admiral Galloway.(25) Stover also stated that the smaller portions of organs were retained in individual jars and then probably placed in the pathology department safe.(26) Dr. Burkley supported this information by informing the committee that he directed the "fixation and retention of the brain for future study."(27)

(110) The pathologists documented the results of the microscopic (gross) examination in a supplemental report.(28) Although the brain was not coronally sectioned, that is, sliced like a loaf of bread, the doctors did remove some sections. (29) Chester Boyers, one of the Navy personnel involved in the microscopic examination, informed the committee in an affidavit that he recalled preparing for analysis sections of organs on November 24, 1963, and the brain on December 2, 1963. (30) Neither Captain Stover nor Chester Boyers could recall what happened to these materials after this examination other than that Dr. Humes and Dr. Boswell, two of the autopsy pathologists, maintained possession of them at Bethesda Naval Hospital.(31) Stover also said that Dr. Burkley had control over the disposition of the materials.(32)

(111) In an affidavit and interview with Dr. Burkley, he informed the committee that shortly after this supplemental examination of the organs and brain, he directed the Bethesda Naval Hospital to transfer all the physical autopsy material in its possession to Bouck at the Executive Office Building.(33) Dr. Burkley stated further that Captain Stover gave him the brain in a white granite or stainless steel bucket and that he personally transferred it to the White House where it was placed in a locked Secret Service file cabinet.(34)

(112) Bouck corroborated this transfer in a memorandum dated April 26, 1965, in which he asserted that

> [s]hortly after the assassination of President Kennedy, Adm. George C. Burkley delivered to this section certain specimens, photographs, and documents relating to the autopsy.(35)

(113) The evidence indicates, therefore, that soon after the autopsy of President Kennedy, all autopsy-related material was transferred from Bethesda Naval Hospital to the Executive Office Building where they were maintained in the custody of Bouck and under the control of Admiral Burkley. Specifically, this material included the autopsy photographs and X-rays, the bone fragments found in Dallas after the assassination, and the tissue sections of organs and brain. The Secret Service maintained custody of all of this material at all times until its transfer to the National Archives in 1965.

Part III. Subsequent History of Materials

(114) On April 22, 1965, then Senator Robert F. Kennedy sent a letter to Dr. Burkley directing him to transfer in person the autopsy material being kept at the White House to Mrs. Evelyn Lincoln, the personal secretary of President Kennedy, for safekeeping at the National Archives.(36) The letter also said that Mrs. Lincoln was being instructed that the material was not to be released to anyone without Robert Kennedy's written permission and approval.(37) This demonstrates Robert Kennedy's firm control over the disposition of the materials.

(115) In response to this directive, Dr. Burkley notified the Protective Research Division of Senator Kennedy's request.(*38*) Before transferring the material, Bouck, Burkley and other Secret Service personnel carefully inventoried all the items present. (*39*) This was the first official inventory of these materials.

(116) On April 26, 1965, Burkley and Bouck transferred the materials to Evelyn Lincoln.(*40*) A letter from Burkley to Lincoln documenting the exchange included the inventory,(*41*) which documented that a stainless steel container 7 by 8 inches in diameter, containing gross material was transferred.(*42*) On the last page of the inventory, Lincoln wrote: "Received, April 26, 1965, in room 409, National Archives, Washington, D.C., from Dr. Burkley and Robert Bouck."(*43*) At the time of the transfer, the items now missing, which are those enumerated under item No. 9 of the inventory,(*44*) were allegedly present.

(117) In his testimony before the committee, Bouck stated that he is quite positive all the autopsy-related material that came into his possession was given to Mrs. Lincoln(*45*) at the time of the 1965 transfer. He also stated that he was uncertain whether Dr. Burkley had custody of the brain, but that if the brain was part of the autopsy materials in the custody of the Secret Service, it was transported to the National Archives.(*46*)

(118) Dr. Burkley clarified this issue, saying that the stainless steel container mentioned in the inventory held the brain and that he saw the bucket in April 1965, when he and Bouck transferred the autopsy materials to Lincoln.(*47*) Since this transfer, Dr. Burkley maintains that he has had no further knowledge of or association with these materials.(*48*)

(119) Mrs. Lincoln was not an employee of the National Archives during this period; she was only assisting in the transfer of the official papers and items of President Kennedy and in this capacity occupied an office in the National Archives.(*49*) Consequently, although the autopsy materials were in the confines of the building, the National Archives did not have authority or responsibility for them.(*50*)

(120) The next documented transaction involving the materials transferred to Mrs. Lincoln occurred on October 29, 1966, when Mr. Burke Marshall, on behalf of the executors of the John F. Kennedy estate, sent a letter to Lawson B. Knott, the Administrator of the General Services Administration, outlining an agreement for formal transfer of materials related to the autopsy to the U.S. Government.(*51*)

(121) Pursuant to this agreement, which constituted a deed of gift, Burke Marshall met with various representatives of the Government on October 31, 1966, in room 6–W–3 of the National Archives to transfer formally the materials related to the autopsy.(*52*) These materials were contained in a locked footlocker for which Ms. Angela Novello, the personal secretary to Robert F. Kennedy, produced a key.(*53*) Others in attendance for the transfer were William H. Brewster, special assistant to the general counsel, GSA, who unlocked and opened the footlocker; Harold F. Reis, executive assistant to the Attorney General; Robert H. Bahmer, Archivist of the United States; Herman Kahn, Assistant Archivist for Presidential libraries; and James B Rhoads, the Deputy Archivist of the United States.(*54*)

(122) After Brewster opened the footlocker, Marshall and Novello departed.(*55*) Bahmer, Reis, Rhoads, Kahn, and Brewster then re

moved all the material from the footlocker and inspected it.(*56*) The footlocker contained a carbon copy of the letter from Robert F. Kennedy to Burkley on April 22, 1965, and the original letter from Burkley to Lincoln on April 26, 1965, which also listed on the itemized inventory list the materials present at that transfer.(*57*)

(123) Upon inspection, the officials realized that the footlocker did not contain any of the material listed under item No. 9 of the inventory.(*58*) This material included:

1 plastic box, 9 by 6½ by 1 inches, paraffin blocks of tissue sections.
1 plastic box containing paraffin blocks of tissue sections plus 35 slides.
A third box containing 84 slides.
1 stainless steel container, 7 by 8 inches in diameter, containing gross material.
3 wooden boxes, each 7 by 3½ by 1¼ inches, containing 58 slides of blood smears taken at various times during President Kennedy's lifetime.(*59*)

(124) The last date these items were accounted for was the April 26, 1965 transfer of the autopsy materials to Lincoln.

(125) The committee contacted Lincoln to determine what happened to the materials in item No. 9, the missing materials, following their documented transfer to her in April 1965. She informed the committee in an interview and subsequent affidavit that Burkley and Bouck brought her some materials in the spring of 1965 that Dr. Burkley identified as being related to the autopsy of the President.(*60*) She recalled that these materials arrived in a box or boxes, and that within 1 day she obtained a flat trunk or footlocker from the Archives personnel to which she transferred the materials.(*61*) She added that these materials were kept in a security room in her office in the National Archives.(*62*)

(126) Mrs. Lincoln stated that within approximately 1 month, Robert F. Kennedy telephoned her and informed her that he was sending Angela Novello, his personal secretary, to move the footlocker that Dr. Burkley had transferred.(*63*) She believed they wanted the materials moved to another part of the Archives, presumably where Robert F. Kennedy was storing other materials.(*64*) Angela Novello soon came to her office with Herman Kahn, Assistant Archivist for Presidential Libraries, and one or more of his deputies, to take the trunk.(*65*) Lincoln believes she had Novello sign a receipt for the materials, which was Lincoln's routine practice, but she is uncertain where it would be today.(*66*) Lincoln also said that she gave Novello both keys to the trunk.(*67*) She added that the trunk was never opened while it was in her office.(*68*)

(127) Lincoln had no further direct contact with the material, but did state that after the assassination of Robert Kennedy, she began to wonder what happened to it.(*69*) Consequently, she contacted Kenneth O'Donnell, former aide to President Kennedy, to make sure the family was aware of its existence. Mrs. Lincoln said it was her understanding that Mr. O'Donnell then called Senator Edward Kennedy, subsequently calling her back to tell her everything was under control.(*70*)

(128) Because of Lincoln's statement and other reports that Novello produced the key to the footlocker in December 1966, the committee interviewed Novello and also obtained an affidavit.(*71*) She informed

the committee that she had no recollection of handling a footlocker, of possessing a key or keys to such a footlocker, or of handling any of the autopsy materials.(*72*)

(129) The committee also contacted Burke Marshall and Senator Edward Kennedy to determine their knowledge of the missing materials. Senator Kennedy indicated that he did not know what happened to the materials, or who last had custody of them.(*73*)

(130) While Burke Marshall also maintained that he had no actual knowledge of the disposition of the materials, he said it was his speculative opinion that Robert Kennedy obtained and disposed of these materials himself, without informing anyone else.(*74*) Marshall said Robert Kennedy was concerned that these materials would be placed on public display in future years in an institution such as the Smithsonian and wished to dispose of them to eliminate such a possibility.(*75*) Marshall emphasized that he does not believe anyone other than Robert Kennedy would have known what happened to the materials and is certain that obtaining or locating these materials is no longer possible.(*76*)

(131) Since Marshall offered the opinion without any vertification, the committee continued to search for the missing materials and to examine any issue related to the autopsy materials in general. The committee interviewed Harold F. Reis, Executive Assistant to the Attorney General who attended the 1966 transfer of the autopsy materials to the National Archives, as well as Ramsey Clark, the Attorney General in 1966, to determine their knowledge of the missing materials. Clark stated that he initiated the action to acquire the materials transferred in the October 1966 deed of gift pursuant to Public Law 89–318, enacted on November 2, 1965.(*77*) This law provided that the acquisition by the United States of certain items of evidence pertaining to the assassination of President Kennedy had to be completed within 1 year.(*78*) When Clark learned the time limit for obtaining the evidence was approaching, he contacted Robert Kennedy, who was not sympathetic to the Government's need to acquire the autopsy material.(*79*) Rather heated negotiations ensued between Clark and Burke Marshall, the Kennedy family representative, which resulted in the October 29, 1966 agreement constituting the deed of gift.(*80*) Clark stated that he had only requested transfer of the autopsy photographs and X-rays and did not recall any discussions with Robert Kennedy about any other autopsy materials.(*81*) Consequently, the brain and the tissue segments were not an issue in the procedures and negotiations during the October 1966 transfer. The committee could not ascertain if the physicial specimens were ever discussed in the negotiations, what type of approval Robert Kennedy gave for transferring the materials, or what procedure was employed to separate the photographs and X-rays from the material now missing.

(132) The next reference to the missing materials and the other autopsy materials in the custody of the National Archives occurred in 1968. Ramsey Clark, the Attorney General, arranged for an independent review of the autopsy evidence by a group of pathologists—commonly referred to as the Clark panel—as a result of growing skepticism concerning the assassination and Warren Commission investigation.(*82*) In a memorandum to the files on February 13, 1969, Thomas J. Kelley, the Assistant Director of the Secret Service, reflected on the

report of the Clark panel, in which the physicians had commented that the materials they reviewed were included on the inventory list that accompanied the letter from Burkley to Lincoln on April 26, 1965.(*83*) Kelley asserted that this reference to the autopsy materials by the Clark panel physicians was phrased in this manner because the doctors did not have access to the materials listed as comprising item No. 9 on the inventory list.(*84*) The memorandum also noted that after discovering in October 1966 that these items were missing, Archives personnel conducted a careful search but could not determine their location.(*85*)

(133) After discussing the "missing" materials with Harry R. Van Cleve, Jr., General Counsel to the General Services Administration, and agreeing that they should attempt to ascertain their disposition, Kelley said he would contact Dr. Burkley.(*86*) Kelley's memorandum related the following:

> [T]hat after turning all of this material over to Mrs. Lincoln [on April 26] [Burkley] never saw nor heard anything about its disposition, and that he was surprised to hear that it was not with the remainder of the material he turned over to Mrs. Lincoln. After discussing the problem, Dr. Burkley offered to call Mrs. Lincoln. He did this in my presence and Mrs. Lincoln told him that all of the material he turned over to her was placed in a trunk or footlocker; that it was locked, and that to her knowledge it was never opened nor the contents disturbed by her. She said, however, that sometime after its receipt all of the material concerning the assassination, with which she was working, was turned over to Angie Novello, Robert Kennedy's secretary.(*87*)

(134) The memorandum further related that Dr. Burkley told Kelley that Henry Giordano, a former White House driver, was working with Lincoln at the time of the transfer and was then employed in Senator Kennedy's office.(*88*)

(135) After contacting Van Cleve again and advising him of the contact with Burkley, Kelley related the following:

> I * * * further advised him that, in my opinion, we should not contact Giordano. He agreed with this and stated he felt that the inquiry would have to remain as it now stands; that perhaps we were borrowing trouble in exploring it any further, and assured me that the Archivist had made a thorough search of all of the material on hand to make sure that the material in question had not been received by the Archivist at another time or under other circumstances.(*89*)

(136) Thus, the General Services Administration, which oversees the National Archives, decided not to pursue the search for the missing materials any further. The officials involved were apparently satisfied with knowing that the National Archives did not have any responsibility in their disappearance and did not wish to instigate trouble by pursuing any investigation.

(137) In 1971, a controversy, not directly involving the missing materials, arose over the chain of custody of the autopsy materials being stored in the National Archives and who should have access to them.

John Nichols, a pathologist, began court proceedings in the Federal courts, challenging the agreement of October 29, 1966, which contains several restrictions limiting public access to the autopsy materials.(*90*) An issue raised by the suit was whether the Kennedy family ever had any legal right to control the autopsy materials at any time and, consequently, whether any deed of gift from the family which contained restrictions limiting public access could be valid.(*91*)

(138) Both the Federal District Court and the Tenth Circuit Court of Appeals upheld the agreement.(*92*) The court of appeals stated that the "letter of agreement of October 29, 1966 is a valid, binding agreement and that the restrictions imposed thereby are reasonable."(*93*)

(139) The legal department of the Congressional Research Service analyzed the *Nichols* case for the committee. The CRS noted that while the "*Nichols* decision represents only the determination of one circuit. until the question is addressed elsewhere it would seem to represent 'the state of the law.' "(*94*) The CRS stated that until the April 1965 transfer, the autopsy materials were "in Government hands with no intervening transfer of like having occurred."(*95*) It then observed:

> At this point, however, as suggested in the November 4, 1966, Treasury Department memorandum * * * the transfer to the Kennedy family may have been interpreted by some as indication of U.S. recognition of Kennedy family rights in the items so transferred. At some point thereafter, either upon delivery to the Archives in 1965 or upon acceptance of the letter of gift of October 1966, the materials may be regarded as having been either (1) returned to their rightful owner, the United States Government, or (2) donated by properly executed deed of gift to the United States, thereby resulting in relinquishment of Kennedy family rights in them.(*96*)

(140) The CRS ended by saying that two conclusions are irrefutable. First, the autopsy photographs and X-rays are now the property of the United States; and second, the letter of agreement between the Government and the Kennedy family remains enforceable.(*97*)

(141) The committee also interviewed Archives personnel to ascertain their present position regarding the missing materials. In response to committee requests, Trudy H. Peterson, Assistant to the Deputy Archivist of the United States, prepared a written statement.(*98*) In this document, Peterson noted that just prior to the October 1966 transfer of the materials to the Archives, the locked footlocker was brought to the National Archives building, although she does not specify from where.(*99*) This suggests that after Novello allegedly took the material from the office of Mrs. Lincoln, it may have been removed from the Archives building as opposed to only being moved to another part of the building as Mrs. Lincoln speculated.(*100*) Peterson also says that Robert Bahmer, the Archivist of the United States in 1966, believed that sometime before the transfer of the materials as a gift, Herman Kahn, the Assistant Archivist for Presidential Libraries supervised the acceptance of the footlocker, along with several other boxes of Robert Kennedy's materials, for courtesy storage in vault 6–W–3.(*101*) Peterson further stated that Herman Kahn, now dead, may have been the only Archives employee present for the transfer and that no record of delivery is available.(*102*)

(142) In response to a subsequent committee inquiry concerning Herman Kahn, Peterson stated that Kahn dealt with members and representatives of the Kennedy family during 1964–68 on numerous issues, including the courtesy storage of Robert Kennedy materials.(*103*) He was present for the October 1966 transfer and, according to Marion Johnson of the National Archives, was one of the original holders of the combination to the safe cabinet in which the autopsy material was stored.(*104*) Kahn also allegedly accompanied Novello when Novello apparently removed the autopsy materials from the office of Lincoln.(*105*)

(143) In response to another committee request, the Office of Presidential Libraries conducted a thorough but unsuccessful search of the office files for 1965–66 for documentation regarding the transfer of the autopsy materials to the physical custody of the Archives.(*106*) Additionally, two members of the Presidential Libraries staff who worked under Herman Kahn at that time stated in interviews and affidavits that they could not recall any pertinent details concerning the autopsy materials.(*107*) The staff of the John F. Kennedy Library also reviewed their files, with negative results.(*108*) Further, one Archives employee, Marion Johnson, Archivist, Office of the National Archives, National Archives and Records Service, remembered that he became aware of the footlocker containing the autopsy materials shortly before the October 31, 1966 transfer, but was not aware of its contents until after the transfer.(*109*) Additionally, at the request of the committee, on July 18, 1978, Clarence Lyons and Trudy Peterson conducted a thorough but unsuccessful search of the security storage vault for the tissue sections and the container of gross material.(*110*)

(144) Given these efforts and findings, it appears that Kahn and Novello removed the autopsy material from the office of Mrs. Lincoln shortly after April 1965. The material was then either kept in another part of the Archives, probably a Robert Kennedy courtesy storage area, or removed from the building to a location designated by Robert Kennedy. The circumstantial evidence would seem to indicate that Robert Kennedy then decided to retain possession of all physical specimen evidence and transferred only the autopsy photographs and X-rays to the Government. The committee has not been able to verify how or when the item No. 9 materials were removed from the other autopsy materials or what subsequently happened to them.

Part IV. Additional Efforts To Acquire the Missing Materials

(145) After failing to determine the fate of the missing materials by tracing that chain of custody, the committee investigated the possibility that someone had placed the missing autopsy items, all of which were physical specimens taken from the body of President Kennedy, in the final grave on reinterment, on March 14, 1967. (*111*) The persons contacted who were present for the ceremony could not recall any additional package or material being placed in the grave. The Superintendent of Arlington National Cemetery from 1951 to 1972, John Metzler, informed the committee that he attended the burial of the President and the reinterment.(*112*) At the time of burial, the coffin was placed in a "Wilbur" vault, which has a lid and vault that op-

erate on a tongue and groove system. Tar is placed on the points of contact of the grooves to insure a tight fit and permanent seal.(*113*) Metzler witnessed the lowering of the lid and the sealing of the vault. (*114*) and believed that the only method to open the vault subsequently would be to break the lid on the main portion of the vault. (*115*)

(146) Metzler supervised the reinterment in 1967 and was present at all phases of the transfer: from the opening of the old site through the transfer by crane of the vault to the closing of the new site(*116*) Metzler said there was no way anyone could have placed anything in the coffin or vault during the transfer without his seeing it.(*117*) Metzler also said that nothing could have been placed in the vault since 1963 because there was no indication of damage to the vault indicating any disturbance.(*118*) Metzler stated further that no one placed anything in the new or old gravesite besides the vault. (*119*)

(147) In the course of its investigation the committee contacted numerous other people in an unsuccessful attempt to locate the missing materials. They included:

1. Dr. James J. Humes, autopsy pathologist;
2. George Dalton, former White House aide and assistant to Mrs. Lincoln at the National Archives;
3. Edith Duncan, administrative assistant to Robert Bouck, Protective Research Section, Secret Service;
4. Joseph D. Giordano, former White House aide and assistant to Mrs. Lincoln at the National Archives;
5. Frank Mankiewicz, former assistant to Robert F. Kennedy;
6. Harry Van Cleve, former General Counsel of the General Services Administration;
7. Lawrence O'Brien, former aide to President Kennedy;
8. David Powers, former aide to President Kennedy;
9. Ken Fienberg, aide to Senator Edward Kennedy;
10. P. J. Costanzo, Superintendent of Arlington National Cemetery;
11. Dr. James Boswell, autopsy pathologist;
12. Dr. Pierre Finck, autopsy pathologist;
13. Adm. George Galloway, commanding officer of the National Naval Medical Center in 1963;
14. Capt. John H. Stover, commanding officer of the U.S. Naval Medical School in 1963;
15. Bruce Bromley, former Justice Department attorney who was called briefly from private practice to serve as counsel to the Clark panel;
16. Carl Eardley, former Justice Department official;
17. Harold Reis, former Justice Department official;
18. Sol Lindenbaum, former Justice Department official;
19. National Archives personnel; and
20. Thomas J. Kelley, Assistant Director of the U.S. Secret Service.

Part V. Conclusions

(148) Despite these efforts, the committee was not able to determine precisely what happened to the missing materials. The evidence indicates that the materials were not buried with the body at reinterment. It seems apparent that Angela Novello did remove the footlocker con-

taining the materials from the office of Mrs. Lincoln at the direction of Robert Kennedy, and that Herman Kahn had knowledge of this transaction. After the removal from Lincoln's office, Robert Kennedy most likely acquired possession of or at least personal control over these materials. Burke Marshall's opinion that Robert Kennedy obtained and disposed of these items himself to prevent any future public display supports this theory.

(149) There are at least two possible reasons why Robert Kennedy would not have retained the autopsy photographs and X-rays. First, the only materials retained were physical specimens from the body of his brother: Tissue sections, blood smear slides, and the container of gross material. He may have understandably felt more strongly about preventing the misuse of these physical materials than the photographs and X-rays. Second, the Justice Department under Ramsey Clark pushed hard to acquire the photographs and X-rays but did not request the physical materials. Even if Robert Kennedy had wished to prevent the release of all the autopsy materials, he was not in a position to do so when confronted with Justice Department demands.

(150) Consequently, although the committee has not been able to uncover any direct evidence of the fate of the missing materials, circumstantial evidence tends to show that Robert Kennedy either destroyed these materials or otherwise rendered them inaccessible.

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(*2*) Ibid.

(*3*) Ibid., letter from Rowley to Sanders, p. 1.

(*4*) Memorandum from James K. Fox, photographer, intelligence division, U.S. Secret Service, Feb. 16, 1967 (JFK Document No. 014879).

(*5*) Ibid.

(*6*) See reference 1, the letter from Rowley to Sanders, p. 2.

(*7*) See reference 4.

(*8*) See reference 1, letter from Rowley to Sanders, p. 2.

(*9*) Id. at p. 2.

(*10*) Id. at p. 3.

(*11*) Id. at p. 2.

(*12*) Ibid.

(*13*) Id. at p. 1.

(*14*) FBI report, Nov. 25, 1963, Dallas, Tex., file No. DL 89–43, p. 150–A.

(*15*) FBI memorandum, June 14, 1964, Dallas, Tex., entitled "Lee Harvey Oswald," pp. 2 and 5.

(*16*) Id. at p. 5.

(*17*) FBI report, Nov. 25, 1963, Dallas, Tex., file No. DL 89–43, p. 150–A.

(*18*) Memorandum for file from G. G. Burkley, M.D., Nov. 27, 1963 (JFK Document No. 002504).

(*19*) Ibid.

(*20*) Ibid.

(*21*) Ibid.

(*22*) Ibid.

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(*24*) Autopsy protocol of President John F. Kennedy, U.S. Naval Medical Center, Bethesda Naval Hospital, Bethesda, Md., A63–272, Nov. 22, 1963.

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(26) Ibid.
(27) Affidavit of George G. Burkley, House Select Committee on Assassinations, Nov. 28, 1978, p. 3 (JFK Document No. 013416).
(28) Supplemental autopsy report of President John F. Kennedy, Bethesda Naval Hospital, A63–272, Dec. 6, 1963.
(29) Ibid. These sections were taken from tissue areas surrounding the missile path. The brain was not, however, sectioned coronally, a normal forensic autopsy procedure.
(30) Affidavit of Chester H. Bowers, Dec. 4, 1978, House Select Committee on Assassination, p. 4 (JFK Document No. 014834). See also outside contact report of Chester Boyers, Apr. 25, 1978, House Select Committee on Assassinations (JFK Document No. 013614).
(31) Affidavit of Chester H. Boyers, Dec. 4, 1978, House Select Committee on Assassinations, p. 4 (JFK Document No. 014834) : outside contact report of John H. Stover, May 11, 1978, House Select Committee on Assassinations (JFK Document No. 013615).
(32) Outside contact report of John H. Stover, Nov. 28, 1978, House Select Committee on Assassinations (JFK Document No. 013315).
(33) Affidavit of George G. Burkley, Nov. 28, 1978, House Select Committee on Assassinations, p. 3 (JFK Document No. 013416).
(34) Ibid.
(35) Secret Service memorandum from Robert I. Bouck to the chief of the Protective Research Service, Apr. 26, 1965 (JFK Document No. 002504).
(36) Letter from Robert F. Kennedy to George G. Burkley, U.S. Senate letterhead, Apr. 22, 1965.
(37) Ibid.
(38) See reference 1, letter from Rowley to Sanders, p. 3.
(39) Ibid.
(40) Letter from George G. Burkley to Mrs. Evelyn Lincoln, White House letterhead, with attached inventory list, White House letterhead, Apr. 26, 1965.
(41) Ibid.
(42) Ibid.
(43) See reference 40, letter from Burkley to Lincoln.
(44) Ibid.
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(55) Ibid.
(56) Ibid.
(57) Id. at p. 2.
(58) Ibid.
(59) See reference 40, letter from Burkley to Lincoln.
(60) Staff interview of Evelyn Lincoln, July 5, 1978, House Select Committee on Assassinations (JFK Document No. 009823) : affidavit of Evelyn Lincoln.

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(*62*) Ibid.
(*63*) Id. at p. 3.
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SECTION IV. AUTHENTICITY

Part I. Introduction

(151) At the outset of the investigation into the issues concerning the medical evidence, the committee determined that experts should examine the autopsy photographs and X-rays for two purposes: First, to establish or repudiate their authenticity (whether they are photographs and X-rays taken of President Kennedy at the time of his autopsy); and second, to determine whether anyone altered or "doctored" them. Such examinations were essential to the analysis of consultants whom the committee charged with interpreting the medical evidence, since their conclusions were to be based principally on the evidence derived from the autopsy photographs and X-rays.

(152) The committee also wanted these examinations conducted as one way to resolve the varying accounts of where the wounds to the President were situated. If the photographs and X-rays were proven to be authentic and unaltered, then any account of the President's wounds which differed from what they showed would be incorrect. Conversely, if the photographs or X-rays or both were proven to be fake or altered, they might then provide a clue which would assist in determining which account of the injuries was correct.

(153) The various accounts of the nature of the wounds to the President differ significantly. As revealed in section 2 of this volume, "Performance of the Autopsy," eyewitness descriptions of the wounds, as described by staff at Parkland Memorial Hospital, differed from those in the autopsy report, as well as from what appears in the autopsy photographs and X-rays.(*1*) Further, the reports of FBI agents Sibert and O'Neill referred to "surgery" of the head area being evident when the body arrived for the autopsy,(*2*) yet no surgery of the head area was known to have been performed. Finally, the Clark panel—the panel of experts assembled in 1968 by then-Acting Attorney General Ramsey Clark—said the entrance wound in the President's head was 10 centimeters (almost 4 inches) higher than was described by the autopsy pathologists.(*3*)

(154) Critics of the Warren Commission's medical evidence findings have found on the observations recorded by the Parkland Hospital doctors.(*4*) They believe it is unlikely that trained medical personnel could be so consistently in error regarding the nature of the wounds, even though their recollections were not based on careful examinations of the wounds.

(155) In disagreement with the observations of the Parkland doctors are the 26 people present at the autopsy. All of those interviewed who attended the autopsy corroborated the general location of the wounds as depicted in the photographs; none had differing accounts.(*5*) Further, in 1967 the autopsy pathologists, Drs. Humes, Boswell, and Finck, as well as Dr. James H. Ebersole, the acting chief

of radiology, and one of the autopsy photographers, John Thomas Stringer, viewed the autopsy photographs or X-rays, or both, and verified them as accurately portraying the wounds of President Kennedy.(*6*)

(156) Aside from using scientific analysis to determine authenticity and verify that no alterations had been made, the committee also considered what reasonably might have happened. It assumed that if the Parkland doctors are correct, particularly with respect to the gaping hole in the back of the President's head, then it would mean: (1) The autopsy photographs and X-rays had been doctored to conceal this hole; (2) the body itself had been altered, either before its arrival at Bethesda or during the autopsy so that the hole was not obvious in the photographs and X-rays; or (3) the photographs and X-rays were not of President Kennedy. Further, if the Parkland doctors are correct, then the autopsy personnel are incorrect and either lying or mistaken.

(157) It did not seem plausible to the committee that 26 persons would be lying or, if they were, that they could provide such a consistent account of the wounds almost 15 years later. Second, it is less likely that the autopsy personnel would be mistaken in their general observations, given their detailed and thorough examination of the body. Consequently, it seems reasonable to assume that the autopsy personnel were correct.

(158) If the autopsy doctors are correct, then the Parkland doctors are incorrect and either lying or mistaken. It does not seem probable that they are lying, because it would be difficult to maintain a conspiracy of lying among the approximately 14 persons involved for 15 years. On the other hand, it does seem possible, that the Parkland personnel could be mistaken, given their cursory observations of the wounds, the brief period of time they examined the President, and their function at the time: To administer emergency procedures to save the life of the President, rather than to document the nature and location of his wounds.

(159) The theoretical possibility also exists that both Parkland and the autopsy personnel are correct in their observations and that the autopsy photographs and X-rays accurately reflect the observations of the autopsy personnel. This could have occurred if someone had altered the body while in transit from Parkland Memorial Hospital to Bethesda Naval Hospital. This possibility however, is highly unlikely or even impossible. Secret Service agents maintained constant vigilance over the body from Parkland to Bethesda and stated that no one alter the body.(*7*) Second, if such alterations did occur, it seems likely that the people present at the autopsy would have noticed them; in which case they are now lying about their observations. As stated previously, this does not appear likely.

(160) A further complicating factor could be the possibility that all persons are somewhat mistaken in their observations or their memories of them and that the autopsy photographs and X-rays do not portray the wounds in sufficient detail to resolve the matter. This possibility would not, however, account for the major disagreement between the Parkland and autopsy personnel: A large, gaping wound in the rear of the head.

(161) Consequently, without considering any scientific analysis to evaluate authenticity and any possibility of the autopsy photographs and X-rays having been altered, it appears more probable that the observations of the Parkland doctors are incorrect.

Part II. Procedures Employed in Examining the Autopsy Photographs and X-rays

(162) As mentioned, the committee did, however, subject the autopsy photographs and X-rays to scientific analysis. These examinations by the committee's consultants established the inaccuracy of the Parkland observations. The experts concluded that the autopsy photographs and X-rays were authentic and unaltered, confirming the observations of the autopsy personnel and providing additional support for the conclusions of the medical consultants.

(163) From the beginning, the committee's investigative approach in the medical evidence area was to assume nothing about the authenticity of the photographs and X-rays. To conduct the analyses to determine whether the photographs and X-rays could be identified as being of the President and whether they were altered, the committee retained experts in the following areas: Anthropology, forensic dentistry, photographic interpretation, forensic pathology, and radiology.

(164) Anthropologists studied the autopsy photographs in an attempt to verify the consistency of the subject matter, specifically, whether the photographs of the rear of the head could be identified as being consistent with photographs of other views of the head in which the President's facial features are recognizable. The anthropologists determined that the posterior photographic views of the head are identifiable as part of the same head as is visible in the side or front views and hence concluded that the posterior views are photographs of President Kennedy.(*8*)

(165) The anthropologists also studied the autopsy X-rays in comparison with premortem X-rays of President Kennedy, obtained from the Kennedy Library in Waltham, Mass.(*9*) The premortem X-rays had been collected by the Library from a number of different sources (*10*) over a period of a couple of years.(*11*)

(166) By studying the premortem X-rays, the anthropologists were able to observe a number of unique anatomic characteristics whose absence or presence among the autopsy X-rays would, in their opinion, be determinative of whether the two sets of X-rays were of the same person.(*12*) Some of the anatomic characteristics they noted included: turcica, cranial sutures, vascular grooves and the air cells of the mastoid bone.(*13*) The anthropologists were able to observe enough of these anatomical features among the autopsy X-rays to conclude that the autopsy and premortem X-rays were taken of the same individual. (*14*)

(167) The committee also retained an expert in dental comparison, Dr. Lowell Levine, a forensic odontologist(*15*) experienced in the identification of victims of unnatural death, including, for example, individuals killed in airplane crashes. Dr. Levine also compared premortem X-rays with the autopsy X-rays. He was confident in his conclusion that the three autopsy skull X-rays are identifiable as being

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of the same person as the premortem dental X-rays of President Kennedy.(*16*) Dr. Levine presented his conclusions in his public testimony before the committee on September 7, 1978.

(168) Once it was determined that the autopsy photographs and X-rays were of the President, the committee used relevant scientific expertise to look for evidence of alteration. Different techniques were used for studying the photographs and X-rays.

(169) Members of the committee's photographic panel carefully studied the autopsy photographs, negatives and transparencies.(*17*) There were a number of features the panel members noticed that were relevant to the issue of authenticity, including: emulsion numbers on the films, a pentagonal shaped light spot, and a number of sets of photographic stereo pairs.(*18*)

(170) On April 8, 1978, David Eisendrath contacted Kodak to determine what information, if any, could be gleaned from the numbers visible on the autopsy films.(*19*) David Greenlaw responded for Kodak on June 8, 1978, providing information that indicated the numbers matched emulsion batches produced in 1963 and, in one film type, an operator number which was discontinued in 1969.(*20*)

(171) Several stereo pairs which the panel observed among the autopsy photographs were suitable for stereoscopic viewing. A stereo pair is created when the photographer takes two pictures of a particular scene with either the camera or the object in slightly different position. According to Scott,(*21*)

> A pair of stereo pairs enables one to see the scene in three-dimensions; stereo pictures add depth to the perception of the photographed scene in much the same way as a pair of human eyes, separated from one another in space, can perceive depth.

(172) Also according to Scott, stereoscopic viewing heightens the ability of the human eye to perceive differences between the two photographs of a stereo pair:

> To successfuly avoid detection of picture alteration requires that each picture of a pair of pictures be altered identically, which is essentially impossible, particularly with a stereo pair * * * Any nonidentical alteration of the pictures of a pair is readily noted when pairs are viewed stereoscopically or microscopically.(*22*)

(173) Fortunately, the autopsy photographer had taken two or more pictures of each scene, some of which were stereo pairs because of slight differences.(*23*)

(174) Scott believed there were pairs of autopsy photographs that provided sufficient stereoscopic viewing quality to permit the conclusion of authenticity, including: The back of the head (Nos. 42 and 43), top of the head (Nos. 32 and 33, and Nos. 34 and 37), the large skull defect (Nos. 44 and 45), and the head from the front right (Nos. 26 and 28).(*24*)

(175) Scott said that in these he "* * * did not find any indication or evidence that any of the pictures were altered * * *" and thus concluded that the photographs for which there were stereo pairs "* * * are authentic photographs."(*25*)

(176) Calvin McCamy, a photogrammetrist, testified in public session of the select committee on September 7, 1978, on behalf of the photographic evidence panel on the issue of the authenticity of autopsy photographs. He agreed with Scott's assessment of the authenticity of the stereophotographic views and added that in his analysis, he found additional stereo pairs permitting the additional conclusions that the photographs of the back wound (Nos. 38 and 39) and of the anterior neck wound (Nos. 40 and 41) are authentic.(*26*)

(177) Dr. Gerald McDonnel examined the premortem and postmortem X-rays for evidence of alteration.(*27*) He reported that an alteration of the images "* * * should be readily * * *" discernible in a number of ways:

a. Observation of a difference in density of the images,
b. Discontinuity of anatomical structures,
c. Alteration of continuity of an abnormal pattern, or
d. Production of an image which is not anatomical or an image of an impossible pathologic process.(*28*)

(178) Dr. McDonnel concluded that "[t]he radiologic images both ante mortem and post mortem, have not been altered in any fashion * * *" except for two small areas of thermal damage and "minor * * * discoloration of the images due to incomplete processing of the film * * *" Neither of these conditions affected the conclusion that the images were not altered "* * * to provide a false image * * *" nor "* * * to produce misinformation and therefore improper conclusions."(*29*)

For further explanation of the authenticity of the autopsy photographs and X-rays, see paragraphs 512–604 of the Report of the Photographic Evidence Panel.

Part III. Conclusions

(179) From the reports of the experts' analyses of the autopsy photographs and X-rays, the evidence indicates that the autopsy photographs and X-rays were taken of President Kennedy at the time of his autopsy and that they had not been altered in any manner.

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(*6*) Blank letterhead memorandum, Jan. 26, 1967, from James J. Humes, M.D., J. Thornton Boswell, M.D.. pursuant to a Department of Justice request to examine the autopsy photographs and X-rays; blank letterhead memorandum entitled, "Report of Inspection by Naval Medical Staff on November 1, 1966. at National Archives of X-Rays and Photographs of Autopsy of President John F. Kennedy," signed James J. Humes, M.D., J. Thornton Boswell, M.D., John H. Ebersole, M.D., and John T. Stringer, Nov. 10, 1966.

(7) Outside contact report, William Greer, Dec. 4, 1978, House Select Committee on Assassinations (JFK Doc. No. 014880) ; Outside contact report, Roy H. Kellerman, Dec. 1, 1978 (JFK Doc. No. 013394).

(8) John F. Kennedy Autopsy Authentication, a report to the House Select Committee on Assassinations by Ellis R. Kerley, Ph. D., and Clyde C. Snow, Ph. D., Feb. 9, 1979, pp. 1–2.

(9) Authentication of John F. Kennedy Autopsy Radiographs and Photographs, a report to the Select Committee on Assassinations, U.S. House of Representatives, by Ellis R. Kerley, Ph. D., and Clyde C. Snow, Ph. D., Feb. 28, 1979, p. 1, Lowell J. Levine, D.D.S., "Identification of the Skull X-ray Films Taken During the Autopsy of President John F. Kennedy," Sept. 7, 1978, p. 5. Levine's report is contained in volume I, pp. 153–176, of the hearings before the House Select Committed on Assassinations, 95th Cong., 2d sess. (Washington, D.C.: U.S. Government Printing Office, 1979).

(10) Some of the premortem dental films were supposed to have been taken by Robert D. Morris, D.D.S., 140 East 54th St., New York, N.Y. In a telephone interview between Dr. Levine and Dr. Morris, Dr. Morris confirmed that he had taken X-rays of the President on the date indicated on the X-ray films. See reference 9, Levine report, pp. 9, 16.

(11) Id. at p. 5.

(12) See reference 8, Kerley and Snow report, pp. 1–2.

(13) Id. at pp. 2–4.

(14) Id. at p. 4.

(15) See reference 9, Levine report, pp. 1–4, for a discussion and description of the function of a forensic odontologist (dentist).

(16) Id. at. p. 20.

(17) Letter from Frank Scott to House Select Committee on Assassinations, Aug. 15, 1978. Testimony of Calvin S. McCamy, Sept. 7, 1978, Hearings Before the Select Committee on Assassinations, U.S. House of Representatives, 95th Cong., 2d sess. (Washington, D.C.: U.S. Government Printing Office. 1979), vol. I, p. 176 (hereinafter referred to as McCamy testimony, Sept. 7, 1978, I HSCA–JFK hearings, 176).

(18) Letter to Michael Goldsmith, from David B. Eisendrath, June 10, 1978, House Select Committee on Assassinations (JFK Doc. 009129) ; letter to Jane Downey from David B. Eisendrath, Oct. 23, 1978, House Select Committee on Assassinations, (JFK Doc. No. 012845) ; see reference 17, McCamy testimony, Sept. 7, 1978, I HSCA–JFK hearings, 176.

(19) Letter from David B. Eisendrath, to David S. Greenlaw, director, Corporate Commercial Affairs Eastman Kodak Co., Apr. 8, 1978, House Select Committee on Assassinations (JFK Doc. No. 012845).

(20) Letter from David S. Greenlaw, assistant vice president, Corporate Commercial Affairs, Eastman Kodak Co., to David B. Eisendrath, June 8, 1978, House Select Committee on Assassinations (JFK Doc. No. 009129).

(21) Letter to Jane Downey from Frank Scott, Aug. 15, 1978, House Select Committee on Assassinations p. 1.

(22) Id. at p. 2.

(23) Id. at p. 1.

(24) Id. at p. 4.

(25) Id. at p. 3.

(26) McCamy testimony, Sept. 7, 1978, I HSCA–JFK hearings. pp. 176–179.

(27) Report of G. M. McDonnell, M.D., concerning observation, analysis, and conclusions in connection with radiographic images and enhanced images attributed to President John F. Kennedy, Aug. 4, 1978. See addendum C of the Forensic Pathology Panel Report (sec. V of this volume) for this document.

(28) Report of G. M. McDonnel, M.D., Mar. 8, 1978, p. 4. See addendum C of the Forensic Pathology Report (sec. V of this volume) for this document.

(29) Ibid.

(180) ADDENDUM A

Authentication of John F. Kennedy Autopsy Radiographs and Photographs

Final Report to the Select Committee on Assassinations, U.S. House of Representatives—March 9, 1979

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BOARD OF ANTHROPOLOGY CONSULTANTS, PHOTOGRAPHIC PANEL, HOUSE SELECT COMMITTEE ON ASSASSINATIONS

Various conspiracy theorists have questioned the authenticity of the post mortem radiographs and photographs taken during the autopsy of President John F. Kennedy at the U.S. Naval Hospital on November 22, 1963. The anthropology consultants were asked by the committee to examine these materials and, if scientifically possible, determine whether or not they were indeed those of the late President. Our approach to this problem was through the comparison of the post mortem X-rays and photographs with those known to have been taken prior to his death.

AUTHENTICATION OF X-RAYS

Introduction

It is a well-established fact that human bone structure varies uniquely from one individual to another. The bones not only differ in their overall size and shape, but also in their minute structural details so that the total pattern of skeletal architecture of a given person is as unique as his or her fingerprints. Forensic anthropologists have long made use of this fact in establishing the positive identification of persons killed in combat, aircraft accidents, or other disasters, by comparing X-rays taken before death with those of the unidentified body taken after death.

Of course, just as no two individuals are alike, no two X-rays of the same bones of the same person are ever exactly alike because there is always some variation in the positioning of the subject, the X-ray technique, and the processing of the film. The skeleton also undergoes some remodeling throughout life, so that a certain amount of variation in detail is to be expected in films of the same individual taken a few years apart. However, with experience, these technical and age variations can be taken into account so that, given a pair of reasonably good films of the same person, posed in the same way, a positive identification can nearly always be made even if the X-rays were made many years apart by different technicians using different equipment.

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In the following analysis we have applied this method in comparing the post mortem X-rays said to be those of President Kennedy with clinical films known to have been taken prior to his death.

Materials examined

Both ante mortem and post mortem X-rays were examined were from the JFK assassination materials created by the U.S. National Archives in Washington, D.C.

The autopsy X-rays bear the case No. 21296 of the U.S. Naval Hospital in Bethesda, Md. They include front and side views of the skull as well as a series of overlapping views of the torso and upper legs. There are also several X-rays of three skull fragments reportedly found in the Presidential automobile after the assassination.

In addition to the autopsy X-rays, the Archives collection includes three sets of clinical X-rays of President Kennedy taken at various times prior to his death. Two of these sets were made by personal physicians who treated the then-Senator Kennedy for an upper respiratory illness in August 1960. The earliest, dated August 14, bears the case No. 202617 of Dr. Stephen White, 521 Park Avenue, New York. The second set was made 3 days later at the clinic of Drs. Groover, Christie, and Merritt, of 1835 I Street NW., Washington, D.C., and bears the case number 336042. Dr. White's series consists of a side view of the head and a routine chest plate. Those from the Groover, Christie, and Merritt Clinic, include side and front views of the skull. The third set of ante mortem X-rays were taken at the U.S. Naval Hospital in Bethesda on March 14, 1962, while President Kennedy was undergoing treatment for a back complaint. These X-rays consist of front and side views of the lower spine and pelvis. Hereafter these three sets of ante mortem X-rays will be referred to as the "White," "Groover," and "Navy" films, respectively.

We first compared the "Groover" and "White" ante mortem X-rays of the skull with the autopsy films.

In the front views, we found that the outlines of the frontal sinuses of the autopsy X-rays were virtually superimposable on those shown in the clinical X-rays. The sinuses, which are lobular air pockets inside the bone that forms the forehead, vary uniquely in size and shape from one person to another. This variability is seen particularly in the outlines of their upper margin which typically cast a set of scallop-like shadows on the X-ray. This scallop pattern is so individually distinctive that forensic anthropologists have termed them "sinus prints." For many years, law courts throughout the world have accepted the matching of ante mortem and post mortem X-rays of the sinuses as evidence for the positive identification of unknown bodies. In the present case, the similarity in shape of the sinus print patterns in the ante mortem and post mortem films is sufficient to establish that they are of the same person on the basis of this trait alone.

In addition to the sinus prints, several other strikingly similar anatomical features were observed in the front view X-rays. For example, the nasal septum—the thin wall of cartilage and bone that separates the nostrils—was deviated to the same side and to an identical degree in ante mortem and post mortem films. Also the outlines of the bony rims of the orbits of the eyes were nearly identical. The very slight variations observed in these three features—sinus pattern, nasal

septum, and orbital margins—are the result of minor differences in the way the X-rays were taken.

The profile views of the skull in the White and Groover films were next compared to the autopsy X-rays. Again, a number of almost identical anatomical features were observed in the ante mortem and post mortem films. For example, the outlines of the *sella turcica* (the saddleshaped depression in the base of the skull), the complex patterns of the cranial sutures (the joints uniting the bones of the skull), and location and arrangement of the vascular grooves (the shallow depressions on the inner surface of the skull which mark the course of blood vessels), were the same. There was also nearly exact duplication of the honeycomb-like air cells of the mastoid bone.

The chest X-ray taken by Dr. White in 1960, was next compared to those of the upper torso taken at autopsy. Again, a number of identical features were noted in both sets of films. Among these were the outlines of the dorsal spines of the thoractic vertebrae. (These spines are the bony projections that are visible just under the skin along the center of the back.) In X-rays these spines project a vertical series of small shadows of varying sizes and shape that, like the architectural features of the skull discussed above, are virtually unique in each individual. In shape these shadows may range from almost perfect circles to irregular trapezoids. They vary not only from one individual to the next, but from one vertebra to another in the same individual so that the series of a dozen or so of these spines usually visible in a standard chest film, form a combination of shapes distinctive for each individual. Allowing for slight distortions due to position and technique, this series of spines can be considered identical in the antemortem and postmortem films.

In addition to the similar pattern of dorsal vertebrae spines, a number of other features common to both sets of films were observed. For example, the size and shape of the medial ends of the clavicula (collar bones) were identical, as was the pattern of ossification of the costochondral junctions of the first ribs. Numerous details in the form and trabecular structure of the ribs could also be matched from one set of films to the other, particularly in the left eighth and ninth ribs which were especially well-defined in both films.

The autopsy radiographs of the lower torso, including the pelvis and upper legs, could be compared to the ante mortem "Navy" films taken in 1962. These also show an impressive number of osseous details in common. Of particular interest was the right transverse process of the fifth lumbar vertebra. In both sets of films it was displaced upward in a manner suggestive of a congenital malformation or an old, ununited fracture.

To summarize, the skull and torso radiographs taken at autopsy match the available ante mortem films of the late President in such a wealth of intricate morphological detail that there can be no reasonable doubt but that they are indeed X-rays of John F. Kennedy and no other person.

AUTHENTICATION OF AUTOPSY PHOTOGRAPHS

The issue

Among the JFK assassination materials in the National Archives is a series of negatives and prints of photographs taken during autopsy. The deficiencies of these photographs as scientific documentation of a

forensic autopsy have been described elsewhere (Wilbur, 1968). Here it is sufficient to note that:

1. They are generally of rather poor photographic quality.
2. Some, particularly closeups, were taken in such a manner that it is nearly impossible to anatomically orient the direction of view.
3. In many, scalar references are entirely lacking, or when present, were positioned in such a manner to make it difficult or impossible to obtain accurate measurements of critical features (such as the wound in the upper back) from anatomical landmarks.
4. None of the photographs contain information identifying the victim; such as his name, the autopsy case number, the date and place of the examination.

In the main, these shortcomings bespeak of haste, inexperience and unfamiliarity with the understandably rigorous standards generally expected in photographs to be used as scientific evidence. In fact, under ordinary circumstances, the defense could raise some reasonable and, perhaps, sustainable objections to an attempt to introduce such poorly made and documented photographs as evidence in a murder trial. Furthermore, even the prosecution might have second thoughts about using certain of these photographs since they are more confusing than informative. Unfortunately, however, they are the only photographic record of the autopsy.

Not all the critics of the Warren Commission have been content to point out the obvious deficiencies of the autopsy photographs as scientific evidence. Some have questioned their very authenticity. These theorists suggest that the body shown in at least some of the photographs is not President Kennedy, but another decedent deliberately mutilated to simulate a pattern of wounds supportive of the Warren Commission's interpretation of their nature and significance. As outlandish as such a macabre proposition might appear, it is one that, had the case gone to trial, might have been effectively raised by an astute defense anxious to block the introduction of the photographs as evidence. In any event, the onus of establishing the authenticity of these photographs would have rested with the prosecution.

With the above considerations in mind, HSCA requested the anthropology consultants to examine the questions surrounding the authenticity of the JFK autopsy photographs. It should be emphasized that our inquiry was limited to determining the identification of the victim shown in the photographs. Other aspects of authentication concerning the possibility of technical alterations of the negatives and prints fall within the purview of other photographic experts. Also, we did not concern ourselves with the description and location of the wounds or of their nature and significance, since this was clearly the responsibility of the forensic pathology consultants.

MATERIALS EXAMINED

Post mortem

According to inventories (Humes et al., 1966, Carnes et al., 1968) of the JFK autopsy materials in the National Archives, the collection includes a total of 52 exposed negatives. These may be divided into two series: (1) 25 4 by 5 inch black and white, and (2) 27 4 by 5 inch color negatives. The entire series is numbered sequentially beginning

with the black-and-white series: Black and white; No. 1 to No. 25; color; No. 26 to No. 52.

Examination of prints of the total series revealed that most of the black-and-white negatives are virtually duplicates, in subject and view, to corresponding negatives in the color series. Therefore, our detailed analysis was limited to an examination of the latter. These items were in the form of 8 by 10-inch enhanced prints especially prepared for HSCA by Kodak Laboratories. Each print was identified by its original negative number. The entire series is described by subject in table I.

Ante mortem

In order to compare the facial features of the autopsy subject with John F. Kennedy, a number of ante mortem photographs of President Kennedy were examined. These were also furnished by the National Archives. Two of these (National Archives Accession Nos. 79–AR–6378G and 79–AR–8008K) were selected for a more detailed comparison since they show a full profile of the subject with his mouth slightly open, and in pose and camera angle, correspond almost exactly with the full profile view of autopsy photograph No. 29.

Analysis

To examine the autopsy photographs from the standpoint of identification of the victim we have considered two hypotheses:

1. That the subject shown in the photographs was not John F. Kennedy, but an unknown victim with a strong resemblance to the assassinated President.
2. That the victim in the photographs, in which the facial features are clearly visible, is indeed John F. Kennedy, but the body in which the face is not shown (particularly photographs No. 32 thru No. 37 which document the location of the critical wounds of the back and head) is that of another, unknown, individual.

In order to test the first hypothesis, it was necessary to compare the facial features of the victim in the autopsy photographs with antemortem photographs of President Kennedy. This comparison was made on the basis of both metric and morphological features.

In making this comparison, it was first noted that there were no gross inconsistencies between the autopsy victim and general physical characteristics of John F. Kennedy. The victim is a well-nourished, dark-haired, middle-aged, white male who appears to be of northern European ethnic stock.

Our metric analysis was based on a comparison of autopsy photograph No. 29 with the two ante mortem photographs (79–AR–6378G and 79–AR–8008K) selected from the National Archives series. The exact date of the ante mortem photographs was not determined, but both were made during the Kennedy Presidency and, therefore, do not antedate the autopsy photograph by more than 3 years. All three photographs show the subject in nearly perfect facial profile; Autopsy No. 29 and 79–AR–8008K are left profile and 79–AR–6378G is a right profile photograph.

A series of 11 facial measurements were taken on each photograph. These measurements are defined in table II. Measurements were recorded to the nearest 1 mm and made from 8 by 10-inch prints.

Three sets of measurements were made on each photograph, and the means were used to calculate the 10 indices given in table III. The arrangement of President Kennedy's hair made it impossible to take Physiognomic Face Height (No. 1) in photographs 79–AR–6378G; otherwise, all the 11 measurements could be taken on each photograph.

As shown in table III, the index values of the autopsy photograph and the two ante mortem photographs correspond very closely. For further comparison, the mean of the ante mortem indices was compared with the post mortem values (represented by a single value in indices 1, 4, and 7 which as based on measurement No. 1 that could not be taken on 79–AR–6378G). The deviation between the ante mortem and post mortem means range from 0.3 to 4 and the average deviation is 2.82 (table III). This small deviation can be accounted for by a combination of several factors such as the fact that in the autopsy the subject is supine while he is standing erect in the ante mortem photographs, and gravitational effects would cause some alteration of the facial features. The facial measurements would also be influenced by post mortem alterations and the effects of the massive cranial trauma. In short, the metric similarities, as expressed by facial indices are insignificant.

In addition to the strong metric similarities between autopsy photograph No. 29 and the two ante mortem photographs, a number of identical morphological features can be observed. Our examination of morphological similarities was not limited to the three photographs from which the measurements were taken, but included comparisons between the other autopsy photographs which show the victim's face (Nos. 26, 27, 28, 29, 30, 31, 40, and 41) and a series of 43 close-up photographs of President Kennedy selected from National Archives files to show his head and face from a variety of angles. In these comparisons, no inconsistencies in the morphological configuration of the eyes, nose, mouth, ears, or other facial features were observed and, on the contrary, a number of identical features were apparent. These include rather distinctive traits such as the downward convexity of the nasal septum and an angular and elevated nasal tip (the latter, by the way, a trait observable in other members of the Kennedy family). Among similarities noted in the ears are a strong antihelix, small, "tucked" tragus, narrow intertragic notch and attached lobes. The lower margin of the helix is strongly concave at its junction with the lobe, giving the latter a rather attenuated appearance. Patterns of facial lines and wrinkles were similar where they could be visualized in autopsy photographs. A partial list of morphological similarities between the autopsy subject and President Kennedy are shown in table IV. While they are simply listed in the table, each has a distinctiveness about it that impressed the examining anthropologists, both of whom have examined similar traits in a large number of human faces. Each of these traits, of course, can be separately observed in the general population. However, the probability of their occurring together in a single person is small. Their occurrence in two individuals with near-identical facial proportions, as expressed by the indices, is extremely remote.

On the basis of the foregoing, we conclude that the individual shown

in the autopsy photographs which show the victim's face is beyond reasonable doubt, President John F. Kennedy.

If it is accepted that the autopsy photographs showing the victim's face are those of John F. Kennedy, it then is necessary to examine the second hypothesis—namely that the remaining autopsy photographs are those of another person.

Examination of table I shows that the entire series of 27 autopsy photographs can be grouped as follows:

Groups:	Negative Nos.
1. Left lateral views	29, 30, 31
2. Right lateral views	26, 27, 28, 40, 41
3. Superior views	38, 39, 42, 43
4. Posterior views	32, 33, 34, 35, 36, 37
5. Cranial cavity	44, 45
6. Brain	46, 47, 48, 49, 50, 51, 52

The photographs within each of the groups vary only slighty in camera angle, lens-subject distance, subject position, lighting and exposure. There is also sufficient commonality in morphological features and other details to leave no doubt but what they are of the same subject. Since we have concluded that photographs in groups 1 and 2 (showing the face) are those of President Kennedy, we can compare these with features observed in the other photographs.

From the standpoint of pathological interpretation, the least informative photographs are those of group 3, which provide a superior view of the head and shoulders. This is because the scalp has neither been shaved or reflected from the cranium, procedures which would possibly have shown some of the crucial details of the cranial trauma. In these photographs, a portion of the victim's forehead and nose are shown from above. The configuration of these facial features are consistent with the nose and upper forehead contours of President Kennedy as surmised from the ante mortem photographs taken from more conventional angles. Also, certain random features such as bloodstains and an apparent post mortem, abrasion on the right shoulder (described in more detail below), which can be seen in the photographs of group 2, can be observed in this set of photographs. We are therefore of the opinion that these photographs are of the same person as shown in groups 1 and 2 of the autopsy photographs—namely, John F. Kennedy.

The most critical set of photographs from the standpoint of identification are those of group 4 that show the head and upper back of the victim from behind. To take these photographs, the victim was apparently raised to a semi-upright position and held there while the pictures were taken from the head of the autopsy table. The purpose of these photographs was to document the scalp and upper back wounds, the exact location of which has been a matter of considerable controversy. In these photographs, the only facial features visible are the back of the ears.

In comparing these photographs with those taken in group 2, which show the right side of the head and face, several features common to both were noted. These include two dried blood stains on the upper right shoulder approximately 16 centimeters lateral to the midline of the back. Approximately 7 centimeters medial to these are a series of 3 narrow parallel marks approximately 3 centimeters in length.

which appear to be slight skin abrasions. These marks and stains are situated several centimeters lateral to the back wound and do not appear to be directly associated with it. It is possible that they were made in the course of the handling and lifting of the body.

There is also a 3- by 5-centimeter area of discoloration at the base of the neck in the right area which apparently represents either a slight contusion or some post mortem lividity. All of these features are very irregular in shape and would thus be very difficult if not impossible to duplicate. Such minor and random details are also the kind of characteristics that would likely be overlooked in any attempted hoax. Likewise, the hair, which is in disarray and matted with blood and body fluids, presents a complex of irregularly arranged strands and locks. Yet, allowing for the different angles of view, these features appear to be identical in size, location and shape in both the posterior (group 4) photographs and those of the right lateral photographs of group 1, which can be identified as being of President Kennedy.

In addition to the above rather transient feature, others of a more permanent nature were noted. These were the network of transverse wrinkles extending across the back and side of the neck. Such lines develop in most individuals by middle age, but their exact arrangement forms a pattern that is virtually unique to the individual. Examination of these in the back photographs of group 4 shows that they are identical in pattern and development (again making allowance for view) as those seen on the lateral side of the neck in the group 1 photographs. In short, the profusion of minute and common detail lend us to conclude that the individual shown in boths sets of photographs is the same.

The photographs of group 5, which show the cranial cavity with the brain removed, are somewhat more difficult to evaluate. One feature of interest is the outline of the fractured margin of the frontal bone which is partially visible in the foreground of these photographs. A deep V-shaped irregularity in this margin is also visible in photographs of group 1 in which the scalp is partially reflected to expose the underlying bone. The anterior margin of the cranial defects also corresponds in shape to the fractures observed in the cranial X-rays.

From the standpoint of positive identification, the most problematical group of autopsy X-rays are those of group 6 which show the isolated brain. Here we could find no anatomical features that would associate this brain with the remaining autopsy photographs. However, the trauma to the brain, effecting primarily the superior aspect of the frontal lobes is certainly consistent with the pattern of cranial trauma observed in the autopsy photographs and X-rays.

CONCLUSION

Based on our examination of the autopsy X-rays and photographs and comparison of these with known ante mortem X-rays and photographs of John F. Kennedy, we conclude as follows:

1. The individual shown in the autopsy X-rays is John F. Kennedy.
2. The individual shown in the autopsy photographs is John F. Kennedy.

3. The brain shown in autopsy photographs Nos. 46 to 52 cannot be positively identified as that of John F. Kennedy. However, this brain displays trauma consistent to the known pattern of injury sustained by President Kennedy and, in the absence of any positive evidence to the contrary, there is no reason to believe that it is not the brain of the late President.

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(*3*) Carnes, W. H., R. S. Fisher, R. H. Morgan, and A. Moritz 1968. "Panel review of photographs, X-ray films, documents and other evidence pertaining to the fatal wounding of President John F. Kennedy on Nov. 22, 1963, in Dallas, Tex." Washington, D.C.: National Archives.

TABLE I.—*Description of autopsy photographs examined in authentication study*

Number:	
26, head, right lateral 27, head, right lateral 28, head right lateral	Superio-lateral view of head in quarter profile. Includes anterior neck wound, upper chest and shoulders.
29, head left lateral 30, head, left lateral 31, head, left lateral	Profile view. Includes anterior neck wound. No. 30 over-exposed.
32, head, superior 33, head, superior 34, head superior 35, head, superior 36, head, superior 37, head, superior	Superior view of head and shoulders.
38, upper torso, posterior 39, upper torso, posterior	Shows shoulder wound.
40, head, right lateral 41, head, right lateral	Inferio-lateral view of head in quarter profile. Includes anterior neck wound.
42, head, posterior 43, head, posterior	Close-up of occipito-partial area showing scalp wound.
44, cranial cavity 45, cranial cavity	Anterio-superior views of cranial cavity. Brain removed.
46, brain interior 47, brain, inferior 48, brain, inferior 49, brain, inferior 50, brain, superior 51, brain, superior 52, brain, superior	Removed from cranial cavity.

TABLE II.—*Measurements used to derive indices for comparison of JFK ante mortem photographs with autopsy photograph No. 29*

1. *Physiognomic face height.*—Distance from the midpoint of the hairline to the lowest point on the chin (trichion to menton).

2. *Forehead height.*—Distance from the midpoint of the hairline to the most anterior point on the lower forehead just above the nasal root depression (trichion to glabella).

3. *Nose length.*—Distance from the deepest point of the nasal root depression to the junction point between the nasal septum and the upper lip (subnasion to subnasale).

4. *Total face height.*—Distance between the most anterior point on the lower

forehead just above the nasal root depression and the lowest point on the chin (glabella to menton).

5. *Ear length.*—Distance between the uppermost point on the helix of the ear and the lowermost point on the earlobe (superaurale to subaurale).

6. *Lobe length.*—Distance between the lowest point in the intertragic notch and the lowest point of the earlobe (intertragion to subaurale).

7. Chin height.—Distance from the point of contact between the upper and lower lip and the lowest point on the chin (stomion to menton).

8. *Chin eminence height.*—Distance from the point of deepest depression between the lower lip and chin and the lowest point on the chin (supramentale to menton).

9. *Nasal projection.*—Distance from the most anterior point on the nasal tip to the junction point between the nasal septum and the upper lip (pronssale to subnasale).

10. *Nasal elevation.*—Distance from the most anterior point on the tip of the nose to the posterior most point on the junction line between nasal alae and the cheek (pronasale to postalare).

11. *Total facial depth.*—Distance between the most anterior point on the nasal tip and the posterior most point on the posterior margin of the helix of the ear (pronasale to postaurale).

TABLE III.—*Comparison of facial index values of ante mortem photographs of President John F. Kennedy (79–AR–6378G, 79–AR–8008K) with left profile photograph (No. 29) of autopsy subject*

Mean deviation=2.82

Index [1] (M/M x 100)	Antemortem			Post-mortem No. 29	Δ [2]
	79–AR–6378G	79–AR–8008K	Mean		
1. 2/1 x 100		27.0	27.0	30.7	3.7
2. 3/4 x 100	26.4	35.1	35.8	33.1	2.7
3. 8/4 x 100	21.4	21.1	21.2	18.1	3.1
4. 7/1 x 100		28.4	28.4	25.6	2.8
5. 7/4 x 100	37.1	36.8	37.0	33.8	3.2
6. 6/5 x 100	29.4	33.9	31.6	33.9	2.3
7. 5/1 x 100		41.2	41.2	37.5	3.7
8. 9/3 x 100	47.1	45.0	46.0	50.0	4.0
9. 10/3 x 100	60.8	61.5	61.2	63.6	2.4
10. 5/11 x 100	49.7	45.9	47.8	47.5	.3

[1] Numbers refer to measurements defined in table II.
[2] Absolute differences between mean of ante mortem index and post mortem index.

TABLE IV.—*Morphological similarities in both the ante mortem and post mortem Kennedy photographs*

Convex angle of nasal septum.
Lower third of nose convexity.
Nasal tip area elevated.
Attached ear lobe.
Strong ear antihelix.
"Tucked" ear tragus.
Distinctive lip profile.
Identical facial crease lines.
Similar neck crease lines.

(181) ADDENDUM B

Report to the Select Committee on Assassinations, U.S. House of Representatives

Identification of the Skull X-Ray Films Taken During the Autopsy of President John F. Kennedy

(By Lowell J. Levine, D.D.S., Consultant for the Select Committee on Assassinations, U.S. House of Representatives, Sept. 7, 1978)

Authentication of Autopsy Films 1, 2, and 3

BASIS FOR DENTAL IDENTIFICATION

The science of dental identification is based upon the fact that characteristics associated with the dentition and the hard and soft tissue structures of the oral cavity occur in astronomical numbers of combinations.

Typically, the adult dentition contains 16 teeth in each jaw; 4 incisors, 2 canines, 4 premolars, and 6 molars. Each tooth has characteristics such as morphology, root configuration, root canal shapes, anomalies, pathology, and the like which are unique and individual to that particular tooth. Similarly, the supporting structures of the oral cavity have unique and individual characteristics.

Teeth are often attached by carious lesions (decay) and other processes which cause unique and individual characteristics.

There are five surfaces on each tooth which may be attacked by dental caries and restored by the dentist. On posterior teeth (premolars and molars), mesial and distal (toward and away from the midline), occlusal (the grinding surface), buccal (towards the cheek), and lingual (towards the tongue). On anterior teeth (incisors and canines) mesial and distal, facial or labial (towards the face or lips), lingual, and incisal (cutting surface). These surfaces may be attacked by dental caries singly or in combination and restored by the dentist in single- or multiple-surface restorations. Different surfaces on the same tooth may be restored with various filling, insulating, and lining materials. Different sized and shaped dental burs (drills) are used to remove the dental caries, and prepare the tooth to receive the filling material.

The dentist uses various materials to repair the effects of dental caries. Metals such as gold in various forms and silver amalgam are commonly used. Porcelains and acrylics are used and various cements are used as temporary restorations, insulating materials, and sealers.

It should be abundently clear that the possible combinations which may occur because of such factors as presence or absence of particular teeth, surfaces of each tooth free of caries or decayed, surfaces of each tooth present restored with various types of dental materials, sizes and shapes of cavity preparations is limitless.

Almost all dental evidence is useful for identification purposes. Dental evidence could include the written records of examinations and treatments. Models of the mouth, teeth, and jaws used for diagnosis and treatment planning or the actual fabrication of prosthetic appliances. The prosthetic appliances themselves. Photographs and X–ray films taken incident to diagnosis and/or treatment.

X-ray films are excellent evidence for identification purposes. The films will graphically exhibit characteristics such as presence or absence of teeth, rotations of teeth, level of eruption of teeth, tipping of teeth, and the relation of these teeth to each other.

The films will show the morphology of teeth, roots, and root canals as well as the presence of caries, root canal therapy, pathology such as retained roots and cysts, unerupted teeth, anomalies, wear, and breakage among other things.

We may examine the shapes of fillings, extent of caries involvement and removal, cement materials present, and density of filling materials. Hard tissue patterns, pathology, and landmarks are also graphically represented.

Even when extensive dental treatment, performed subsequent to the date of the X-ray films, has considerably altered the visual appearance of the teeth, the underlying hard tissue characteristics remain quite distinctive.

DENTAL IDENTIFICATION PROCESS

The dental identification process will include a comparison by the forensic odontologist of the unique and individual characteristics exhibited by the evidence at hand with previously existing records containing evidence of those same characteristics. The forensic odontologist will use his training, experience, skill, and expertise to form an opinion as to whether his comparison is positive. He will render that opinion in a report which will also contain the basis for that opinion.

The early use of dental identification in the United States can be documented in two historically significant cases which both occurred in President Kennedy's home State of Massachusetts.*

Paul Revere, noted for his famous ride and as a silversmith, also practiced dentistry. Gen. Joseph Warren, a Revolutionary War hero killed at the Battle of Bunker Hill, had been a patient of Revere. Originally buried by the British, his remains were subsequently identified by Revere some 10 months later when Revere recognized a prosthetic appliance he had made for General Warren.

In 1850 the Webster-Parkman case shocked Boston. Dr. John White Webster, professor of chemistry and mineralogy at Harvard Medical School was convicted of murdering Dr. George Parkman, professor of anatomy at Harvard Medical School. In his first recorded instance of dental identification in the courtroom, Dr. Nathan Cooley Keep, subsequently first dean of Harvard Dental School, identified a few fragments of lower jaw and an intact porcelain bridge which fitted the cast Dr. Keep had preserved from recent dental care of the

*Historical references: Sognnaes, Reider F., "Talking Teeth", American Scientist, vol. 64, p. 369 Luntz & Luntz, "Handbook for Dental Identification," J. B. Lippincott, Philadelphia, 1973, pp. 1–15.

missing Dr. Parkman. An expert witness for the defense was William Morton, the young Boston dentist of ether anesthesia fame.

EVIDENCE USED IN THE DENTAL IDENTIFICATION PROCESS

The evidence to be used for the comparisons was in the custody of the National Archives of the United States at the time I examined it. There was a "descriptive list" of the materials which was apparently made when the National Archives received them from the Kennedy Library.

"Descriptive list" (items I personally used for comparisons):

1. *Manila envelope—business letter size.*—Addressed to Capt. J. W. Pepper, D.C., USN, containing two dental films, loose JFK July 12, 1962.

2. *Manila envelope—business letter size.*—marked JFK April 4, 1962, containing two dental films, loose.

3. *Manila envelope—about 5 by 6 inches.*—

a. One mounted dental film dated March 11, 1961.
b. Two mounted dental films dated March 11, 1961.
c. Five mounted dental films dated January 18, 1961.
d. One mounted dental film dated March 8, 1962.

6. *Manila Sleeve, about 10 inches by 12 inches.*—JFK sinus films, August 17, 1960, containing five films.

7. *Manila envalope (sic), about 10 inches by 12 inches.*—JFK sinus films, August 14, 1960, containing four films.

Description of 1, 2, 3, 6, 7:*

1. *Two dental films loose.*—Both are left mandibular periapical** type films. The root apices (ends of the roots) do not appear on the films. One film is taken slightly anterior to the other. The anterior film includes a portion of the lower left canine, both lower left premolars, the lower left first molar, and a portion of the lower left second molar. (Universal Nos. 22, 21, 20, 19, 18.)

The posterior film includes a portion of the lower left first premolar, the lower left second premolar, the lower left first molar, and a portion of the lower left second molar. (Universal Nos. 21, 20, 19, 18.)

The following surfaces are interpreted to be restored: first premolar (No. 21), distal occlusal; second premolar (No. 20), mesial occlusal distal; first molar (No. 19), mesial occlusal distal; second molar (No. 18), mesial occlusal.

The restorations are interpreted as cast metal restorations. A less radio opaque material pulpal (toward the "nerve") to the restorations is interpreted as dental cement. The lower left first molar (No. 19) appears to have a portion of a previous metallic restoration on the pulpal floor.

2. *Two dental films loose.*—Both are left mandibular periapical type films. One film includes the root apicies, the other does not. Both films

*The teeth will be described by name and by the universal numbering system. In this system the maxillary (upper) right third molar is No. 1, the maxillary left third molar No. 16, the mandibular (lower) left third molar No. 17, the mandibular right third molar No. 32.

**This type film usually is of the crown and root portions of a tooth or teeth in a segment of one jaw.

include a portion of the lower left canine, the two lower left premolars, the lower left first molar, and a portion of the lower left second molar. (Universal Nos. 22, 21, 20, 19, 18.)

The following surfaces are interpreted to be restored: first premolar (No. 21), distal occlusal; second premolar (No. 20), mesial occlusal distal; first molar (No. 19), mesial occlusal distal; second molar (No. 18), mesial occlusal.

The restorations are interpreted as cast metal restorations. A less radio opaque material pulpal to the restoration is interpreted as dental cement. The lower left first molar (No. 19) appears to have a portion of a previous metallic restoration on the pulpal floor.

3a. *One mounted dental film dated March 11, 1961.*—A film mount marked, "Kennedy JF March 11, 1961," contains a left bite wing* type film. It includes a portion of the upper left first premolar, lower left first premolar, upper and lower second premolars, first and second molars. (Universal Nos. 12, 13, 14, 15, 21, 20, 19, 18.)

The following surfaces are interpreted to be restored:

Upper: First premolar (No. 12), mesial occlusal distal; second premolar (No. 13), mesial occlusal distal; first molar (No. 14), mesial occlusal distal; second molar (No. 15), mesial occlusal distal.

Lower: First premolar (No. 21), distal occlusal; second premolar (No. 20), mesial occlusal distal; first molar (No. 19), mesial occlusal distal; second molar (No. 18), mesial occlusal.

The restorations are interpreted as cast metal on all surfaces except for those of the two upper premolars. The restored surfaces on these two teeth are metallic and may be either cast metal or silver amalgam. There is dental cement pulpally on all teeth except the upper and lower first premolars. There appears to be a portion of a previous metallic restoration on the pulpal floor of the lower left first molar.

3b. *Two mounted dental films dated March 11, 1961.*—A film mount marked, "Kennedy John F 11 March 61" contains two maxillary left periapical type films. These include a portion of the upper first premolar, upper second premolar, upper first molar, and upper second molar. (Universal Nos. 12, 13, 14, 15.)

The following surfaces are interpreted to be restored: First premolar (12), distal occlusal (mesial portion of tooth is not shown on the film); second premolar (13), mesial occlusal distal; first molar (14), mesial occlusal distal (probably lingual); second molar (15), mesial occlusal distal.

All restorations are interpreted as being of metal with the molars probably cast metal. There is cement visable under all restorations with the exception of the first premolar.

3c. *Five mounted dental films dated January 18, 1961.*—A film mount marked, "Kennedy, Pres John F January 18, 1961". The mount bears a stamp, "Robert D. Morris, D.D.S., 140 East 54th St., New York, 22, N.Y.".** The mount contains five X-ray films. There are two right bite

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*This type film is usually of the crown portions of opposing teeth of a segment or an entire side.

**Dr. Morris confirmed the fact that he treated President Kennedy on Jan. 18, 1961 in a telephone conversation which occurred on June 7, 1978. This appointment was 2 days prior to his inauguration. He had a routine "check up" which included X-rays and "cleaning".

wing type films, two left bite wing type films, and one maxillary left periapical type film.

One right bite wing film is taken anterior to the other. The more anterior film contains a portion of the upper and a portion of the lower canine, the upper and lower first and second premolars, the upper and lower first molars, a portion of the upper and lower second molars. The more posterior film contains a portion of the upper and a portion of the lower second premolars, the upper and lower first and second molars.

The following surfaces are interpreted to be restored:

Upper right: Canine (6), distal; first premolar (5), occlusal; second premolar (4), mesial occlusal distal; first molar (3), mesial occlusal distal; second molar (2), mesial occlusal.

Lower right: First premolar (28), occlusal, occlusal; second premolar (29), distal occlusal; first molar (30), mesial occlusal distal; second molar (31), mesial occlusal.

The upper right canine is interpreted as having a cement restoration. All other restorations are metal. The first premolars appear to have silver amalgam restorations, all others appear to be cast metal. There appears to be cement pulpal to all restorations except those of the first premolars.

One left bite wing film is taken anterior to the other. Both films include the upper and lower first premolars, second premolars, first molars and second molars. The more anterior film includes a portion of the upper and lower second molars, the more posterior film, a small portion of the upper and lower first premolars.

The following surfaces are interpreted to be restored:

Upper left: First premolar (12), distal occlusal; second premolar (13), mesial occlusal distal.

Upper left: First molar (14), mesial occlusal distal; second molar (15), mesial occlusal distal.

Lower left: First premolar (21), distal occlusal; second premolar (20), mesial occlusal distal; first molar (19), mesial occlusal distal; second molar (18), mesial occlusal.

The restorations are interpreted as cast metal on all surfaces with the exception of the two upper premolars. The restored surfaces on these two teeth are metallic and may be either cast metal or silver amalgam. There is dental cement pulpally on all teeth except the upper and lower first premolars. There appears to be a portion of a previous metallic restoration on the pulpal floor of the lower first molar.

The maxillary left periapical film includes a portion of the upper first premolar, second premolar, first and second molars.

The following surfaces are interpreted to be restored:

Upper left: First premolar (12), distal occlusal; second premolar (13), mesial occlusal distal; first molar (14), mesial occlusal distal (probably lingual); second molar (15), mesial occlusal.

The restored surfaces of the molars are interpreted as cast metal. The premolars may be either cast metal or silver amalgam. There appears to be cement under all restorations with the exception of the first premolar.

3d. *One mounted dental film dated March 8, 1962.*—A film mount marked, "JF Kennedy March 8, 1962" contains an upper left periapi-

cal-type film. The film concludes a portion of the upper left canine, first and second premolars, first molar, and a portion of the second molar.

The following surfaces are interpreted to be restored:

Upper left: First premolar (12), distal occlusal; second premolar (13), mesial occlusal distal; first molar (14), mesial occlusal distal; second molar (15), mesial occlusal (the distal portion of) No. 15 is not in the film.

All surfaces are restored in metal. The molars appear to be restored with cast metal the premolars with either cast metal or silver amalgam. Cement is apparent pulpally on all teeth but the first premolar.

6. *JFK sinus films, August 17, 1960, * * * five films.*—There is a container marked, "5 sinus films"—J.F.K.

It is labeled: "Name Kennedy, Mr. John F., No. 336042; Remarks August 17, 1960.

Drs. Groover, Christie & Merritt
1835 I Street NW.
Washington 6, D.C."

The manila sleeve contains five X-ray films. One is a lateral skull film. Four are AP films taken at various angulations.

The configuration of the frontal sinuses can be clearly determined from the AP films.

The following dental restorations can be interpreted from the lateral skull film:

Upper left: First premolar (12), distal occlusal; second premolar (13), mesial occlusal distal; first molar (14), mesial occlusal distal; second molar (15), mesial occlusal distal.

Lower left: First molar (19), mesial occlusal distal; second molar (18), mesial occlusal.

Superimposition in the premolar area makes clear interpretation difficult. Overlapping makes clear interpretation difficult toward the anterior region.

These restorations all appear to be metallic. Cement can be clearly seen pulpal to the restorations in the molar area. There appears to be a portion of a previous metallic restoration pulpal to the restoration and cement liner on the lower left first molar (19).

7. *JFK Sinus Films, August 14, 1960, * * * four films.*—There is a container marked, "#202617, 8–14–60, JFK, Dr. Stephen White, 'Sinus X-Rays' ".

The envelope contains one lateral skull film and three AP-type films taken at various angulations.

The configuration of the frontal sinus can be clearly determined from the AP films.

The following dental restorations can be interpreted from the lateral skull film: Upper right second molar (2), occlusal portion of restoration; upper left second molar (15), distal portion of restoration; lower right first molar (30), mesial occlusal distal; lower right second molar (31), mesial occlusal.

There is considerable superimposition and overlap.

Authenticity of 1, 2, 3a, 3b, 3c, 3d, 6, 7.

The first task of the forensic odontologist is to form an opinion as to whether the films he will use for comparison with the films in ques-

tion are authentic. The 22 films described were received by the National Archives from the Kennedy Library. According to a source at the Kennedy Library, the films were found in the White House after the death of the President. They came to the Kennedy Library through a family member.*

Dates of Films and Source:

August 14, 1960—later skull film; three AP skull films—Dr. Stephen White, No. 7.

August 17, 1960—lateral skull film, four AP skull films—Drs. Groover, Christie, & Merritt No. 6.

January 18, 1961—five dental films—Dr. Robert D. Morris—No. 3c two right bite wings, two left bite wings, one left maxillary periapical.

March 11, 1961—three dental films—Capt. J. W. Pepper, D.C., USN—No. 3a, 3b; one left bite wing, two left maxillary periapicals.

March 8, 1962—one dental film—Capt. J. W. Pepper, D.C., USN—No. 3d; one left maxillary periapical.

April 9, 1962—two dental films—Capt. J. W. Pepper, D.C., USN—No. 2; two left mandibular periapicals.

July 12, 1962—two dental films—Capt. J. W. Pepper, D.C., USN—No. 1; two left mandibular periapicals.

Films of the left side:

No. 1. Two films July 12, 1962—two mandibular periapicals.

No. 2. Two films April 9, 1962—two mandibular periapicals.

No. 3a. One film March 11, 1961—bite wing.

No. 3b. Two films March 11, 1961—two maxillary periapicals.

No. 3c. Three films January 18, 1961—two bite wings, one maxillary periapical.

No. 3d. One film March 8, 1962—maxillary periapical.

No. 6. One film August 17, 1960—lateral skull.

There are 12 films taken over a 23 month period by at least three different sources, Drs. Pepper, Morris, and White.

Films of the right side:

No. 3c. Two films Jan. 18, 1961—two bite wings.

No. 7. One film Aug. 14, 1960—lateral skull (also shows portion of left).

There are three films taken in a 5-month period by two different sources, Dr. Morris and Drs. Groover, Christie, and Merritt.

There are seven films useful for comparing frontal sinus configurations, No. 6 and No. 7 from two different sources, Dr. White and Drs. Groover, Christie, and Merritt.**

Opinion as to the authenticity of the films to be used for comparisons

Dr. Robert D. Morris confirms the fact that he did expose X-ray films on President John F. Kennedy on Jan. 18, 1961. There are numerous unique and individual characteristics reproduced in the 15 films illustrating the dentition. The films were acquired from at least four different sources. Films taken in like areas may be easily

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* William Moss, chief archivist, Kennedy Library.

**It is interesting to note that President Kennedy had numerous X-ray films of the left side taken in the period between Mar. 11, 1961 and July 12, 1962. One could speculate that he was suffering from some nonspecific dental pain of the left posterior area during that period.

compared with each other. It is my opinion that all films were taken on the same person, John F. Kennedy.

Autopsy films 1, 2, 3

Description of films:

1. AP skull film.
2. Lateral skull film.
3. Lateral skull film.

Each film is marked, "21296" U.S. Naval Hospital, NNMC, Bethesda, Md.

Description of areas of comparison of autopsy 1, 2, 3

Autopsy 1.—The configuration of the frontal sinuses are quite distinctive. The right side is "heart" shaped, the left almost "rhomboid."

Autopsy 2.—There is considerable superimposition and overlap of the jaws, teeth, and restorations, however, the right side appears slightly superior. There is a radio-opaque rectangular-shaped object with three small and one large radiolucent circular areas in it extending from the second lower premolar considerably beyond the third molar area. It obliterates the roots of the molars and extends at an angle beyond the inferior border of the mandible. Because of the angulation at which this film was taken, this object is parallelogram shaped, the circular areas oval-shaped.

The configuration and juxtapositions of a number of the dental restorations are useful for comparison purposes. The two occlusal restorations can be clearly interpreted on the lower right first premolar (28) as can the occlusal portion of the distal occlusal restoration on the lower right second premolar (29). In the second molar area the two second molars are superimposed upon each other. The very distinctively shaped cement liner in the lower left second molar (18) is quite apparent. It is kidney-shaped with the concavity toward the pulpal floor. The deeper portion extends toward the distal. Immediately above the cement liner is the occlusal portion of the mesial occlusal restoration. The concave distal occlusal wall is apparent. The shallow portion of the distal occlusal wall of the mesial occlusal restoration in the lower right second molar (31) can be interpreted immediately above the convexity of the distal occlusal wall of the lower left second molar (18) restoration. The deeply rounded floor of the mesial portion of the mesial occlusal restoration on the lower left second molar (18) can be seen.

The distal portions of restorations on the upper second molars can be interpreted although considerably superimposed upon each other.

There are unquestionably ample unique and individual characteristics which can be interpreted for comparison purposes contained in this film.

Autopsy 3.—There is no superimposition of the maxillary left segment. Although there is slight overlap, the configuration and juxtapositions of the dental restorations in this segment can be readily interpreted. There is superimposition of the right maxillary molar area on the superior portion of the occlusal of the lower right second premolar (29) and lower right first molar (30). There is a radio-opaque rectangular object, apparently the same object as in autopsy 2, which obliterates almost entirely both lower left premolars, the roots of the

lower left first molar, and a portion of the roots of the lower left second molar. The lower left second molar appears free of distortions.

The characteristics of the restorations and existing lining materials can be readily interpreted on the following teeth: Upper left: First premolar (12); second premolar (13); first molar (14); second molar (15).

Upper right: First premolar (5); second premolar (4).

Lower left: First molar (19); second molar (180).

There are numerous unique and individual characteristics which can be interpreted for comparison purposes contained in this film.

Comparisons

Autopsy 1.—The configurations and relationships of the frontal sinuses depicted in this film and in films contained in sinus 6 and sinus 7 are similar.

Autopsy 2.—The unique and individual characteristics described in this film can also be interpreted in films contained in: 1, 2, 3a, 3c, 6, and 7.

Autopsy 3.—The unique and individual characteristics described in this film can also be interpreted in films contained in: 1, 2, 3a, 3b, 3c, 3d, 6, and 7.

Conclusions

It is my opinion that autopsy films 1, 2, and 3 are unquestionably of the skull of President John F. Kennedy. It is further my opinion that the unique and individual dental and hard tissue characteristics which may be interpreted from autopsy films 1, 2, and 3 could not be simulated.

LOWELL J. LEVINE, D.D.S.

EXHIBITS

Comparison of dental X-rays are visually quite persuasive when presented to juries of lay persons as photographic "blowups". The forensic odontologist can easily demonstrate the characteristics and relationships he has interpreted to form his opinion.

Almost at the outset of my examination in consultations between Dr. Michael M. Baden, the committee staff, and myself, it was decided it would be very desirable to attempt to get permission to reproduce portions of X-ray films which were significant in forming my opinion.

The strongest reason for publishing facsimiles of the X-ray evidence is that they are so much more convincing than a narrative description of characteristics compared.

The committee staff obtained permission for me to photograph and reproduce portions of the films I felt were necessary to document the identification and authentication. Autopsy No. 1, was not photographed at that time because it was my understanding that my permission precluded reproducing areas which depicted injury pattern. The fact that documentation of autopsy No. 1, is not included in these exhibits should in no way be construed to imply that my opinion as to the authenticity of that film is anything less than a positive identification.

On November 15, 1977, I personally photographed the films at the National Archives. The exhibits were produced under my direction

by Walter Poppe, forensic photographer, office of the medical examiner, Nassau County, N.Y., while employed as a private consultant.



FIGURE 1.—Dental film (descriptive list 1) taken July 12, 1962. The more posterior of the two films described.



FIGURE 2.—Dental film (descriptive list 2) taken April 9, 1962. One of the two films described.



FIGURE 3.—Dental film (descriptive list 3a) taken Mar. 11, 1961.

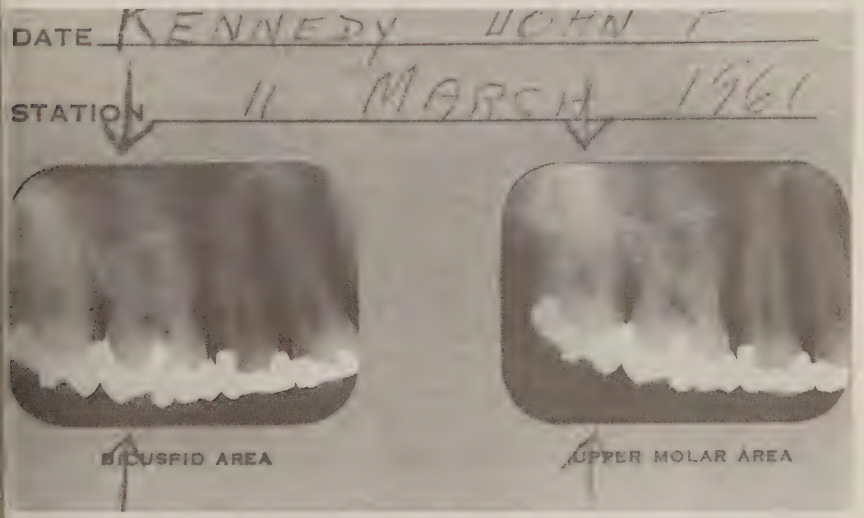


FIGURE 4.—Dental films (descriptive list 3b) taken Mar. 11, 1961.

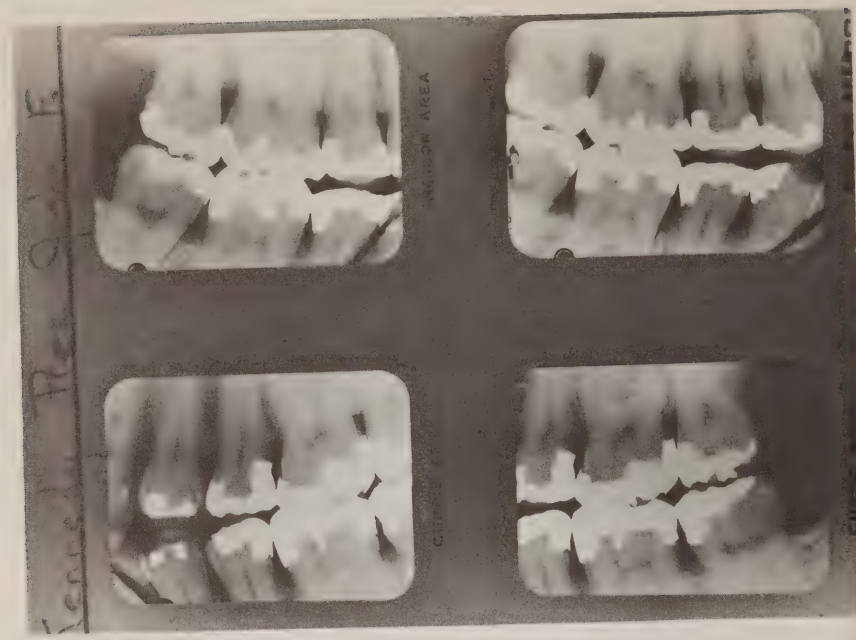


FIGURE 5.—Dental films (descriptive list 3c) taken Jan. 18, 1961. Four of the five films described.



FIGURE 6.—Dental film (descriptive list 3d) taken Mar. 8, 1962.



FIGURE 7.—Sinus film (descriptive list 6) taken Aug. 17, 1960. Dentition and supporting structures depicted in lateral skull film.



FIGURE 8.—Sinus film (descriptive list 6) taken Aug. 17, 1960. "Waters Position" type film.



FIGURE 9.—Sinus film (descriptive list 7) taken Aug. 14, 1960. Dentition and supporting structures depicted in lateral skull film.



FIGURE 10.—Autopsy 2. Dentition and supporting structures.



FIGURE 11.—Autopsy 3. Dentition and supporting structures.

*(182) ADDENDUM C

WEST REDDING, CONN., *August 15, 1978.*

MS. JANE DOWNEY,
House Select Committee on Assassinations, U.S. House of Representatives, House Office Building. Annex 2, Washington, D.C.

DEAR JANE: Enclosed is a report on the authenticity of the color autopsy pictures.

With best regards,

FRANK SCOTT.

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*Paragraphs (183) to (190) represent duplicated material.

REPORT ON AUTOPSY COLOR PHOTOGRAPHS AUTHENTICITY

(By Frank Scott, August 15, 1978)

I have carefully analyzed the original color transparencies exposed in the camera used by the photographer during the autopsy of President Kennedy. The photographer took two or more pictures of each scene; for each scene he used a different exposure (different shutter speed or different lens f-number) for each of the two or more pictures; this is a common practice of photographers to enhance the probability that one of the pictures of a particular scene is exposed properly and also as insurance in the event any of the two or more pictures of a scene are lost due to camera or processing (developing) failures.* The two or more pictures taken by the photographer of a particular scene in several instances were made with the camera in slightly (a few centimeters) different positions in space. For other scenes, the photographer made the two or more exposures from the same position in space, probably using a tripod on which the camera was mounted or using a specimen stand as was, apparently, the case for the pictures made of the brain specimen. The fact that two or more pictures of a particular scene were made from slightly different positions is very fortunate because the variation in camera position provides true stereophotography, somewhat analogous to the different positions of microphones in stereo recording of an orchestra. A pair of stereo pictures enables one to see the scene in three dimensions; stereo pictures add depth to the perception of the photographed scene in much the same way as a pair of human eyes, separated from one another in space, can perceive depth.

The stereo pairs of pictures provide a sound basis upon which to assess the authenticity of the photographs. The same is true of the nonstereo pairs, such as the brain pictures, but to somewhat lesser extent.

In the case of nonstereo pairs of pictures, the pictures can be superimposed on one another; the superimposition can be achieved physically (actually placing one transparency over or on another transparency) or by optical means (where the image of the transparencies are optically brought together in register). Careful examination of the superimposed pictures will reveal differences between the two pictures. In viewing stereo pairs of photographs, one eye views one picture and the other eye views the second picture; the eyes, coupled with the visual image processes of the brain, very readily reveal differences be-

* I was employed as a medical photographer at the M. D. Anderson Hospital and Tumor Research Institute while attending college; for the photography of patients, for autopsy photography, and for anatomical specimen photography it was a policy of the photography department to take three pictures of every scene photographed for the reasons cited above; after film processing the two poorest pictures were discarded.

tween the two pictures. When viewing a photographed scene using a stereo pair of photographs, differences in the scene between the two pictures tend to "pop out at you", that is, are easily noted. When viewing a photographed scene using a nonstereo pair of photographs, differences between the photographs are apparent but not as readily noted and thus require more careful examination.

To successfully avoid detection of picture alteration requires that each picture of a pair of pictures be altered identically, which is essentially impossible, particularly with a stereo pair since each picture of a stereo pair is a picture of the scene from a slightly, but directly comparable, point of view. Any nonidentical alteration of the pictures of a pair is readily noted when pairs are viewed stereoscopically or monoscopically. A clear demonstration of this is provided by one particular stereo pair: In one picture of the pair there are more droplets of blood on the towel directly beneath a clump of hairs of President Kennedy's head than there are in the other picture of the pair; when viewing this scene in stereo, it becomes very quickly and clearly apparent that the two pictures are not identical with specific respect to this blood-droplets detail; obviously, during the elapsed time between the two pictures, additional blood dripped from the hair onto the towel.

In a careful examination of the pictures made of each scene, and in searching for, and finding, candidate pictures for stereo pairs for use by medical experts for the select committee, I did not find any indication or evidence that any of the pictures were altered and, thus, I conclude that these pictures are authentic photographs. In forming this conclusion, I assume that the object photographed is, indeed, the body of President Kennedy.

Attachment.

TRANSPARENCY IDENTIFICATION NUMBERS

Among the autopsy transparencies, the following pairs provided stereoscopic viewing of the photographed scene:

43 JB and 42 JB
33 JB and 32 JB
44 JB and 45 JB
34 J7B and 37 J7B
26 J7B and 28 J7B

while the following pairs provided stereoscopic viewing but of poor stereo quality:

38 JB and 39 JB
41 J7B and 40 J7B

while the following pairs, or sets of three pictures, appeared to be identical to one another but did not provide stereoscopic viewing:

32 JB and 36 JB
37 JB and 35 J7B
29 J7B and 31 JB and 30 J7B
26 J7B and 27 J7B
47 JB and 46 JB and 48 JB
52 J7B and 51 JB and 50 JB

The numbers refer to those appearing on the envelopes or protective cellophane sleeves of the 4 by 5 inch positive transparencies as provided

to me by Archive Courier, Mr. Bill Grover, on March 2, 1978; these numbers may not be consistent with other references to these photographs during the past years since the transparencies may not have been stored consistently in their own, correct, envelope or sleeve; the "JB" or "J7B" portion of the notations or labels may not be correct since it is merely my interpretation of letters/numbers which were not clearly written and possibly misread by me.

43-377 O - 79 - 6

EVALUATION OF THE MEDICAL, PATHOLOGICAL AND RELATED EVIDENCE PERTAINING TO THE DEATH OF PRESIDENT JOHN F. KENNEDY

(By the Forensic Pathology Panel)

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Werner V. Spitz, M.D., Medical Examiner, Detroit, Mich.
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EVALUATION OF THE EVIDENCE

(191)* Dr. Loquvam prepared the initial draft and conclusions of this report. Subsequently it was redrafted and edited by Dr. Weston at the Center of Forensic and Environmental Science, School of Medicine, University of New Mexico, Albuquerque, N. Mex.

(203) The charge addressed to the members of the Panel within the appointing letter of August 8, 1977 was as follows:

1. To determine whether there are fundamental conclusions within the field of forensic pathology on which all or most of the consultants can agree;
2. To write a report containing descriptions and interpretations of the medical evidence and detailed explanations supporting any conclusions;
3. To compile recommendations regarding those matters deemed to be outside the expertise of forensic pathologists; and
4. To conduct a detailed, objective critique of the professional manner in which the autopsy on President Kennedy was conducted.

(204) In accordance with the wishes of the committee, this report is divided into several parts, as follows:

I. Procedures followed by the forensic pathology panel;

II. Recommendations for additional examinations, procedures and consultations by nonpathology disciplines;

III. Observations and conclusions derived from the examination of the available evidence, interviews, specifically requested ancillary procedures, and consultations;

IV. Critique of the earlier examination, with presentation of suggested procedures to be followed in performing an investigation and examination on the remains of a gunshot victim;

V. Suggested procedures to be followed in the event of subsequent assassinations of Federal officials;

VI. Dissenting view to the forensic pathology panel report, submitted by Cyril H. Wecht, M.D., J.D.

VII. Majority response to the dissent of Cyril H. Wecht, M.D., J.D.

VIII. Glossary of terms (those appearing in the glossary are denoted in the text by an asterisk (*).

Various addenda and the footnotes follow part VIII.

Part I: Procedures Followed By the Forensic Pathology Panel

(205) The larger subpanel, which had not previously reviewed the medical evidence, convened initially on Sept. 15, 1977, at the House Office Building, Annex II; on Sept. 16 and 17, 1977 at the National Archives; and on Sept. 18, 1977, at the House Office Building, Annex II. The material listed in addendum A to this report was made available to the subpanel at the initial meeting. The material listed in addendum B was made available the second and third days at the National Archives.

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*Paragraphs (192) to (202) represent duplicated materials.

(206) The second subpanel convened initially on Sept. 22, 1977, at the House Office Building, Annex II; and on the next day, Sept. 23, 1977, at the National Archives; and, subsequently at the House Office Building, Annex II. The material listed in addendum A was made available to this subpanel at the initial meeting. The material listed in addendum B was made available at the second meeting at the National Archives. All members of both subpanels were allowed unlimited access to these materials for individual examination.

(207) On September 17, members of the larger subpanel met with Drs. James J. Humes and J. Thornton Boswell, who had performed the autopsy on Nov. 22, 1963, and with Dr. J. Lawrence Angel, a forensic anthropologist with the Smithsonian Institution, to discuss the procedures followed during President Kennedy's autopsy and the degree of fragmentation of the President's skull. On Sept. 22, 1977, the second subpanel was afforded the opportunity to hear the tape recording of the interview of Drs. Humes and Boswell conducted by the first subpanel. Both subpanels were shown a film and slide presentation of the assassination prepared by Robert Groden, which included the Zapruder film.

(208) The larger subpanel met on the afternoon of Sept. 18, 1977, at the House Office Building, Annex II, to discuss the individual findings and to commit to writing its opinions relative to the evidence viewed. At that meeting, it became apparent that the members were in substantial agreement with respect to the interpretation of the evidence.

(209) Members of the other subpanel met on the afternoon of Sept. 24, 1977, at the House Office Building, Annex II, to discuss their findings and opinions relative to their examination and reexamination of the evidence. Members of this group, who had previously publicly expressed differing interpretations of the evidence, were not in agreement as to the interpretation of all the evidence.

(210) The two subpanels selected Dr. Loquvam and Dr. Weston, respectively, to draft preliminary working reports. Dr. Weston subsequently drafted a report that incorporated the views of both subpanels.

(211) The members of the subpanels met together on Friday, Mar. 10, 1978, at the National Archives. Drs. Weston, Loquvam, and Baden also met with members of the photographic evidence panel that day to review selected photographs that had been enhanced using a photographic reexposure* technique, as well as several other photographs arranged in pairs to permit stereoscopic visualization.* Following that, all members of the forensic pathology panel met with members of the photographic panel to hear presentations concerning the photographic panel's interim work that might be relevant to that of the forensic pathology panel.

(212) The reports of the two pathology subpanels, being in essential agreement as to the pathology evidence, were then combined, with the understanding that any panel member not concurring with any statement could express a dissenting opinion that would be noted and incorporated in the body of the report.

(213) On Saturday, Mar. 11, 1978, members of the forensic pathology panel met again at the National Archives and deposed Dr.

John H. Ebersole, the radiologist who had taken the autopsy X-rays, and subsequently Dr. Pierre A. Finck, one of the pathologists who assisted in the autopsy. The pertinent portions of their testimony is summarized in section III of this report.

(214) During the early evening of Saturday, Mar. 11, members of the forensic pathology panel met with members of the photographic evidence and firearms panels, other experts, and members of the select committee staff to discuss and present each panel's findings and observations.

(215) On Sunday, March 12, members of the panel once again met at the House Office Building, Annex II, and discussed joint observations and the report previously prepared by Dr. Loquvam. During the discussion, Dr. Finck was interviewed at his request because of his concern that the views he expressed during his deposition the previous day may have been misunderstood. The panel adjourned in midafternoon on that date with the understanding that members of the photographic panel, assisted by either or both Drs. Petty and Coe, if necessary, would attempt to enhance further selected photographs of the President's posterior head and neck, anterior neck, and back, while Dr. Weston would represent the panel at a preliminary review of the computer-assisted image enhancement of selected photographs* and X-rays. It was further agreed that Dr. Weston would prepare a second draft of the panel's report on behalf of the entire panel, using Dr. Loguvam's earlier draft and incorporating new information and suggestions from panel members and the committee.

Part II: Recommendations for Additional Examinations, Procedures, and Consultations by Nonpathology Disciplines

(216) The initial review of evidence available, listed in addenda A and B, led members of the subpanels and then the panel as a whole to offer the following suggestions for additional procedures, examinations and consultations to be conducted by specialists in nonpathology disciplines, with the understanding that such evidence might have significance in the panel's final observations and conclusions:

(217) 1. Photographic experts should examine the individual photographs to insure that none of them has been retouched or otherwise altered.

(218) 2. The X-rays identified as those taken of President Kennedy prior to and during the course of the autopsy, and of Governor Connally during his hospitalization, should be examined by a photographic expert and subsequently by a forensic odontologist* and a radiologist for the following purposes:

—To insure validity of the identity of these X-rays by comparison with in-life* films;

—To insure that the X-rays have not been altered since being taken, except as otherwise noted.

—To evaluate more completely, in order to determine their significance, the somewhat randomly distributed, small, radiopaque particles visible in the X-ray of the soft tissues lateral to the right, lower cervical spine of John F. Kennedy;

—To provide interpretation by a radiologist with experience in the examination of gunshot wounds.

(219) 3. The X-rays of particular importance should be examined to determined the desirability of subjecting all, or portions of them to a computer-assisted image enhancement process which might make possible more definitive interpretation, particularly of fracture lines. These X-rays include: the anterior-posterior * and lateral views of the skull (numbered 1, 2, and 3 on the films); those of the thoracolumbar * region (7 and 11); the chest anterior-posterior * view (9); the right hemithorax,* shoulder and upper arm, anterior-posterior * view (8); and the left hemithorax, shoulder and upper arm, anterior-posterior * view (10).

(220) 4. Those photographs considered most important should be considered for photographic enhancement.* One procedure, regraphy for definition,* with varying degrees of exposure, might increase contrast. Computer-assisted image enhancement* could be used to modify the photographs, rendering recognizable the variations in color or shade otherwise imperceptible to the human eye.

(221) These photographs include: the entrance wound in the upper back (4- by 5-inch positive color transparency* No. 38. or 39 or correspondingly numbered 8- by 10-inch prints); the entrance wound at the back of the head (4- by 5-inch positive color transparency No. 42 or 43 or correspondingly numbered 8- by 10-inch color prints); the exit defect on the anterior neck (4- by 5-inch positive color transparency No. 40 or 41 or correspondingly numbered 8- by 10-inch black and white positive prints No. 13 or 14); and the area of the exit defect on the skull showing a semicircular defect in the bone (4- by 5-inch positive color transparency No. 44 or 45 or correspondingly numbered 8- by 10-inch color prints).

(222) 5. Soft X-ray * and energy dispersive X-ray * examination of pertinent portions of the clothing of President Kennedy and Governor Connally, particularly around the entrance and exit wounds, should be conducted to determine if they reveal particles of metal deposited by the missile. Any particles found should then be examined by neutron activation analysis * to correlate their composition with missiles suspected of having perforated the clothing in these areas.

(223) 6. The panel should interview each member of the pathology team that conducted the original autopsy: Drs. Humes, Finck, and Boswell, and the radiologist assisting with the examination, Dr. Ebersole. These interviews are suggested as a means of elucidating the circumstances surrounding the autopsy, the restrictions, if any, perceived by the prosectors, and the apparent discrepancy between the findings of the panel and the original pathologists as to the location of the entrance wound of the head. The interviews would also help in evaluating more fully the entire autopsy examination and report.

(224) 7. The panel should meet with Dr. J. Lawrence Angel, a forensic anthropologist at the Smithsonian Institution, to review the X-rays and photographs of the skull and skull bones to assist it in simulating a repositioning of the skull fragments within the defect of the right side of the skull and in locating more precisely the missile exit defect indicated by the beveling* on two separately recovered skull fragments. (This meeting occurred on Sept. 17, 1977.)

(225) 8. Members of the panel or the committee or both should interview the surgeons who provided emergency care to President Kennedy

to determine more precisely the characteristics of the wounds as first noted on the President and to ascertain that medical information was not overlooked. It was further suggested that similar interviews be conducted with the surgeons and radiologists who provided treatment to Governor Connally in anticipation that such interviews might provide more precise and detailed information on the Governor's injuries, both external and internal, than had been documented in previous testimony or available reports.

(226) 9. The panel considered the potential value of additional ballistics tests with cadavers to simulate the wounds suffered by President Kennedy and Governor Connally, particularly because the panel determined that the entrance wound in the head was located considerably above the point described in the autopsy report, which had been used as the point of aim in previous experimental shootings. The actual, higher entrance location is on a more convex superior portion of the head, which would be an important fact to know to replicate more accurately the known injuries to the scalp and underlying skull than was accomplished in previous experiments. The panel considered experiments, using a comparable weapon, ammunition and target distance, wherein a wound or wounds would be inflicted in the upper back of cadavers, in an attempt to simulate the damage, angle and bullet track of the missile(s) which proceeded through President Kennedy and Governor Connally.

(227) The majority of the panel concurs that the difference between the effects of missiles on cadavers and living persons, the inability to duplicate completely all the factors that were present in the original shooting, and the limitations of information concerning the location of the entrance and exit wounds and the precise bullet track, would render such an experiment of limited and controversial value. While the experiment might eventually replicate the conditions of impact on the bodies of President Kennedy and Governor Connally, many attempts might have to be made before a valid replication could be obtained. To determine whether the replication was in fact valid or fortuitous would be difficult and might itself generate controversy.

(228) One panel member, Dr. Wecht, does not concur, but urges that such additional experiments be conducted, directed at the approximate wound locations, with several cadavers appropriately arranged so as to simulate the possible bullet track through the body. It is Dr. Wecht's opinion that without such tests, the single bullet theory cannot be scientifically defended; hence, he cannot but continue to reject this conclusion of the Warren Commission.

(229) 10. The panel requested a new medical examination of Governor Connally relative to the injuries he received in 1963. The panel considered the possibility that there might still be missile fragments in the Governor. The panel also requested consideration by experts in the field of neutron activation analysis* as to any potential value of an analysis of such fragments at this date.

(230) 11. The panel members discussed the possible value of disinterring the remains of President Kennedy. All agreed that such examination could confirm the exact entrance point of the bullet that struck the back of the President's head, initially a point of disagreement between the pathologists who conducted the autopsy and the panel. (Subsequently, in his public testimony, Dr. Humes agreed with the panel's conclusion as to the location and disagreed with his

Warren Commission testimony and his earlier statement to the forensic pathology subpanel.) In addition, an examination of the remains would probably permit determination of both the nature and extent of the bony injury and skull defects, thus enabling, through reconstruction, a more precise determination of the location of the exit wound from the skull. Further, it might be possible to pinpoint the entrance wound in the upper back and the exit wound in the anterior neck with reference to fixed body landmarks and thus enable more precise determination of the angle of the bullet track through the thorax* (back) relative to the body's axis. The majority of the panel concurs, however, that in the absence of photographic documentation of the body's precise position at the moment the missile struck the back, more accurate wound locations would be of limited value in determining the bullet's point of origin.

(231) Dr. Wecht, in disagreeing, points out that in the Zapruder film, the Stemmons Freeway sign obstructed the President from view for an interval of only approximately 0.9 second, during which Wecht assumes the shooting occurred. In his opinion, this interval was too short for there to have been sufficient movement to result in an alinement consistent with one bullet passing through both men.

(232) Neither the autopsy pathologists nor the panel, at this time, can determine the exact pathway and angle of this missile track in the President for reasons discussed subsequently in this report.

(233) 12. The panel strongly suggested that the committee undertake a vigorous effort to determine the fate of the missing microscopic slides, paraffin blocks,* tissues from which they were prepared, and brain, and make these available to the panel for review. (A search was conducted, as described in an attached staff report.)

Part III: Observations and Conclusions Derived From the Examination of the Available Evidence, Interviews, Specifically Requested Ancillary Procedures, and Consultations

(234) The following is the consensus of the panel as to the medical facts of this homicide, based on the evidence available, listed in addenda A and B and developed from interviews and examinations.

Description of President Kennedy's wounds

(235) The President sustained two wounds from behind, caused by two missiles, one entering the upper right back and exiting the anterior (front) neck, the second entering high on the back of the head, partially fragmenting in the head, and exiting from the right side, front-parietal* region, of the head. Documentation of these wounds is as follows:

Entrance (inshoot) wound of the upper back and neck

1. Clothing—Suit jacket (back)

(236) The suit is made of a lightweight, gray fabric that resembles a tropical worsted in a sack weave. The jacket collar, back and upper sleeves are stiff and stained with a dark brown substance resembling dried blood. The sleeves are slit, as are the front panels across the nipple line; this was done to facilitate rapid removal in the Parkland emergency room.

(237) Two defects are noted in the back of the jacket. The defect caused by the missile is described in an FBI report as follows:

> Examination of the President's clothing revealed the presence of a small hole in the back of the coat and shirt. The hole in the back of the coat is positioned approximately 5⅜-inches below the top of the collar and 1¾-inches to the right of the middle seam. (*1*) (See figs. 1 and 2, photographs of the suit jacket.)

That report goes on to describe the defects of the shirt and then states "[t]hese holes are typical of bullet entrance holes." (*2*)



FIGURE 1.—Photograph of the suit jacket, taken from the back, showing the bullet hole entrance.



FIGURE 2.—Photograph of the suit jacket taken from the front, showing the bullet hole entrance in the back. The suit jacket, shirt and tie were cut during emergency procedures at Parkland Memorial Hospital, Dallas, Tex., to afford easy removal.

(238) The second defect was artificially created in the FBI laboratory to obtain a sample of material for subsequent studies. It is located just below the collar and 3.3 centimeters to the right of the midline. It measures 0.9 centimeter in vertical diameter and 0.8 centimeter in transverse diameter. This defect does not penetrate the full thickness of the coat and was identified in the testimony of Special Agent R. A. Frazier of the FBI laboratory as the site of a control cloth sample removed and analyzed by the laboratory.

(239) The panel locates the defect created by the missile at 5 centimeters (approximately 2 inches) to the right of the middle of the coat and 13.5 centimeters (5.3 inches) below the top margin of the collar and identifies it as a gunshot defect measuring 1.5 centimeters in vertical diameter and 1 centimeter in transverse diameter and passing through all layers of cloth.

(240) Correspondence from J. Edgar Hoover, Director of the FBI, to J. Lee Rankin, General Counsel, Warren Commission, characterized the posterior holes in the clothing as follows:

> The hole in the back of the coat and the hole in the back of the shirt were, in general, circular in shape and the ends of the torn threads around the hole were bent inward. These characteristics are typical of bullet entrance holes.(*3*)

The panel concurred that such a description of the undisturbed clothing would characterize entrance defects. No earlier reports indicated the dimensions of the defect in the coat, nor of that in the shirt. The intervening handling of the clothing prevents the panel from drawing any independent conclusions based on its own observations of the defect and surrounding fibers.

(241) The panel had access to the results of an earlier spectrographic analysis* detailed within the above-referenced FBI report that states:

> The evidence bullets submitted in this case are clad with copper metal. Spectrographic examination of the fabric surrounding the holes in the back of the coat and shirt revealed minute traces of copper.(*4*)

2. Clothing—shirt (back)

(242) The shirt is white with a thin triple gray stripe alternating with a thin triple brown stripe. The back, collar and upper sleeves are stiff and stained with a dark brown substance resembling dried blood.

(243) There is a defect in the shirt measuring 1.2 centimeters in vertical diameter and 0.8 centimeter in transverse diameter. It is in a location corresponding to the defect in the jacket, with its upper margin 14 centimeters (5.5 inches) below the upper margin of the shirt collar and 2.5 centimeters (approximately 1 inch) to the right of the midline of the shirt. This defect is also described in the FBI report:

> The hole in the shirt back is located in the same relative area, being 5¾ inches below the top of the collar and 1⅓ inches to the right of the middle.(*5*)

(244) A second defect was created in the shirt in order to obtain control cloth for FBI spectrographic analysis,* as described in the above-referenced report. This manmade defect measures 1.7 centimeters (approximately 0.7 inch) in vertical diameter and 0.3 centimeter in horizontal diameter, and is located 14 centimeters below the upper collar border and 2.5 centimeters to the right of the midline of the shirt. (See fig. 3, a photograph of the missile defect in the back of the shirt.)



FIGURE 3.—Photograph of the shirt, taken from the front, showing bullet hole entrance in the back.

3. Photographs

(245) The Panel examined photographs of the upper right back with the body on its left side; these included 8 inch by 10 inch black and white negatives and prints Nos. 11 and 12 and 4 inch by 5 inch positive color transparencies and prints. Nos. 38 and 39. (All photographs and X-rays were examined with and without the aid of a 10X magnifying lens.) Stereoscopic visualization * of paired photographs* Nos. 38 and 39 revealed a slight change in the position of the camera between the two exposures. Essentially the photographs con-

sist of a view of the right upper posterior thorax (back), with the camera in a position such that it would be approximately horizontal to the body if the body were erect, or at right angles to the skin surface and parallel to a sagittal plane * of the body. Within each photograph is a centimeter ruler which overlies the midline of the back, extending approximately 2.5 centimeters above the upper wound margin and 2 centimeters below the lower wound margin, with its edge approximately 2.5 centimeters medial to the wound margin. The ruler is in the plane of focus of the wound, enabling reasonably accurate measurement of the wound, which is oval, with one end of the long axis between 2 o'clock and 3 o'clock and the opposite end between 8 o'clock and 9 o'clock. The maximum wound diameter, determined by interpolation from the photos, is 0.9 by 0.9 centimeter. The midpoint is estimated to be 13.5 centimeters below the right mastoid process*, with the head and neck, as positioned within the photograph, 6 centimeters below the most prominent neck crease and 5 centimeters below the upper shoulder margin. (See fig. 4, a drawing of this wound, and fig. 5, a close-up photograph of it.)



FIGURE 4.—Drawing of the posterior thorax of President John F. Kennedy, revealing the general location and appearance of the entrance wound in the upper back.



FIGURE 5.—Close-up photograph of the entrance wound in the upper back.

(246) There is a sharply outlined area of red-brown to black around the wound in which there is dried, superficial denudation of the skin, representing a typical abrasion collar* resulting from the bullet's scraping the margins of the skin at the moment of penetration. This is characteristic of gunshot wounds of entrance and not typical of exit wounds. This abrasion extends around the entire circumference, but is most prominent between 1 o'clock and 7 o'clock about the defect (with the head at 12 o'clock). In addition, there are several small lin-

ear, superficial lacerations or tears of the skin extending radically from the margins of the wound at 10 o'clock, 12 o'clock and 1 o'clock. These measure 0.1, 0.2 and 0.1 centimeter respectively. Photographically enhanced* prints of photographs Nos. 38 and 39 reveal much more sharply contrasted color determination and, to some degree, more sharply outlined detail of the abrasion collar described above.

(247) Several members of the panel believe, based on an examination of these enhancements, that when the body is repositioned in the anatomic position* (not the position at the moment of shooting) the direction of the missile in the body on initial penetration was slightly upward, inasmuch as the lower margin of the skin is abraded in an upward direction. Furthermore, the wound beneath the skin appears to be tunneled from below upward.

(248) The panel concurs with the assessment that the color photographs made during the autopsy of President Kennedy are authentic, as described in correspondence of Frank Scott of the photographic evidence panel, dated June 13, 1978.(*6*)

4. X-rays

(249) As is detailed in a late section, "Course of the Missile Through the Body," the X-rays demonstrate that the missile did not strike the scapula* (wing bone) or ribs and did not remain in the body. This evidence, coupled with the photographs, indicates that the entrance perforation is medial to the scapula and superior to the ribs.

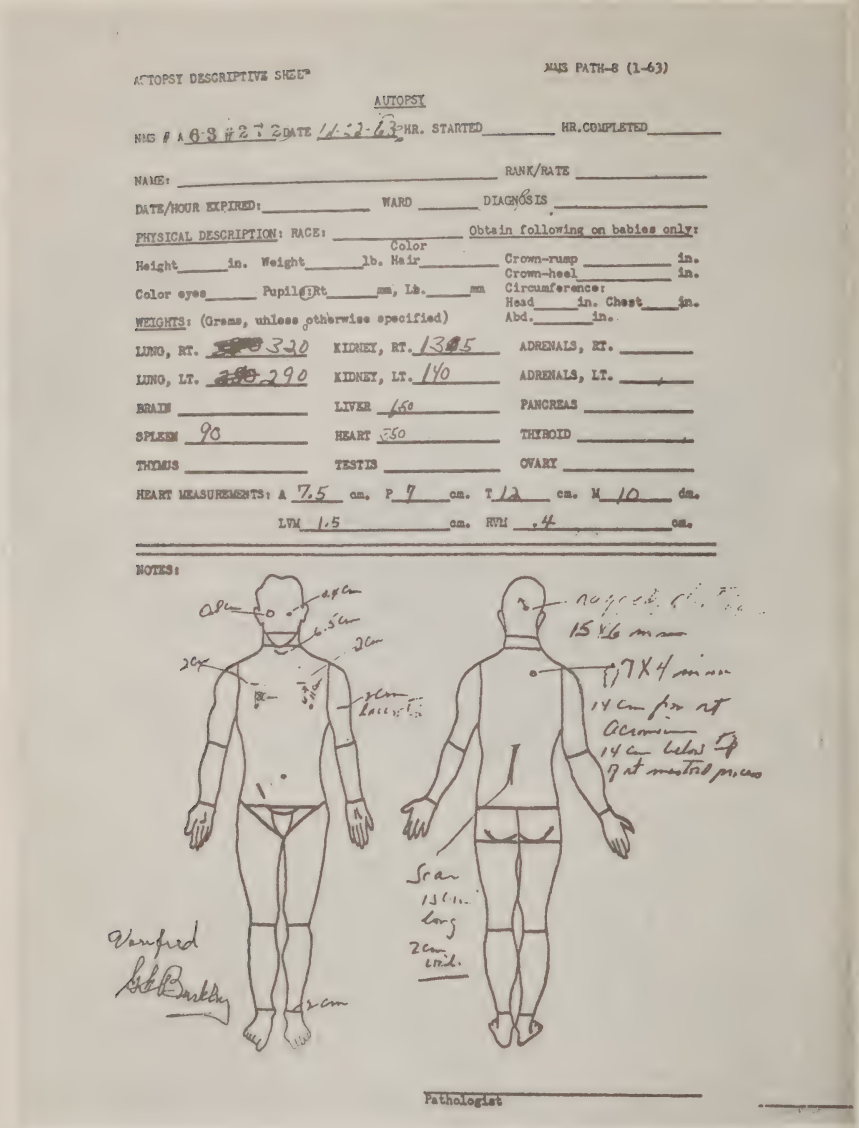
5. Autopsy report

(250) The autopsy report, known technically as the autopsy protocol, submitted by Drs. James J. Humes, J. Thornton Boswell, and Pierre A. Finck, localized and characterized the wound in the right upper back:

> Situated on the upper right posterior thorax, just above the upper border of the scapula there is a 7 millimeter by 4 millimeter oval wound. This wound is measured to be 14 centimeters from the tip of the right acromion process* and 14 centimeters below the tip of the right mastoid process.*(*7*)

The original pathologists' localization of this wound by measurement to body landmarks which change with different pody positions, and their failure to localize this wound relative to the usually accepted fixed body landmarks such as the heel, preclude reconstruction of the exact entrance point.

(251) An attempt to localize this wound more accurately is further frustrated by its designation on a drawing contained within the "autopsy descriptive sheet," which was prepared during the autopsy. In this drawing (see fig. 6, a reproduction of the drawing), a small



AUTOPSY DESCRIPTIVE SHEET

NMS PATH-8 (1-63)

AUTOPSY

NMS # A 63 #27 2 DATE 1-22-63 HR. STARTED _____ HR. COMPLETED _____

NAME: _____ RANK/RATE _____

DATE/HOUR EXPIRED: _____ WARD _____ DIAGNOSIS _____

PHYSICAL DESCRIPTION: RACE: _____ Obtain following on babies only:

Height _____ in. Weight _____ lb. Color Hair _____ Crown-rump _____ in.
Crown-heel _____ in.

Color eyes _____ Pupils Rt _____ mm, Lt. _____ mm Circumference:
Head _____ in. Chest _____ in.

WEIGHTS: (Grams, unless otherwise specified) Abd. _____ in.

LUNG, RT. [redacted] 330 KIDNEY, RT. 135 ADRENALS, RT. _____

LUNG, LT. [redacted] 290 KIDNEY, LT. 140 ADRENALS, LT. _____

BRAIN _____ LIVER 1560 PANCREAS _____

SPLEEN 90 HEART 350 THYROID _____

THYMUS _____ TESTIS _____ OVARY _____

HEART MEASUREMENTS: A 7.5 cm. P 7 cm. T 12 cm. M 10 cm.

LVM 1.5 cm. RVM .4 cm.

NOTES:

15 X 6 mm

7 X 4 mm

14 cm for rt Acromion

14 cm below Tip rt mastoid proc.

Scar 13 cm. long 2 cm. wid.

Pathologist _____

FIGURE 6.—Reproduction of "Autopsy Descriptive Sheet" drawing depicting anterior and posterior views of the body, with wounds as sketched by the autopsy pathologists

circle at the junction of the upper one-third and lower two-thirds of the right posterior back is characterized with the legend "7 millimeters by 4 millimeters 14 centimeters from the rt. [right] acromion plus 14 centimeters below tip of rt. [right] mastoid process."(*8*) The panel considered the location of the wound as it appears in photograph No. 38 or figures 4 and 5 in relation to this drawing. The panel concludes that the drawing was merely a crude representation used as a work-

sheet primarily to assist in the preparation of the final report and was not necessarily an exact representation of the wound. The majority of the panel agrees that if the wound were located as low as represented on the worksheet, it probably would have penetrated and collapsed the right lung, an effect that would have been apparent on the initial chest X-ray.

Exit (outshoot) wound of the anterior (front) neck

1. Clothing—shirt (front)

(252) Examination of the shirt reveals a slit-like defect in the upper left front portion, 1.4 centimeters below the topmost buttonhole. This defect measures 1.4 centimeters in length, with its long axis parallel to the long axis of the body. There is a corresponding slit-like defect 1.5 centimeters below the center of the button on the right. This defect measures 1.5 centimeters in length and is also parallel to the long axis of the body (See fig. 3, a photograph of the shirt.)

2. Clothing—Necktie

(253) Examination of the necktie in the normal knotted position reveals a linear defect along the left lateral margin of the knot. This defect measures 0.7 by 0.4 centimeter and involves only the outer facing of the tie. The lining is not altered.

(254) These clothing changes were characterized in initial examination by the FBI laboratory:

> A ragged, slit-like hole approximately one-half inch in length is located in the front of the shirt seven-eighths inch below the collar button. This hole is through both the button and buttonhole portions of the shirt due to the overlap. This hole has the characteristics of an exit hole for a projectile. No bullet metal was found in the fabric surrounding the hole in the front of the shirt. A small elongated nick was located in the left side of the knot of the tie, Q24 [FBI designation], which may have been caused by the projectile after it had passed through the front of the shirt.(*9*) (See fig. 7, a photo-



FIGURE 7.—Photograph of the necktie, showing the bullet defects

graph of the tie.) X-ray and other examinations of the clothing revealed no additional evidence of value.

(255) In the correspondence from Hoover to Rankin, referred to earlier, Hoover further characterized the defect in the shirt:

> The hole in the front of the shirt was a ragged, slit-like hole and the ends of the torn threads around the hole were bent outward. These characteristics are typical of an exit hole for a projectile. A small elongated nick was present in the left

side of the knot of the tie. This nick may have been caused by the projectile after it passed through the front of the shirt. No additional observations relative to the nick could be made due to the characteristics of the nick.(*10*).

(256) While the FBI laboratory's initial description did not offer evidence concerning the direction of the fibers, the observations in this letter were substantive evidence of the direction of the penetration. provided that the position of the threads had not changed in the interim. As stated previously, the panel itself cannot assess evidentiary significance to the fiber direction because of the numerous intervening examinations.

(257) Careful attention was paid to the possible presence of any contaminant visible at the margins of any of these defects. The panel suggested examination of appropriate portions of the clothing of the President and the Governor by soft X-ray* and energy dispersive X-ray* and, if warranted thereafter, by neutron activation analysis.* The first two types of nondestructive examinations were concluded, but there was insufficient metal present for neutron activation analysis. (The report of the tests is contained in addendum F.)

(258) The tests were undertaken to:

1. Determine if any particles of missile still remained on the clothing.
2. Analyze the missile fragments, if any, and define the elemental nature of them.
3. See if any correlation might be made between the elements found and missile behavior after striking J.F.K. and J.B.C.(*11*)

(259) The soft X-ray* examination revealed the presence of some very tiny particles of foreign material in the back of the shirt at the margins of the defect, but no copper or lead was found by energy dispersive X-ray analysis.* The energy dispersive X-ray analysis* yielded a borderline count for copper in the area of the back defect on the President's jacket and in the area of the right front defect on his shirt. Iron, apparently from the bloodstain, was detected about the defect in the jacket.

(260) The panel considers that at this time the appearance of the upper back skin wound, particularly its abrasion collar, is more significant in determining the direction of the missile's passage than examination of the clothing. The limited amount of foreign material demonstrated by soft X-ray and energy dispersive X-ray analysis* was considered insufficient for further characterization by neutron activation analysis* by Vincent P. Guinn, Ph. D., of the University of California at Irvine, the committee's consultant in this area. The panel agrees that slit-like defects in clothing are common and typical at missile exit sites.

3. Photographs

(261) The panel examined photographs of the President's face, neck. and upper torso taken from above and to the right which reveal the scalp lacerations in the right frontal and temporal* regions and a tracheotomy incision in the neck. The photographs included: Black and white 8- by 10-inch prints No. 13 and 14; 4- by 5-inch positive color

transparencies and prints Nos. 40 and 41; and correspondingly numbered 8- by 10-inch color prints. There is no ruler in the photographs, so measurements are approximate. The maximum transverse diameter of the incision in the neck is approximately 5 centimeters, while the maximum vertical diameter is approximately 1.5 to 2 centimeters; it is approximately 4 centimeters below the shoulder line and 3 centimeters above the suprasternal notch.* (See fig. 8, a drawing of the tracheotomy incision and fig. 9, a closeup photograph of the tracheotomy incision.)



FIGURE 8.—Drawing of the anterior neck and thorax, showing the general location and appearance of the tracheotomy incision.



FIGURE 9.—Closeup photograph of the tracheotomy incision.

(262) There is a semicircular missile defect near the center of the lower margin of the tracheotomy incision, approximately in the midline of the neck, with margins which are slightly denuded and reddish-brown.

(263) Although the black and white prints are more sharply focused than the color photographs, none are clear. Figure 19 shows the wound approximately in the midline of the anterior neck. The panel suggested photographic* or computer-assisted enhancement* of either one or both of black and white photographs Nos. 13 and 14, inasmuch as they were in sharper focus and the results might better delineate the margins of the exit defect in the anterior neck which was not properly identified and documented at the time of autopsy.

4. X-rays

(264) As is detailed in a later section ("Course of the Missile Through the Body"), the X-rays indicate that the missile track proceeds toward the midline of the body. This analysis is based on the fracture of the transverse process of T–1 and the air in the soft tissues, which probably resulted from the laceration of the trachea. The air could have been caused by either a bullet laceration of the trachea or the surgeon's tracheotomy. The X-rays show that no missile is present and therefore that the bullet exited the body without causing any fracture other than of the lateral transverse process.

5. Autopsy Report

(265) The autopsy report characterized the anterior neck wound as:

> Situated in the low anterior neck at approximately the level of the third and fourth tracheal rings is a 6.5-centimeter long transverse wound with widely gaping irregular edges. (*12*)

The appearance of this wound was further characterized by Dr. Humes in his report as follows:

> The wound presumably of exit was that described by Dr. Malcolm Perry of Dallas in the low anterior cervical* region. When observed by Dr. Perry, "the wound measured" a few mm in diameter, however it was extended as a tracheotomy incision and thus its character is distorted at the time of autopsy. However, there is considerable ecchymosis of the strap muscles of the right side of the neck and of the fascia* about the trachea adjacent to the line of the tracheotomy wound. (*13*)

(266) This wound is further depicted in the Autopsy Descriptive Sheet, in which the anterior view, showing a semicircular line with its convex border pointing inferiorly below the lower crease of the neck, bears the legend "6.5 centimeter." (See fig. 6.) It is conspicuously unclear from the autopsy report alone that during autopsy, the pathologists were unaware and failed to recognize that there was a missile perforation in the anterior neck. This may account for the fact that the neck, trachea, strap muscles, and spine were not dissected and examined.

6. Statements of the surgeons

(267) Dr. Perry testified before the Warren Commission that:

> In the lower part of the neck below the Adams Apple was a small, roughly circular wound of perhaps 5 mm. in diameter from which blood was exuding slowly.(*14*).

In a committee interview, Dr. Perry further characterized the wound:

> Dr. Perry began by stating that one of the wounds that JFK had suffered was "about ⅓ of the way" up on the anterior aspect of the neck. Dark blood (a sign of insufficient oxygen) was oozing from the wound when Dr. Perry first observed JFK. Dr. Perry believes that the wound measured approximately 6–7 millimeters in size and was roughly round, although he couldn't state for sure since combating the two primary medical emergencies of restoring breathing and stopping bleeding prevented him from even taking the time to wipe the blood from the wound.(*15*)

The report on the interview continued:

> Dr. Perry said that Dr. Jones, who was already treating JFK when Perry arrived, had inserted a tube down the trachea to facilitate breathing but that the air passage still seemed blocked. Due to this dilemma, Dr. Perry determined that a tracheotomy was necessary "then or never" and therefore made a transverse incision straight through the bullet wound on the anterior aspect of the neck at approximately the second or third tracheal ring.(*16*)

(268) Dr. Perry declined to express an opinion to the Warren Commission on the origin of the missiles that caused the damage. He explained:

> I didn't clearly identify either an entrance or an exit wound. In the press conference I indicated that the neck wound appeared like an entrance wound, and I based this mainly on its size and the fact that exit wounds in general tend to be somewhat ragged and somewhat different from entrance wounds. Now, this doesn't pertain, of course, in bullets that are tumblers,* and many bullets, especially fired from the hand guns and this sort of thing, tend to tumble, and as a result, they make keyhole injuries and various things. But, in general, full-jacketed bullets make pretty small entrance holes. And so I don't really know. I thought it looked like an entrance wound because it was small, but I didn't look for any others, and so that was just a guess. (*17*)

(269) Dr. C. James Carrico characterized the wound in the anterior neck as: "One small penetrating wound of the ant. (anterior) neck in lower third."(*18*) Dr. Carrico further characterized this wound in a Select Committee staff interview:

> My total recollection of that wound, it was, a small, fairly circular wound, with material issuing from it. And that's really my total recollection.(*19*)

When asked whether he was able to draw any conclusions about the direction in which the missile had been passing, Dr. Carrico said "not for sure." (*20*)

(270) The panel considered the appearance of the wound in the anterior neck as initially described and subsequently altered. It is of the opinion that such a wound, uniformly regular in shape and small in size, might be anticipated from an intermediate or even high velocity missile if the tissues through which the missile exited were shored, buttressed or otherwise reinforced by clothing or other external objects that would minimize the outward displacement of the skin and underlying superficial tissue and consequent tearing and distortion of these tissues. The similarity between entrance and shored exit wounds may extend to the production of clothing abrasion patterns, that is, the imprint of the fabric of the clothing on the skin, because the missile, prior to exiting through the skin, forces the skin against the overlying restraining clothing.

(271) The panel members agree that the fabric of the shirt and tie and their anatomic relationship to the underlying missile wound might have served as sufficient reinforcement to diminish distortion of the skin. Several panel members are also of the opinion that an unshored exit wound of a missile of comparable size and velocity might be similar if the missile were not misshapen by striking a substantial bone within the body. The panel believes that it would be reasonable for a surgeon not to appreciate or even consider the significance of the clothing in terms of the wound shape produced, especially if the clothing had been removed prior to his initial examination, as was described within the above-referenced exhibits and interviews. The panel further notes that the shoring or buttressing effect of the wound by the clothing might serve to seal the defect in the President's trachea if he rotated his head, thus permitting him to speak after this wound was inflicted.

Course of the missile through the body

1. Photographs

(272) There is no photographic evidence available that shows any of the internal injuries described by the pathologists within the trunk of the body. Dr. Humes recalled directing that a single photograph of the upper interior aspect of the right thoracic (chest) cavity be taken to illustrate the hemorrhage* just exterior to the pleura (lining) of this cavity, adjacent to the missile track (*21*). There is, however, no such photograph among those in the collection, although there is one 4 by 5 inch positive color transparency on which there is no image.

2. X-rays

(273) The panel examined X-rays of the anterior-posterior* view of the thoracicolumbar* region (No. 7); the anterior-posterior* view of the right neck, thorax (chest) and upper arm (No. 8); the anterior-posterior* view of the chest (No. 9); the anterior-posterior view of the left neck, thorax (chest) and upper arm (No. 10); and the anterior-posterior* view of the thoracicolumbar* region (No. 11). X-ray No. 9 had been taken before the start of the autopsy; X-rays (Nos. 7, 8, 10,

11, and 14) were taken after removal of the internal organs. (See addendum J for a statement regarding the authenticity and description of the X-rays.)

(274) The panel noted a general haziness and poorly defined decrease in radiodensity* in the neck tissues just above the right chest cavity in films 8 and 9, and attributed this to interstitial emphysema.* This was probably related to the surgical tracheotomy or missile injury to the trachea, followed by positive pressure insufflation*, with a slight escape of air into the adjacent tissues. Continued breathing by the President, possible even after the trachea had been perforated by the missile because the overlying defect was more or less sealed by the shirt and necktie, could also have caused air to leak into the adjacent soft tissues.

(275) The panel noted a number of small, radiopaque densities apparent in the No. 8 film and not apparent in No. 9. With one exception, these densities measured less than 0.1 centimeter in diameter and appeared to be more densely aggregated in the area immediately lateral to the right transverse processes of the seventh cervical (C–1) and first thoracic vertebrae (T–1). The panel took special note of a slightly larger shadow immediately lateral to the right transverse process of the seventh cervical vertebra. (See figs. 10 and 11, photographs of X-rays 8 and 9.)



FIGURE 10.—Photograph of an anterior-posterior X-ray of the neck and chest (from autopsy X-ray No. 8), showing small radiopaque densities adjacent to the transverse process of C–6 and C–7.



FIGURE. 11.—Photograph of the anterior-posterior X-ray of the neck and chest (from film No. 9), showing small radiopaque densities adjacent to the transverse process of C–6 and C–7.

(276) The forensic pathology panel requested that consultant radiologists review these opacities. Dr. G. M. McDonnel of Los Angeles indicated that the smaller shadows were randomly distributed on the X-rays in other locations far removed from this portion of the body. They were found even in films that did not overlie the trunk itself, such as in X-ray film No. 13 of the President's pelvis and upper thighs. Dr. McDonnel, who had served as an X-ray consultant to the coroner/medical examiner in Los Angeles and had had experience in such analysis, interpreted the shadows as artifacts not uncommonly caused by foreign materials on the film or in the developing solutions.

(277) Dr. McDonnel further noted that the larger shadow was not present in the initial films of the thorax (film No. 9), but only in subsequent films taken after removal of the thoracic organs, suggesting again that this shadow was an artifact. Dr. McDonnel's complete report, which also authenticates the X-rays by comparison with films taken while the President was living, is contained in a letter dated August 4, 1978, addressed to the select committee, and is incorporated in its entirety into this report as addendum C.

(278) The panel noted an interruption in the continuity of the right transverse process of the 1st thoracic vertebra, much more clearly delineated in the computer-assisted enhancement* of film No. 8. Dr. David O. Davis, M.D., professor and chairman of the department of radiology at the George Washington University Hospital and Medical School, Washington, D.C., also observed these same findings, both on

the original X-ray films and on the computer-assisted enhancement* of these films. Dr. Davis' complete report is contained in a memorandum to the committee dated August 23, 1978. (This letter, in its entirety, is incorporated in this report as addendum D.)

(279) Increased radiolucency,* most probably caused by the interstitial emphysema* noted earlier, rendered it virtually impossible to ascertain whether or not there was a similar fracture of the right transverse process of the seventh cervical vertebra. Norman Chase, M.D., professor and chairman of the department of radiology of New York University School of Medicine—Bellevue Hospital Medical Center, also examined the X-rays and their computers-assisted enhancements* on Feb. 27, 1978. He noted the presence of a metal fragment or artifact in the area of the transverse process that was definitely not a bone fragment. He observed air in the subcutaneous tissue in the same region, which he concluded was caused by the passage of a missile or air or both entering the region due to the tracheotomy incision. He said the 1 by 2.5 millimeter object was too small and dense to be bone; rather, the little trail of dots near the fragment was indicative of artifacts. Dr. Chase said that if a fracture was present in T–1, it was peculiar in that there was no displacement of the bone. He suggested that enhancement of X-ray No. 9 might provide additional information.

(280) William B. Seaman, M.D., professor and chairman of radiology of Columbia Presbyterian Hospital and Physicians and Surgeons Medical School in New York City, also examined the X-rays:

> Regarding the neck X-ray, Dr. Seaman said there was a fragment-like object present near the transverse process which was too dense to be bone ('fairly confident'). He said the transverse process appears normal with air present (possibly byproduct of tracheotomy), calling it "* * * highly suspicious compared with the other side." He thinks he can "* * * see the fragment separate (also in No. 9) and concludes there is a possible fracture in C–7.(*22*)"

3. Autopsy report

(281) The autopsy report characterized the internal injuries and missile path:

> 2. The second wound presumably of entry is that described above in the upper right posterior thorax. Beneath the skin there is ecchymosis* of subcutaneous tissue and musculature.* The missile path through the fascia and musculature cannot be easily probed. The wound presumably of exit was that described by Dr. Malcolm Perry of Dallas in the low anterior cervical region * * *. However, there is considerable ecchymosis* of the strap muscles of the right side of the neck and of the fascia* about the trachea adjacent to the line of the tracheotomy wound. The third point of reference in connecting these two wounds is in the apex (supra-clavicular portion)* of the right pleural cavity. In this region there is contusion* of the parietal pleura and of the extreme apical portion of the right upper lobe of the lung. In both instances the diameter of contusion* and ecchymosis* at the point of

maximal involvement measures 5 centimeters. Both the visceral and parietal pleura are intact overlying these areas of trauma. (*23*)

(282) See figure 12, a drawing of these anatomic structures, injuries to them, and possible trajectories on the position of the body.

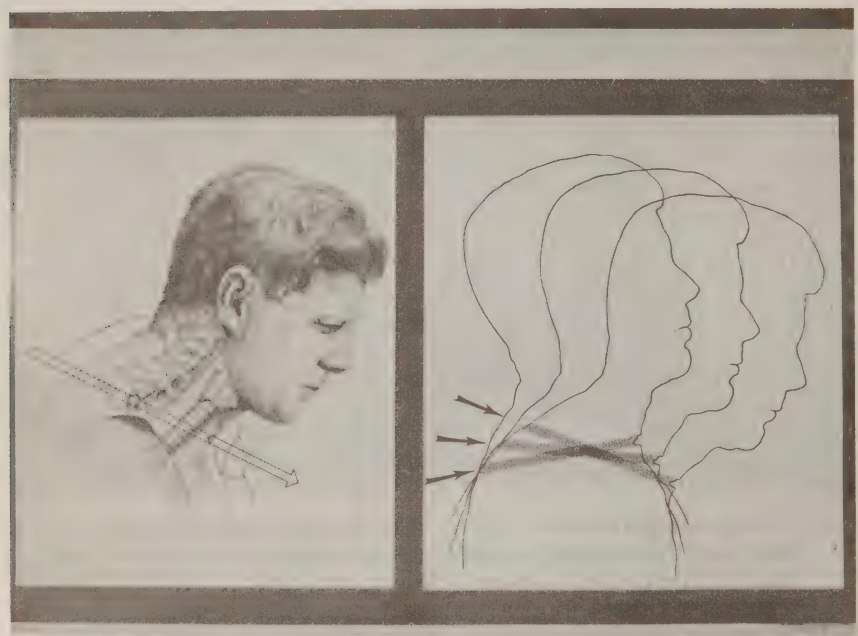


FIGURE 12.—Drawing of the lateral cross-section of the chest, depicting the visceral and parietal pleura, lower neck and right lung, with the injuries described to them. Also depicted is a drawing demonstrating the possible trajectories through the neck of President Kennedy, depending on the position of the body.

(283) Further evidence of internal injury in the thorax is reflected in the autopsy pathologists' description of the lungs:

> The lungs are of essentially similar appearance the right weighing 320 grams, the left 290 grams. The lungs are well aerated with smooth glistening pleural surfaces and grey-pink color. A 5-centimeter diameter area of purplish red discoloration and increased firmness to palpation is situated in the apical portion of the upper right lobe. This corresponds to a similar area described in the overlying parietal pleura. Incision in this region reveals recent hemorrhage into pulmonary parenchyma.* (*24*)

(284) The autopsy report makes no reference to any defect in the trachea, although this was described by the attending surgeons. Of particular interest relative to the location of the missile wound in the right neck is the description of the thoracic cavity within the report:

> The bony cage is unremarkable. The thoracic organs are in their normal positions and relationships and there is no increase in free pleural fluid. The above described area of contusion* in the apical portion of the right pleural cavity is noted. (*25*)

(285) Again, had the wound of entrance been below the uppermost extension of the right lung, this lung would have collapsed and blood would have been present within the cavity.

(286) Correspondence of Dr. Finck, dated February 1, 1965, and addressed to Brig. Gen. J. M. Blumberg, contained these observations concerning the pathway of the missile in the neck:

> This wound cannot be probed with the soft probe available. There is subpleural hemorrhage in the right apical mesial region. The apex of the right lung is hemorrhagic, without laceration of the pleura. On the basis that there is a wound possibly of entrance, which cannot be probed through the body, I suggest X-ray films be taken, anteroposterior and lateral, of the entire body, before going any further with the autopsy. This radiologic survey does not reveal any major missile in the President's cadaver. There is a recent tracheotomy wound (transversal incision) with moderate hemorrhage in the subcutaneous tissue. Thanks to a telephone call from commander Humes to Dallas, I found out later that the surgeon in Dallas had extended the exit wound in the anterior aspect of the neck to make his tracheotomy. The tracheotomy wound was examined by the three prosectors. None of us noticed a bullet wound along its course. The organs of the neck were not removed: The President's family insisted to have only the head examined. Later, the permission was extended to the chest. (*26*)

(287) The summary in the autopsy report includes additional reference to the pathway of this missile:

> * * * entered the right superior posterior thorax above the scapula and traversed the soft tissues of the supra-scapular and supra-clavicular portions of the base of the right side of the neck. This missile produced contusions* of the right apical parietal pleura and of the apical portion of the right upper lobe of the lung. The missile contused the strap muscles of the right side of the neck, damaged the trachea and made its exit through the anterior surface of the neck. As far as can be ascertained, this missile struck no bony structures in its path through the body. (*27*)

(288) The autopsy report makes no further reference to the wound in the front of the neck.

4. Interviews with the surgeons

(289) In his interview with the committee, Dr. Perry described a laceration on the right lateral side of the trachea. He did not recall precisely how he initially characterized it, but in his interview said, "* * * it was on the right side of the trachea * * * it was incomplete * * *." Further,

> I don't remember whether it was a third or a quarter of the circumference * * * I can't remember exactly. There was a laceration. The bruising I mentioned was in the apical pleural and the strap muscles. The trachea was clearly lacerated. (*28*)

(290) Dr. Perry's interview was also of interest relative to the possibility of the wound being low enough to have penetrated the right thoracic cavity. He said that he had placed a chest tube in the right thoracic cavity. Specifically:

> I surmised there might be a hemothorax (blood within the thoracic cavity) or pneumothorax (air within the thoracic cavity) because, not knowing the trajectory of the missile, and when I saw the bruised apical pleural and there was some bubbly blood in that area, * * * I didn't know whether that blood had been frothed a little bit as a result of air coming out of the trachea in our attempt to breathe for him or whether it was coming out of a lung. And as a result, since a tension pneumothorax or serious chest injury could have obviously been a serious problem, why we elected to put in a chest tube. But the chest tube, I later learned, was not necessary because the chest cavity was not violated. (*29*)

(291) He later explained that he did not become aware that the chest cavity had not been violated until he reviewed the autopsy report.
(292) Dr. Perry further indicated in this interview that there was "essentially very little bleeding." (*30*) Asked if he believed that a major arterial injury had been inflicted, particularly to the adjacent common carotid artery, he said that:

> Even if he had had a major arterial injury, why he might have bled out and there wouldn't have been much (blood); but there was no evidence of a major arterial injury. And the artery, of course that's closely applied to the trachea, is the common carotid artery at that level. But it was not injured. (*31*)

(293) Description of the autopsy procedure makes no reference to removal or dissection of the neck organs nor of examination of the arteries of the neck. Dr. Finck testified on February 24, 1969:

> I was interested in the track and I had observed the conditions of bruising between the point of entry in the back of the neck and the point of exit at the front of the neck, which is entirely compatible with the bullet's path.

When asked, "But you were told not to go into the area of the neck, is that your testimony?", his answer was, "From what I recall, yes, but I don't remember by whom." Queried further, "Did you attempt to probe this wound in the back of the neck?", his answer was, "I did." Counsel, on learning of his difficulty in attempting to probe the missile pathway, asked: "Isn't this good enough reason to you as a pathologist to go further and dissect this area in an attempt to ascertain whether or not there is a passageway here as a result of a bullet?" Dr. Finck's answer was, "I did not consider a dissection of the path." (*32*)

Entrance (inshoot) wound of the back of the head

1. Clothing

(294) The bullet perforated no clothing prior to its penetration into the skin of the posterior scalp.

2. Photographs

(295) The panel examined photographs of the back of the head, including: Black and white negatives and prints Nos. 15 and 16; color transparencies Nos. 42 and 43; and correspondingly numbered color prints of the back of the head. These were studied with both the naked eye and 10X magnification. The photographs again all appear to have been taken from approximately the same position, and stereoscopic visualization* of the two 4 by 5 inch color transparencies enables three-dimensional perception. In the center of the photographs is a vertical centimeter ruler, which, by stereoscopic visualization,* is demonstrated to be slightly closer to the comera than the adjacent skin surface. The upper portion of the ruler, which is in sharpest focus, is adjacent to a slightly oval scalp defect located in the "cowlick" area of the scalp just above or superior to a line drawn between the superior or upper margins of the area. (See fig. 13, a drawing of the back of the President's head.) This defect is partially covered by hair and dried blood. This wound is located considerably above the occipital protuberance,* slightly to the right of the midline, and approximately 13 centimeters above the most prominent neck crease. It has a maximum vertical diameter in the photograph of approximately 1.5 to 2 centimeters, and a maximum transverse diameter of approximately 0.9 centimeter.

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FIGURE 13.—Drawing depicting the posterior head wound. Note also the position "white mass," described later.

(296) Accurate reconstruction of the exact dimensions of the wound is difficult because the ruler and wound are in different planes of focus. The long axis of the wound more closely approximates a vertical angle than that depicted within the "Autopsy Descriptive Sheet." (See fig. 6.) The inferior margin of this wound, from 3 to 10 o'clock, is surrounded by a crescent-shaped reddish-black area of denudation, again presenting the appearance of an abrasion collar, resulting from the rubbing of the skin by the bullet at the time of penetration. From 12

to 3 o'clock, there is a suggestion of undermining, that is, tunneling of the tissue between the skin surface and the skull. Three small linear lacerations or tears of the skin, measuring less than 0.2 centimeter, in length, extend radially from the margins of the defect at 11 o'clock, 12 o'clock, and 3 o'clock. (See fig. 14, a close-up photograph of this wound.)



FIGURE 14.—Close-up photograph of the posterior head wound.

(297) An irregular, somewhat rectangular white object is also seen in these photographs, near the lower margin at the scalp hair at a point which most of the panel considers to be consistent with a localization slightly to the right of, and most likely below, the occipital protuberance.* The panel agrees that the object is dried brain tissue.

(298) Examination of the enhanced photographs* prepared from the 4 by 5 inch color transparency of the photograph of the back of the head (print No. 42) reveals more sharply contrasted detail of the wound described in the upper occipital region and the dried brain tissue in the lower occipital region. Stereoscopic visualization* of this fragment indicates that it is adherent to and on the surface of the hair. Computer-assisted image enhancement* of this photograph reveals a dark oval shadow within the margins of the scalp perforation in the cowlick area which may be the perforation of the underlying skull. The hole in the scalp lines up with the hole in the skull. The X-rays also locate the skull defect at this point.



FIGURE 15.—Close-up photograph of the "white mass," dried brain tissue, situated in the lower occipital region.

(299) Examination of the dried brain tissue in the lower occipital region* by computer-assisted image enhancement* also clearly demonstrates that it is on the surface of the hair. Such enhancement further provides some three-dimensional characterization. (See fig. 15, a close-up photograph of the dried brain tissue.) All members of the panel agree that the upper scalp wound, the location of which is identified by X-rays as approximately 10 centimeters (as measured on the

X-ray) above the external occipital protuberance,* is a typical entrance wound. All concur in its striking similarity to the entrance wound in the upper back. All agree that the white material is a piece of brain tissue and that it has no relationship to the location of the entrance wound, despite the interpretations of the autopsy pathologists in their Warren Commission testimony and interviews.

(300) Stereoscopic visualization* of the inside of the cranial cavity at its depth, after removal of the brain, reveals a semicircular beveled* defect of the inner table in the posterior parietal area to the right of the midline, from which fracture lines radiate corresponding to the entrance perforation indicated in the skull X-rays.

3. X-rays

(301) Skull X-ray No. 2, a lateral view of the head, reveals rather marked disruption of the smooth contour of the skull on the right side in the temporal-parietal region, with multiple fractures through other portions of the skull. There is sharp disruption of the normal smooth contour of the skull 10 centimeters (as measured in the X-ray) above the external occipital protuberance,* with suggested beveling* of the inner table and with fracture lines radiating superiorly and inferiorly. (See fig. 16, showing the beveling process.) At this point

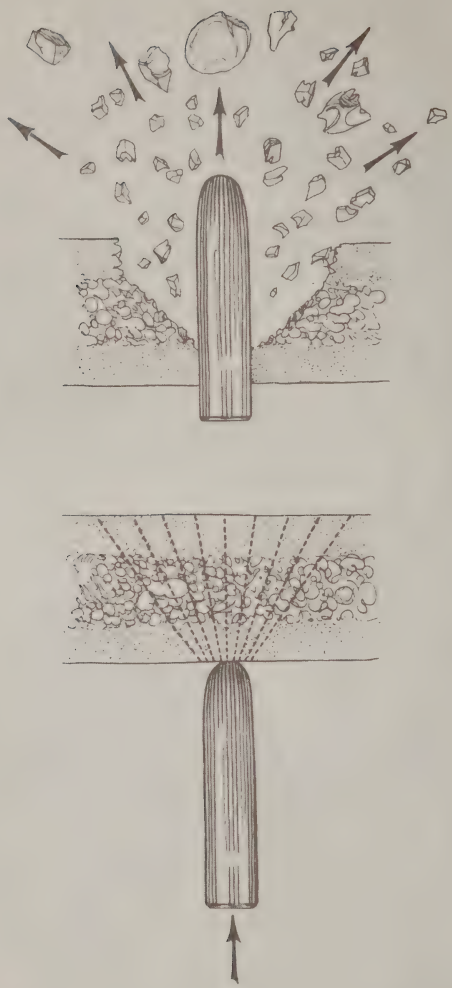


FIGURE 16.—Diagram depicting beveling which occurs on the interior surface to the site of entrance and exterior surface at the site of exit when a missile perforates the skull.

there is an irregular, radiopaque, sharply outlined bullet fragment. The skull defect, apart from its location, corresponds with the description within the autopsy report, in which it characterized as follows:

> In the underlying bone is a corresponding wound through the skull which exhibits beveling* of the margins of the bone when viewed from the inner aspect of the skull.(*33*)

(302) The location of the missile fragment and transverse fractures of the occipital region of the skull is also apparent in the anterior-posterior * X-ray view of the skull (No. 1). It shows the missile fragment to be slightly to the right of the midline and in approximately the same vertical plane as in the above-described lateral view. (See figs. 17 and 18, photographs of X-rays Nos. 1 and 2 respectively.)



FIGURE 17.—Photograph of the anterior-posterior X-ray of the skull (autopsy X-ray No. 1), showing the occipital defect and adjacent missile fragment.



FIGURE 18.—Photograph of the lateral X-ray of the skull (autopsy X-ray No. 2), showing the occipital defect with beveling and adjacent missile fragment.

(303) Computer-assisted image enhancement* of this film more sharply delineates the fracture lines and bone fragments, as well as the missile fragment in the occipital region. The defect in the skull and the inward beveling* thereof provide definite evidence of an entrance wound of the head at a point corresponding to that noted by the panel in the upper back of the scalp, rather than "slightly above" the external occipital protuberance* as indicated in the autopsy report, or in the lower part of the head near the hairline, as stated by the autopsy pathologists in their interviews with the panel. (See figs. 19 and 20, and computer-assisted enhancements* of X-rays 1 and 2 respectively. See also fig. 21, a photograph of a premortem X-ray of the skull of the President, against which to compare the damage shown in autopsy X-rays Nos. 1 and 2.)



FIGURE 19.—Photograph of a computer-assisted image enhancement of anterior-posterior X-ray of the skull (autopsy X-ray No. 1).



FIGURE 20.—Photograph of a computer-assisted image enhancement of a lateral X-ray of the skull (autopsy X-ray No. 2).



FIGURE 21.—Photograph of a pre-mortem lateral X-ray of the skull of President John F. Kennedy, against which to compare the damage shown in the autopsy X-rays Nos. 1 and 2.

4. Autopsy Report

(304) The autopsy report localizes and characterizes the posterior head wound as follows:

> Situated in the posterior scalp approximately 2.5 centimeters laterally to the right and slightly above the external occipital protuberance* is a lacerated wound measuring 15 x 6 millimeters. In the underlying bone is a corresponding wound through the skull which exhibits beveling* of the margins of the bone when viewed from the inner aspect of the skull. (*34*)

The "Autopsy Descriptive Sheet" shows a round circle overlying the occipital protuberance,* with an arrow extending superiorly and to the left at approximately 11 o'clock and the notation "ragged, slanting, 15 by 6 millimeters." (See fig. 6.) Conspicuous by its absence is any descriptive legend which localizes this wound relative to body landmarks.

(305) Dr. Finck, in his correspondence to Brigadier General Blumberg, made this observation concerning the entrance wound:

> I also noticed another scalp wound, possibly of entrance, in the right occipital region, lacerated and transversal, 15 by 6 millimeters. Corresponding to that wound, the skull shows a portion of a crater, the beveling* of which is obvious on the internal aspect of the bone; on that basis, I told the prosectors and Admiral Galloway that this occipital wound is a wound of entrance. (*35*)

(306) The panel was concerned about the apparent disparity between the localization of the wound in the photographs and X-rays and in the autopsy report, and sought to clarify this discrepancy by interviewing the three pathologists, Drs. Humes, Boswell, and Finck, and the radiologist, Dr. Ebersole. Each was asked individually to localize the wound of entrance within any one of several of the above-referenced photographs after reviewing the photographs, X-rays and autopsy report. In each instance, they identified the approximate location of the entrance wound on a human skull and within the photographs as being in a position perceived by the panel to be below that described in the autopsy report. (See figs. 22 and 23, photographs of a human skull.) They also said it coincided with the rectangular white material interpreted by the panel as brain tissue present on top of the hair near the hairline. Each physician persisted in this localization, notwithstanding the apparent discrepancy between that localization and the wound characterized by the panel members as a typical entrance wound in the more superior "cowlick" area.

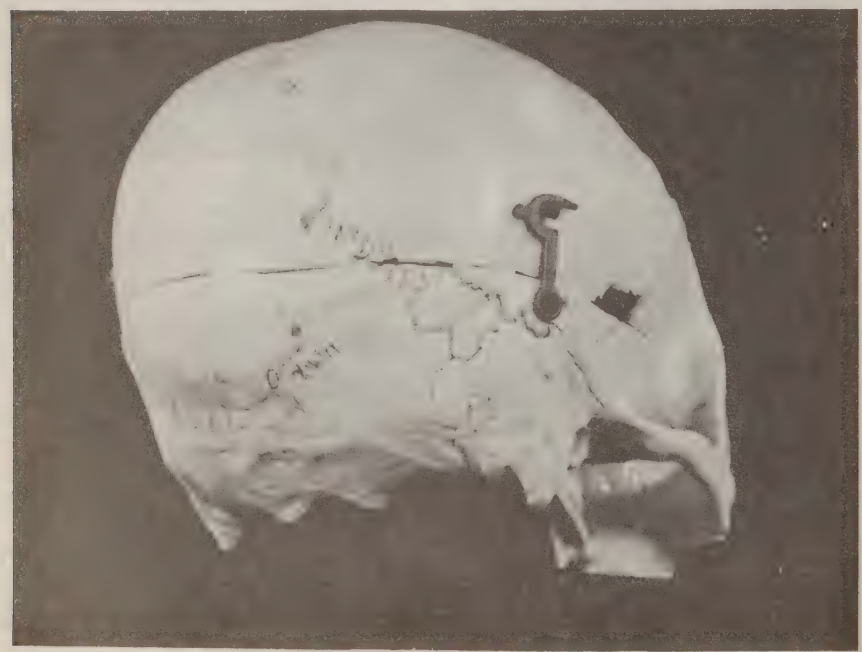


FIGURE 22.—Photograph of the posterior view of a human skull on which the autopsy pathologists, Drs. Humes, Boswell, and Finck, identified the approximate location of the entrance wound. The two initialed circles on the lower portion of the skull and to the right of the midline represent the general area where the autopsy doctors believe the entrance wound to be. (There are two circles because Dr. Finck marked the skull independent of Drs. Humes and Boswell, and without knowing where Drs. Humes and Boswell had placed their circle.) The circle on the top portion of the skull and to the right of the midline represents the general area where the forensic pathology panel believes the entrance to be. (The fourth circle on the lower portion of the skull and approximately on the midline represents the location of the external occipital protuberance.)



FIGURE 23.—Photograph of the posterior-lateral view of the skull on which the autopsy pathologists identified the approximate location of the entrance wound. (See caption fig. 22.)

(307) Drs. Ebersole, Finck, and Boswell offered no explanation for the upper wound, while Dr. Humes first suggested that it might represent an extension of a more anterior scalp laceration, incident to the exit wound, in spite of the fact that within the photograph the margins of the wound appear to be intact around the entire circumference. Dr. Finck believed strongly that the observations of the autopsy pathologist were more valid than those of individuals who might subsequently examine photographs.

(308) The panel continued to be concerned about the persistent disparity between its findings and those of the autopsy pathologists and the rigid tenacity with which the prosectors maintained that the entrance wound was at or near the external occipital protuberance.* Subsequently, however, in his testimony before the select committee, Dr. Humes agreed that the defect was in fact in the "cowlick" area and not in the area of the brain tissue.

(309) The photographs of the brain, described later, also support the panel's conclusions.

(310) One panel member, Dr. Rose, wishes to emphasize the view of the majority of the panel (all except Dr. Wecht) that the absence of injury on the inferior surface of the brain offers incontrovertible evidence that the wound in the President's head is not in the location described in the autopsy report.

(311) All members of the panel except Dr. Wecht concur that there is one and only one wound of entrance in the head and that it is located

in the "cowlick" area of the back of the head, and that the white substance referred to by the original prosectors is a fragment of brain tissue. Dr. Wecht agrees that there is an entrance wound in the "cowlick" area and that the white substance is brain tissue, but he cannot exclude the possibility that it might overlie a very small skin and bone performation of either entrance or exit. (See fig. 13, a drawing of the back of the President's head, with the wound as previously identified by the panel. It shows the adherent white brain tissue and the localization of the entrance wound as described within the body of the pathologists' autopsy report and during recent interviews. See also fig. 24, a drawing of the posterior view of a human body depicting the location of the entrance wounds in the head and the upper back.)

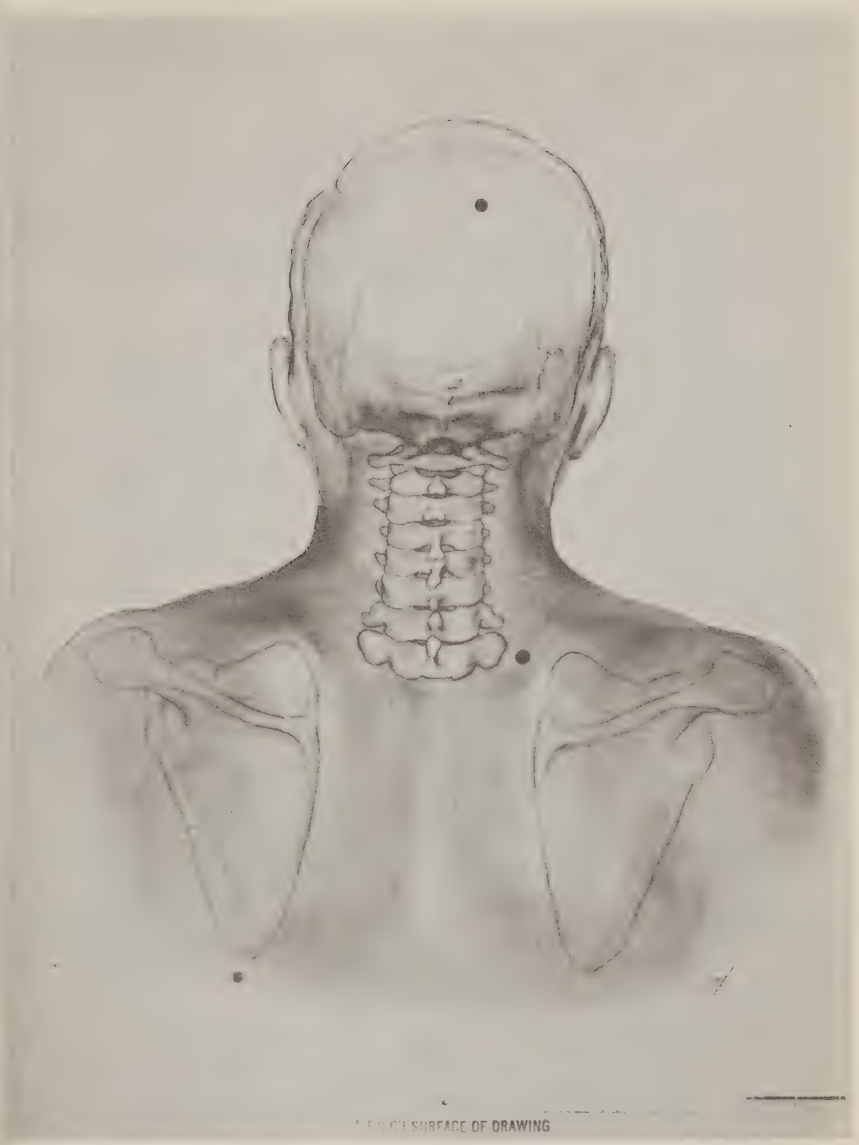


FIGURE 24.—A drawing of the posterior view of a human body depicting the location of the entrance wounds in the head and the upper back.

Exit (outshoot) wound of the side of the head

1. Photographs

(312) The panel examined photographs of the face and head of President Kennedy, taken from the front and to the right, including black and white prints No. 5 and 6 and color transparencies and prints Nos. 26, 27, and 28. These reveal a series of lacerations, described within the

autopsy report as extending from an area in the right parietal region, anteriorly to the right frontal region, to a point 1 to 2 centimeters below the hairline; inferiorly and to the right, almost to the upper border of the tragus* of the ear; and posteriorly toward the occipital region and to the left across the midline. There is a large skin flap in the right frontal region anteriorly and laterally, with two fragments of an anterior compound fracture of the calvarium* of the skull deflected outward and toward the right ear.

(313) The photographs also show brain substance within the margins of the skin and skull defect, similar to the white material adherent to the hair in the right occipito-parietal* region described above.

(314) The panel also examined photographs taken from a position superior to the midportion of the President's head, including black and white prints Nos. 7, 8, 9, and 10 and color transparencies and prints Nos. 32, 33, 34, 35, 36, and 37. These reveal many of the features described in the preceding series of photos, including brain substance in the right temporoparietal* region. A fragment of bone extends from the right frontotemporal* region.

(315) Black and white photograph No. 17 and color transparency and print No. 44 are closeups of the margins of the fracture line in the right frontoparietal* region after reflection of the scalp. On the margins of this fracture line is a semicircular defect which appears to be beveled* outward, although the photograph is not in sharp focus. Computer-assisted image enhancement* of this photograph revealed the defect more clearly. (See fig. 25, a closeup photograph of the semicircular exit defect on the margin of the fracture line in the right parietal region.)



FIGURE. 25.—Closeup photograph of the semicircular exit defect in the margin of the fracture fragment in the right parietal region.

(316) Anthropologist Dr. Angel's evaluation of the "Harper bone fragment" (see below) indicates that it may include a portion of the sagittal suture* which is probably in apposition (corresponds) to this exit defect.

2. X-rays

(317) Left and right lateral skull X-rays Nos. 2 and 3, partly described above, when subjected to computer-assisted image enhancement,* more clearly revealed the extent of the fractures of the temporoparietal* region and their extensions into the fronto* and occipital* portions of the skull bilaterally. The displacement of the residual fracture fragments in the right temporoparietal region, with consequent overriding of several margins of the residual bony defect is also apparent. (See fig. 20.)

(318) Three additional X-rays, Nos. 4, 5, and 6, show three irregularly shaped pieces of skull recovered from within the President's limousine. The largest piece is almost triangular, with a serrated, or zigzag, edge on the longest straight margin, which the panel interprets as to be a portion of the right coronal suture.* This edge meets a much sharper straight edge which represents an obvious fracture margin. At the junction of these two margins is a semicircular defect, described in the autopsy report as showing outward beveling,* with small particles of radiopaque materials. These the panel considers to be missile fragments. (See fig. 26, an X-ray of the three bone fragments.)



FIGURE 26.—Photograph of an X-ray of the three bone fragments recovered from the limousine. These are depicted in X-ray films Nos. 4, 5, and 6. On the triangular fragment is the semicircular defect with outwardly beveled margins and radiopaque shadows which have the appearance of tiny missile fragments.

3. Autopsy Report

(319) The autopsy report characterized the exit defect as follows:

1. There is a large irregular defect of the scalp and skull on the right involving chiefly the parietal bone,* but extending somewhat into the temporal* and occipital* regions.

In this region there is an actual absence of scalp and bone producing a defect which measures approximately 13 centimeters in greatest diameter. From the irregular margins of the above scalp defect tears extend in stellate fashion into the more or less intact scalp as follows:

a. From the right inferior temporoparietal* region anterior to the right ear to a point slightly above the tragus.
b. From the anterior parietal margin anteriorly on the forehead to approximately 4 centimeters above the right orbital ridge.*
c. From the left margin of the main defect across the midline antero-laterally, for a distance of approximately 8 centimeters.
d. From the same starting point as 10 centimeters postero-laterally. (*36*)

(320) This description does little except locate the general area of convergence of the scalp lacerations. It is probably misleading in the sense that it describes "an actual absence of scalp and bone." The scalp was probably virtually all present, but torn and displaced; probably only the separately recovered bone fragments (described below) were absent. The description of the bone fails to recognize either the semicircular defect or any beveling* in the bone fragments still attached to the head.

(321) The note prepared by Dr. Finck for presentation to Brigadier General Blumberg, dated February 1, 1965, states, with respect to the exit wound:

No exit wound is identifiable at this time in the skull, but close to midnight, portions of cranial vault are received from Dallas, Tex. X-ray [sic] films of these bone specimens reveal numerous metallic fragments. Two of the bone specimens, 50 millimeters in diameter, reveal beveling* when viewed from the external aspect, thus indicating a wound of exit. Most probably, these bone specimens are part of the very large right skull wound, 130 millimeter in diameter and mentioned above. This right fronto-parieto-occipital wound is therefore an exit.(*37*)

4. "Harper bone fragment"

(322) The "Harper bone fragment" is a fragment of bone found near the scene of the assassination at 5:30 p.m. on November 23, 1963, by Billy A. Harper, then a premedical student. He was taking photographs of the assassination scene and, on finding the fragment, took it to his uncle, Jack C. Harper, M.D., who, in cooperation with A. B. Cairns, M.D., chief pathologist at the Methodist Hospital in Dallas, had photographs taken on November 25, 1963, by M. Wayne Balleter, chief medical photographer at that hospital. Two 35 millimeter color transparencies of the convex and concave surfaces of the fragment, with an inch ruler in place, were picked up from Mrs. Jack C. Harper on July 10, 1964, by Special Agent Robert P. Gemberling of the FBI. The panel examined both these photographs and 8- by 10-inch black and white and color prints prepared from them.

(323) Dr. J. Lawrence Angel, in a written memorandum addressed to the panel, dated October 24, 1977, characterized this fragment as follows (see addendum E for full text) :

> The Harper fragment photographs show it as a roughly trapezoidal piece, 7 centimeters by 5.5 centimeters in size, coming mainly from the upper middle third of the right parietal* bone. Near its short upper edge vascular foramina* on the inside and a faint irregular line on the outside indicate saggital suture.* Its posterior inferior pointed edge appears to fit the crack in the posterior section of the right parietal [bone] and its slightly wavy lower border can fit the upper edge of the loose lower section of right parietal [bone]. Its upper short border, on the left of the midline near vertex, may meet the left margin of the gap. Behind it there appears to be a large gap and in front a narrow one. (*38*)

(See figs. 27 and 28, photographs of both the interior and exterior surfaces of the "Harper bone fragment.")

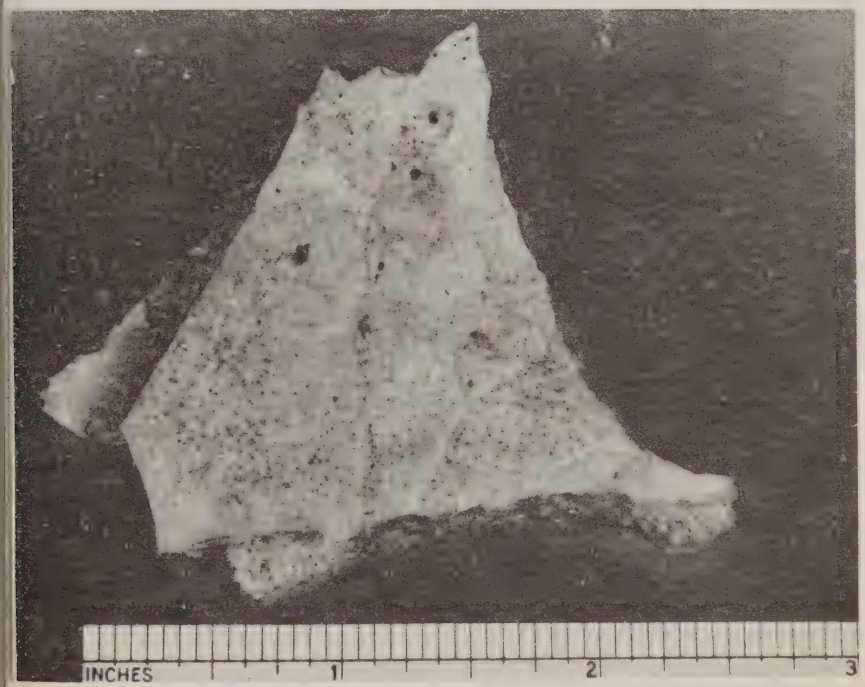


FIGURE 27.—Photograph of the interior surface of the Harper bone fragment.

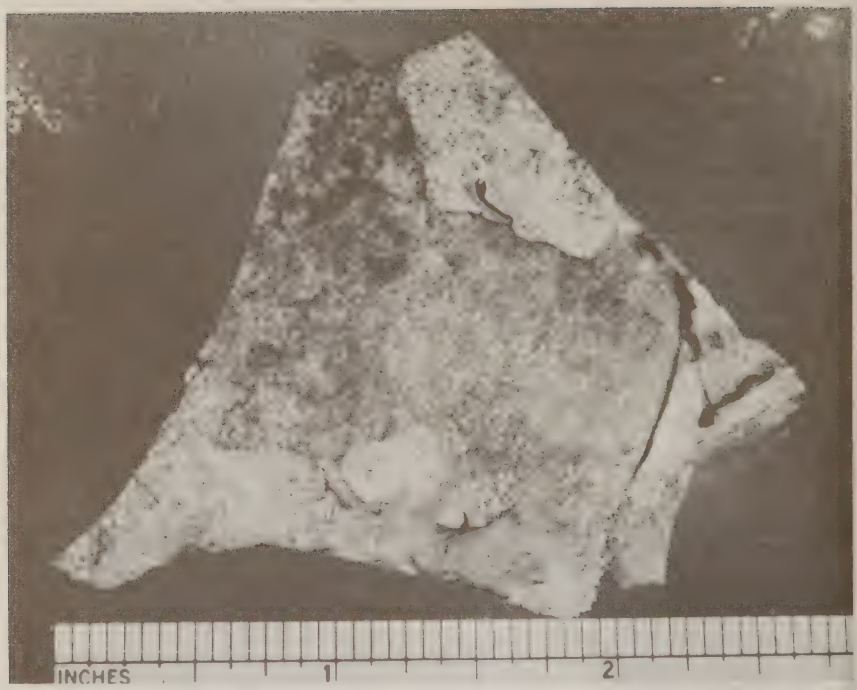


FIGURE 28.—Photograph of the exterior surface of the Harper bone fragment.

5. Attempted reconstruction of the skull fractures

(324) Paper cutouts were prepared to approximate the shape and size of the bone fragments demonstrated in X-rays Nos. 4, 5, and 6 and the photograph of the "Harper bone fragment." The panel attempted to locate the correct position of these fragments, and then, using the paper cutouts, to place these bone fragments on a human skull for the purposes of reconstruction. The largest of the X-ray fragments—that on which outer beveling and tiny metal fragments are evident—completes a portion of the exit perforation, with the suture line fitting into the coronal suture;* the Harper bone fragment completes the circular perforation in the suture line immediately superior to the temporal* bone. No other exit or entrance perforation is identified. (See fig. 29, a scale drawing of the frontal and right side of a human skull, which shows the displaced bone fragments and the extensive fragmentation of the skull.) The sagittal suture* follows the midline in the anterior-posterior* direction and is joined at approximately right angles by the coronal suture in front, which extends downward to the right and left sides, approximately midway between the outside margin of the orbit and the outer ear canal. (See also fig. 30, another scale drawing, showing the path of the bullet through the head, and fig. 31, a drawing of a profile view of President Kennedy, showing the internal anatomic structure and the location of the entrance and exit wounds to the head (the entrance wound is only partially visible).)

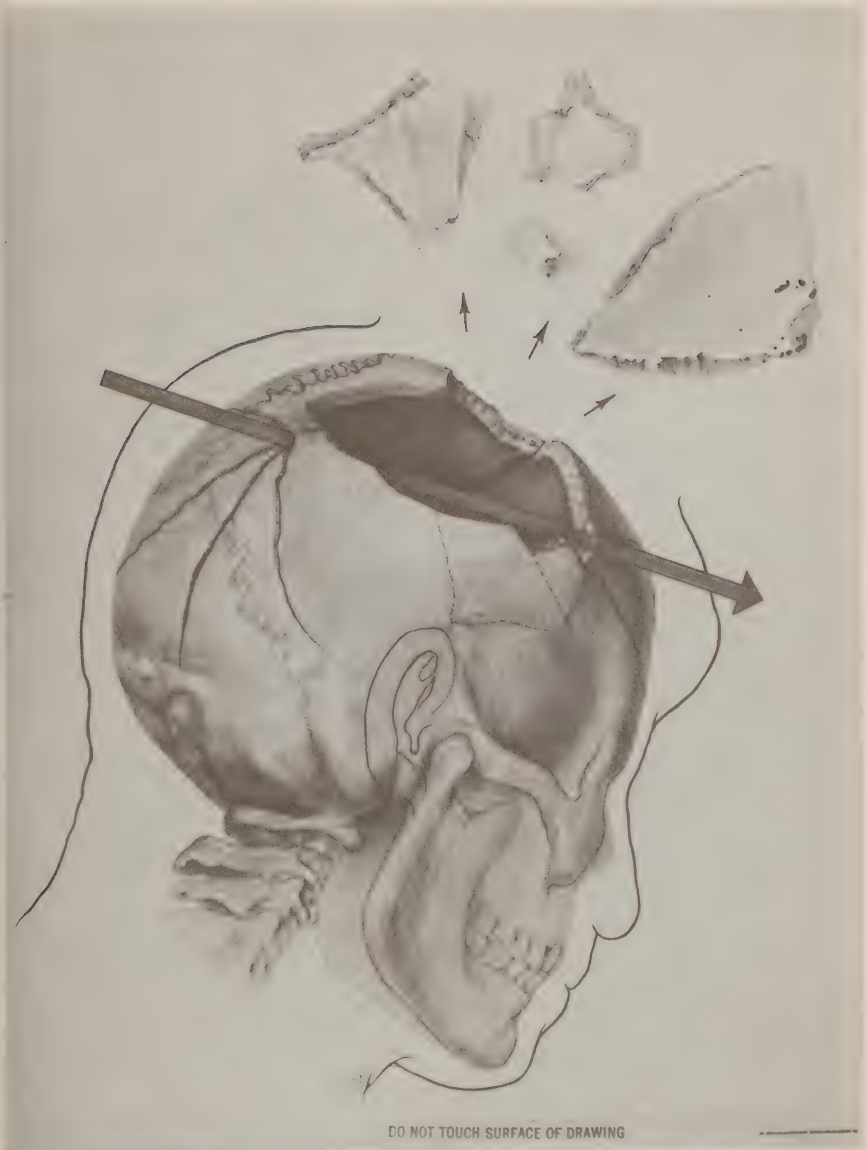


FIGURE 29.—Scale drawing of the frontal and right side of a human skull, which depicts the displaced bone fragments and the extensive fragmentation of the skull.

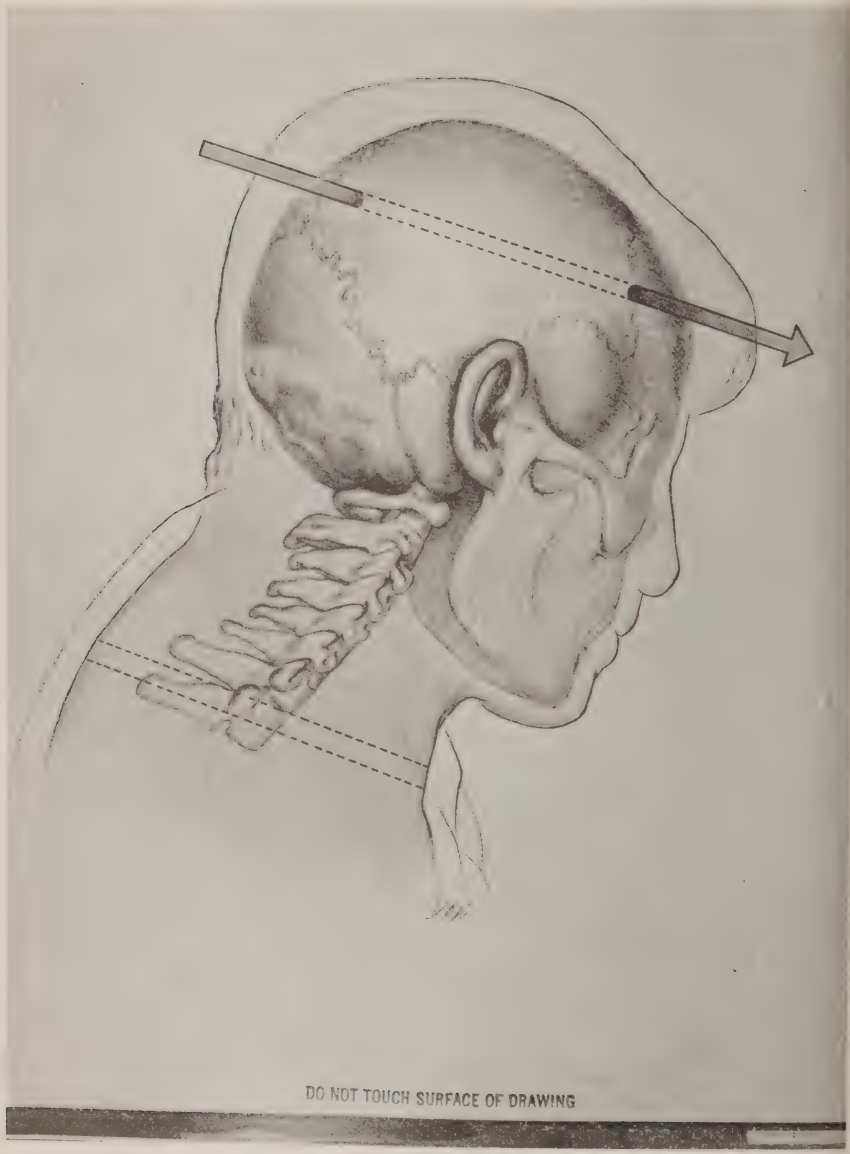


FIGURE 30.—Scale drawing which shows the path of the bullet through the head.



FIGURE 31.—A drawing of a profile view of President Kennedy, showing the internal anatomic structures and the location of the entrance and exit wounds to the head (the entrance wound is only partially visible).

(325) The size of the exit defect is most accurately estimated from the X-rays of the largest separately received bone fragment, in which a segment of the circumference of the defect is demonstrated at one corner. Geometrically, by drawing a chord segment between the two extremities of this portion of the circumference and reconstructing

a perpendicular radius, the central extremity of which is equidistant from all portions of this curve, the diameter of the defect is estimated to be 2.5 centimeters. This is consistent with the size of the defect as seen in the photographs, but cannot be determined more precisely because no ruler was present in the same plane.

(326) According to Dr. Angel's report:

> The two big loose fragments of skull vault, from upper frontal and parietal areas, more on the right than on the left side, do not articulate with each other and leave three appreciable gaps unfilled.(*39*)

Thus, the additional gaps may be accounted for by collapsed superimposed fragments of bone within the skull or there may still be fragments missing. Within one or several of these fragments, there might be an additional exit defect if the principal missile had divided into two major fragments within the skull, although in the experience of the members, the estimated size of the principal exit defect is consistent with the size of a single existing missile representing the mass of the two major fragments recovered outside the body.

(327) The panel considered and rejected the possibility that if there were a residual defect, it might conceivably have been the location for an additional entrance wound. It did so because there was no radiographic evidence of such a missile within the skull, nor any observation or description of the effects of such a missile either on the skin, on the skull bones or within the brain.

(328) One panel member, Dr. Wecht, suggests there is a remote possibility that a "soft-nosed" or frangible bullet could have struck the right side of the President's head in the exit defect leaving no visible evidence of a separate entrance wound. Further, according to Dr. Wecht in his dissent (which follows this report):

> [s]ince this kind of ammunition would not have penetrated deeply into the brain, there would be no evidence of damage to the left cerebral hemisphere, nor would there be fragments of such a missile deposited in the left side of the brain.(*40*)

Dr. Wecht points out further that "there would not be a separate exit wound if this kind of ammunition had been used."(*41*)

(329) All other members of the panel believe that such speculation about the timing and placement of separate wounds is without merit, and, further, they know of no soft-nosed or frangible missile that would disintegrate so completely on striking a surface as soft as the brain. There is no evidence of any such disintegration in the X-rays.

Course of the missile through the head

1. Photographs

(330) The panel examined photographs (including Nos. 17, 18, 44, and 45) they were taken from the front right side of the body, with the scalp reflected down and away from the fractured skull bones and with the brain removed. The lens was focused on the interior-posterior deepest portion of the wound, apparently in an attempt to depict the interior of the bullet perforation of the posterior region of the skull. In the photograph prepared from color transparency No. 45, the ex-

terior bone fragment with the semicircular defect is more in focus than the base of the skull in the depth of the picture which is out of focus. In the photographs prepared from positive color transparency No. 45, the exterior fragment is out of focus, but the depth of the photograph is in sharper focus. The photographs, also studied using the computer-assisted enhancement technique,* show a possible portion of the beveled* inner table corresponding to the semicircular margin of the entrance wound at the back of the head in the right posterior parietal bone. Color transparencies and prints Nos. 46, 47, 48, and 49 and black and white prints Nos. 19, 21, and 22 reveal the inferior aspect of the brain, with extensive fragmentation and laceration of the right inferior cerebral hemisphere, some loss of cerebral substance on the inferior surface of the left temporal lobe,* and scattered areas of subarachnoid hemorrhage* in the underlying cortex.* The right Sylvian fissure* shows dark red-brown to black discoloration suggestive of blood clot. The surface of the midtemporal region is lacerated and depressed. The cerebral peduncles* are likewise lacerated. The panel notes that the posterior-inferior portion of the cerebellum* virtually intact. It certainly does not demonstrate the degree of laceration, fragmentation, or contusion* (as appears subsequently on the superior aspect of the brain) that would be expected in this location if the bullet wound of entrance were as described in the autopsy report. There is no damage in the area of the brain corresponding to the piece of brain tissue on the hair which the autopsy pathologists told the panel was the entrance wound.

331) The panel examined the photographs of the superior aspect of the brain, including color transparencies and prints No. 50, No. 51 and No. 52 and black and white prints No. 20, No. 23, No. 24 and No. 25. The left cerebral hemisphere is covered by intact arachnoid* beneath which dark brown to black subarachnoid hemorrhage* is most prominent over the frontal and parietal gyri* and within the adjacent sulci.* On the right cerebral hemisphere is an anterior-posterior cylindrical groove in which the brain substance is fragmented or absent. This groove extends from the back of the brain to the right frontal area of the brain and contains within the depths of its central portion a grey-brown rectangular area. The majority of the panel considers this to be a blood vessel in the Sylvian fissure.*

332) The majority of the panel members agrees that examination of the brain itself even now would substantiate this opinion. One member, Dr. Wecht, can justify no such opinion without first examining the brain itself.

333) Laceration of the corpus callosum within the deep margins of the wound of the right cortex is also evident (see fig. 32, a drawing of the superior surface of the brain).

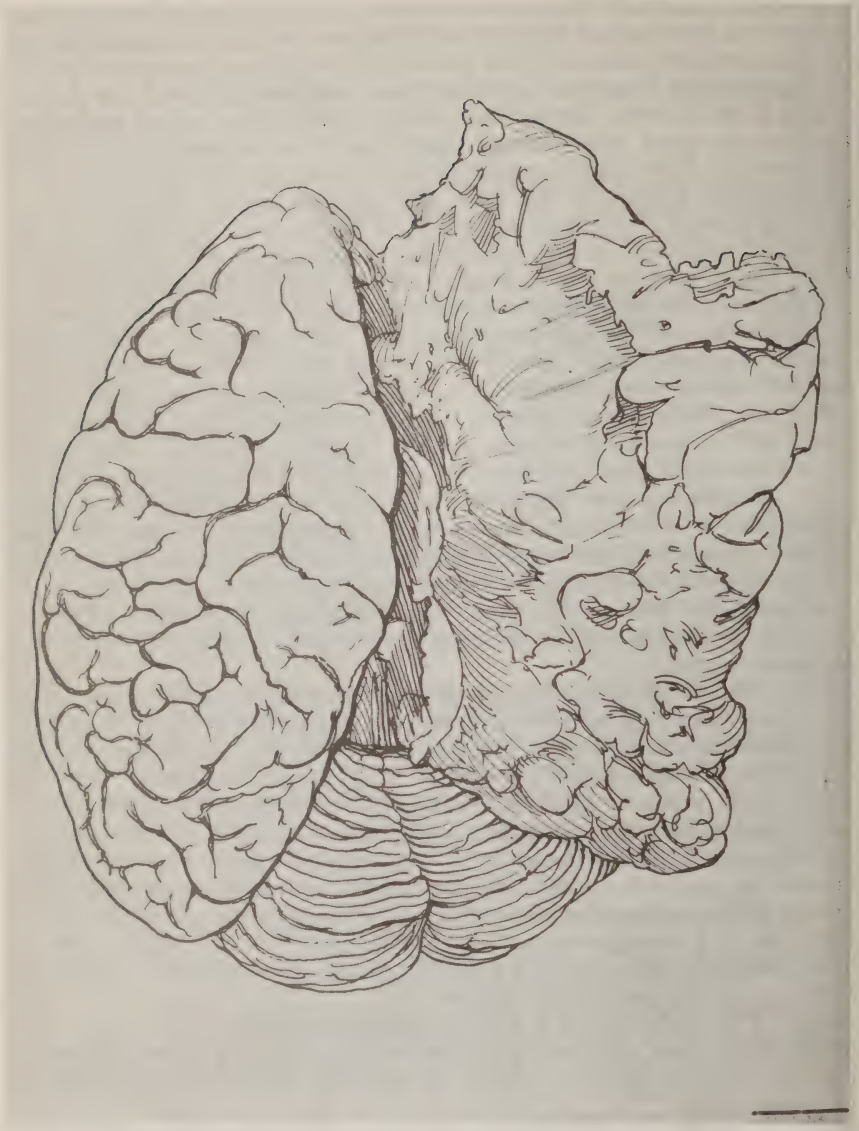


FIGURE 32.—Drawing of the superior surface of the brain, showing the extensive lacerations.

2. X-rays

(334) The panel examined X-ray films of the anterior-posterior view of the skull (No. 1) and left (No. 2), and right (No. 3) lateral views of the skull with the naked eye and with 10× magnification. Film No. 2 reveals the defect referred to above in the posterior parietal region,* in a location corresponding to the previously described skin defect in the "cowlick" area of the scalp. Embedded in the skull in the lower

margin of this defect is a radiopaque shadow which, in the opinion of the panel, is a fragment of the missile. This shadow is 10 centimeters above the external occipital protuberance and 2.5 centimeters to the right of the midline in this film. One surface of this fragment, visualized in film No. 1, is round. The maximum diameter of the fragment measures 0.65 centimeter.

(335) Within the right side of the head are randomly distributed, irregularly shaped, radiopaque shadows which are missile fragments. These shadows, measuring from 0.2 to 0.6 centimeter in diameter, extend from the back to the front; the largest one is present beneath the skin in front. Another group of smaller, more uniform shadows, 0.1 centimeter or less in diameter, so-called "missile dust,"* forms a cylindrical pattern, with the axis directed anterior-posterior,* approximately paralleling the sagittal plane,* and extending toward the large bony defect in the right temporal-parietal* region on the right side of the head. The long axis of this grouping, if extended backward, approaches the entrance defect and missile fragment in the right side of the back of the head.

(336) The panel considered the location and grouping of the smaller missile fragments seen in films Nos. 2 and 3 and suggests that the extensive fragmentation and disruption of the skull bones, and the movement of the body after death, could have caused movement of the missile fragments in movable portions of skin, bone, and brain. The panel also noted the absence of any metal fragment within the left cerebral hemisphere, as demonstrated in film No. 1, although a number of extensive fractures involving the upper portion and base of the right skull extend across the midline.

(337) The panel also noted several artificially caused defects on these films. Two round, puckered areas on film No. 1 were apparently due to examination under a high intensity light that was too close. Dr. Ebersole advised the panel that he placed the converging pencil lines on film No. 2 after the autopsy, pursuant to an official White House request to obtain certain anthropometric measurements for a sculptor. None of these defects interfered with accurate interpretation of these films.

(338) In March 1978, Dr. McDonnel of Los Angeles, examined the skull films for the panel and reported:

> My preliminary (prior to analysis of computer-assisted enhanced images of these X-rays) interpretation follow (sic):
>
> 1. A nearly complete loss of structure in the right frontal and parietal bone.
> 2. A metallic fragment on the outer table of the right occipital bone approximately 10 centimeters above the external occipital protuberance. In the same area is a depressed fracture. In the anterior-posterior projection, there appears to be fracture lines to the occipital, parietal and temporal bone, radiating from the area of the fracture and metallic fragments. The metallic fragment is nearly spherical in this projection.
> 3. There is elevation of the galea* medial and lateral to the area of the fracture and metallic fragment in the occipital region. A small metallic fragment is located

medial to the location of the spherical metallic fragment and fracture between the galea lying and the outer cranial table.

4. There is a fracture line through the floor of the sella turcica* with bony fragments in the sphenoid sinus.*
5. There are fracture lines through the anterior and posterior aspects of the anterior ethmoid* cells with air in the right side anterior ethmoid. (*42*)

(339) Dr. McDonnel further examined these films using computer-assisted enhancements* of the anterior-posterior* (fig. 19) and left lateral (fig. 20) views and submitted a more detailed report on August 4, 1978. Such separation of the galea* from the outer skull bones often occurs as a result of the dislocation of adjacent bone fragments and is seen in an explosive-type injury to the skull. The location of the metallic fragment inside the galea*, medial to the defect in the skull representing the initial penetration, suggests that this separation commenced on initial impact, allowing the tiny above-described missile fragment to be displaced medially within this space created by explosion (between the skull and its overlying galea). Dr. McDonnel also indicted that such dislocation of this and other missile fragments might have occurred as a consequence of manipulation of the head prior to, during or following transit, but prior to the X-ray examination of the skull, although such medial dislocation would not be expected as a consequence of gravity alone.

(340) Dr. Chase, during his examination, noted the presence of extensive comminuted fractures of the calvarium.* He said that the extensive damage apparent from the X-ray precluded interpretation of exactly what happened to the top of the skull, based on radiographic examination alone. He indicated that he saw no evidence of any posterior missile perforation apart from one in the posterior parietal area. Stated more explicitly, there was no perforation in the area of the external occipital protuberance.* He further indicated that the degree of damage to the skull and the fact that there was "little residual material" (relatively small amount of bullet fragments present) led him to believe that the missile was jacketed.* He said further that there was no evidence in the X-rays of a shot coming from the front or of more than one bullet striking the skull. Dr. Chase indicated that for there to be a second entrance perforation, there would have to be another exit point in the skull or a bullet that was left behind, neither of which is present.

(341) Dr. Davis described the entrance wound visible in the X-rays as follows:

> There is an extensive comminuted, open, explosive calvarial fracture which seems to radiate in various directions as described above from a central point which is located in the right parietal bone, 3 centimeters from the midline and about 9 or 10 centimeters from the external occipital protuberance.* (*43*)

(342) The panel understands the vertical distance mentioned above to mean 9 or 10 centimeters above the horizontal plane through the external occipital protuberance.*

3. Autopsy report

(343) The autopsy report describes the track of the missile through the head as follows:

> Clearly visible in the above described large skull defect and exuding from it is lacerated brain tissue which on close inspection proves to represent the major portion of the right cerebral hemisphere. At this point it it noted that the falx cerebri* is extensively lacerated with disruption of the superior sagittal sinus.
>
> Upon reflecting the scalp, multiple complete fracture lines are seen to radiate from both the large defect at the vertex and the smaller wound at the occiput. These vary greatly in length and direction, the longest measuring approximately 19 centimeters. These result in the production of numerous fragments which vary in size from a few millimeters to 10 centimeters in greatest diameter.
>
> The complexity of these fractures and the fragments thus produced tax satisfactory verbal description and are better appreciated in photographs and roentgenograms* which are prepared. (*44*)

(344) The panel acknowledges the difficulty of and necessity for describing the fractures and suggests that the autopsy examination at the very least should have noted evidence in the skull and scalp that would assist in localizing the exit wound. An appropriate examination would have included replacement of the bone fragments in approximate anatomic position and then description of the missile track from the entrance to the exit wound.

(345) The autopsy report states that: "The brain is removed and preserved for further study following formalin fixation." (*45*) The brain, which had been fixed in formalin, the chemical preservative normally used to prevent deterioration, was further examined. The results are described in the "Supplementary Report of Autopsy No. A63–272, President John F. Kennedy" (Commission Exhibit No. 391). This document observes:

> Following formalin fixation the brain weighs 1500 grams. The right cerebral hemisphere is found to be markedly disrupted. There is longitudal laceration of the right hemisphere which is a parasagittal in position approximately 2.5 centimeters to the right of the midline which extends from the tip of the occipital lobe* posteriorly to the tip of the frontal lobe* anteriorly. The base of the laceration is situated approximately 4.5 centimeters below the vertex* in the white matter. There is considerable loss of cortical* substance above the base of the laceration, particularly in the parietal lobe. The margins of this laceration are at all points jagged and irregular, with additional lacerations extending in varying directions and for varying distances from the main laceration. In addition, there is a laceration of the corpus callosum* extending from the genu to the tail. Exposed in this latter laceration are the interiors of the right lateral and third ventricles.*

When viewed from the vertex the left cerebral hemisphere is intact. There is marked engorgement of meningeal blood vessels of the left temporal and frontal regions with considerable associated subarachnoid hemorrhage.* The gyri* sulci* over the left hemisphere are of essentially normal size and distribution. Those on the right are too fragmented and distorted for satisfactory description.

When viewed from the basilar aspect* the disruption of the right cortex is again obvious. There is a longitudinal laceration of the midbrain through the floor of the third ventricle* just behind the optic chiasm and mammillary bodies. This laceration partially communicates with an oblique 1.5 centimeter tear through the left cerebral peduncle.* There are irregular superficial lacerations over the basilar aspects of the left temporal and frontal lobes.(*46*)

(346) The panel notes that the brain was not coronally sectioned, a standard pathological practice which permits examination of the inside of the brain. Rather, as evidenced in the autopsy report, supplemental report and Dr. Humes' testimony before the Warren Commission,(*47*) the brain was preserved intact without a complete examination. Only very limited microscopic sections were taken. The panel stresses that coronal sectioning* is the most acceptable and accurate method of determining precisely the effects of a missile on the brain, as well as the angle of a bullet track in the head. The failure to section the brain also precluded collection of interior samples for microscopic study.

(347) The panel members do not concur with the rationale for having limited the examination in this way. The brain should have been scientifically examined, with sectioning and description of the interior injuries. Only those portions necessary to document the findings need have been retained as evidence for potential court proceedings or for other purposes.

(348) The autopsy report lists the outer brain areas from which sections were taken for microscopic examination:

a. From the margin of the laceration in the right parietal lobe.*
b. From the margin of the laceration in the corpus callosum.*
c. From the anterior portion of the laceration in the right frontal lobe.*
d. From the contused left fronto-parietal cortex.*
e. From the line of transection of the spinal cord.
f. From the right cerebellar cortex.*
g. From the superficial laceration of the basillar aspect of the left temporal lobe.*(*48*)

(349) These sections are described as follows:

Microscopic examination—Brain.—Multiple sections from representative areas as noted above are examined. All sections examined are there significant abnormalities other brain tissue with associated hemorrhage. In none of the sections examined are there significant abnormalities other than those directly related to the recent trauma.(*49*)

(350) The summary within the autopsy report contains this statement concerning the missile pathway:

> The fatal missile entered the skull above and to the right of the external occipital protuberance.* A portion of the projectile transversed the cranial cavity in a posterior-anterior direction (see lateral skull roentgenogram) 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 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. (*50*)

(351) The summary concludes:

> In addition, it is our opinion that the wound of the skull produced such extensive damage to the brain as to preclude the possibility of the deceased surviving this injury.

(352) The panel concurs with this opinion.

(353) Dr. Finck, in his personal note to Brigadier General Blumberg dated February 1, 1965, added this additional information on the observation of the head wound:

> The scalp of the vertex* is lacerated. There is an open comminuted fracture of the cranial vault, many portions of which are missing. The autopsy had been in progress for 30 minutes when I arrived. Commander Humes told me that he only had to prolong the lacerations of the scalp before removing the brain. No sawing of the skull was necessary. The opening of the large head wound, in the right fronto-parieto-occipital region, is 130 millimeters in diameter. (*51*)

Other Autopsy considerations

1. Other wounds

(354) With the exception of Dr. Wecht, as noted earlier, the panel, having viewed all of the photographs, X-rays and other documentary information concerning the autopsy on President Kennedy, concurs that there is evidence of two, and only two, gunshot wounds, and that they both entered from behind. The panel notes that the autopsy pathologist did not know that the tracheotomy incision had been made through a bullet wound in the front of the neck until sometime after the autopsy and removal of the body from Bethesda Naval Hospital. They did indicate the other wounds on the body which resulted from surgical treatment. These were recorded in the autopsy report prepared by Drs. Humes, Finck and Boswell as follows:

> Situated on the anterior chest wall in the nipple line are bilateral 2 centimeters long recent transverse surgical incisions into the subcutaneous tissue. The one on the left is situated 11 centimeters cephalad to the nipple and the one on the right 8 centimeters cephalad to the nipple. There is no hemorrhage or ecchymosis associated with these wounds. A similar clean wound measuring 2 centimeters in length is situation on the anterolateral aspect of the left mid arm. Situated on the

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anterolateral aspect of each ankle is a recent 2 centimeters transverse incision into the subcutaneous tissue. (*52*)

(355) The panel also took note of a summary of the findings, prepared by the three original pathologists, at the time of their review of the photographs and X-rays on November 1, 1966, and signed on January 26, 1967. The following is from that document:

> *No other wounds.*—The X-ray films established that there were small metallic fragments in the head. However, careful examination at the autopsy, and the photographs and X-rays taken during the autopsy, revealed no evidence of a bullet or of a major portion of a bullet in the body of the President and revealed no evidence of any missile wounds other than those described above. (*53*)

(356) The panel concurs with these observations.

2. Examination of the Abdominal Organs

(357) The panel took note of the observations recorded within the autopsy report prepared by the three pathologists in which the gross description* is limited to the following statement:

> *Abdominal Cavity.*—The abdominal organs are in their normal positions and relationships and there is no increase in free peritoneal fluid. The vermiform appendix is surgically absent and there are a few adhesions joining the region of the cecum* to the ventral abdominal wall at the above described old abdominal incisional scar. (*54*)

(358) Microscopic examination of the abdominal organs was limited to the liver, spleen, and kidneys, described as follows:

> *Liver.*—Sections show the normal hepatic architecture to be well preserved. The parenchymal cells exhibit markedly granular cytoplasm indicating high glycogen content which is characteristic of the "liver biopsy pattern" of sudden death.
>
> *Spleen.*—Sections show no significant abnormalities.
>
> *Kidneys.*—Sections show no significant abnormalities aside from dilatation and engorgement of blood vessels of all calibers. (*55*)

(359) The panel is concerned that the Autopsy Protocol and Supplemental Report do not include reference to, nor description of, the President's other organs, including the adrenal glands. The panel took note of several publications in the medical literature relevant to his adrenal glands:

1. Nichols, John, M.D., "President Kennedy's Adrenals," *Journal of the American Medical Association*, July 10, 1967, vol. 201, No. 2, pp. 115–116.
2. Nicholas, James A., M.D., Philip D. Wilson, M.D., and Charles J. Umberger, Ph. D., "Induced Hypoadrenalism in Patients Requiring Orthopedic Surgery," *Journal of the American Medical Association*, May 18, 1957, vol. 164, No. 3, pp. 261–265.
3. Nicholas, James A., M.D., Charles L. Burstein, M.D., Charles J. Umberger, Ph. D., and Philip D. Wilson, M.D., "Management of Adrenal Cortical Insufficiency During Surgery," *Archives of Surgery*, vol. 771, 1955, p. 737.

(360) The 1967 article persuasively presents correlation for the dates listed in the 1955 and 1957 articles, when then-Senator John Kennedy underwent spine surgery, specifically lumbar fusion, at a New York hospital, and describes the successful medical management of his hypoadrenalism (Addison's disease). Although Senator Kennedy's name is not mentioned in these reports, the majority of the panel is convinced that he could still definitely be identified, substantially earlier contentions that he did suffer from hypoadrenalism. That he suffered from this condition is further supported by the fact that the President's physician provided the attending surgeons at Parkland Hospital with steroids. The gunshot injuries clearly were fatal, however, and would have been fatal independent of the condition of his adrenal glands.
(361) Pathologists in courts of law are usually asked to provide evidence concerning the condition of organs other than those directly concerned with the immediate cause of death. All of the panel members are of the opinion that a medicolegal autopsy report should be complete, whether or not it is ultimately available to the public. In support of this position, the panel suggests that, were the injuries inflicted upon the President of such a nature that a preexisting disease might alter the prognosis, observations about such a condition would be essential to evaluating properly the interrelationship of the preexisting natural disease and the terminal injuries. The panel believes the autopsy should be complete, even though in many jurisdictions in the United States all of the information derived as a result of examination at public expense pursuant to statute may be made public on presentation of a request with reasonable cause.

3. Organs and histologic sections

(362) All members of the panel acknowledge that, as a rule, when reviewing another pathologist's work, they should have access to all pertinent materials, including written reports, histologic slides, and any tissues or other evidence which was retained. In this instance, since no descriptions, photographs, or microscopic slides were available to document the condition of the inside of the brain, and since injuries to the brain were critical in evaluation aspects of the President's death, the panel urged to committee to search for the missing histologic slides, tissues, and the brain itself. The majority of the panel (all except Dr. Wecht) believes that a most reasonable and diligent search was undertaken at considerable expense and effort by the committee and that the missing materials are not available. The majority of the panel further believes that the documentation that is available—photographs of the body and the uncut brain, X-rays, and autopsy and physician reports—are sufficient to permit accurate evaluation of the gunshot injury to the head and brain, and that proper examination of the brain itself would only further confirm the panel's conclusion that one, and only one, bullet struck the President's head from behind. The panel believes that all of the histologic sections should also be reviewed, but that such review would not alter its conclusions, which are based on the extensive gross injuries described and documented and on the microscopic report available.

DESCRIPTION OF GOVERNOR CONNALLY'S WOUNDS

(363) Governor Connally sustained an entrance wound in the right lateral back, with a corresponding exit wound on the right front chest below the right nipple; a reentry wound on the dorsum (back or top) of the right wrist, with a corresponding outshoot wound on the volar (palmar or lower surface) of the right wrist; and a superficial entrance wound in the left thigh. Documentation of these wounds is as follows:

Entrance (inshoot) wound of the right lateral back (thorax)

1. Clothing—suit jacket (back)

(364) The suit is of lightweight, black, closely woven fabric; the jacket is three-buttoned, single-breasted, size 42 tall. There is an irregularly shaped oval defect perforating all layers of the jacket on the right back, with its midpoint 19.5 centimeters to the right of the midline and 13.6 centimeters below the upper shoulder-seam, measuring approximately 1.7 by 1.2 centimeters. (See fig. 33, a photograph of the back of Governor Connally's jacket.) Further characterization of this and other defects in Governor Connally's clothing was not undertaken prior to the garments being cleaned. (The Connally clothing was cleaned, presumably to make it more presentable, before any members of the original investigative team determined that scientific examination might be of value.) There was never any attempt to preserve the chain of custody of this evidence, an essential procedure if it were to be used in a subsequent criminal proceeding.



FIGURE 33.—Photograph of the back of Governor Connally's suit jacket, showing the posterior entry hole.

(365) This situation is explained in correspondence from Hoover to Rankin, dated April 16, 1964:

> Reference is made to your letter dated April 9, 1964, covering transmittal to the FBI laboratory of Gov. John Connally's coat, shirt, trousers and tie, and requesting an examination of these items. The results of the examination are set forth below.
>
> For your information the coat has been designated C311, the trousers C312, the shirt C313, and the tie C314.

Nothing was found to indicate which holes were entrances and which holes were exits. The coat, shirt and trousers were cleaned prior to their receipt in the laboratory, which might account for the fact that no foreign deposits of metal or other substances were found on the cloth surrounding the holes. Further, no characteristic position of the fibers of the cloth around the holes, which is one of the factors considered in determining whether a hole is an entrance or an exit hole, was found. The sizes of the holes in the clothing do not necessarily aid in this determination, since a hole can be enlarged if the bullet strikes at an angle, sideways or partially sideways, or if it passes through a fold in the cloth. Also, if a bullet is irregularly mutilated, an entrance hole could be larger than an exit hole.

It was not possible from an examination of the clothing to determine whether or not all of the holes were made by the same projectile or projectile fragments.(*56*)

(366) The panel suggested that appropriate areas of Governor Connally's clothing, including the area of the jacket around the back entrance defect and corresponding exit and reentry defects elsewhere on the clothing, be subjected to two types of analysis: Soft X-ray* and energy dispersive X-ray* examination. The purpose would be primarily to determine if any missile particles remained on the clothing, to analyze and define the elemental nature of such fragments, and, finally, to determine if any correlation might be made between the elements found and the missile's behavior after striking Governor Connally.

(367) The analysis was conducted at the Southwest Institute for Forensic Sciences in Dallas, Tex. (a copy of the complete report is found in addendum F). It contains the following discussion on the defects in Governor Connally's clothing:

In regard the J.B.C.'s clothing: It should be noted that the clothing had been subjected to dry cleaning at some time after the shootings. The validity of the results may therefore be questioned.

One aberrant result, unexplained, possibly due to a misrecording of data or a temporary malfunction of the instrument (EDX) or perhaps an ephemeral contamination, was encountered. Reanalysis of the questioned area proved the aberrance. Copper was found in quantity in the region of the defect in the right front. The results would indicate that the apparent borderline copper analysis is due to the lining containing some copper. Iron, apparently from blood, was still detectable near the right front defect in the coat, despite dry cleaning.

The analytical results are of interest, because there is proof of very little fragmentation of the missile (missiles) as it (they) passed through the person(s) of J.F.K. and J.B.C. Indeed, the only indication of copper in any quantity was in the region of the front defect of the coat of J.B.C. The term "in quantity" means only that copper was found in clearly detectable amounts by the use of the EDX [energy-

dispersive X-ray] equipment. The actual amount is very small, and the absence of particulate material on the SC [soft X-ray] film is not surprising. (*57*)

2. Clothing—Shirt (back)

(368) The shirt is long-sleeved, French-cuffed, white dress, size 16–35. A defect in the back measuring up to 0.8 centimeter in vertical diameter and 1.3 centimeters in transverse diameter is in a position corresponding to the defect in the jacket, with its upper margin 12 centimeters below the shoulder seam and 5 centimeters medial to the right shoulder seam (See fig. 34, a photograph of the back of Governor Connally's shirt)



FIGURE 34.—Photograph of the back of Governor Connally's shirt.

3. Surgical report and interview with the surgeon

(369) Dr. Robert Shaw's operative record characterizes the posterior wound of entrance as follows:

> It was found that the wound of entrance was just lateral to the right scapula close [to] the axilla yet had passed through the latysmus [latissimus] dorsi muscle * * * the wound of entrance was approximately three centimeters in its longest diameter * * * (*58*)

(370) A report on a committee interview with Dr. Shaw included the following:

> The rear entrance wound was not 3 centimeters [in diameter] as indicated in one of the operative notes. It was a puncture-type wound, as if a bullet had struck the body at a slight declination [i.e., not at a right angle]. The wound was actually approximately 1.5 centimeters in diameter. The ragged edges of the wound were surgically cut away, effectively enlarging it to approximately 3 centimeters.(*59*)

(371) Shaw also said in the interview that this wound was shaped as if the bullet had entered at a slight declination. Shaw probed through this wound with his finger and felt the Penrose drain that he had placed in the latissimus dorsi muscle.*

(372) In measuring the diagram, made by Dr. Shaw at the time of the staff interview in order to illustrate better the size of the entrance and exist wounds, it is interesting that the entrance wound measurements taken from this diagram are 1.5 by 0.8 centimeters, with the long dimension in the longitudinal plane of the body (the long axis), and that the exit wound is approximately 5 centimeters in greatest dimension. (See fig. 35, a drawing prepared during the interview in which Dr. Shaw attempted to convey the actual size and location of both the entrance wound in the right posterior thorax and the corresponding exit in the right anterior thorax.)

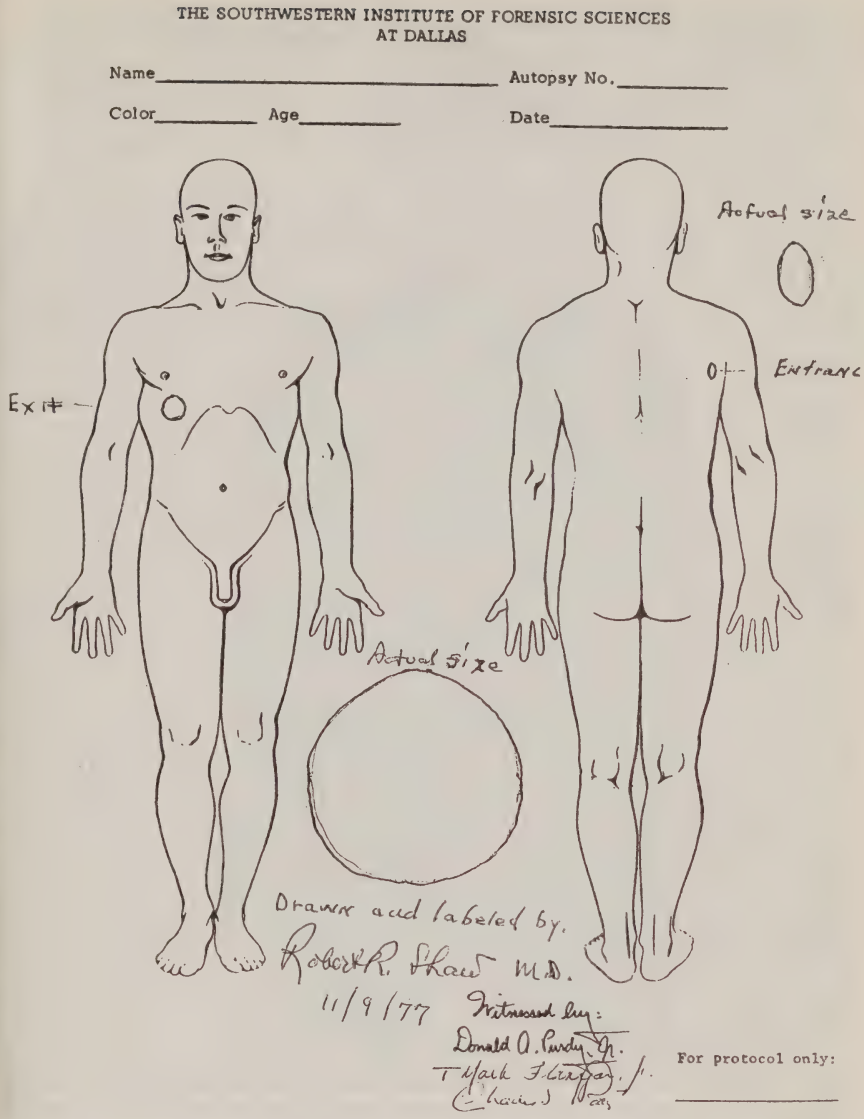


FIGURE 35—Reproduction of a drawing prepared during a staff interview with Dr. Robert R. Shaw, in which Dr. Shaw attempted to convey the actual size and location of both the entrance hole in the posterior thorax and the corresponding exit in the right anterior thorax.

(373) In September 1978, Dr. Baden conducted a physical examination on Governor Connally to see the scars resulting from his wounds (see addendum G for the complete report on this examination). Dr. Baden localized these wounds as follows:

> [A]t the site of gunshot perforation of the right upper back there is now a 1⅛ inches long horizontal pale, well

healed scar that is up to three-eights inch wide centrally, with a lateral border slightly lower than the medial border (about 5 inches). The medial margin is one-half inch superior to and five-eights inch medial to the apex of the right posterior axilla. The lateral border is 6 inches to the right of the midline of the back and 4¾ inches below the shoulder line.(*60*)

(374) The panel believes that the ovoid characterization of this wound requires interpretation. The examination of the clothing, had it been conducted immediately after the wounding, might have been of assistance. One possible interpretation is that the ovoid entrance wound, as described, could have resulted from the missile striking the skin surface on a tangential plane, causing an abrasion most pronounced on the margin adjacent to the acute angle of the trajectory that would create the illusion that the wound was more ovoid than it actually was. The undermining of the contralateral margin, when the wound itself is looked into, would accentuate the out-of-round character of the wound inself. Dr. Shaw, in his original description and subsequent interview, did not note any significant undermining or abrasion by the missile which would have been produced by a non-tumbling,* tangential impact.

(375) Another possible interpretation of this ovoid wound is that the missile itself, just prior to striking the body, was out of alinement with its trajectory (due to striking an intervening object). That is to say, it had tumbled * slightly before entering the body, thereby creating an elongated defect.

(376) The panel, in its evaluation, also considers it important that the shape of the defect in the clothing would have been a more uniformly round hole if the bullet had struck on a tangential plane with the missile alined with its trajectory. The panel (except for Dr. Wecht) concludes, therefore, that the wound in Governor Connally was probably inflicted by a missile which was not alined with its trajectory but had yawed* or tumbled* prior to entry into the Governor. This conclusion incorporates consideration of the testimony of relatively inexperienced, somewhat hurried observers, not fully aware of the subsequent implications of their findings.

Exit (outshoot) wound of the right anterior chest

1. Clothing—Suit jacket (front)

(377) There is an irregularly round defect, measuring 1 by 1 centimeters in maximum diameter, penetrating all layers of the coat on its right front side. The midpoint of the defect in the jacket is 34.5 centimeters below the upper border of the collar, 49 centimeters above the lower margin of the coat, and 15 centimeters to the right of the midline. (See fig. 36, a photograph of the front of Governor Connally's coat, illustrating the location of the anterior exit bullet hole.)



FIGURE 36.—Photograph of the front of Governor Connally's suit jacket, showing the location of the anterior exit bullet hole.

2. Clothing—Shirt (front)

(378) There is a slit-like defect in the front of the shirt, measuring 3.8 centimeters in length and varying from 0.1 to 0.2 centimeter in width. The midpoint of the defect is 15.7 centimeters to the right of the midline and 27.9 centimeters below the shoulder seam. The long axis extends inferiorly and medially at an angle of approximately 60° from the vertical axis of the shirt. This joins medially a vertical linear tear measuring 3.1 by 0.1 to 0.2 centimeters and is paralleled by another vertical linear tear measuring 4.8 by 0.1 to 0.2 centimeters.

The difficulties of further characterizing these defects by laboratory examination were described earlier in the letter from Hoover to Rankin and in the report describing the nondestructive analyses (soft X-ray* and energy dispersive X-ray*) results obtained after examination of the clothing. (See fig. 37, a photograph of the front of Governor Connally's shirt, illustrating the location of the anterior, exit bullet hole.)



FIGURE 37.—Photograph of the front of Governor Connally's shirt, showing the location of the anterior exit bullet hole.

3. Surgical report and interview with the surgeon

(379) Dr. Shaw's operative record characterizes the exit wound as follows:

> [The missile] emerged below the right nipple * * * [T]he wound of exit was a ragged wound approximately 5 centimeters in its longest diameter. (*61*)

(380) Subsequently within his report, Dr. Shaw described his operative procedure: "An elliptical incision was made around the wound of exit removing the torn edges of the skin and the damaged subcutaneous tissue." In a committee interview, Dr. Shaw further localized and characterized the exit wound in a drawing in which he attempted to reproduce the actual size of the exit defect (see fig. 35).

(381) In Dr. Baden's report of his recent examination of Governor Connally, he localizes the residua of this wound as follows:

> The exit wound scar is in the right front chest 1 inch below the central nipple line and has been incorporated in a surgical scar that is 9½ inches long that extends from 3 inches to the right of the midline, 1 inch beneath the nipple line, and proceeds superiorly to the right upper posterior axillary area. (*62*)

Course of the missile through the back (thorax)

1. X-rays

(382) Dr. J. Reynolds' X-ray report includes the following which is relevant to the missile's path through the thorax:

> Anterior-posterior film of the chest was obtained on November 22, 1963. There is marked soft tissue swelling of the lateral aspect of the right thorax and free air is seen in the soft tissues at this site and in the region of the axilla.* The right fifth rib is fractured in several places. The right lung base shows a dense confluent infiltration presumed to be the result of pulmonary contusion.* No free pleural fluid* or pneumothorax* is identified at this time but the shadow of a safety pin is superimposed on the right hemithorax, perhaps marking the site of a chest tube. (*63*)

(See fig. 38, a reproduction of the anterior-posterior* X-ray film of the chest of Governor Connally, illustrating the multiple fractures of the right fifth rib and the contusion of the right lung.)

(383) The report states further:

> A subsequent film on November 23, 1963 was taken in posterior-anterior projection. Again, it shows that the right base is obscured by a homogeneous density which probably represents pulmonary contusion.* The heart and mediastinum* the study of the previous day. (*64*)



FIGURE 38.—Photograph of the anterior-posterior X-Ray film of the chest of Governor Connally, showing the multiple fractures of the right fifth rib and the contusion of the right lung.

2. Surgical report and interview with the surgeons

(384) Dr. Shaw's operative record characterizes the pathway of the missile and its effects as follows:

> The incision was then carried in a downward curve up toward the right axilla* so as to not have the skin incision over

the actual path of the missile through the chest wall. This incision was carried down through the subcutaneous tissue to expose the serratus anterior muscle* and the anterior border of the latissimus dorsi muscle.* The fragmented and damaged portions of the serratus anterior muscle were excised. Small rib fragments that were adhering to the periosteal tags were carefully removed preserving as much periosteum* as possible. The fourth intercostal muscle bundle and fifth intercostal muscle bundle were not appreciably damaged. The ragged ends of the damaged fifth rib were cleaned out with the rongeur. The pleura had been torn open by the secondary missiles created by the fragmented fifth rib. The wound was opened widely and exposure was obtained with a self retaining retractor. The right plural [pleural] cavity was then carefully inspected. Approximately 200 cubic centimeters of clot and liquid blood was removed from the plural [pleural] cavity. The middle lobe had a linear rent starting at its peripheral edge going down toward its hilum and separating the lobe into two segments. There was an open bronchus in the depth of this wound. Since the vascularity and the bronchial connections to the lobe were intact it was decided to repair the lobe rather than to remove it * * * This laceration had undoubtedly been caused by a rib fragment * * * There was no evidence of injury of the mediastinum and its contents * * * The upper lobe was found to be uninjured * * * It was found that the latissimus dorsi muscle although lacerated was not badly damaged * * *(*65*)

(385) Dr. Shaw's recent committee interview report contains this recharacterization of the findings of his procedure:

There was a smaller tunneling wound in the back/chest. The bullet struck the fifth rib in a tangential way pushing it out, causing a fracture at a point farther up the rib (like a tree limb breaking from pressure exerted near its end). Bullet and rib fragments exited out the front of the Governor causing the larger exit hole.

Shaw said the lower two-thirds of the Governor's lower lung lobe was like liver, full of blood and holes caused by secondary (bone) missile fragments. There was a rent in the latissimu dorsi.(*66*)

(386) Dr. Petty, also present at Dr. Shaw's interview, summarized Dr. Shaw's observations concerning the course of the missile:

There was a tunnel made by the missile in passing through the chest wall.

The bullet struck the fifth rib in a tangential manner and shattered approximately 10 centimeters of the posterior and lateral aspect of the fifth rib. The serratus anterior muscle was torn and the fifth and sixth intercoastal muscles were intact and the periosteum of the rib was nearly intact.

Shaw removed more of the fifth rib to enter the chest wall. There was damage of the middle lobe of the right lung due to

the impact upon the chest. It actually was ripped into two segments and there was a leak in the bronchus. The lower two-thirds of the lower lobe of the right lung looked just like liver, "just a bag of blood."

Shaw repaired the right middle lobe. It inflated well. There was no need to touch the lower lobe of the right lung except for a 1 centimeter long rent in it. This was oversewn. (*67*)

(387) In his summary of the interview, Dr. Petty suggested that the missile tunneled around the chest wall and did not proceed in a straight line from entrance to exit.

(388) The majority of the panel members, however, disagree. They would have expected a comparable missile, which was slowed only by passage through the President's neck and by striking only a relatively thin and readily shattered rib, to pass from entrance to exit in a fairly straight line and to perforate the lung. They are not certain that the surgeon could have known whether the injury to the lung was caused by the missile or by rib fragments only. They cannot conclude solely from the findings on the internal injuries whether the missile which injured Governor Connally had struck an intervening target. They note, however, that the findings are entirely consistent with such a path. The relatively large back entrance perforation is indicative of the missile having first struck an intermediate target, and the relative lack of damage to the bullet is believed by some panel members and Larry M. Sturdivan, the wound ballistics expert, to indicate that the missile had passed through other tissue, slowing it down, before it hit the Governor, striking his rib and wrist.

(389) Dr. Baden's report comments on the angle of the trajectory:

> Positioning the Governor while erect in the anatomic posture shows the missile track to proceed from back to front, downwards at approximately a 10 degree angle, for a distance of 12½ inches through the body. (*68*)

Reentry wound into the dorsum (top or back) of the right wrist

1. Clothing—Suit jacket

(390) There is an irregular defect through all layers of the medial edge of the right sleeve of the coat, located 1.9 centimeters from the medial sleeve seam posteriorly; it measures 1.6 by 0.9 centimeters and involves both anterior and posterior (front and back) surfaces, representing the defect of both entry and exist in the coat sleeve.

2. Clothing—shirt

(391) There is a defect which passes through both layers of the French cuff of the right shirt sleeve. The defect on the outer layer of the cuff measures 1.6 by 0.9 centimeters, that on the inner layer of the cuff 1.8 by 0.5 centimeters. These two defects approximate each other and are 10.0 centimeters from the cuff margin and 10.6 centimeters medial to its anterior corner.

3. Medical record review

(392) Dr. Charles Gregory's operative record describes the wound of entry on the Governor's wrist:

> The wound of entry on the dorsal aspect* of the right wrist over the junction of the right distal fourth of the radius and shaft was approximately 2 centimeters in length and rather oblique with the loss of tissue with some considerable contusion at the margins of it. (*69*)

This enlarged entrance perforation is suggestive of a reentrance wound.

(393) Dr. Vernie A. Stembridge's surgical pathology report includes a characterization of the wound to the dorsal surface of the wrist:

> Specimen (A) consists of an ellipse of skin which is white and hairy measuring 30 millimeters by 10 millimeters by 6 millimeters. In the middle of the epidermal* portion of the specimen is a ragged laceration extending into the dermis* and measuring 10 millimeters by 2 millimeters by 2 millimeters. A small amount of hemorrhage is present in the subcutaneous tissue and dermis.*
>
> Microscopic examination of skin from the right wrist reveals a focal absence of epithelium* with hemorrhage and disruption of the underlying dermis and soft tissue. (*70*)

(394) The panel considers this histologic description to be consistent with the defect being an entrance wound.

Exit wound on the volar (lower) surface of the right wrist

1. Clothing—Suit jacket (see above)

2. Clothing—Shirt

(395) The defect passes through both layers of the French cuff of the right shirt sleeve on the under surface. It measures 1.9 by 1.3 centimeters in the outer layer and 2 by 1.5 centimeters in the inner layer. It is 2.8 centimeters from the cuff margin and 11.3 centimeters medial to its posterior corner.

3. Medical record review

(396) Dr. Gregory's operative record characterizes the exit wound on Governor Connally's wrist as follows: "There was a wound of exit along the volar* surface of the wrist about 2 centimeters above the flexion crease of the wrist and in the midline." (*71*)

Course of the missile through the right wrist

1. Medical record review

(397) Dr. Gregory's operative record describes the course of the missile through the wrist:

> It was noted that the tendon of the abductor palmaris brevis was transected, only two small fragments of bone were removed, one approximately 1 centimeter in length and consisted of lateral cortex which lay free in the wound and had no soft tissue connections, another much smaller fragment perhaps 3 millimeters in length was subsequently removed. Small bits of metal were encountered at various levels throughout the wound and wherever they were identified and could be picked up were picked up and have been submitted to the pathology department for identification and

examination. Throughout the wound and especially in the superficial layers and to some extent in the tendon and tendon sheaths on the radial side of the arm are small fine bits of cloth consistent with fine bits of Mohair. It is our understanding that the patient was wearing a Mohair suit at the time of the injury and this accounts for the deposition of such organic material within the wound.(*72*)

(398) Dr. Stembridge's report characterizes the tissue removed from the right wrist:

Specimen (C) is labeled bone and debridement from right wrist and consists of several small pieces of tissue. Two small fragments each 3 mm. in greatest dimension appeared to be pieces of cotton and/or wool. Two other small pieces, the largest of which measured 8 millimeters by 3 millimeters by 2 millimeters and the smallest of which measured 3 millimeters by 3 millimeters by 2 millimeters appear to be soft tissue. The other portion of the specimen consists of three irregular fragments of bone, the largest of which measures 1 centimeter by 5 millimeters by 3 millimeters and is composed of both cortical and cancellous bone and the other two measuring 6 millimeters by 2 millimeters by less than 1 millimeter and appearing to be composed of cortical bone only. The soft tissue fragments are submitted for microscopic examination.

Microscopic examination of debridement from the right wrist reveals multiple fragments of bone, and small amounts of fibrofatty connective tissue. Embedded within the fibrofatty tissue is a small segment of fragmented peripheral nerve.(*73*)

The panel concludes that its findings further indicated that the missile had passed through Governor Connally's suit jacket and wrist and had remained intact.

(399) Dr. Baden, in his recent examination of Governor Connally, localizes the residua of these wounds:

Examination of the right wrist shows the gunshot wound of entrance to be incorporated into a well healed surgical dorsally and extending to the wrist; there are well healed fine surgical scars on the ventral aspect (undersurface) of the wrist, horizontally and longitudinally.(*74*)

2. X-Rays

(400) Dr. J. Reynolds' X-ray report describes the wound in the wrist:

Films of the wrist were obtained on November 22, 1963, and they show a comminuted fracture * of the distal portion of the radial shaft. In this area, in the volar aspect of the distal forearm, a few small metallic fragments are seen in the soft tissue. The alignment of the bone at the fracture appears good.(*75*)

(See figs. 39, 40, and 41 and reproductions of the X-rays.)



FIGURE 39.—Photograph of an X-ray of the wrist, showing the extent of the fracture and missile fragmentation.



FIGURE 40.—Photograph of an X-ray of the wrist, showing the extent of the fracture and missile fragmentation.



FIGURE 41.—Photograph of a LogEtronic enhancement of a wrist X-ray, showing more clearly the extent of the fractures and missile fragmentation.

3. Disposition of the missile fragments from the wrist

(401) An FBI report by Special Agent J. Doyle Williams, dated November 30, 1963, describes the disposition of the missile fragments, about which there are some confusion:

> Doctor Charles Francis Gregory, Parkland Hospital, stated he and Doctor Tom Shires and other staff physicians per-

formed surgery on Governor John Connally on November 22, 1963. He states surgery performed by him was done on the Governor's right arm, and that he removed from the arm a small fragment of metal. He stated the metal fragment was placed into a transparent container for preservation, and that during the operation, he recalled no other pieces or bits of metal being removed from the Governor's body.

Doctor Gregory was asked whether or not he removed or saw another doctor remove a small fragment of metal from the left thigh of Governor Connally, and he states that although X-rays indicated the possibility of a small fragment of metal embedded in the left thigh that no surgery was performed to remove same.

Doctor Gregory stated Surgery Supervisor Audrey Bell took custody of the fragment of metal removed from the Governor's arm, and that the ultimate disposition of the metal which was considered to be of possible evidentiary value, could best be explained by Miss Bell. He stated he did not on his own knowledge know, however, but he had been advised [that] Miss Bell obtained a receipt from State Trooper Bob Nolan [a State of Texas highway patrol officer] and transferred the metal fragment to him in accordance with instructions from the Governor's office at Parkland Hospital. (*76*)

In another FBI report, dated November 23, 1963, Special Agent Williams said:

Bobby M. Nolan, Texas highway patrolman, Tyler district, was interviewed relative to a bullet fragment removed from the left thigh of Governor Connally, which was turned over to him at Parkland Hospital in Dallas for delivery to the FBI.

Nolan stated his instructions were apparently not clear at the outset and that following contact with his superior officers while at the Dallas Police Department, he turned the bullet fragment over to Captain Will Fritz [Dallas Police Department] at approximately 7:50 p.m. He stated he had no further information concerning the matter and that his only participation in this series of events was the acceptance of the fragment and delivery of same to Captain Fritz. (*77*)

(402) All the panel members except Dr. Wecht agree, after a review of the notes of Drs. Gregory and Shires on the operation, that the missile fragment that Officer Nolan attributed to the thigh was probably the fragment recovered from the right wrist. This fragment is labeled "Q9 metal fragment from arm of Governor John Connally" in FBI report "DL 89–48" and in correspondence addressed to Dallas Police Chief Jesse E. Curry.

(403) All the panel members except Dr. Wecht would have expected a comparable rifle missile perforating the wrist, without being slowed by striking an intervening target, to have produced significantly greater soft tissue and bone injury and a smaller skin entrance perforation. They also agree that the method of labeling and handling this evidence was so poor that there might have been difficulty in having it admitted as evidence in a criminal proceeding.

Reentry wound in the left thigh

1. Clothing—Trousers

(404) There is a defect of the left pant leg 61.5 centimeters below the top of the trousers and 6.4 centimeters medial (inward) to the crease of the pants; it measures 0.7 by 0.9 centimeter and is rectangular in shape. (See fig. 42, a photograph of the defect in Governor Connally's trousers.)

2. Medical record review and interview of the surgeons

(405) Dr. Shires' operative record characterizes the thigh wound as follows:



FIGURE 42.—Photograph of the suit trousers of Governor Connally, showing the location of the missile defect.

There was a 1 centimeter punctuate missile wound over the juncture of the middle and lower third, medial aspect, of the left thigh. X-rays of the thigh and leg revealed a bullet fragment which was embedded in the body of the femur* in the distal third. The missile wound was seen to course through the subcutaneous fat and into the vastus medialist.* The direction of the missile wound was judged not to be in the course of the femoral vessel, since the wound was distal and anterior to Hunter's canal.(*78*)

(406) Dr. Stembridge's report characterizes the tissue removed from the left thigh as follows:

Specimen (B) is labeled skin from left thigh and consists of an ellipse of white skin measuring 22 by 8 by 7 millimeters. In the center of the ellipse is a 6 by 4 by 3 millimeter oval laceration extending down into the subcutaneous tissue from the epidermis.*

Microscopic examination of the tissue from the left thigh reveals an area from the epithelial puncture with complete disruption of the underlying dermis and soft tissue producing necrosis.* PP/md Pathologic diagnosis: "Tissue from left thigh: Recent hemorrhage (history of gunshot wound.)"(*79*)

(407) The report on the committee interview with Dr. Shires states that his examination of the thigh was:

"* * * largely an exploration to insure there was no vessel damage." [T]he only significant wound in the thigh was a missile track. He says he merely did a debridement. When asked if the thigh wound could have been caused by a secondary fragment, Dr. Shires said, you "* * * can't tell anything from the size or shape of the wounds as to whether or not it is an entrance or exit wound." He said that when dealing with fragments, there are too many unknown variables and that it is hard to differentiate fact from fiction. [He also said] the wound was small and that the thigh had very little damage and did contain a metal fragment. Dr. Shires was asked about his Warren Commission testimony that noted a peculiarity in the nature of the wound; namely, that the tissue damage seemed more significant than the size of the fragment present. He said that it is difficult to determine how the fragment entered. He said, "* * * all you can say is that a tangential wound occurred." He said that there was a large range of possibilities for what happened.

Significantly, Dr. Shires said the main issue he was seeking to resolve by the examination of the thigh was whether the missile could have hit a major vessel. He said it did not, and that he did not physically pursue the fragment that was there because it was "* * * not medically significant." Dr. Shires said he was able to determine that the fragment was in the thigh bone from his examination of the original Connally X-rays.(*80*)

(408) After reviewing the three original thigh X-rays and the enhancement (LogEtronics*) of these X-rays, Dr. Shires indicated:

> [I]t doesn't make any difference whether the metal fragment is in the femur* or just under the skin with regard to the issue of whether there was a full bullet striking the thigh or a fragment of a bullet. He said the wounds were probably caused by a tangential hit. He said a tangential wound could have sent the fragment anywhere into the thigh. Dr. Shires noted that on the enhancement of the thigh (LogEtronics*) the item in the bone looks more like an artifact than when he examined the original. He was openminded about the possibility that the fragment could have been just under the skin, but preferred to reiterate his initial impression that the fragment was in the thigh bone. Dr. Shires said that while they explored the entire track of the missile, they were not "* * * exploring it as a track * * *," rather they were "* * * exploring the wound looking for a big missile injury." Dr. Shires found little hemorrhage, though he thought it was likely that a high velocity missile did not pass through the skin causing the wound.(*81*)

(See figs. 43 and 44, enhanced X-rays of Governor Connally's thigh.)

3. X-rays

(409) Dr. Reynolds' report on Governor Connally's X-rays describes the X-ray of the left femur and left lower leg:

> Film of the shaft of the left femur and of the left lower leg reveals no fracture in this area. A tiny metallic fragment is seen in the lower medial aspect of the thigh, in the subcutaneous fat.(*82*)



FIGURE 43.—Photograph of a LogEtronic enhancement of a thigh X-ray, showing the location of the missile fragment in the subcutaneous fat.



FIGURE 44.—Photograph of a LogEtronic enhancement of a thigh X-ray, showing the location of the missile fragment in the subcutaneous fat.

(410) On November 29, 1963, Dr. Reynolds prepared a supplementary X-ray report which further characterizes the shadows within the thigh:

> AP (anterior-posterior) and lateral films of the digital portion of the left thigh were obtained and include the distal portion of the shaft and the region of the knee. One film is in the AP projection and the other the lateral projection with the direction of the beam from medial to lateral and the film lying adjacent to the lateral aspect of the thigh.

No fractures are seen. A few punctuate and linear densities are seen on the film but these are inconsistent, and appear on one and not the other and therefore interpreted as artifacts.

There is, however, one density which remains constant on both films and appears to lie beneath the skin of the region of the subcutaneous fat in the medial aspect of the thigh. By measurement on the films, without correction for target film distance and object film distance, this small density lies 15.2 centimeters above the distal end of the medial femoral condyle* on the AP film and, on this film, lies 8 millimeters beneath the external surface of the skin. It is 6.25 centimeters medial to the femoral shaft. On the lateral film, the center of this small metallic density lies 15 centimeters above the distal end of the medial femoral condyle. It lies 4.9 centimeters posterior to the skin of the anterior surface of the thigh and it is superimposed on the shaft of the femur.* In relation to the femur, the density is superimposed on a point 1.5 centimeters posterior to the exterior of the anterior cortex.

The shape of this density is irregular but is roughly oval. Precise measurements are difficult but it is estimated that the greatest length in the AP projection is about 3.5 millimeters and the greatest width about 1.3 millimeters.

Measurements of the densities in the lateral projection reveal the greatest length to be about 2 millimeters and the greatest width to be about 1.5 millimeters. The long axis of the metallic object is oriented generally along the axis of the femur.(*83*)

(411) The panel concurs with Dr. Reynolds' opinion that the 2-millimeter density is a missile fragment that was just under the skin and was not deep within the thigh in the femur bone, as described in the Warren Commission Report. The panel believes the density in the femur bone was erroneously described and is an artifact in the X-ray film and not a bullet fragment.

(412) The panel members, except Dr. Wecht, agree that in their experience a comparable rifle missile that did not strike an intervening target would produce greater soft tissue and bone injury and would penetrate much deeper into the thigh and probably pass through it.

4. Nondestructive analysis of tissues from the right wrist and left thigh and of slides prepared from them

(413) Panel member Dr. Petty obtained the paraffin blocks containing residual tissue excised from the wrist and thigh of Governor Connally from Vernie A. Stembridge, M.D., the original examining surgical pathologist. Dr. Petty subjected the tissue to nondestructive analysis at the Southwestern Institute of Forensic Sciences in Dallas, using techniques which employ X-ray back scatter* with scanning electron microscopy* and energy dispersive X-ray*. The report of this examination states:

The three microscopic slides were examined and no evidence of metallic fragments was noted either by direct observation or by seeing evidences of tearing of the tissues which might have occurred as a result of the nicking of the microtome knife

due to contact with metallic fragments that would occur during preparation of the microscopic slides.

The paraffin blocks containing the tissues from the debridement were then subjected to energy dispersive X-ray analysis. No evidence of copper, lead, zinc, or nickel was found.

After preparation the paraffin blocks* containing the tissues removed at the time of debridement and still remaining following the preparation of microscopic slides were subjected to analysis using a scanning electron microscope fitted with a low angle detector for X-ray back scatter. No copper, lead, zinc, or nickel was found by means of this analysis. (*84*)

(See addendum H for the complete report.)

(414) The panel conclude that no metal fragments were present in the available tissues removed from the injured wrist and thigh for possible further analysis and comparison.

SUMMARY OF THE FORENSIC PATHOLOGISTS' PERSPECTIVE OF WOUND BALLISTICS

(415) To understand better the significance of the panel's observations and the bases for its conclusions, it is useful to review some of the terminology and basic concepts of wound ballistics and to indicate the limitations that certain variables impose on interpreting the findings. Some of these factors were considered and recorded in a reasonably accurate manner during the original autopsy and subsequent experimentation; others were not.

(416) The forensic pathologist is trained to observe the morphologic (structural) or physical effects of a missile or missiles on a body and to interpret these effects in order to provide an investigator with as much information as possible, as detailed in section V of this report, including: the distance or range of the weapon from the body; relationship of the weapon and trajectory of the missile to the body; approximate mass and velocity of the missile (which together characterize its kinetic energy); and the amount of this kinetic energy transferred from the missile to the body after striking, together with the results of such impact on, or perforation of, the tissues damaged and the body as a whole. These observations will be discussed separately, with particular emphasis on their relationship to specific evidentiary items examined.

Range of the weapon from the target

(417) A missile must have sufficient velocity (speed) to cause a particular wound. The velocity depends on the type of ammunition employed, including the type of powder and powder charge. Velocity drops off as the distance between the weapon and the target increases.

(418) The missile is not the only object that emanates from the firearm. Expanding gas produced by the burning of the powder, which actually pushes the missile out of the bore of the firearm, bursts forth from the muzzle with great velocity, causing the audible report associated with discharge. Powder grains are also blown out of the muzzle; these may be partially burned or completely unburned. Thus, gas,

powder and missile are all actually forced out of the bore of the weapon in any discharge of a firearm.

(419) The incandescent nature of the gas also causes flame and heat to emanate from the muzzle. In addition, small fragments of the missile itself and its coating are forced from the muzzle, together with any fragments of material that may have been in the bore of the weapon.

(420) The forensic pathologist estimates the range of fire and other particulars concerning injury from a firearm by examining the pattern of deposit of these substances about the bullet's point of impact on either the body or the clothing. Distance may be determined by comparing the pattern of these deposits with patterns produced by the same weapon fired with similar ammunition under similar environmental conditions at selected distances, with the weapon in a comparable position relative to the surface. Terms such as "contact," "close range" and "intermediate range" are used to characterize the shooting; characteristic details can vary from weapon to weapon and with various types of ammunition.

(421) When a weapon is fired close against the skin's surface, virtually all the substances, including those from the muzzle blast itself, penetrate the skin to the underlying tissues, where they may be detected by physical or chemical means. In addition to these deposits, the missile itself is often coated with a lubricant in which microscopic and macroscopic particles of primer or powder charge residue may be mixed, which, barring an intermediate target between the weapon and the body, are usually deposited at the margins of the perforation of the clothing or the skin. This residue is termed "bullet wipe" by the forensic pathologist.

(422) If all the above-mentioned residues are missing except "bullet wipe," the gunshot wound is characterized as a "distant" wound, meaning that the muzzle of the weapon was discharged at a distance from which it would cause no residue to be deposited on the target. Such a wound consists of a missle perforation about which there might be a deposit of bullet wipe on the clothing and/or in the superficial margins of the wound; this is in addition to the abrasion collar, described earlier, produced when the entering bullet rubs against the margins of the indented skin.

(423) Wound ballistics research has shown that a missile velocity of 125 to 170 feet per second is necessary for penetration of the human skin when using steel spheres varying from one-sixteenth to one-quarter inch in diameter. Clothing also impairs perforation, but is usually less efficient than skin in hindering penetration, depending on its nature. The size of the defect in the skin varies considerably depending on the size and velocity of the missile. Skin is extremely elastic; it often stretches considerably to allow missile penetration and then returns to its normal shape thereafter, leaving a defect smaller than the missile itself. Close proximity of the weapon to the skin or bone beneath the skin and the angle of impact may enlarge the entrance perforation.

(424) The characteristics of the abrasion collar surrounding the entrance perforation reflect the direction of the bullet at the instant of impact with the skin and the angle of the trajectory prior to contact with the skin, as well as the shape of the missile itself. If the trajectory is perpendicular to the surface of the skin, the hole is usually round

and the abrasion collar correspondingly symmetrical around it. (See fig. 45, a picture of an abrasion collar when the missile was perpendicular to the target.) If the angle of the trajectory of the missile to the skin surface is other than perpendicular, the abrasion collar may be asymmetrical, that is, more prominent on the surface with the most acute angle between the skin and the bullet, and less apparent on the opposite surface, where there may be undermining of the tissues. (See fig. 46, showing an abrasion collar produced by a missile striking at an acute area.)

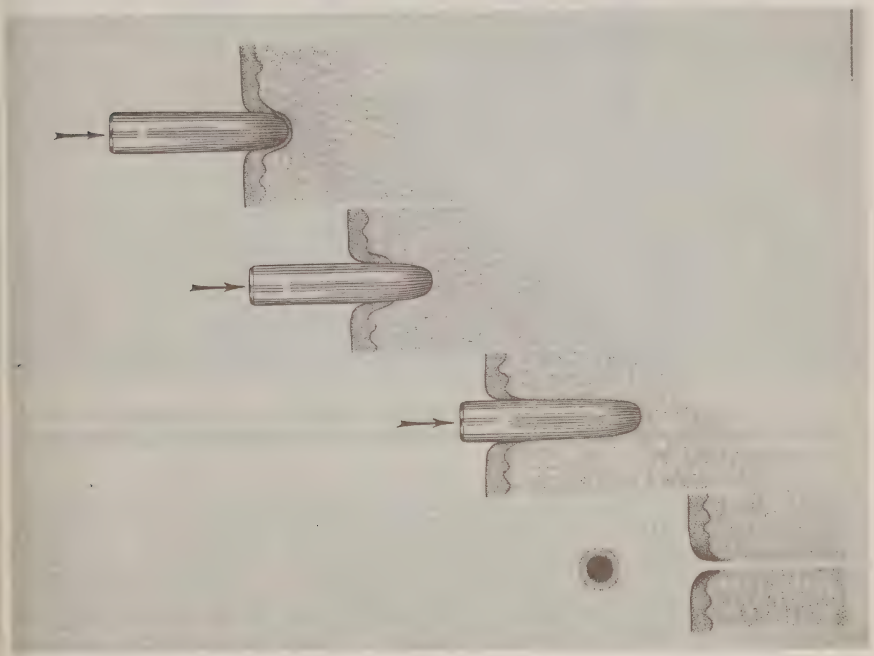


FIGURE 45.—Drawing of a typical entry wound, displaying a symmetrical abrasion collar resulting from a distant rifle shot with a trajectory at right angles to the skin surface.

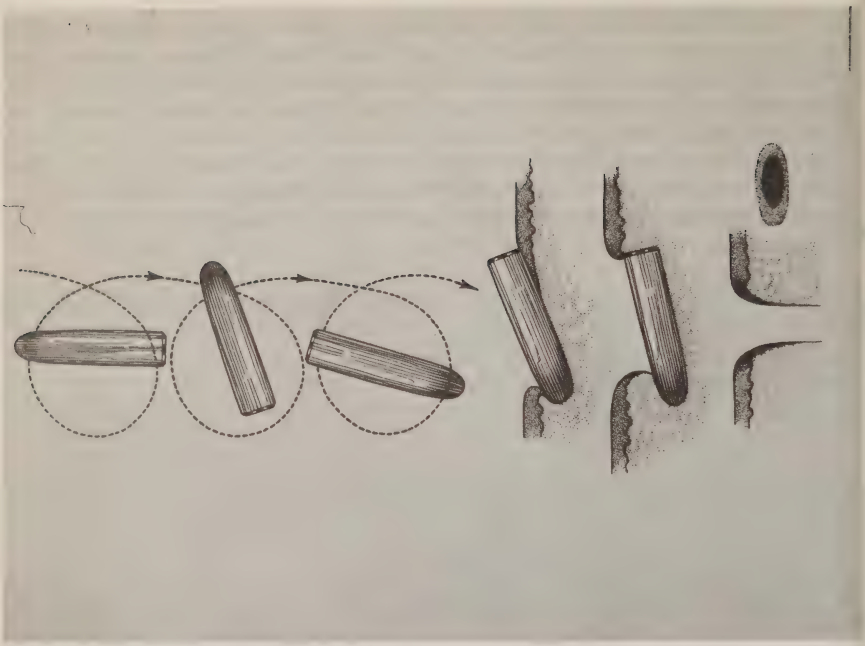


FIGURE 46.—Drawing of a typical entry wound, displaying an asymmetrical abrasion collar resulting from a distant rifle shot with a trajectory at an acute angle to the skin surface.

(425) If a missile strikes an intervening target, its normal yaw* may be exaggerated, or it may begin to tumble.* The entry wound in a subsequent target might reflect this distortion in trajectory by anything from a very slight asymmetry to an ovoid or virtually rectangular reentry wound. The latter would be the case if the missile were to strike sideways and is somewhat similar to what was described in some of the initial medical reports on the wound in the posterior thorax of Governor Connally. (See fig. 47, a drawing showing yawing or tumbling.) Such a subsequent entry wound might show no wipe residue in the skin because of the missile's prior passage through skin and tissue. Some small fragments of the metal from the missile's surface might break off as the missile strikes, however, and adhere to the margins of the defects in either the clothing or skin.

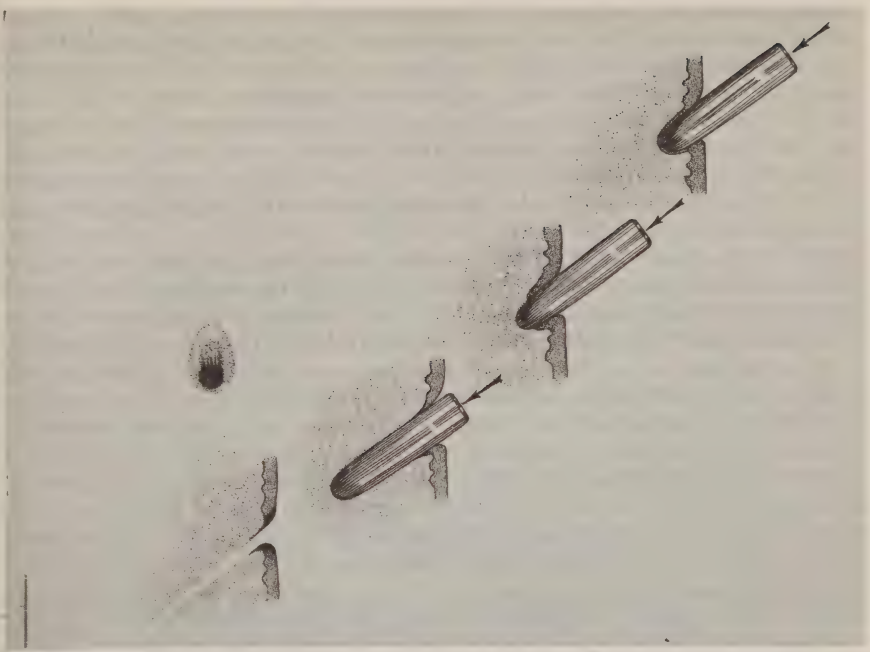


FIGURE 47.—Drawing of an entry wound caused by a tumbling or yawing missile.

(426) A missile's path may also be deflected from a true straight line by striking an intervening target, with the extent of deflection usually based on the mass of the intervening object. Slight deflection could result from striking a twig or small branch of a tree. The panel members fully considered the potential effects of intervening targets on yaw and deflection of the missiles and their possible significance to bullet paths and injury patterns.

Relationship of the weapon and missile trajectory to the target

(427) The accuracy of a weapon is provided by the spin imparted by the rifling* within the weapon and, to a lesser degree, the shape of the projectile. An elongated, symmetrically shaped missile is a more accurate than an irregular or spherical one. Other considerations in accuracy are distance to the target, effect of gravity on the missile while in flight, and effects of air resistance. Air resistance varies considerably with the speed of the missile. A very high velocity missile, after leaving the weapon, losses its speed at a much greater rate than does a low or intermediate velocity missile.

(428) A missile's pathway from the weapon to the target is known as its trajectory. A bullet should travel only a short distance after leaving the barrel before it stabilizes, minimizing the tendency to yaw.* During the first hundred yards or so, the bullet yaws* periodically, with its tip oscillating slightly from the line of flight. While in flight, the bullet's movement, although much quicker because of its high rate of spin, mimics that of a spinning top. At one instant the bullet is point on, at the next its axis is at a slight angle to the line of flight. These motions are periodic. This angle of yaw* increases to a certain

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degree and then progressively decreases until it is again zero, whereupon another similar gyration commences. During flight the degree of yaw* is normally comparatively slight, usually less than 3° in properly designed bullets of the type used in this homicide, except when near to the terminal, or maximum, range from the weapon. The tendency to yaw* increases in proportion to the density of the medium through which the missile passes relative to air; in tissues it may be increased many times more than in air (approximately 800), resulting in rapid, complex bullet motions.

(429) The yaw* of a bullet passing through a body may be rather extreme from point to point. Nevertheless, in the experience of panel members, if the missile enters the body without tumbling* or appreciable yaw,* its pathway or track is essentially a straight line as long as it does not strike a significant bony surface. To reconstruct this linear path, the tissues may be placed in the same anatomic relationship to each other as they were at the time of missile perforation. Consequently, in the absence of an intervening target, the missile's trajectory from point of origin to the body represents a backward extension of the bullet's pathway within the body. Bone or other extremely dense tissue, such as cartilage, in the immediate pathway of the missile might alter the angle of the track through the body after the characteristic skin perforation. This alteration is distinguishable from that produced by yaw,* which, at a particular point in the passage through the body, might cause the missile to be out of line with its pathway, although the pathway itself remains straight.

(430) The panel believes that the difficulty which Drs. Humes, Finck, and Boswell experienced in trying to place a soft probe through the bullet pathway in President Kennedy's neck probably resulted from their failure or inability to manipulate this portion of the body into the same position it was in when the missile penetrated. Rigor mortis may have hindered this manipulation. Such placement would have enabled reconstruction of the relationships of the neck and shoulder when the missile struck. It is customary, however, to dissect missile tracks to determine damage and pathway. Probing a track blindly may produce false tracks and misinformation.

(431) The panel is concerned as to the degree of accuracy attainable in determining the missile trajectory based on backward extension of a bullet track from within the body, particularly if precision within the range of a few degrees is required. An intermediate or high velocity bullet creates a temporary bullet track relatively larger than that of the bullet itself. This precludes reconstruction within the required degree of accuracy.

(432) Another factor hampering precise determination of the bullet track by the backward extension method is imprecision in knowing the relative position of various portions of the body at the instant of missile penetration. For example, the placing of President Kennedy's arm in the position it was in at the instant the missile struck the back might not be important because the relatively medial location of the entrance wound probably would minimize significant interference by the shoulder movement. The exit wound in the neck, on the other hand, might move to either side as much as several centimeters if his head or neck were to be rotated normally.

(433) The alinement of missile tracks that passed through several parts of the same body enables recreation of the relationships of these structures at the moment when struck. This allowed Governor Connally's posture at the time he was struck to be recreated.

(434) The determination of the point of origin of a missile by backward extension from a bullet track through a body must take into account not only the above variable factors, but also requires knowing, reasonably precisely, the exact position of that portion of the body penetrated at the instant it was struck. Any motion of the body, no matter how slight, would alter the extended trajectory of the missile from the bullet track in the body considerably and thereby change the point of origin. The longer the distance of the trajectory, the greater the magnification of even the smallest error in determining body position or path in the body.

(435) In the panel members' experience, if a missile, having struck an intervening target, is tumbling* significantly at the time it strikes a target, the missile's course through the second target is much more unpredictable, both as a result of its exaggerated yawing* at the point of impact and its loss of kinetic energy prior to striking the second target. Thus, the track through the Governor is less reliable for use in determining origin than that through the President, if the bullet struck the President first.

(436) The panel members agree that in their experience, if a missile strikes an object capable of creating a shearing force, such as the skull, the bullet's pathway in the body might be significantly different from the line of its trajectory prior to impact. The missile fragment lodged within the margin of the entrance skull defect is evidence of obvious shearing force with lateral torque. The only conclusion that the panel members can reach as a group is that all of the missile's mass, small and large fragments alike, would have moved forward from the point of impact with such a bony surface. The degree of lateral movement of the pathway would be influenced by the surface's convexity, amount of kinetic energy propelling the missile forward, and nature of the tissue through which the missile fragments were traveling.

(437) In the present case, the anterior-posterior and lateral X-rays of the skull indicate that the vast majority of the missile fragments moved in a cylindrical, slightly coned, pathway, in the same direction as the bullet's path prior to its striking the skull.

Wounding capability of the missile

(438) A missile's wounding capability is a consequence of the transfer of kinetic energy from the missile to the body. A missile's kinetic energy is the same as that of any moving object: $KE = mv^2/2g$, where m is the weight in English pounds and v is the striking velocity in feet per second. The results in conventional foot-pounds are derived by dividing by 2 times the acceleration due to gravity (32.2 feet per second per second). From this formula it can be deduced that the missile's kinetic energy varies as the square of its velocity. Thus, doubling the velocity increases the kinetic energy by a factor of 4, while doubling the mass serves only to double the kinetic energy.

(439) A missile passing through a body produces, around the wound track, a hemorrhagic area composed of the tissues which have been torn by the direct impact of the bullet. The missile creates a permanent

cavity, the size of which is generally proportional to the missile's total loss of kinetic energy while in the wound. As the bullet passes through the tissue, considerable radial motion is imparted to the tissue elements and a large temporary cavity is formed. When the wound track is dissected, extensive bleeding and tissue injury may be found extending for a considerable distance away from the track produced by high velocity bullets. After sectioning the tissues, this hemorrhagic area is often well-defined; its extent is proportional to the missile's loss of kinetic energy while in the wound. High speed X-rays and motion pictures have also demonstrated the formation of this temporary cavity, with a volume that may be as much as 27 times that of the permanent cavity.

(440) The panel agrees that the tissue disruption due to the temporary cavity created by passage of a high or intermediate velocity missile might have produced fractures of the transverse processes of one or several of the lower cervical and/or upper thoracic vertebrae in President Kennedy's neck, as indicated by the postmortem X-rays. There are significant muscle masses attached to the vertebrae which would receive tremendous shock, even if several inches distant from such a missile. A direct grazing missile impact may have occurred, but it would not have been necessary to cause the damage visible in the X-rays.

(441) The missile's rate of energy loss in the wound and the consequent transfer of this energy to the body is dependent on several factors, including the amount of initial energy and the degree of retardation of the missile within the body. This retardation varies according to the missile's shape, the density of the tissues through which it is passing, and its degree of yaw while passing through the target. A soft-pointed hunting bullet loses a greater portion of kinetic energy than a full, metal-jacketed military bullet, the ammunition used in this instance. In the case of a full-jacketed, nondeforming bullet, yaw* is the most significant retarding factor as the bullet travels through the tissue. This yaw*, as previously indicated, varies along the bullet's path, producing maximum energy loss at points where it is greatest and minimum energy loss where it is absent. A small entry hole through the skin, extensive internal damage, and a relatively small exit hole indicate that the bullet had minimum yaw* at the moments of entrance and exit, with a release of energy, possibly due to yawing*, in between.

(442) The changes in density from air to skin, muscle, and bone may produce marked variations in yaw*. A bullet that is positioned appropriately relative to its trajectory on penetrating the skin may be tipped 90° to 100° within 3 inches of penetration, thus dramatically reducing speed, with a corresponding increase in energy transfer and tissue destruction. Subsequently its posture may again change, so that its long axis is in the line of flight and considerably less energy is lost and consequent tissue damage is minimized.

(443) The majority of the panel members, on the basis of the nature and extent of the Governor's chest injury alone, could not determine whether the missile that struck Governor Connally in the back had already passed through President Kennedy. They could, however, from the nature of the entrance wound in Governor Connally's back,

the nature of the damage to his wrist, and the limited penetration of his thigh, determine that the bullet which struck those areas had lost sufficient kinetic energy prior to inflicting these wounds to permit the conclusion that one bullet caused all of the wounds to the Governor. The panel cannot rule out the possibility, if confined only to the surgical evidence, that the wound to Governor Connally's wrist was caused by a large fragment of the bullet which struck the President's head.

(444) The majority of the panel members, after fully evaluating the objections of Dr. Wecht, believes that the medical evidence of a diminishing degree of injury to the chest, wrist and thigh, the ability to aline these body parts to conform to a single bullet track, provide strong support for the conclusion that all of the Governor's injuries were caused by one missile.

Effect of a missile on the body

(445) The effects of a missile striking a portion of the body will conform to the basic laws of motion, readily understood and often observed in everyday occurrences such as the collision of a moving with a stationary billiard ball. If the two balls are of equal mass and the energy of the first is transmitted on impact to the second, the first ball will stop completely, while the second will be propelled at a velocity comparable to the striking velocity of the first. If the second ball is twice the mass of the first and the transmitted kinetic energy is comparable to that of the first, it will be propelled forward at only half the velocity. Much of the kinetic energy transferred by the first ball is due to its velocity, since its mass, relative to that of the second ball, is insignificant. Nevertheless, the sum of mass and velocity will result in significant imparted velocity to the motionless target.

(446) This situation can be best observed using nonjacketed missiles designed to impart maximum transfer of kinetic energy to the target during and after striking, thereby maximizing the missile's "knockdown" capability and minimizing the possibility of exit from the target and the striking of a second target. A jacketed missile transfers significant, but considerably less, kinetic energy to the target. Instead, the energy transfer propels the target body or a portion of it in the same direction as the missile. The vector of propulsion might affect the body in its entirety if the victim were standing, or might affect only the upper portion of the body if the victim were seated depending on the site of impact. The movement of the body, or of a large portion of it, will be minimal because of the bullet's small mass, notwithstanding its high velocity. If the bullet strikes the head, an object of relatively low mass in comparison with the entire body, the movement of the head in the direction of missile travel may be considerable. Rotational movement of the head, or of a lightweight portion of the body may also occur.

(447) By comparing the bullet tracks, a forensic pathologist may be able to determine if the wounds were inflicted on a body in an unsupported position that would permit movement, and, if so, in what order the wounds might have occurred. In cases where the body was in a supported position that would preclude motion, such as lying against a firm surface, a transfer of kinetic energy from the missile to

the body will result but not cause motion. Transmission of such energy to the body will be manifest by injury to areas in contact with the supporting surfaces.

(448) Accurate determination of the bullet pathway and careful observation of the missile wounds themselves are useful in determining whether several wounds to different portions of a body were caused by the same missile. By placing a rigid probe through the bullet tracks after careful dissection and inspection and after evaluation of deflections possibly caused by striking bone and other tissues, and then attempting to aline the tracks by moving the body, a conclusion may be reached as to whether multiple perforations were caused by a single missile.

(449) Bullet reentry wounds are often of a different configuration than initial entry wounds as a consequence of the missile's deformation during penetration and the tumbling effects produced. When various portions of the body are in contact during multiple perforations, one surface may serve to shore another from which a missile exits, so that the exit wound, even from an intermediate or high velocity missile, may exhibit little of the damage and tearing usually seen in exit perforations. Reentry wounds may also show adjacent injuries incident to secondary missiles* from the primary injury. The primary wound or the reentry wound may contain fragments of clothing such as was present in the wound in Governor Connally's wrist.

Effect of the body on a missile

(450) The panel members individually have had considerable experience with how the various portions of the body affect missiles passing into or through them. Individually and collectively, they have seen the effects on missiles varying from .22 caliber long rifle bullets to those similar in size and velocity to the missiles used in this homicide—6.5 millimeters or 0.26 inch—and larger. In some cases the missiles had perforated similar portions of bodies—as in the upper back wound of President Kennedy, and thereafter penetrated significantly harder surfaces. These could not be distinguished from missiles fired through soft tissue alone. A bullet striking soft tissue decelerates so that if it then strikes a hard surface such as bone, it is appreciably less deformed than if it struck the hard surface directly. Dr. Wecht alone had had experiences contrary to this.

(451) Most panel members also agree that entrance penetrations of the skull by jacketed missiles, with the resultant shearing forces produced by impact with the sharp, rigid bone margins, often result in significant distortion of the missile, while perforation of the thorax or abdomen usually results in little or no deformation of the missile, except in those instances in which the missile hits a vertebra. Several members of the panel have investigated deaths in which missile impact resulted in deformation similar to the flattening noted in Warren Commission exhibit CE 399 and instances in which there was loss of the central core mass of a jacketed bullet as a result of deformation of the intact jacket and squeezing of the lead core backwards (a toothpaste effect).

(452) The panel members agree that in cases where jacketed missiles strike bony surfaces such as the skull, long bones or vertebra, a portion

or all of the jacket might separate at the point of initial missile deformation, with the central, heavy lead core continuing in a path usually in the same direction as that of the missile trajectory prior to entry into the target. It is not unusual for a portion of a missile to separate into additional fragments upon exiting from the skull or other part of the body and entering a second structure.

(453) Another consideration about missile wounds that has been emphasized by others(*85*) is the relatively short time that a missile is actually moving through tissue, usually less than a thousandth of a second. A bullet of 150-grains weight, passing through 8 inches of tissue, entering at 2,000 feet per second (approximately the velocity of the 6.5 millimeter Mannlicher-Carcano bullet) and exiting at 1,000 feet per second will pass through the body in 0.00045 second and impart to the tissue 998 foot-pounds of energy, the work equivalent of more than 4,100 horse power. This energy transfer produces a temporary cavity as described earlier, which actually develops after the bullet has passed through the tissue. Accordingly, a bullet can pass through a head and be about 100 feet further along before a photograph reveals the explosive destruction of the head. This also explains the presence of entry and exit bullet holes in bones and tissue even though the skull is extensively fragmented or blown apart by the subsequent formation of the temporary cavity. The velocity of the outward-moving tissue particles may be only 125 feet per second, far less than the 1,000 to 2,000 feet per second velocity of the bullet projectile. Thus, when the Zapruder film reveals the explosion of the skull, the bullet had already passed through.

(454) Finally, the panel members also discussed their experiences with the explosive effects of shotgun and, to a lesser extent, military rifle wounds to enclosed portions of the body such as the head. Rarely has any member observed photographs documenting the reactions of victims' bodies to being shot, although crime scene reconstruction has often enabled panel members to establish body position prior to the shooting. The panel members have critically evaluated the observations of Alvarez(*86*) and the physical principles he considers in explaining the President's head movements in the Zapruder film. The panel members took note of the differences between the missile and targets (melons) in Alvarez's work and the missile and targets in this homicide. The work of Lattimer and associates,(*87*) which addressed some of these differences by using a weapon and missiles similar to those used in the Kennedy assassination and which attempted to duplicate the injury pattern on skulls, was also critically reviewed, as were studies by Dr. John Nichols.(*88*)

(455) The panel members agree that the exit wound of a missile seriously deformed by initial penetration of the skull might be considerably larger than the entrance defect and that the forces related to yaw* and the large temporary cavity created by the missile would usually be transmitted fairly equally throughout a closed space such as the skull. The larger exit defect in the front of the skull would theoretically permit greater exodus of tissue under pressure, and a resulting backward movement of the head could occur.

(456) The panel is aware of the time interval between the backward motion of the President's head and the earlier, slight forward motion, possibly caused by the initial missile impact and transfer of energy

to the head, as recorded in frames 313–314 of the Zapruder film. The panel further recognizes the possibility of the body stiffening, with an upward and backward lunge, which might have resulted from a massive downward rush of neurologic stimuli to all efferent nerves (those which stimulate muscles). The disparity in mass and strength between those muscles supporting the body on the back (dorsal surface) of the spine and those muscles on the front (ventral) surface could account, at least partially, for this type of motion, although it would be reasonable to expect that all muscles would be similarly stimulated.

(457) The panel suggests that the lacerations of a specific portion of the brain—the cerebral peduncles* as described in the autopsy report (*89*)—could be a cause of decerebrate rigidity,* which could contribute to the President's backward motion. Such decerebrate rigidity as Sherrington (*90*) described usually does not commence for several minutes after separation of the upper brain centers from the brain stem and spinal cord. It is, however, most intense in those muscles which normally counteract the effects of gravity.

(458) The panel is also aware of possible effects on motion that could be caused by the moving car within which the President sat.

(459) The panel concludes that the backward movement of the head following its forward movement occurred after the missile had already exited from the body and had created a large exit defect in the skull, and that it was most probably due to a reverse jet effect,* or a neuromuscular reaction, or a combination of the two. The short interval between the two motions supports this explanation.

(460) One panel member, Dr. Wecht, suspects that the backward head motion might be explained by a soft-nosed bullet that struck the right side of the President's head simultaneously with the shot from the rear and disintegrated on impact without exiting the skull on the other side. The remaining panel members take exception to such speculation, since they are unaware of any missile with such capabilities. Further, the X-rays taken prior to the autopsy show no evidence of a second missile, nor do the photographs of the head and brain show evidence of any injury to the left side.

Summary of the Forensic Pathology Panel's Conclusions Concerning the Missile Wounds of President Kennedy and Governor Connally

(461) Pathology is that specialty of medicine concerned with the investigation and evaluation of disease and other abnormalities in the human body. Forensic pathology is that area of pathology concerned with the legal aspects of death and injury, and the ability to present and evaluate the manifestations of death in courts of law and legal proceedings. Forensic pathologists are routinely asked to evaluate or develop hypotheses that involve pathological abnormalities and to suggest circumstances that could have produced them. Although it is often hoped that such evaluations can be made with absolute certainty, forensic pathologists can rarely state unequivocally that a given situation is explainable by one and only one hypothesis.

(462) More commonly the forensic pathologist makes a conclusion

that has a reasonable degree of medical certainty or states that the evidence is or is not consistent with any given hypothesis. In some cases, more than one hypothesis may explain the evidence.

Number, location, and nature of President Kennedy's wounds

(463) The majority of the forensic pathology panel (in each case, all members except Dr. Wecht) conclude that President Kennedy was struck by only two bullets, fired from some distance to the rear of his limousine. One bullet struck the President in the right upper midback and exited the front of the throat. This occurred prior to or during the segment in the Zapruder film of the assassination when the President is obscured from view by the Stemmons Freeway sign. This wound might have proven fatal.

(464) The second bullet struck the President in the upper back of the head and exited somewhat forward and to the right through the top, causing a massive defect in the skull. This second wound was fatal in and of itself. The wound in the upper right midback measures approximately 0.9 by 0.9 centimeter in maximum diameter and was located approximately 5 centimeters below the shoulder and 5 centimeters to the right of the midline of the back. The wound cannot be located more precisely from the available evidence because the autopsy pathologists failed to measure it with reference to standard fixed body landmarks and did not dissect the missile track.

(465) A red-brown to black area of skin surrounds the wound, forming what is called an abrasion collar. It was caused by the bullet's scraping the margins of the skin on penetration and is characteristic of a gunshot wound of entrance. The abrasion collar is larger at the lower margin of the wound, evidence that the bullet's trajectory at the instant of penetration was slightly upward in relation to the body.

(466) The majority of the panel concludes that the bullet that struck the President in the back exited in the front of the neck, at approximately the third tracheal cartilage. The exit wound was almost obscured by a tracheotomy performed on the President at Parkland Hospital, but could still be observed afterward at the lower margin of the tracheotomy incision. This wound is located approximately at the point where the bullet would be expected to exit, given the nature of the entrance wound in the uper right back and the damage to the transverse process of the lower cervical and first thoracic vertebras, which are situated on a line between the entrance and exit points.

(467) The panel believes that Parkland doctors mistakenly identified the defect in the neck as an entrance wound because of its small size, which is characteristic of an entrance wound but occurs not uncommonly in exit wounds caused by high velocity missiles that have passed through soft tissue. It is also possible that this exit wound may have been small because the tissues through which the missile exited were supported by clothing, inhibiting the normally extensive distortion or tearing often characteristic of an exit wound. In addition, the Parkland doctors had not looked at the President's back and did not realize there was another perforation.

(468) Compounding the oversight of the Parkland doctors was the lack of communication between them and the pathologists performing

the autopsy at Bethesda Naval Hospital who did not realize that the tracheotomy had been made through a bullet wound. The autopsy pathologists only saw the back wound. On learning the day after the autopsy that the incision had been made through an existing wound, the pathologists concluded that the missile which entered the upper back exited through the neck defect.

Location of the head wound

(469) The panel concludes unanimously that the head entrance wound was located approximately 10 centimeters above the external occipital protuberance and slightly to the right of the midline, near the upper convexity of the back of the head at the "cowlick" portion of the President's hair part. The external surface of the skin around the wound was very similar to that of the back wound.

(470) The autopsy pathologists did not describe this location in their report or in their testimony before the Warren Commission. It does correspond, however, to the location described by two separate teams of medical experts convened by Attorney General Ramsey Clark and the Rockefeller Commission, respectively, as well as by other independent medical examiners. Further, while testifying before this committee, Dr. Humes, the chief autopsy pathologist, changed his earlier testimony and supported the panel's conclusion as to the location of the wound.

(471) The panel notes that the skull X-rays, photographs of the head and photographs of the brain substantiate this location. The scalp wound, as it appears in the photographs, has many of the features described in the autopsy report, including size, an abrasion cuff which is more prominent on the lower margin than the upper, and linear tears extending radially from the upper margins of the wound. The scalp wound overlays skull damage characteristic of an entrance wound (inward beveling*), also described in the autopsy report.

Nature and trajectory of the missile striking the head

(472) The majority of the panel concludes that only one missile caused the damage to the head. The nature of the damage is consistent with that caused by a jacketed missile. The X-ray evidence indicates that the missile fragmented on impact, produced a number of outwardly radiating fractures, and proceeded in an essentially straight and forward path and to the right, paralleling the upper surface of the head. This type of missile fragmentation is consistent with a jacketed missile. The main core mass probably existed in a single fragment that remained intact until striking the automobile, causing it to fragment into several pieces. The small missile fragment present at the margin of the entrance wound was probably a portion of the missile jacket and indicates that the skull might have slightly deflected the course of the missile and its fragments through the head.

(473) The bullet exited in the top front area of the skull (right frontoparietal portion) adjacent to the coronal suture. There is a considerable loss of bone in the area where the bullet exited, with multiple fractures extending from the defect. In the photographs, part of the perimeter of the 2.5 centimeters, beveled exit hole is visable along the margin of the defect and is somewhat larger than the diameter of the bullet itself. On the basis of these photographs and simulated skull reconstruction, the panel was able to determine the location of the point of exit within a reasonable margin of error.

Deficiencies in the autopsy

(474) The panel unanimously concluded that the deficiencies of the autopsy contributed to the uncertainty over the locations of the entrance and exit wounds in the head. The pathologists did not describe the wounds with reference to fixed body landmarks, nor did they examine the brain adequately. The panel itself was unable to examine the brain because it is among certain autopsy materials which are unaccounted for. The majority of the panel is satisfied that the select committee made a diligent though unsuccessful, effort to locate these missing materials. The majority of the panel believes that examination of the materials would fully support its conclusions.

(475) The panel discussed the methods for and difficulty of determining the trajectory and origin of the missiles. It notes that inherent in the procedures is a margin of error because of (1) the difficulty of establishing the precise angles of the missile tracks through the President's head and body, and (2) the difficulty of knowing the exact time of impact and the exact position of the body at the time of impact. These problems are greater for the bullet passing through the President's back and neck because it is less clear exactly when it struck the President. The impact to the head appears clearly in the Zapruder film, and its timing has therefore been determined with a high degree of accuracy.

(476) As the panel noted, the locations of both sets of entrance and exit wounds are approximations and are less precise than can often be made. The autopsy pathologists used nonfixed body landmarks such as the mastoid process* to locate the wounds. The location of these landmarks will change with movement of the body; hence, the measurements to the wounds will vary depending on the position of the body when the measurement is taken.

(477) The position of the body itself when the bullets struck also affects the relationship of the entrance and exit wounds and the trajectory of the missiles. For example, if the President were moving his head to the left or right, the location of the entrance would relative to the landmarks used as reference points by the autopsy pathologists would vary. Similarly, the relationship of the exit wound to the entrance wound and the angle of the missile trajectory prior to striking the body would differ substantially.

(478) Finally, the autopsy doctors failed to dissect the upper back missile track. The panel is, therefore, unable to determine conclusively whether the missile's path was in a straight line from entrance to exit and whether this injury would necessarily have been fatal.

(479) The panel considered the value of disinterring the President's body to locate more precisely the various wounds and their relationships to one another and the pathways of the missiles. The majority concludes that an examination of the body would fully support its conclusions and thus would not further its investigative goals. Consequently, the majority of the panel decided against recommending disinterment.

Second head wound

(480) When questioned by panel members, the autopsy pathologists stated that the piece of brain tissue on the lower rear of the head just above the hairline covered the entrance wound they described in their

report. The majority of the panel concludes, however, that the brain tissue actually lies on top of the hair and does not obscure a wound of any kind. If the brain tissue were obscuring a wound, the X-rays of the underlying skull would show evidence of wound damage, as would the photographs of the brain. There is no such evidence.

(481) Dr. Wecht raises the possibility of a tiny wound of entrance or exit being present beneath the white piece of brain that would not necessarily show up in the X-rays or the photographs of the brain. Dr. Wecht is also unwilling to rule out the possibility of another wound having occurred almost simultaneously with the area of the defect in the right front of the head without examining the brain.

(482) The other panel members believe that a near simultaneous wound from another shot, occurring at the instant when the skin and underlying bone are separated as a result of the known shot, is unfounded speculation. We believe strongly that another missile did not enter the right front of the head within the area of the large defect. We find no evidence supporting this speculation in the photographs of the head or brain, or in any of the X-rays of either adjacent bone fragment or the left side of the head where, in such an event, one might expect such a missile to lodge. No other missile was found, and the majority knows of no bullet that would completely disintegrate on hitting the soft tissue of the brain, as Dr. Wecht suggests.

(483) The majority also points out the following excerpt from Dr. Wecht's testimony in public hearings before the select committee on September 7, 1978. He said that there is "[v]ery meager" evidence to support his minority view, that there is an "extremely remote" possibility that the President was shot in the head by a second bullet from the side or front. Later in his testimony he reiterated his position:

> Mr. PURDY. Dr. Wecht, does the present state of available evidence permit the conclusion that to a reasonable degree of medical certainty there was not a shot from the side which struck the President?
>
> Dr. WECHT. Yes, with reasonable medical certainty I would have to say that the evidence is not there. I have already said it is a remote possibility and I certainly cannot equate that with reasonable medical certainty. (*91*)

(484) The issue of a second bullet striking the head from the front or side originates in part from the pronounced backward and leftward motion of the President's head and shoulders after being shot, as seen in the Zapruder film. To some, this motion appears explainable only by a shot coming from the front or side.

(485) The majority of the panel believes that there is a possibility that this movement may have been caused by neurologic response to the massive brain damage caused by the bullet, or by a propulsive effect resulting from the matter that exited through the large defect under great pressure, or a combination of both. Whatever the cause of the President's movement, the majority of the panel concludes that only one bullet struck the President's head and that it entered at the rear and exited from the right front.

Governor Connally's wounds

(486) The majority of the panel concludes that the evidence on the nature of the wounds suffered by Governor Connally to his torso, wrist

and thigh provides strong support for the conclusion that the wounds were caused by one bullet. The ovoid shape of the entrance wound on Governor Connally's back, described by one of the doctors at Parkland Hospital who treated the Governor, was most probably caused by a yaw* or tumble* in the flight of the bullet, which was deviating from its normal flight characteristics and path because of passing through President Kennedy. The majority does not feel, however, that the evidence is sufficient to eliminate entirely the possibility that the wobble was caused by a different intervening object.

(487) The medical evidence alone does not provide the panel with sufficient information to state with absolute certainty that the bullet that struck Governor Connally was the same one which had previously struck President Kennedy in the upper right back, exiting through his neck. The majority believes, however, that the medical evidence is consistent with this hypothesis and much less consistent with other hypotheses. Further, the panel considered other nonmedical evidence that strongly indicates that a single bullet injured both men. This evidence includes: The position of the two men, as shown in the Zapruder film; the fact that the two men can be alined consistent with the trajectory of one bullet; photographs of the seat locations in the limousine; the actual distortion of the so-called "pristine bullet"; the failure to recover any other bullet from the limousine or body; ballistics studies of the ammunition involved; and the results of neutron activation analysis of the bullet fragments conducted by Vincent P. Guinn, Ph. D. (These factors are discussed in the reports of other expert panels convened by the select committee.)

(488) The panel notes the interval between the observable reactions of the President and the Governor at the time of their injuries, as seen in the Zapruder film. Some observers have contended that the interval is too long to permit the conclusion that a single bullet struck both men.

(489) The majority of the panel believes that the interval is consistent with the single-bullet theory. At issue is the time delay between bullet impact and the observable reactions of each man to his injury, which in turn is determined by many factors, including whether or not their reactions were voluntary or involuntary. If involuntary, they would have occurred almost simultaneously with the injuries. If voluntary, there is often a slight delay in reacting.

(490) The first visual evidence that the President was struck was the movement of his hands to a position in front of his neck and his facial expressions. The majority of the panel construes these movements to have been voluntary, although it recognizes that they could have been involuntary had the bullet caused sufficient shock to his spine and spinal cord. The majority cannot say definitely, based on the available evidence, whether this more serious injury occurred and precisely when the President was struck.

(491) Similarly, the panel cannot determine precisely when Governor Connally was struck from either the medical evidence or his reactions as seen in the film: the puffing of his cheeks and the dropping of his shoulders. The majority believes that the nature of his injuries could have resulted in a voluntary motion, which would mean a delayed reaction. Thus, the majority believes that there could have been suffi-

cient delay in Governor Connally's reaction to account for the interval seen in the film and to permit the conclusion that a single bullet injured both men, notwithstanding its inability to determine whether President Kennedy's reaction was voluntary or involuntary.

(492) Panel members have differing views as to how soon Governor Connally would be expected to drop the hat he was holding in his right hand following the injury to his right wrist, but generally agree that there is little empirical data on which to determine with confidence what specific reaction should be expected from this type of wound.

Autopsy procedures

(493) As noted earlier, the panel unanimously concludes that the autopsy was faulty for a number of important reasons, some of which contributed to the speculation and controversy concerning the medical evidence. The panel believes that many of the difficulties are a result of inexperience with or neglect of the standard procedures which should be followed in forensic autopsies. The purpose of the medicolegal autopsy, as described in detail elsewhere in this report, is to answer anticipated or actual questions about the manner of death and to document the findings and answers in such a way that independent examiners may review the findings and procedures and reach their own conclusions.

(494) The panel urges unanimously that procedures such as those outlined elsewhere in this report be adopted as a model to be followed in the event of the suspicious death or obvious homicide of high Government officials.

Part IV: Critique of the Earlier Examination, With Presentation of Suggested Procedures To Be Followed in Performing an Investigation and Examination on the Remains of a Gunshot Victim

INTRODUCTION

(495) The members of the forensic pathology panel were asked to comment on the post mortem examination conducted by the pathologists, Dr. Humes, Boswell, and Finck, including the procedure and the report prepared afterwards.

(496) According to a summary report prepared by Drs. Humes, Boswell, and Finck pursuant to requests by the Department of Justice following a meeting on January 20, 1967, at the office of Dr. Robert H. Bahmer, Archivist of the United States,(*92*) then-Commander Humes was directed to perform the autopsy by the Surgeon General of the U.S. Navy because of the decision to bring the body of the late President to the Naval Medical Center in Bethesda, Md., where Dr. Humes was Director of Laboratories. According to the summary, the Surgeon General of the Navy advised Dr. Humes "to determine the nature of the President's injuries and the cause of his death.(*93*)

(497) The same record indicates that the autopsy began at approximately 8 p.m. on Friday, November 22, 1963, and was concluded at approximately 11 p.m. The autopsy report, written by Dr. Humes with the assistance of Drs. Boswell and Finck, was prepared the morning of November 23 and delivered by Dr. Humes to Admiral Burkley, the President's physician, on November 24 at about 6:30 p.m.

(498) The Navy "Clinical Record Authorization for Post Mortem Examination, U.S. Naval Hospital, Bethesda, Md.," dated November 22, 1963, indicates the following:

> 2. You are hereby authorized to perform a complete post mortem examination on the remains of John F. Kennedy. Authority is also granted for the preservation and study of any and all tissues which shall be removed. This authority shall be limited only by the conditions expressly stated below: [no restrictions are indicated] Signature : [Mrs.] John F. Kennedy [typed]; Address: White House, Washington, D.C.; Authority to consent: wife [no signature is present]. The performance of the autopsy specified above is approved: R. O. Canada, Captain MC USN; Title: Commanding Officer; Date: 22 November 1963 [no signature in this location either].(*94*) Signature of witness: Robert Kennedy.

On the bottom of this document is a block designated "Patient's Identification (for typed or written entries give: name—last, first, middle; grade; date; hospital or medical facility) is the signature "G. G. Burkley, Physician to the President."(*95*)

(499) The autopsy doctors had the following qualifications, as detailed in their report on their 1967 review of the autopsy photographs and X-rays:

> In charge was James J. Humes, M.D., at the time commander, Medical Corps, U.S. Navy, and Director of Laboratories, Naval Medical School. He was certified in 1955 by the American Board of Pathology in anatomic and clinical pathology. Assisting him were J. Thornton Boswell, M.D., and Pierre A. Finck, M.D. Dr. Boswell at that time was a commander in the Medical Corps, U.S. Navy, and Chief of Pathology, Naval Medical School. He was certified in 1957 by the American Board of Pathology in anatomic and clinical pathology. Dr. Finck, a lieutenant colonel, Medical Corps, U.S. Army, was then chief of the Military Environmental Pathology Division and Chief of the Wound Ballistics Pathology Branch, Armed Forces Institute of Pathology, Walter Reed Medical Center. He was certified in 1956 by the American Board of Pathology in anatomic pathology and in 1961 in forensic pathology. (*96*)

(500) In his testimony before the Warren Commission, Dr. Humes characterized his experience as follows:

> My type of practice, which fortunately has been in peacetime endeavor to a great extent, has been more extensive in the field of natural disease than violence. However, on several occasions in various places where I have been employed, I have had to deal with violent death, accidents, suicides, and so forth. Also, I have had training at the Armed Forces Institute of Pathology, I have completed a course in forensic pathology there as part of my training in the overall field of pathology.(*97*)

(501) When asked what his specific function was in connection with the autopsy, Dr. Humes responded as follows:

> As the senior pathologist assigned to the Naval Medical Center, I was called to the center by my superiors and informed that the President's body would be brought to our laboratories for an examination, and I was charged with the responsibility of conducting and supervising this examination; told to also call upon anyone whom I wished as an assistant in this matter that I deemed necessary to be present. (*98*)

(502) Dr. Humes said he selected Dr. Boswell as one of his assistants and, later, Lt. Col. Pierre Finck, who was made available to him by Brigadier General Blumberg, the commanding officer of the Armed Forces Institute of Pathology, because "I felt it advisable and it would be of help to me to have the services of an expert in the field of wound ballistics and for that reason I requested Colonel Finck to appear.(*99*)

(503) Many of the difficulties that arose in relation to the post mortem examination or autopsy developed in part because of the basic differences between an autopsy conducted in a hospital pursuant to

the wishes of the next of kin and one conducted under the aegis of a medicolegal investigative system, pursuant to statute, for official purposes. The investigation of a death that is known or suspected to be unnatural is a multidisciplinary effort, requiring cooperation amongst a number of scientific disciplines and ongoing communication between those disciplines from the initiation of the investigation until its completion. The medicolegal autopsy is only one stage of this investigation, albeit an important one. To be performed properly, it requires that the prosecutor evaluate information obtained from those aware of the circumstances of the death and that the prosecutor anticipate and address questions which might arise subsequently.

(504) In a suspicious death, the body is initially the property of the State (state's evidence), and the autopsy is usually, if not invariably, conducted in accordance with a statute, in anticipation that the evidence gathered as a result of the procedure may be introduced into a civil or criminal proceeding. Such an examination is conducted without the consent of surviving members of the family who, on completion of the examination, assume custody of the body and make final disposition.

(505) Traditionally, the hospital pathologist conducts the examination in a hospital setting, invariably pursuant to the wishes of the family. Such an examination is concerned primarily with pathologic appraisal of the clinical diagnosis for which the physician was attending the patient, with evaluation of the treatment afforded the patient, and, in a more general sense, with the education of the medical community concerning the interrelationship between morphologically recognizable disease and the manifestation of this disease in the patient while alive. Such a procedure is also conducted in order to understand the development (pathogenesis) of the one or several diseases that the deceased person may have had, commencing with the identification of the causative (etiologic) agent or process responsible for initiating the disease, and continuing through the primary and subsequent secondary changes in the body incident to this disease. This usually culminates with an understanding as to which disease processes were immediately responsible for the patient's death. Correlation of the clinical presentation of the patient while alive with the disease processes identified at the autopsy is the responsibility of the traditionally trained hospital pathologist, who usually commences this procedure with a thorough review of the medical history of the deceased and with consultation with the attending physicians in an attempt to define the "problems" or questions to be answered during this type of procedure.

(506) The medicolegal autopsy, on the other hand, addresses itself to a number of different problems, although it has a number of features in common with the traditional hospital autopsy discussed above. The forensic pathologist conducting this examination has an educational background that initially is the same as the hospital pathologist's and includes a thorough understanding of natural disease processes, the manifestation of these diseases within the body and the correlation of these changes with clinical findings in the living person. He must also, however, fully understand the manifestations and ramifications of so-called "unnatural disease," that is, dis-

ease deriving from the effects of violence of all types, as well as other exogenous, unnatural agents on the body. The examination conducted by the hospital pathologist is designed to establish "clinical pathological correlation"—the relating of the medical illness to the findings of the autopsy. The forensic pathology examination is conducted after understanding the questions which have arisen in the course of the investigation prior to the autopsy and with anticipation of questions that might arise during or after the procedure. Such questions must be specifically addressed in the subsequent report.

(507) Such an investigation and examination should be conducted so that the observations and findings are objectively documented, before conclusions or opinions deriving from them are reached. Such documentation entails careful scrutiny, appropriate measurements, photography and use of any other means to make the observations and findings of the initial procedure available to professionals in the same or related fields whose expertise might be sought for further evaluation, or for review by other physicians in the event of criminal or civil litigation. Therefore, the medicolegal autopsy is conducted not only as a problem-oriented procedure that addresses itself to questions raised or anticipated, but also as a procedure that attempts to document the answers to these questions in such a way that other independent experts may review the findings and reach their own conclusions. The procedure is conducted in a systematic sequence, and a number of examinations by several different disciplines may be conducted concurrently.

(508) The general steps of any medicolegal investigation might be summarized as follows:

(509) 1. Careful scrutiny of the scene of death, with collection and preservation of evidence gathered, whether or not it is immediately apparent that it has a bearing on the evaluation of death. Such an investigation naturally includes careful documentation, not only by photography, but also by detailed report, from which a subsequent evaluator may be able to reconstruct independently the circumstances of death. If there is any possibility that the victim may survive, the body is moved from the crime scene prior to this examination by the investigator. Even then the subsequent investigation and documentation should be as thorough as is reasonable.

(510) 2. The medicolegal autopsy. This procedure begins after members of the team responsible for the onscene investigation have been consulted. The examiner should be familiar with the evidence derived from it and from all of the other individuals who may have had contact with the body of the victim subsequent to injury, with detailed collection of information concerning artifacts which may have been introduced onto or into the body incident to therapeutic management. The medicolegal autopsy in every instance should address itself to establishing the cause of death beyond a reasonable doubt and the elimination of other competing causes of death, these being criteria for presentation of such evidence in a criminal proceeding. The medicolegal autopsy is intended to be a complete examination which minimizes speculation.

(511) In a gunshot homicide, there are other specific questions, in addition to the above, which the examiner should address, including:

1. The identification, characterization, and localization of all wounds of missile entrance (inshoot), and the identification, characterization, and localization of all wounds of exit (outshoot).

2. The correlation of individual entrance and exit wounds, examination of the internal bullet track, the structures penetrated or perforated, and the extent of resulting injury.

3. The evaluation, if possible, of the lethality of individual wounds, the expected survival period, and the capability and extent of physical activity after injury.

4. The evaluation, if possible, of the sequence of individual wounds from observations on and in the body.

5. The determination of the cause of death and the exclusion of other antecedent and competing conditions.

The medicolegal examination

1. Physical facilities

(512) The pathologist conducting the procedure should have access to facilities that will allow all team members to proceed in an orderly systematic fashion, without undue pressures, to complete the examination successfully and collect all of the necessary evidence in an expeditious manner. Included among equipment which should be available are examining and washing facilities and instruments, equipment for color, and black and white photography, X-ray equipment, and recording equipment to enable onsite observation and description of the findings.

2. Personnel

(513) Among the members of the team who should be available for consultation in examination of a gunshot victim are:

a. A radiologist and technical assistant to take and evaluate X-rays prior to commencement and during the procedure, if necessary.

b. A representative from the physical evidence laboratory who should have appropriate containers and labels for collecting individual items of evidence for subsequent examination. Such evidence should be individually itemized, packaged, and sealed and the chain of custody maintained by appropriate receipts.

c. Representatives of such other professional disciplines as may be needed to assist in the identification. These may include a forensic odontologist and/or a forensic anthropologist.

d. A forensic toxicologist to assist in determining that specimens should be collected to rule out intervening or antecedent chemical conditions which might cause, contribute, or otherwise relate to the death.

e. An investigator from the onscene investigation team should be available to assist in correlating onscene findings with the ongoing autopsy findings.

(514) Considering the purposes and significance of a medicolegal autopsy, it is necessary that every attempt be made to have appropriate professional staff and physical facilities available, recognizing that such resources to vary from community to community. This is especially true when a medicolegal autopsy is conducted on the President

of the United States. The examination must be conducted without compromising professional or physical resources, even if there were contrary pressures in the interests of time or for some other expediency. The decision to perform an autopsy should take into consideration the wishes of the family, and the necessity and requirements of the procedure should be explained to the family as sensitively as possible, but the forensic pathologist must retain final decisionmaking authority and responsibility as to whether an autopsy should be performed and its scope.

3. Details of the procedures

(515) The individual steps that should be followed in the course of such procedures and the reasons for these steps include the following:

a. Examine exterior to body, clad, as received. Look for any abnormalities and other signs of cause and manner of death.

b. Photograph body overall as received. These photographs will aid in the documentation of the chain of custody and serve to refresh the memory of the investigator and examiner.

c. Search for and remove special items of evidence and individually package and label. Undress the body carefully and air dry clothing. Control samples of hair, et cetera, for comparison with similar evidence recovered from a suspect should be collected at this time. Trace evidence may provide clues to identify the assailant and/or help rule suspects in or out. It may also assist in identifying the scene of death or the location of the body, if moved after death.

d. Examine exterior of body, unclad. Look for evidence of violence.

e. Describe clothing, indicating general nature, defects due to violence of any type, their location, size (in centimeters) and approximate location (in centimeters, from fixed landmarks). Clothing defects may provide valuable clues about the cause and manner of death, as well as the events leading to death.

f. Photograph external unusual features of the body as received, with body landmarks. Diagrams of involved areas may also be important. These photographs may aid in documentation of the chain of custody and serve to refresh the memory of the investigator and examiner and may reveal features not noted previously.

g. At this point, careful cleaning of the body may be undertaken, with particular care to insure that significant external manifestations of trauma, et cetera, are not altered or removed. The cleaning of the body so as to rid it of excess blood, grease, and the like, is necessary to permit propert external examination. The removal of dirt, drainage, and debris may afford better visualization of external injury. The time delay associated with these procedures may allow for the settling of blood by gravity (dependent lividity) and thus afford beter delineation of poorly defined bruises.

h. Describe natural external features of the body. This procedure is a normal part of the medicolegal autopsy and is vital for victim identification.

i. Describe unusual identifying marks, scars, and tattoos if present. Describe unnatural external features of body (external evidence of injury).

j. Size, shape, color, and location (both to fixed body landmark, such as above the heel or gluteal fold, or below the top of the head, and relationships to each other) of each gunshot entrance and exit wound should be noted, along with the diameters of wound, residues, abrasions, et cetera. The size and shape of the wound and surrounding residue may be compared with test patterns fired with the same or a similar weapon. Distances of the defects above the floor, ground or a seat may be used for reconstruction by triangulation.

k. Photograph face of body from the front, with identification number. This photograph can establish identity in court. Photograph unusual identifying features of body (tattoos, scars, et cetera.)

l. Photograph the closeup appearance of gunshot entrance and exit wounds, including wound residues from the gunshot and missile, with landmark and ruler in the photograph. Reconstruction of the measurements of wounds, their relationship and surrounding residues would be possible from such a photograph, in the event the voice recorded report or other notes are lost. These may also serve as illustrations in court to indicate the procedures used to determine the range of the weapon from the body.

m. Photograph all unusual external features of the body after cleaning, using body landmarks and an identifying number and ruler if necessary. The hair should be shaved around wounds prior to this final series of photographs. The examiner must remember that proper photographs take time. These photographs document the descriptive report.

n. X-ray the body as appropriate. X-rays may establish the presence of a bullet within the body and indicate its location. Removal of all the bullets is imperative for subsequent examination. X-rays also provide documentation for court.

o. Open the body cavities to inspect organs in their natural position (in situ). Internal evidence of injury should be noted and not be obscured by careless organ removal.

p. Collect specimens for appropriate toxicologic and serologic examination.

1. Blood.
2. Urine.
3. Other samples, as indicated, after consultation with the toxicologist. Blood should be collected from the heart and/or a large, more peripheral artery or vein, and labeled accordingly. Urine should be collected free of contamination. Vitreous humor from the eye may also be of toxicologic value.

q. Collect samples for serology. Serologic typing of the victim's blood may provide important information for comparison with blood stains found on the alleged assailant or at the scene.

r. Describe internal evidence of injury, and effects of medical or surgical therapy, if any. Photograph any internal evidence of injury or therapy in situ and after dissection. These photographs document the descriptive report.

s. Describe internal evidence of injury and distinguishing abnormalities due to hospital treatment. Again, descriptions must be thorough, accurate, concise, and logically ordered.

t. Photograph internal evidence or organ injury dissected. Of value may be photographs of the body from sagittal and coronal locations, with rigid probes in place to indicate angles of bullet tracks. These may be used to measure more accurately the angles of the bullet track(s), to remeasure these angles in the event the voice recorded report or notes are lost, or for court illustration.

u. Describe internal natural findings. The pathologist should note evidence of natural disease, as it may be relevant to a traumatic death.

v. Collect representative sections of unusual pathologic findings from appropriate organs and samples of all organs for histopathologic examination. This is the standard procedure for all well-conducted autopsies and is not unique to a forensic autopsy.

w. Retain appropriate gross organs as necessary and appropriate for illustration for the attending physician or as subsequent evidence in criminal or civil proceedings. In those cases in which there is known or suspected injury or disease of the brain, supplemental examination with sectioning should be conducted after 10–14 days of fixation (usually in formalin).

x. Photograph significant findings on dried clothing, with identifying number and ruler. Individually package significant portions and seal and label. Individual packaging will prevent cross-contamination with other articles of clothing and will aid in documenting the chain of custody.

y. Bag all clothing. Clothing helps in preserving the chain of custody and in avoiding contamination.

z. Fingerprint body for definite and independent identification.

aa. Complete the description of findings and conclusions concerning the cause and manner of death. The final report should be completed promptly after all pertinent examinations are finished. The opinions and conclusions of this report should attempt to interpret subtle medical findings and anticipate questions of lay readers.

bb. Submit collected specimens to the forensic physical science laboratory, maintaining a proper chain of custody.

Specific considerations pertaining to the John F. Kennedy autopsy

(516) The panel evaluated some of the major difficulties encountered during and after the Kennedy autopsy and the reasons for these difficulties, in addition to those which might have been encountered had a defendant allegedly responsible for this crime been placed on trial within the jurisdiction where the crime occurred.

1. Jurisdiction

(517) Chapter 49 in the Code of Criminal Procedure in the State of Texas details the responsible authorities and procedures for "Inquests upon dead bodies."(*100*) Article 49.01, entitled "When Held," states: "It is the duty of the justice of the peace to hold inquests, with or without a jury, within his county in the following cases * * *"(*101*) Paragraph two lists these cases, among others: "When any person is killed, or from any cause, dies an unnatural death, except under sentence of the law; or dies in the absence of one or more good witnesses." (*102*) Paragraph four includes: "When the circumstances of the death of any person are such as to lead to suspicion that he came to his death

by unlawful means."(*103*) The same section also contains this statement: "The inquests authorized and required by this article shall be held by the justice of the peace of the precinct in which the death occurred."(*104*)

(518) Article 49.03, entitled "Autopsies and Tests," states the following concerning an inquest held to ascertain the cause of such death:

> The justice of the peace shall in all cases call in the county health officer, or if there be none or if his services are not then obtainable, then a duly licensed and practicing physician, and shall procure their opinions and advice on whether or not to order an autopsy to determine the cause of death. If, upon his own determination he deems an autopsy necessary, the justice of the peace shall, by proper order, request the county health officer, or if there be none or if it be impracticable to secure his services, then some duly licensed practicing physician who is trained in pathology to make an autopsy in order to determine the cause of death, and whether death was from natural causes or resulted from violence, and the nature and character of either of them.(*105*)

(519) The record of inquest details that the formal inquest on John Fitzgerald Kennedy was held on November 22, 1963, at 1 p.m., at Parkland Memorial Hospital in Dallas, Tex., and that the date of death was November 22, 1963, at Parkland Hospital.(*106*) The "Nature of Information given J.P." was "Death as a result of two gunshot wounds of head and neck."(*107*) The document states that the information was provided by Dr. Malcolm Perry, M.D., Parkland Memorial Hospital, Dallas, Tex.(*108*) It also contains the official "Findings by the Justice:"

> I, Theran Ward, justice of the peace, precinct No. 2, Dallas County, Tex., after viewing the dead body of John Fitzgerald Kennedy and hearing the evidence, find that he came to his death as a result of multiple gunshot wounds of the head and neck. With this, my hand, officially, this the 10th [sic] day of November A.D. 1963, Theran Ward, justice of the peace, precinct No. 2, Dallas County, Tex.(*109*)

(520) Thus, the Texas statute in effect at that time placed the responsibility for determination of the cause of death with a layman, the justice of the peace, who might consult the county health officer and might order an autopsy by a qualified pathologist, if deemed necessary, "to determine the cause of death."(*110*)

(521) Other than the official record of inquest, which states specifically that Ward did, in fact, view the remains of President Kennedy, there is no record of a formal inquest or other procedure to gather evidence from the body within the territorial jurisdiction of death. Nor does the record indicate whether Ward was consulted prior to removal of the body from Dallas County, Tex., for which the President's personal physician, Admiral Burkley, was responsible. If such was the case, the authority to approve an autopsy subject to the wishes of the next of kin in Bethesda was a legal order, and evidence obtained as a result of that procedure undoubtedly would have been admissible in a subsequent criminal procedure. If he was not consulted and chose

to make an issue of his responsibilities and their abrogation by authority other than himself, and had criminal litigation ensued, a duly constituted court in the State of Texas might have found legal problems to be associated with the criminal proceeding.

(522) The record of inquest signed by Ward was dated November 10, antedating the assassination of the President by some 12 days. The panel concludes that the document is in error and that the correct date of issue most probably was December 10, some 18 days after assassination of the President.

(523) The official certificate of death, signed by Ward on December 6, 1963, records the "Findings by the Justice" as follows:

> I, Theran Ward, justice of the peace, precinct No. 3, Dallas County, Tex., after viewing the dead body of John Fitzgerald Kennedy and hearing the evidence find that he came to his death as a result of two gunshot wounds (1) near the center of the body and just above the right shoulder, and (2) 1 inch to the right center of the back of the head. Witness my hand, officially, this the sixth day of December A.D. 1963, Theran Ward, justice of the peace, precinct No. 3, Dallas County, Tex.

On the same document is the official recording:

> I, Theran Ward, a justice of the peace, in and for Dallas County, Tex., do hereby certify that said inquest was held before me, on the day mentioned, and the proceedings in said inquest, as described above are correct. (s) Theran Ward, justice of the peace, precinct No. 3. (*111*)

2. Pathologists conducting the autopsy

(524) As his Warren Commission testimony indicates, Commander Humes was selected to perform the post mortem examination because he was the senior pathologist at the U.S. Navy Medical Center in Bethesda, where the President's body was taken at Mrs. John F. Kennedy's request. (*112*) His testimony further indicates that Commander Humes was directed to seek assistance from any individual of his choosing, recognizing the distinct difference between the background and training of an individual regularly employed in hospital practice and one trained in forensic pathology. (*113*) As Commander Humes stated to the Warren Commission, his training in forensic pathology was limited to a course "at the Armed Forces Institute of Pathology," and his experience was limited to "several occasions in various places where I have been employed (where) I have had to deal with violent death, accidents, suicides, and so forth." (*114*)

(525) The panel concludes that the assistance of experienced pathologists engaged in the full-time practice of forensic pathology, not merely in a consulting or review capacity (such as was the experience of Lieutenant Colonel Finck), would have materially assisted in the proper performance of this autopsy.

3. Secrecy during and following the autopsy

(526) A memorandum directed to Commander Humes and his associates by Capt. John H. Stover, dated November 25, 1963, officially reminded the physicians of his earlier verbal admonition that they not

discuss any of the procedure or findings with anyone unless with his specific authorization. Lieutenant Colonel Finck, in his letter to J. M. Blumberg dated Feb. 1, 1965, recalled this admonition:

> After the completion of the post mortem examination, the Surgeon General of the Navy told us not to discuss the autopsy with anyone, even among prosectors or with the investigators involved. (*115*)

This directive prohibiting communication, even with "the investigators involved," would certainly impede a proper medicolegal investigation and timely preparation of an accurate report.

4. Completeness of the autopsy

(527) As stated earlier, a complete medicolegal autopsy is necessary not only to determine the exact cause of death and to gather other evidence that might be of value in identifying the manner of death, but also to rule out other or contributing causes. Commander Humes has indicated on record and before this panel that he was not advised of any restrictions on the performance of a complete autopsy. Dr. Finck indicated the contrary during a trial in New Orleans, La., on February 24, 1969. This was the trial of the *State of Louisiana* v. *Clay L. Shaw*, that resulted from the investigation of New Orleans District Attorney Jim Garrison into the possibility that Clay Shaw and others conspired to kill President Kennedy. In connnection with the medical inquiry in this trial, Finck had been called to testify and was asked, "Why did you not dissect the track of the bullet wound that you have described today and that you saw at the time of the autopsy at the time that you examined the body? Why? I asked you to answer that question." Dr. Finck replied: "As I recall I was told not to, but I don't remember by whom." Question: "Could it have been one of the admirals or one of the generals in the room?" Answer: "I don't recall." Question: "Do you have any particular reason why you can't recall at this time?" Answer: "Because we were told to examine the head and chest cavity, and that doesn't include the removal of the organs of the neck." (*116*)

(528) Dr. Finck, in his letter further detailed his understanding of the restrictions:

> After the publication of the Warren report, numerous physicians criticized the autopsy protocol that did not describe the adrenal glands of Kennedy who suffered from adrenal insufficiency. The prosectors complied with the autopsy permit and its restrictions. I was told that the Kennedy family first authorized autopsy of the head only and then extended the permission to the chest. Organs of the neck were not removed, because of the same restrictions. I feel that the prosectors accomplished their mission that was to determine the direction of the shots and the cause of death. (*117*)

(529) He further noted the restrictions of the procedure as he understood them: "The organs of the neck were not removed: The President's family insisted to have only the head examined. Later, the permission was extended to the chest." (*118*) He also states:

> On Sunday, November 24, 1963, I went to the naval hospital to help Commander Humes who had written an

autopsy report. Humes, Boswell, and Finck, the three prosectors, signed the autopsy report in the office of Admiral Galloway. (I had suggested several corrections in the autopsy report. While we were checking the autopsy report in the admiral's office, the television announced the murder of Oswald by Ruby.)

In my discussion with Commander Humes, I stated that we should not check the block "complete autopsy" in the autopsy report form. In compliance with the wishes of the Kennedy family, the prosectors had confined their examination to the head and chest. Humes declared that the block "complete autopsy" should be checked. (*119*)

(530) Lieutenant Colonel Finck also indicated:

I was denied the opportunity to examine the clothing of Kennedy. One officer who outranked me told me that my request was only of academic interest. The same officer did not agree to state within the autopsy report that the autopsy was not complete, as I had suggested to indicate. I saw the clothing of Kennedy, for the first time on March 16, 1964, at the Warren Commission, before my testimony, more than 3 months after the autopsy. (*120*)

(531) Commander Humes indicated to the panel that during the autopsy Admiral Galloway ordered that the procedure be a complete examination. As indicated in section III of the panel's report, the autopsy report acknowledged removal and description of thoracic and abdominal organs, but not of neck organs. Likewise, the forensic pathologist on the team, Dr. Finck, the individual who might have observed changes on the clothing which would characterize entrance and exit wounds, did not have access to this evidence, apparently because the senior pathologist, Dr. Humes, did not have the experience or education to be aware of the value of such an examination.

(532) As indicated elsewhere in this report, the panel members also took note of the failure to include the description of certain organs, including the adrenal glands, within the body of the autopsy report. The panel members are divided in their opinion as to the propriety of this omission in a public report, but all agree with the need to maintain permanent records of such observations in the event that there is need to provide them in subsequent criminal litigation.

(533) The panel also took note of the unavailability of the histopathologic sections and the brain, which had not hitherto been sectioned. The panel acknowledges the need for such evidence in subsequent criminal litigation and the adverse effect that failure to retain such evidence might have on the proper outcome of such litigation.

(534) The panel likewise took note of the failure to record properly the findings during the procedure, particularly the measurements of the location of the entrance wound in the head, or even to retain the original notes from which the final report was prepared for reasons stated by Dr. Humes before the Warren Commission. The panel

believes that the inability to examine such documentation in the event of a legal dispute could adversely affect the outcome of subsequent criminal litigation.

(535) Finally, prosectors should have reviewed the preliminary report in conjunction with the photographs taken during the course of this procedure and prepared a more complete diagram which included critical measurements not otherwise recorded. By doing so they might have avoided a very obvious error in the location of the wound of entry in John F. Kennedy's head, as documented elsewhere in this report.

5. Examination procedure

(536) The more serious procedural errors of the post mortem examination include the following:

(537) a. The body was moved out of the geographical area statutorily responsible for investigation of the death and autopsy. b. The pathologist(s) charged with performing the autopsy had insufficient training and experience to evaluate a death from gunshot wounds. They did not confer with the physicians who had treated the President at Parkland Hospital before commencing their examination and did not therefore realize that a bullet perforation in the neck had been altered by a tracheotomy procedure until after the body had been removed.

(538) c. The pathologists did not or could not control the circumstances at the time of autopsy to afford privacy to the remains and to work unimpeded by visitors.

(539) d. Proper photographs were not taken.

(540) e. The President's clothing was not examined by the pathologists.

(541) f. The autopsy procedure was incomplete:

1. The external examination did not take thorough note of all the wounds: The anterior neck exit wound was not noticed, the head entrance wound was not accurately located with reference to fixed anatomic reference points, and the head was not reconstructed in order to determine the precise location of the head exit wound.
2. The bullet track in the back and neck was not dissected, so the extent of injury to the neck structures was not evaluated and the course through the body not fully appreciated.
3. The angles of the bullet tracks through the body were not measured relative to the body axis.
4. The brain was not properly examined and sectioned.

(542) g. The autopsy report was incomplete, prepared without reference to the photographs, and was inaccurate in a number of areas:

1. The entrance head wound location was incorrectly described.
2. The entrance and exit wounds on the back and front neck were not localized with reference to fixed body landmarks and to each other so as to permit reconstruction of trajectories.
3. There was no description of the neck areas which were not dissected. Instead, the pathologists referred to the observations of the treating physician at Parkland (hearsay) and did not mention that they failed to detect the presence of the missile exit in the anterior neck.

4. There was no description of the adrenal glands or of other organs.

(543) Resources available to conduct medicolegal autopsies vary tremendously in different sections of the country, with accompanying variation in the degree of sophistication of the examination and related ancillary procedures, such as odontology, toxicology, et cetera. The resources available for this autopsy, however, were extensive.

(544) The above list of deficiencies in the autopsy reflects only those gross errors which would have been avoided in most metropolitan medicolegal jurisdictions and which probably would have been avoided in this instance if a forensic pathologist with day-to-day experience in the investigation and examination of such deaths had been present at the autopsy.

(545) Despite the deficiencies of the postmortem examination of the President, the panel found that sufficient documentation was available for it to arrive at correct and valid conclusions, as stated in this report, as to the cause of death of President Kennedy and the precise injuries the President suffered.

Part V: Suggested Procedures to be Followed in the Event of Subsequent Assassinations of Federal Officials

(546) The panel has taken note of chapter 18 of the United States Code annotated, entitled "Presidential Assassination, Kidnaping, and Assault," enacted in 1965, which states:

Sec. 1751. Presidential assassination, kidnaping, and assault; penalties:

(a) Whoever kills any individual who is the President of the United States, the President-elect, the Vice President, or, if there is no Vice President, the officer next in the order of succession to the office of President of the United States, the Vice-President-elect, or any individual who is acting as President under the Constitution and laws of the United States, shall be punished as provided by sections 1111 and 1112 of this title.

(b) Whoever kidnaps any individual designated in subsection (a) of this section shall be punished (1) by imprisonment for any term of years or for life, or (2) by death or imprisonment for any term of years or for life, if death results to such individual.

(c) Whoever attempts to kill or kidnap any individual designated in subsection (a) of this section shall be punished by imprisonment for any term of years or for life.

(d) If two or more persons conspire to kill or kidnap any individual designated in subsection (a) of this section and one or more of such persons do any act to effect the object of the conspiracy, each shall be punished (1) by imprisonment for any term of years or for life, or (2) by death or imprisonment for any term of years or for life, if death results to such individual.

(e) Whoever assaults any person designated in subsection (a) of this section shall be fined not more than $10,000 or imprisoned not more than 10 years, or both.

(f) The terms "President-elect" and "Vice-President-elect" as used in this section shall mean such persons as are the apparent successful candidates for the offices of President and Vice President, respectively, as ascertained from the results of the general elections held to determine the electors of President and Vice President in accordance with title 3, United States Code, sections 1 and 2.

(g) The Attorney General of the United States, in his discretion, is authorized to pay an amount not to exceed $100,000 for information and services concerning a violation of this section. Any officer or employee of the United States or of any State or local government who furnishes information or renders service in the performance of his official duties shall not be eligible for payment under this subsecton.

(h) If Federal investigative or prosecutive jurisdiction is asserted for a violation of this section, such assertion shall suspend the exercise of jurisdiction by the State or local authority, under any applicable State or local law, until Federal action is terminated.

(i) Violations of this section shall be investigated by the Federal Bureau of Investigation. Assistance may be requested from any Federal, State, or local agency, including the Army, Navy, and Air Force, any statute, rule, or regulation to the contrary notwithstanding. (*121*)

(547) Chapter 18, entitled "Congressional Assassination, Kidnaping, and Assault," also enacted since the Presidential assassination, states:

SEC. 351. Congressional assassination, kidnaping, and assault: penalties—

(a) Whoever kills any individual who is a Member of Congress or a Member-of-Congress-elect shall be punished as provided by sections 1111 and 1112 of this title.

(b) Whoever kidnaps any individual designated in subsection (a) of this section shall be punished (1) by imprisonment for any term of years or for life, or (2) by death or imprisonment for any term of years or for life, if death results to such individual.

(c) Whoever attempts to kill or kidnap any individual designated in subsection (a) of this section shall be punished by imprisonment for any term of years or for life.

(d) If two or more persons conspire to kill or kidnap any individual designated in subsection (a) of this section and one or more of such persons do any act to effect the object of the conspiracy, each shall be punished (1) by imprisonment for any term of years or for life, or (2) by death or imprisonment for any term of years or for life, if death results to such individual.

(e) Whoever assaults any person designated in subsection (a) of this section shall be fined not more than $5,000, or imprisoned not more than 1 year, or both; and if personal injury results, shall be fined not more than $10,000, or imprisoned for not more than 10 years, or both.

(f) If Federal investigative or prosecutive jurisdiction is asserted for a violation of this section, such assertion shall suspend the exercise of jurisdiction by State or local authority, under any applicable State or local law, until Federal action is terminated.

(g) Violations of this section shall be investigated by the Federal Bureau of Investigation. Assistance may be requested from any Federal, State, or local agency, including the Army, Navy, and Air Force, any statute, rule, or regulation to the contrary notwithstanding. Added Public Law 91–644, title IV, section 15, January 2, 1971, 84 Stat. 1891. (*122*)

(548) The panel considered these statutes and the method whereby a medicolegal autopsy would be conducted as a consequence of these statutes. Currently under a contingency plan developed by the Fed-

eral Bureau of Investigation in cooperation with the Armed Forces Institute of Pathology, the institute would cooperate in the selection of qualified individuals to assist in the examination.

(549) The panel is compelled to offer the following alternative, more viable procedures for consideration by the select committee.

(550) On the death of any of the officials designated in the two statutes, where it has apparently been caused or aggravated by any criminal act specified in this section, a complete and thorough post mortem examination and autopsy shall be performed on the dead body. No person, member of any government agency or otherwise shall forbid or interfere in any way with the performance of such an autopsy.

(551) Three or more physicians, each licensed to practice medicine in at least one State of the United States or, in lieu thereof, holding a commission in one of the armed services of the United States, shall perform this autopsy. Each of the physicians shall have been certified by the American Board of Pathology in the medical specialty of forensic pathology. In the event that the death has occurred within the jurisdiction of a medical examiner or coroner of any State or political subdivsion thereof, the medical examiner or coroner may attend the autopsy, and in the event that he or she is a licensed doctor of medicine certified by the American Board of Pathology as specified above, will be designated to participate in the performance of the autopsy.

(552) The Attorney General of the United States shall designate the forensic pathologists who will perform the autopsy, on the advice and recommendation of the Director of the Armed Forces Institute of Pathology.

(553) Another alternative is to have all U.S. attorneys establish prior working relationships or standardized procedures with a medical examiner or coroner from their jurisdictions so that, if a death occurs in their jurisdiction, this person automatically participates in the autopsy. The medical examiner or coroner must be certified by the American Board of Pathology in the specialty of forensic pathology. The U.S. attorney and the previously designated medical examiner or coroner in the jurisdiction where death occurs will then designate the remaining forensic pathologists. In the event the death occurs outside the jurisdiction of any U.S. attorney, the Attorney General will then choose the forensic pathologists.

(554) One of the three or more physicians designated to perform the autopsy will be designated as the team leader and will be responsible for the preparation of the final report, with the concurrence of a majority of those participating in the autopsy. If the medical examiner or coroner in the community where the death occurred meets the designated qualifications, he will be the team leader. In the event that a material divergence of opinion arises between team members pertaining to an interpretation of a salient finding of the autopsy or subsequent laboratory testing of fluids or tissues from the body, a minority report may be prepared.

(555) Laboratories designated by the team leader will examine and document all material evidence unless such evidence is of the type that is customarily examined by crime laboratories, in which case the designated investigator from the FBI will designate the laboratory and will see that the evidence is properly transferred, with documen-

tation. No photograph taken of the body or its accouterments, or of any evidence removed from the body, will be destroyed; all should be retained as evidence, regardless of quality. All laboratory test results, all photographs, and all other evidence material to the determination of the events associated with the injury to the victim will be made available to the forensic pathology team as frequently as may be requested by its leader during the preparation of its reports. The forensic pathologist may also consult with laboratories and individuals apart from the FBI.

(556) On completion of all criminal court proceedings arising out of the prosecution of the person or persons responsible for the death under investigation, all physical evidence, including photographs, that can be preserved will remain the property of the United States of America and be preserved in the custody of the Archivist of the United States at the National Archives.

(557) The panel suggests that these procedures might be considered as the implementing rules or regulations to support section 1751 of title 18, but believes that they might also be incorporated into paragraph (h) of the existing legislation. This would preclude the development of a situation similar to that which existed at the time of the assassination of President Kennedy. Military medicine still does not acknowledge the need for a full-time mediocolegal investigative system within its programs, but depends on pathologists, many of whom are not specifically trained in forensic pathology, to act as consultants to investigators, performing autopsies on request. These examinations are often performed without adequate interaction between the investigator and the pathologists, who frequently has not had appropriate training. As review of the findings of such investigations and examinations by the forensic pathology branch of the Armed Forces Institute is usually delayed, it is often too late to correct inadequacies of the investigation or examination which may result in inadequate documentation and interpretation of evidence in subsequent criminal or civil litigation.

Dissenting View Part VI: Addendum to the Forensic Pathology Panel Report,* Submitted by Cyril H. Wecht, M.D., J.D.

(558) The single-bullet theory (SBT) is unequivocally repudiated by an objective, thorough evaluation and analysis of all the medical, scientific, and physical data in the assassination of President John F. Kennedy (JFK).

(559) Despite the semantical sophistry and intellectual gymnastics of the forensic pathology panel report (FPPR), it is clear that the SBT can no longer be maintained as an explanation for the bullet wounds in JFK's back and neck, and all the bullet wounds in Gov. John B. Connally (JBC). The angles at which these two men were hit do not permit a straight line trajectory (or near straight line trajectory) of Commission exhibit 399 (the so-called magic bullet) to be established. Indeed, quite the opposite is true. In order to accept the SBT, it is necessary to have the bullet move at different vertical and horizontal angles, a path of flight that has never been experienced or suggested for any bullet known to mankind. I am submitting a sketch, marked Wecht exhibit 11, to demonstrate this point in graphic fashion.

(560) An examination of the physical relationship between JFK and JBC immediately prior to and immediately following the moment that their wounds are alleged to have been inflicted by Commission exhibit 399 (as required by the SBT) provides unquestionable evidence that the bullet could not have moved in the direction claimed by the FPPR. I am submitting several photographs, marked Wecht exhibits 1 through 6, which demonstrate this relationship.

(561) Wecht exhibit 6 shows JBC firmly clutching his hat. This is approximately 1½ seconds after he is alleged to have been shot through the chest, right wrist, and into his left thigh. Indeed, the FPPR states that they were surprised that although he had suffered the injury to his wrist, he did not drop his hat. The panel should not only be surprised, but incredulous. If they were not so slavishly dedicated to defending the Warren Commission report (WCR), and the previous opinions submitted by two of the panel members, Dr. James Weston and Dr. Werner Spitz, they would have interpreted this picture correctly and accepted it for what it obviously and clearly demonstrates—namely, that JBC was not struck in the chest, wrist, or thigh by CE 399, and the SBT is, therefore, indefensible.

(562) I do not accept the conclusion of the FPPR that the configuration of the gunshot wound on JBC's back indicates that the bullet that struck him at that location had to have been tumbling, and that such tumbling was most probably caused by the bullet (CE 399) having first gone through JFK's back and neck. There is strong evidence to indicate that the elongation of the wound on JBC's back was in the horizontal plane, and not in the vertical plane, which would be

*References to or quotes from the Forensic Pathology Report refer to drafts of the report.

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consistent with the shot having struck JBC on a tangential angle from the right rear. Furthermore, if, in fact, the bullet that struck JBC was tumbling, such tumbling could just as easily have been caused by the bullet nipping a small tree branch or leaves during the course of its preimpact trajectory.

(563) With regard to this portion of the discussion, I should like to note for the record that the FPP and HSCA staff placed much emphasis on and gave a great deal of credence to so-called ballistics studies performed by Dr. John Lattimer, a urologist with no training, experience, or expertise whatsoever in forensic pathology. At the same time, the FPP and HSCA paid no attention whatsoever to the ballistics studies performed by Dr. John Nichols, a board-certified pathologist and full-time professor of pathology on the faculty of the University of Kansas School of Medicine. This is additional evidence of clearcut bias on the part of both the HSCA staff and the FPP.

(564) Examination of CE 399, correlated with various studies previously performed with identical ammunition fired from a Mannlicher-Carcano rifle, definitely proves that this bullet could not have inflicted all the damage attributed to it under the SBT to JFK and JBC. Specifically, there is no way that this bullet could have caused all the bone damage to JBC's right fifth rib and right radius, without having sustained more physical deformity.

(565) I am submitting pictures of CE 399 (Wecht exhibits 7, 8 and 9) to show that the only deformity of this bullet was minimal indentation at the base, with absolutely no damage to the nose of the bullet and no defects in the copper jacket.

(566) I am also submitting another picture (Wecht exhibit 10), which is a composite photograph of identical ammunition fired under the auspices of the Warren Commission in 1964. These other bullets were fired into cotton wadding, a goat carcass (breaking one rib of the goat), and the wrist of a human cadaver (breaking the distal end of the radius), respectively. They all showed more deformity than CE 399, especially the bullet that was fired through a human wrist. And yet, we are asked to accept the fact that CE 399 broke both a rib and a radius in JBC, and emerged intact and only minimally deformed at the base. This finding alone destroys the SBT in an objective, scientific manner.

(567) Despite repeated requests by me that further studies be performed on animal carcasses and human cadavers with 6.5-millimeter ammunition (copper jacket, lead core), the FPP members refused to go along with this very reasonable and logical request. It is clear to me that their reluctance was based upon their knowledge that such studies would further destroy the SBT.

(568) Similarly, I repeatedly requested that our panel be given access to JFK's brain, so that it could be properly examined. Although some members of the FPP did give affirmative lip service to this request, it was quite clear from their deliberations in the FPPR that they did not choose to emphasize and pursue properly this scientifically logical and reasonable demand.

(569) In this regard, with reference to both of my requests concerning test-firings through animal carcasses and human cadavers, and an attempt to locate and gain access to JFK's brain, I should like to note that there was also great reticence on the part of Prof. G. Robert

Blakey, chief counsel and director of the House Select Committee on Assassinations (HSCA), to undertake these pursuits. As a matter of fact, Professor Blakey did not seem the least bit interested in undertaking such studies. I wish to emphasize the fact that such controlled test-firings were performed at the request of the Warren Commission in 1964, and undoubtedly could have been repeated at this time with a reasonable expenditure of time, effort, and money.

(570) The FPPR states that: The panel considered the question that the residual defect might conceivably have been the location for an additional inshoot wound, but noted that there was no radiographic evidence of such a missile within the skull, nor any observation or description of the effects of such a missile on the skin flaps, within the brain, or interior of the skull.

(571) In my opinion, the medical evidence and other physical evidence and investigative data in this case do not rule out the possibility of an additional gunshot wound of JFK's head. This shot could have been fired in synchronization with the other shot that struck JFK in the back of the head, and would most probably have been fired from the right side (in relationship to the Presidential limousine).

(572) A soft-nose bullet, or some other type of relatively frangible ammunition, that would have disintegrated upon impact, could have struck the right side of JFK's head in the parietal region. Inasmuch as there is a large defect of JFK's skull in this area, it is not possible to rule out the existence of a separate entrance wound at the site. Since this kind of ammunition would not have penetrated deeply into the brain, there would be no evidence of damage to the left cerebral hemisphere, nor would there be fragments of such a missile deposited in the left side of the brain. Also, there would not be a separate exit wound if this kind of ammunition had been used.

(573) Again, it must be reemphasized that examination of JFK's brain is a critical element of this assassination investigation. It is truly incredible that appropriate dissection and examination of JFK's brain was not performed by the pathologists who did this autopsy on November 22, 1963, or at the time of their supplemental examination of the brain 2 weeks later on December 6, 1963. It is equally incredible, and most unfortunate, that the members of the FPP and HSCA staff have cursorily dismissed my frequent requests that JFK's brain be recovered and properly examined at this time. Their perfunctory dismissal of this obviously important and medically critical aspect of the investigation demonstrates without question their preconceived bias and professionally injudicious attitude vis-a-vis this case.

(574) The FPPR engages in a lengthy discussion to explain the basis for their conclusion that "Solely on the basis of others' descriptions of the wounds in Governor Connally's wrist and thigh, the panel could not rule out the possibility that these were caused by a fragment of the bullet striking the President's head, although the panel felt that the ability to align the wounds in the chest, wrist, and thigh, offered strong presumptive evidence that they were caused by one missile." I wish to take strong exception to this conclusion and express my unequivocal disclaimer to this so-called "presumptive evidence."

(575) The FPPR goes to great lenths to explain why it is not possible to draw straight lines through JFK and JBC in an attempt either to corroborate or disprove the SBT. Then, with incredible, intellectual inconsistency, the report nevertheless goes on to conclude that the SBT is physically possible and plausible. This blatant disregard of medical and scientific evidence and deliberate distortion and misrepresentation of analytical studies demonstrate more vividly than anything else the bias of my colleagues on the FPP.

(576) As further evidence of my allegation that the FPP began its deliberations with a preconceived bias vis-a-vis the WCR, I should like to point out in its report (first page of part 1), the statement that following its very first meeting at the National Archives on September 18, 1977, "it was disclosed that subpanel 1 was in unanimous agreement with respect to the interpretation of the evidence." (Subpanel 1 consisted of all the FPP members except Spitz, Wecht, and Weston.) And yet, when subpanel 1 met with subpanel 2 (Spitz, Wecht, and Weston), I pointed out many problems and emphasized various specific issues, other members of the overall FPP also expressed strong differences of opinion. This clearly demonstrates the strong, premature desire on the part of the FPP to rush headlong into another superficial whitewash of the WCR.

(577) I also wish to point out for the record that a meeting was arranged between subpanel 1 of the FPP and Drs. Humes and Boswell in Washington, D.C., during the time of their first meeting in September 1977. There is no question in my mind that this meeting was arranged by the HSCA staff and members of the FPP at that time in order to exclude me from participating in the discussion and interrogation of Humes and Boswell (two of the three pathologists who performed the autopsy on JFK on November 22, 1963).

(578) The FPPR does not adequately and definitively address itself to the numerous procedural and substantive deficiencies of the original autopsy and related medical-scientific investigative studies. The FPPR states that "Rather than proceed step by step with a critical review of the autopsy conducted by these individuals who were acting in response to official military orders under duress, with time and other constraints, the panel felt it wise to delineate some of the basic differences between a 'hospital autopsy' and a forensic autopsy performed as a necessasy step in an official medicolegal investigation of death."

(579) I would like to have it noted as a matter of the official record that I never agreed to such an approach. I feel that a constructive, detailed, critical analysis of the JFK autopsy should most definitely be incorporated as a vital part of the FPPR. In fact, this objective was specifically set forth as one of the four charges addressed to the members of the FPP at the outset of the deliberations in September 1977 (see p. 2 of the FPPR). The panel was "to conduct a detailed objective critique of the professional manner in which the autopsy of President Kennedy was conducted."

(580) Once again, the FPP demonstrates more concern about the feelings, sensitivities and reputations of its personal friends and professional colleagues than it does about uncovering the ultimate truth involving the assassination of President John F. Kennedy. My exclusion from the above-mentioned meeting serves as further evidence of

the bias that existed on the part of Professor Blakey and the FPP toward me personally.

(581) At this time, I have not seen the final proposal prepared by Dr. Weston, but I know from the previous drafts that he was requesting photographs and data from members of the FPP that would corroborate various points that Dr. Weston felt should be emphasized in the FPPR. I cannot accept any such photographs and interpretations without having full details of those respective cases from the jurisdictions of the FPP members who have submitted such materials. In light of the bias and scientific inconsistency that these panel members have demonstrated in various facets of their overall involvement in this undertaking, I am not prepared blindly and naively to accept their representations of what a particular photograph is supposed to demonstrate and prove.

(582) There are numerous other items in the FPPR which are equally incorrect, inconsistent or susceptible to interpretations substantially different from the conclusions drawn by the FPPR. Regrettably, because of the August 11 deadline that has been imposed by Professor Blakey, I simply have not had sufficient time to mention and discuss each of these items in this Addendum report. In this regard, I wish to point out that I consider the time restriction imposed by Professor Blakey to have been extremely short and most unreasonable in light of the great amount of time that was given to Dr. Weston to prepare the FPPR.

(583) Also, I wish to point out for the record that I believe it was quite inappropriate and injudicious to have had the FPPR prepared by Dr. James Weston, in light of his previous involvement in a review of the WCR and his publicly acknowledged and officially recorded stance vis-a-vis the WCR. Once again, the fact that Professor Blakey and his staff either assigned, or permitted this assignment to be made to Dr. Weston is clear evidence of their blatant disregard for an objective, impartial approach to all the evidence in this case.

(584) Furthermore, at this time, I am not aware of the findings, interpretations and conclusions of other specialty panels that had been created by the HSCA to review the evidence in the JFK assassination. I do not understand how the FPP can prepare a final report without knowing what the final deliberations are of these other specialty panels. This is not the way forensic pathologists function, and I am truly amazed that they would have engaged in such an unprofessional approach in a matter of this magnitude.

CYRIL H. WECHT, M.D., J.D.,
Coroner of Allegheny County.

Figures used in the dissenting view to the Forensic Pathology Panel Report, submitted by Cyril H. Wecht, M.D., J.D.

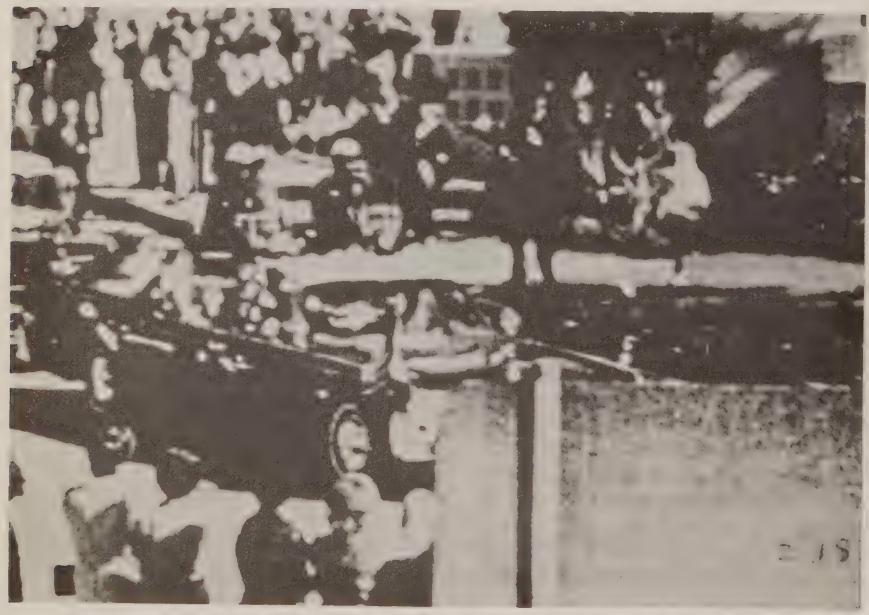
Wecht exhibits 1–6. Photographs demonstrating the physical relationship between President Kennedy and Governor Connally.

Wecht exhibits 7, 8, and 9. Photographs demonstrating the degree of deformity of bullet CE 399.

Wecht exhibit 10. Photograph displaying ammunition identical to CE 399, fired under the auspices of the Warren Commission in 1964.

Wecht exhibit 11. Photograph of a sketch illustrating the positions of the occupants in the presidential limousine.







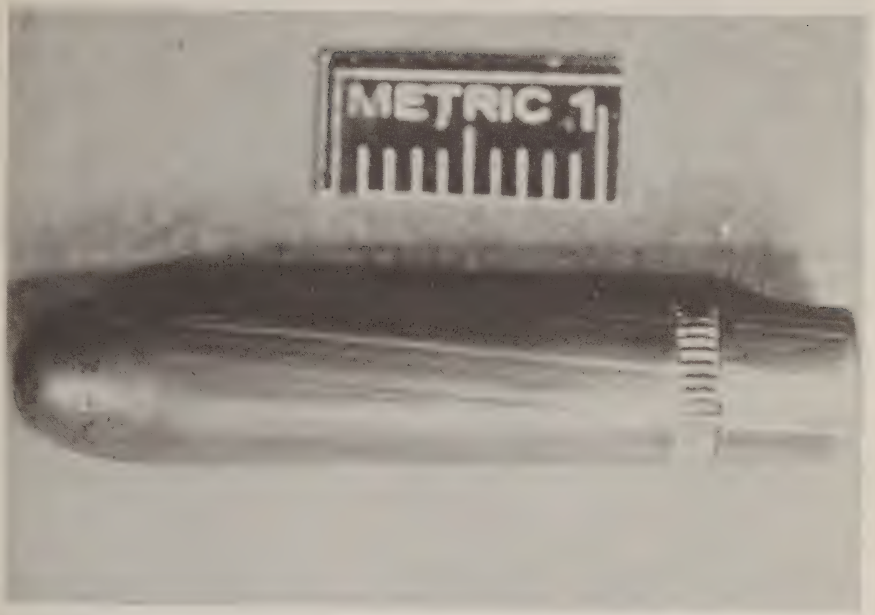


Clear of sign. Connally is unhurt. he say



Kennedy. emerging from behind sign. is wo

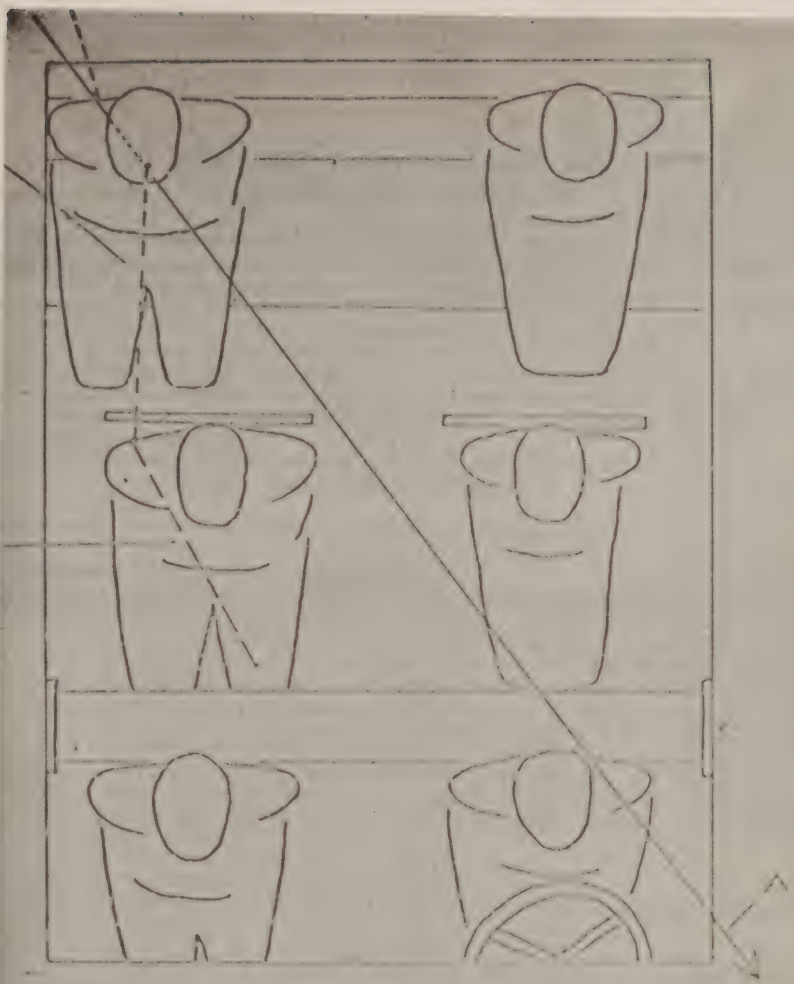



METRIC 1


METRIC 1


METRIC 1


CE399
CE572
CE853
CE856



Figure

Part VII: Majority Response to the Dissent of Dr. Cyril H. Wecht, M.D., J.D.

(585) The panel majority has considered all the issues raised by the panel minority of one. The conclusions of the panel majority remain unchanged in the absence of additional bona fide evidence.

GLOSSARY

Abrasion collar: The dark circle around the margins of a bullet perforation of entrance, caused by the rubbing of a bullet against the skin as it stretches and penetrates it at the moment of impact.

Acromion process: The lateral end of the spine of the scapula (shoulder blade) which forms the top, outside, back portion of the shoulder.

Anatomic position: The position of the body at attention, with the face forward, the arms at the side, and the palms of the hand facing forward.

Anterior-posterior: Refers to X-rays taken with the beam proceeding from the front of the body (anterior) to the back (posterior), with the back part of the body against the X-ray plate (posterior-anterior view of the chest indicates that the chest is against the X-ray plate and the beam enters from the back).

Apical or supraclavicular portion of the pleural cavity: The uppermost part of the pleural cavity (lung cavity) adjacent to the neck and above the collarbone.

Arachnoid: A thin, transparent, delicate membrane that covers the brain.

Axilla: The armpit.

Basilar aspect: The underside of the brain.

Beveling: Beveling in bone resembles the beveling observed when a BB or small caliber missile strikes a plate glass window. (See fig. 16, depicting beveling.) Pathologists use this information to characterize the direction of travel of a missile through bony surfaces, since the margins of the defect on the bony surface where the bullet enters the bone are sharply outlined and may approximate the dimensions of the missile itself, while the margins where the bullet exits from the opposite bony surface are large, more irregular, and cratered. Missile fragments or bullets exiting from the skull produce a similar pattern in reverse direction, that is, the point where the bullet first strikes the skull on the inside of the exit point is smaller and the beveling extends to a larger, more irregular defect on the outer surface of the bone.

Calvarium: The top of the skull; the skullcap.

Cecum: The beginning of the large intestine or colon.

Cerebellum: The part of the brain immediately behind and below the cerebrum and situated in the lower back part of the skull.

Cervical: Refers to the area of the neck.

Comminuted fracture: A fracture in which the bone is broken into a number of fragments.

*Computer-assisted image enhancement:** A procedure in which graphic images are recorded on a television camera and then, with the assistance of an operator or by preprogramed instructions to the computer, color or light variations which are barely perceptible or are even imperceptible to the human eye are magnified so that they are more easily seen. The procedure assigns numbers indicating the level of intensity of the three primary colors in many tiny spots comprising the televised image. These numbers are stored systematically on the computer, thus "digitizing" the image. The programer uses various mathematical manipulations of these numbers to render the enhancement.

Contusion: Bruise (results from trauma and bleeding from injured small blood vessels).

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*Computer-assisted image enhancement of X-rays—a process somewhat different from that of photographic enhancement. In this technique, the initial steps of image digitalization are similar, but the mathematical programing serves to reduce the fuzzy, ill-defined shadows on the X-ray to rather concise lines, simulating line drawings prepared from X-rays.

Coronal sectioning: A technique for sectioning the brain, similar to slicing a loaf of bread. The brain is cut parallel to the coronal suture line of the skull, which extends from the front of one ear to the front of the other ear.

Coronal suture: See "suture lines."

Corpus Callosum: The part of the brain that connects the cerebral hemispheres.

Cortex: The outer part of an organ such as the brain or adrenal glands.

Decerebrate rigidity: Rigidness of the body or a part of the body which is caused by a muscle spasm of the entire body below the neck resulting from interference in the transmission of stimuli from the higher centers of the brain which maintain balance and muscle tone to the spinal cord.

Definition: In optics, the power of a lens to give a distinct image.

Dermis: The innermore layers of the skin.

Dorsal aspect: Refers to the posterior or back surface of the body or a part of the body as opposed to the ventral aspect, or anterior or front surface.

Ecchymosis: Hemorrhage or bleeding into tissues; often referred to as black and blue marks.

Energy dispersive X-ray examination: A technique which measures the radiation characteristic of different (chemical) elements when excited by an X-ray source. It allows one element to be distinguished from another, such as lead, copper, or zinc.

Epidermis: The thin, outermost layer of the skin.

Epithelium: A purely cellular layer covering the surface of the skin.

Ethmoid: Resembling a sieve.

External occipital protuberance: The prominence in the middle of the back of the skull.

Falx cerebri: A thin, fibrous membrane that extends between the cerebral hemispheres.

Fascia: A fibrous, connective tissue membrane.

Forensic odontologist: One who applies the technique of dentistry for medical-legal purposes to assist in identification of individuals by dental comparisons and examination of bite mark evidence.

Frangible bullet: A bullet composed of metal fragments designed to splinter on impact; often used in shooting galleries to prevent the richoceting of bullets.

Frankfort plane: A standard reference point. It is a horizontal plane of the head which passes through the most inferior portion of the left orbit and the superior margin of the left external auditory foramen (ear canal).

Fronto-parietal: Refers to the front and upper aspects of the head and skull.

Fronto-temporal: Refers to the front and side aspects of the head and skull.

Galea: A thick, fibrous membrane between the scalp and the skull bones.

Gross description: Description of the body or body organs made with the naked eye and without the aid of a microscope.

Gyri: The rounded elevation of the outside of the cerebral hemisphere of the brain; the depressions are called sulci.

Hemithorax: One-half of the chest.

Hemorrhage: Bleeding.

In-life: Taken while the person was living.

Interstitial emphysema: Abnormal accumulation of air within tissues.

Latissimus dorsi muscle: The broadest muscle of the back.

Lobe: A rounded, projecting part.

Mastoid process: The lowest projection of temporal bone immediately behind the ear.

Medial femoral condule: In the middle of the rounded articular surface at the extremity of the bone.

Mediastinum: The middle part or aspect of the chest.

"Missile dust": Refers to the X-ray appearance of tiny metal fragments deposited in the tissues along the course of a missile track.

Necrosis: The death of tissues.

Obelion: A point on the sagittal suture between the parietal foramina (small holes located approximately 0.5 to 1 centimeter lateral to the sagittal suture) approximately 5 centimeters above its posterior margin where it terminates in the lambdoidal suture, the semicircular suture extending around the occipital or back portion of the head and separating the parietal bones from the occipital bone.

Occipital protuberance: See external occipital protuberance.
Occipital region: The back part of the head.
Occipital-parietal: The upper, back part of the head and skull.
Orbit: The body socket which contains the eye.
Paraffin blocks: Wax blocks containing small pieces of tissue used in the preparation of slides for microscopic examination. It enables the cutting of the very thin sections necessary for microscopic study.
Parietal: Upper part of the skull or head.
Periosteum: Thin, fibrous membrane covering the bone.
Photographic enhancement: A process for improving the quality of an image for example, with a computer by converting picture elements into digital numbers that are systematically modified and converted back into picture elements.
Pleural cavity: The space in the chest containing the lungs.
Pleural fluid: Fluid present in the pleural cavity.
Pneumothorax: Air or gas in the pleural cavity.
Positive pressure insufflation: The Propulsion of air through a tube into the trachea and the lungs by a mechanical device during emergency treatment.
Pulmonary contusion: Contusion or bruising of the lung.
Pulmonary parenchyma: The substance of the lungs.
Radiolucency: Appearing as an empty space on an X-ray.
Reverse jet effect: The movement of an object in a direction opposite of the release of energy.
Rifling: Refers to the grooves in the barrel of a gun or rifle designed to impart rotation to a missile and make flight more accurate.
Roentgenogram: X-ray.
Sagittal plane: The plane through or parallel to the sagittal suture line of the skull which is at the top of the head between the parietal bone and extends from front to back in an anterior-posterior direction.
Sagittal suture: See suture.
Scanning electron microscopy: A technique in which a beam of focused electrons moves across an object. The secondary electrons produced by the object and the electrons scattered by the object are collected to form a three-dimensional image in a cathode-ray tube.
Scapula: Shoulder blades.
Secondary missiles: Objects which have become missiles as a consequence of being struck by the primary missile, which is usually a bullet. These missiles may include fragments of bone.
Sella turcica: Literally, "turkish saddle"; the depression in the sphenoid bone of the skull that contains the pituitary glands.
Serratus anterior muscle: A thin muscle between the ribs and scapula and the upper portion and sides of the chest.
Soft-nosed bullet: A bullet with a lead or unjacketed nose.
Soft-nosed bullet: A bullet with a lead or unjacketed nose.
Soft X-ray examination: A technique which employs X-rays at low levels to reveal materials not seen by normal X-ray techniques.
Spectrograhic analysis: Technique in which a spectrograh is used to subject charged and accelerated ions to a magnietic field to detect differing molecular structures. This allows identification of various substances.
Sphenoid sinus: The air spaces in the sphenoid bone of the skull; they serve as accessory air spaces for the nose.
Stephanion: The junction of the coronal suture at its lateral extremity with the temporal line (the upper margin of the temporalis muscle insertion).
Stereoscopic visualization: Technique which involves the use of a stereoscope, an optical instrument with two eyeglasses, to assist the observer in combining the images of two pictures taken from points of view a small distance apart and thus to get the effect of solidity or depth.
Subarachnoid: Underneath the arachnoid membrane.
Sulci: See gyri.
Supraclavicular: The area above the collar bone (clavicular) at the root of the neck.
Suprasternal notch: The V-shaped indentation at the upper border of the sternum or breast bone at the base of the neck, in the midline.

Suture lines: The junctures in the skull between the various flat bones where growth occurs until the individual reaches maturity, when they close or fuse, thereby making the skull virtually one large bone. Even after closure, there are slightly indented residual lines, usually arranged in a somewhat zigzag pattern. Each of these suture lines has been named.

Sylvian fissure: The deepest and most prominent lateral cerebral fissure of the brain.

Temporo-parietal: Refers to the side and upper aspects of the head and skull.

Thoracolumbar: Refers to the chest and lower part of the vertebral column.

Thorax: Chest.

Tragus: The cartilaginous protusion in the front part of outer ear.

Transparency: An image (usually positive) intended to be observed by light that passes through the image and base, as on a viewer or by projection.

Tumbling: The rotation of a bullet over its longitudinal axis; sometimes resulting in the bullet "tumbling" end over end.

Turcica: See sella turcica.

Vascular foramina: Opening in bone through which blood vessels travel.

Vastus medialis: A prominent muscle in the front of the upper leg.

Ventricles: In reference to the brain, the normal cavities within the brain containing cerebro-spinal fluid.

Vertex: The crown or topmost part of the head.

Visceral pleura: A thin semitransparent membrane covering the outer surface of the lung and separated from the "parietal pleura" which lines the inside of the chest cavity, where the lung is suspended only by its attachment or hilium in the midportion of its medial surface.

Volar: Refers to the palm of the hand or the sole of the foot.

X-ray back scatter: A technique used to determine the presence of metal in tissue.

Yaw: The deviation of a bullet from its longitudinal axis during its line of flight, resulting from the spin imparted to the bullet by rifling and imperfection in the bullet due to construction or deformation in the bore or other imperfections in the gun, and also caused by resistance of air or tissues.

ADDENDA TO THE REPORT OF THE FORENSIC PATHOLOGY PANEL

Addendum A

List of the documentary materials provided to the forensic pathology panel by the house select committee on assassinations (packets I and II)

PACKET I

Autopsy protocol (Nov. 22, 1963).

Supplementary autopsy report (Dec. 6, 1963).

C.E. 397 (Humes' notes of Nov. 23, 1963 call to Dr. Perry and Humes' handwritten draft of autopsy report).

Autopsy descriptive sheet (Nov. 22, 1963).

W.C. autopsy diagrams (C.E. 385, 386, 400).

JFK documents: Death certificate (Nov. 22, 1963); authorization for post mortem examination (Nov. 22, 1963); and report of inquest (Dec. 6, 1963).

Secret Service reports on bullet trajectories: Dec. 12, 1963 by Elmer Moore; Feb. 14, 1964 by Roger C. Warner; and Jan. 28, 1964 by Roger C. Warner.

Connally medical records: admitting summary (Nov. 22, 1963); admitting note (Nov. 22, 1963); Parkland Hospital operative record (Nov. 22, 1963) (from C.E. 392); Secret Service report on Connally's wounds (Feb. 14, 1964, by Roger C. Warner); and body diagram (Commission No. 326) Nos. 1, 2, 3, 4, 5, 6.

Narrative summary—Anesthesia care for Governor John Connally (Nov. 25, 1963), Dr. Giesecke to C. J. Price).

Reports of diagnostic X-ray consultation by Dr. J. Reynolds—November 22, 24, 25, 26, 27 and 29, December 2 and 4, 1963; supplementary report (Nov. 29, 1963)

Surgical pathology report (Nov. 30, 1963—by Dr. Stembridge).

FBI reports regarding: metal fragment (Nov. 30, 1963—by J. Doyle Williams; Nov. 23, 1963).

Parkland operative record (Nov. 27, 1963—by Gregory).

Parkland operative record (Dec. 4, 1963—by Gregory).

JFK PARKLAND MEDICAL REPORTS—PACKET II

1966, index by Humes, Boswell, Ebersole, and Stringer; 1967, report by Humes, Boswell, and Finck; 1968, Clark panel report; 1975, Rockefeller panel reports; and receipts for photographs and X-rays.

FBI reports regarding: Harper skull fragment; FBI report (C.D. 205, pp. 153–4) regarding: examination of JFK clothing, and Hoover letter (to Rankin, Apr. 16, 1964) regarding: examination of Connally clothing.

Warren Report regarding: "The Autopsy" (W.R. 59–60) and regarding: "The Bullet Wounds" (W.R. 85–96).

FBI reports regarding: autopsy by O'Neill and Sibert—November 26 and 29, 1963.

Articles by Cyril H. Wecht, M.D., J.D.

"Appendix D: A Critique of President Kennedy: Autopsy," "Six Seconds In Dallas," by Josiah Thompson.

"The Medical Evidence in the Assassination of President Kennedy," "Forensic Science," 3 (1974): 105–128 (and Robert P. Smith).

"JFK Assassination: A Prolonged and Willful Cover-up," "Modern Medicine," October 28, 1974.

Interviews with Ken Rankin, "Physician's Management," October 1975 ("Part 1: The Evidence"); ("Part 2: The Cover-up"), November 1975.

"Pathologist: View of JFK Autopsy: An Unsolved Case," "Modern Medicine," November 27, 1972.

"A Post Mortem on the Warrenfeller Commission," "Juris," December, 1975.

Articles by John K. Lattimer, M.D., F.A.C.S.

"An Experimental Study of the Backward Movement of President Kennedy's Head," "Surgery, Gynecology, and Obstetrics," February, 1976 (and Jon Lattimer, Gary Lattimer).

"The Kennedy—Connally Single Bullet Theory—A Feasibility Study," "International Surgery," December, 1968 (and Jon Lattimer).

"Observations Based on Review of the Autopsy, Photographs, X-rays, and Related Materials of the late President John F. Kennedy," "Resident and Staff Physician," May 1972.

"Factors in the Death of President Kennedy," "Journal of the American Medical Association," October 24, 1966.

"The Kennedy—Connally One Bullet Theory: Further Circumstantial and Experimental Evidence," "Medical Times," November, 1974 (and Gary Lattimer and Jon Lattimer).

Other documentary materials

Warren Commission testimony of: Cdr. James J. Humes, Lt. Col. Pierre A. Finck, Cdr. J. Thornton Boswell, Dr. Malcolm O. Perry, Dr. George T. Shires, Dr. Charles F. Gregory, Dr. Martin G. White, Dr. Paul G. Peters, Dr. Adolph A. Giesecke, Jr., and Dr. William K. Clark.

Warren Commission testimony of: Dr. Don T. Curtis, Dr. Fuoad A. Bashour, Dr. Gene C. Akin, Dr. Charles J. Carrico, Dr. Charles R. Baxter, Dr. Robert Shaw, Rufus W. Youngblood, Clinton Hill, Roy H. Kellerman, and William Greer.

Warren report and volumes of hearings and exhibits.

Original autopsy documents (Archives: "Autopsy 4–1").

The original autopsy photographs and X-ray (including transparencies and negatives) were available, along with comparison X-rays of President Kennedy (X-rays taken from 1960–63), black and white enlargements of selected autopsy photographs, the original Connally X-rays, the original clothing, the bullet and bullet fragments, rifle, cartridges, limousine photographs, windshield, and slides from the Zapruder film. A film and slide presentation of the assassination was prepared and shown by Robert Groden.

Addendum B

LIST OF ADDITIONAL DOCUMENTARY MATERIALS PROVIDED TO THE FORENSIC PATHOLOGY PANEL BY THE HOUSE SELECT COMMITTEE ON ASSASSINATIONS

Black and white prints, color prints, and original transparencies:

1[1] (18 JB[2])	16 (10 JB)	38
2 (17 JB)	17 (2 JB)	39
3 (14 JB)	18 (JB)	40
4 (13 JB)	26	41
5 (9 JB)	27	42
6 (3 JB)	28	43
7 (16 JB)	29	44
8 (7 JB)	30	45
9 (11 JB)	31	46
10 (12 JB)	32	47
11 (6 JB)	33	48
12 (5 JB)	34	49
13 (8 JB)	35	50
14 (15 JB)	36	51
15 (4 JB)	37	52

[1] National Archive Numbers.
[2] Dr. J. Thornton Boswell.

Pictures of Harper Bone Fragment.

Film and slide presentations by Robert Groden. Photographs of the presidential limousine.

X-rays:

1	6	11
2	7	12
3	8	13
4	9	14
5	10	

Comparison X-rays of John F. Kennedy (taken 1960–63).

Bullets and fragments: CE 399, CE 567, CE 569, and CE 840.

Motion picture films: CE 904—Zapruder film and CE 905—Nix film.

Single frame pictures of Zapruder film, frames 215 through 334.

Clothing of John F. Kennedy: CE 393 suit coat; CE 394 shirt; and CE 395 necktie.

Clothing of Governor Connally: Suit coat, shirt, and trousers.

Other: Oswald rifle, clips, spent shells and windscreen and windshield from the Presidential limousine.

Addendum C

Report of G. M. McDonnel, M.D., Concerning the Observations, Analysis, and Conclusions in Connection With the Radiographic Images and Enhanced Images of X-Rays Attributed to President John F. Kennedy, Dated August 4, 1978

DEPARTMENT OF RADIOLOGY
THE HOSPITAL OF THE GOOD SAMARITAN
616 SOUTH WITMER STREET
LOS ANGELES, CALIFORNIA 90017

Diagnostic Radiology
Robert E. Levis, M.D.
Gerald M. McDonnel, M.D.
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Radiation Therapy
R. Wilbur Melbye, Ph.D., M.D.
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Radiation Physicists
Richard M. Garver, M.S.
Melissa C. Martin, M.S.

Nuclear Medicine
Leonard A. Swanson, M.D.
Telephone 488-8245

TO: Michael Goldsmith
Senior Staff Counsel
Select Committee on Assassinations
U.S. House of Representatives
3342 House Office Building, Annex 2
Washington, D.C. 20515

DATE: August 4, 1978

SUBJECT: Report of G.M. McDonnel, M.D. concerning observation, analysis, and conclusions in connection with radiographic images and enhanced images attributed to President John F. Kennedy.

This report replaces my report of March 8, 1978 and supplements my presentation of July 21, 1978 in the Rayburn Building, Washington, D.C.

I was exposed to radiographic images identified by the number 21296 at Aerospace Corporation, El Segundo, California on March 7, 1978. At my suggestion portions of these radiographs were digitized and enhanced by Aerospace Corporation for further observation and analysis.

I participated in discussions during the photographic evidence panel on 6 and 7 April 1978 durng which time I dialogued with Dr. James Weston concerning my interpretation of these radiographs and the enhanced images.

On 2 June 1978 I again viewed and analyzed the radiographic images at the National Archives Building in Washington, D.C. As requested I also interpreted and analyzed skull and sinus radiographs obtained during the lifetime of the subject for the specific purpose of authenticating the radiographs obtained before and after the autopsy.

The original radiographs seen on 7 March were:

a. An attempted anteroposterior projection of a skull identified as:
21296 (numbers upside down)
US Naval Hospital
NNMC Bethesda Maryland
11 22 63

b. Right lateral projection of a skull with the same identification symbols.

c. Left lateral projection of a skull with the same identification symbols.

d. Three radiographs of three fragments of bone unidentified by symbols.

e. An anteroposterior projection of a chest with the same identification symbols as a, b, c above. This radiograph was obtained with the thoracic cage intact, i.e., before autopsy.

f. An anteroposterior projection of a chest with the same identification as e above. This radiograph was obtained after the thorax had been opened and the lungs and mediastinal contents had been removed.

The findings and interpretation of the skull films are:

1. Nearly complete loss of right parietal bone, the upper portion of the right temporal bone, and a portion of the posterior aspect of the right frontal bone.

2. Subdural air over the left parietal hemisphere.

3. Multiple skull fractures and disruption of continuity of the bony tables.

4. A metallic fragment on the outer table of the right occipital bone 9.6 cm. above the mid portion of the external occipital protuberance (EOP). 1 cm. above the metallic fragment is a depressed fracture from which stellate type fractures "radiate" into both occipital bones, the right parietal bone and the right temporal bone. These are vividly and convincingly displayed in the enhanced images, specifically the "anteroposterior" (AP) projection of the skull. The metallic fragment in this projection is nearly spherical in contour.

5. There is a fracture line extending through the floor of the sella turcica with bony fragments in the sphenoid sinus. This is vividly depicted in the enhanced images.

6. There are fracture lines through the anterior and posterior aspects of the right frontal sinus with air in this sinus. There is a metallic fragment above the sinus appearing to be between the bony tables of the frontal bone.

7. There is elevation of the galea medial and lateral, as well as anteriorly, to the depressed fracture in the right occipital bone. A small metallic fragment lies medial to the fracture site between the galea and the outer table of the skull.

The mechanism of damage to the skull is concluded to be:

1. A low mass, high velocity, metallic projectile penetrated the right occipital bone at the area of the depressed fracture, leaving behind the spherical shaped contoured metallic fragment in 4 above.

2. The reflected shock wave from the outer table propelled a metallic fragment medially as in 7 above.

3. The stellate type "radiating" fractures as in 4 above resulted from the entering metallic projectile.

4. (also 8 in findings).

A linear alignment of tiny metallic fragments is associated with the entry, path of travel, and exit in the posterior aspect of the right frontal bone.

CHEST

The pre-autopsy radiograph of the chest shows air in the soft tissues of the right supraclavicular area soft tissues.

There is an undisplaced fracture of the proximal portion of the right transverse process of T1 (or the region of the costovertebral junction).

There is no evidence of fracture of the cervical spine or its associated appendages.

In the post autopsy film of the thoracic region there is debris in the radiographic image superimposed over the area to the right of the C7 vertebral body.

In the enhanced post autopsy image of the same area, there appears to be fractures of the posterior aspects of the 2nd, 3rd, and 4th ribs. These are artifacts.

Authenication of Radiographs.

The following radiographs were provided at the National Archives, Washington, D.C. on June 2, 1978.

a. A left lateral skull radiograph dated 8/17/60 performed by Groover, Christie and Merritt, with number 336042 and blue ink writing of "Kennedy".

b. A paranasal sinus series performed by (or for) Stephen White, M.D., 521 Park Ave. NYC, dated 8/14/60, and identified by number 202617.

The following anatomical and bony structures are common and identical to all three sets of radiographs.

1. The thickness and contour of the frontal bones.

2. Deviation of the mid portion of the nasal septum from right to left.

3. The contour of the frontal sinuses.

4. The contour and shape of the sella turcica.

5. The contour of the posterior clinoids.

6. The contour and calcification of the posterior clinoid ligaments.

7. There is thickening of the medial and superior aspects of the mucoperiosteal margin of the left frontal sinus. This is less severe in the radiographs of 8/14/60 and 8/17/60 than in the radiographs of 11/22/63. The general margin of this tissue swelling is similar in all three studies.

In my opinion the three sets of radiographs are positively and without controversy, of the same individual. It is impossible to simulate the referenced anatomical landmarks, the nasal septum deviation, and the documentation of the progressive disease process in the left frontal sinus.

Enhancement of the Radiographic Images.

The digitized and enhanced images produced by Aerospace Corporation permitted definitive observation and analysis of the original radiographs. Further, enhancement permitted analysis or elimination of artifacts on the images. The most vivid result is the clear definition of the multiple fractures radiating from the area of the entrance of the penetrating missile in the right occipital bone.

"Doctoring" of the Radiographic Images"

In my opinion the images which I have seen have not been "doctored" or "treated" in any fashion, except for:

a. Two small areas of thermal damage resulting from a light source held too close to the "anteroposterior" image. These were reported to be present on an observation report dated November 1, 1966 and validated by signature November 10, 1966. This report is in the National Archives. Interestingly, the enhanced images downgrade the prominence of the "burns" while enhancing the true radiographic image.

b. Minor "staining" or discoloration of the images due to incomplete processing of the film in the developing process. This discoloration has, and will continue to be, more prominent with the passage of time.

The linear opacities associated with the images have been said to be the result of manipulation. These opacities or normal grid lines from the grid used to eliminate "scatter fogging" of the images at the time of exposure of the films and therefore represent normal images without evidence of manipulation.

Final Summary:

1. The observations of the findings are as stated and validated by the enhanced images.

2. The described mechanisms of damage are the writer's professional opinion.

3. The radiographs observed are incontrovertibly of the same individual during life and the early post mortem period.

4. The observed radiographic images have not been altered in an effort to provide a false image.

G.M. McDonnel, M.D.

GMM:st

8 March 1978

ENCLOSURE NO. 1

Statement by Dr. G. M. McDonnel

On 7 March 1978, at The Aerospace Corporation, I was asked to interpret six radiographs which are identified by the Number 21296, dated 11/22/63, and Bethesda NMC. The views were

a. an attempted anterior-posterior projection of a skull

b. two lateral projections of a skull--one marked "L", the other marked "R"

c. three radiographs of three fragments of skull

These radiographs were unenhanced. My preliminary interpretation follows:

1. A nearly complete loss of structure of the right frontal and parietal bone.

2. A metallic fragment on the outer table of the right occipital bone approximately 10 cm above the external occipital protuberance. In the same area is a depressed fracture. In the anterior-posterior projection, there appears to be fracture lines to the occipital, parietal, and temporal bone, radiating from the area of the fracture and metallic fragments. The metallic fragment is nearly spherical in this projection.

3. There is elevation of the galea medial and lateral to the area of the fracture and metallic fragment in the occipital region. A small metallic fragment is located medial to the location of the spherical metallic fragment and fracture lying between the galea and the outer cranial table.

4. There is a fracture line through the floor of the sella turcica with boney fragments in the sphenoid sinus.

5. There are fracture lines through the anterior and posterior aspects of the anterior ethmoid cells with air in the right side anterior ethmoid.

My preliminary cronological conclusions are:

1. A low mass, high velocity projectile entered the right occipital region.

2. A shock wave is reflected off the outer table of the occipital bone in the region of entry with elevation of the galea and medial movement of the metallic fragment as in Paragraph 3 above.

3. Fractures into the sphenoid sinus and the anterior ethmoid area.

4. There is tremendous intracranial pressure resulting in disruption of the cranial tables as in Paragraph 1 above with loss of brain substance and the projectile.

It is respectfully requested that this interpretation may be modified after analysis and study of enhanced images of the referenced radiographs.

Addendum D

Report of David O. Davis, M.D., Concerning the Examination of the Autopsy X-Rays of President John F. Kennedy, Dated August 23, 1978

Report of David O. Davis, M.D., Concerning the Examination of the Autopsy X-Rays of President John F. Kennedy, Dated December 22, 1978

THE
GEORGE
WASHINGTON
UNIVERSITY
MEDICAL CENTER

The University Hospital / 901 Twenty-Third Street, N.W. / Washington, D.C. 20037

Department of Radiology
Diagnostic Division
(202) 676-4600

1053

MEMORANDUM TO: Mr Mark Flanagan, US House of Representatives Select Committee on Assassinations Staff Member

FROM: David O Davis, MD
Professor and Chairman
Department of Radiology
The George Washington University Hospital
Washington DC

PLACE: The George Washington University Hospital
Department of Radiology
Washington DC

DATE: August 23, 1978

SUBJECT: Examination of JFK Autopsy X-Rays

PERSONS PRESENT: Doctor Davis, Mr Mark Flanagan (HSCA), Mr Michael Leahy (National Archives)

I reviewed the Kennedy skull films labeled #1 and #2, taken at the US Naval Hospital on September 22, 1963, and two aerospace enhanced images of those films.

The findings are as follows:

There is massivecalvarial damage, which will be described below. There is a metallic fragment about 9 or 10cm above the external occipital protuberance. which metallic fragment is apparently imbedded in the outer table of the skull. On the frontal view, this metallic fragment is located 2.5cm to the right of midline, and on the lateral view, it is approximately 3-4cm above the lambda. There are a large number of fractures in the calvarium, and the linear fractures seem to more or less emanate from the imbedded metallic fragment, and radiate in a stellate fashion in various directions. There is a large fracture extending directly anteriorly along the sagittal suture, which is, at least at the point visualized, widely separated. This fracture seems to extend into the frontal bone, more or less at the midline, down to

the frontal sinus which is also fractured. There is a sharply defined linear fracture extending laterally from the metallic fragment into the left side of the calvarium, around the parietal bone to the lateral aspect of the skull. Two linear fractures extend inferolaterally from the metallic fragment, one into the occipital bone, about 3cm from the midline, and this fracture crosses the lambdoid suture. The other one is more lateral, and extends down toward the lateral sinus, probably above the lambdoid suture.

Additionally, there is a fracture line extending more or less laterally from the metallic fragment toward the temporal bone on the right side, which is identified only by the anterior edge of the posterior fragment, since there is apparently absence of bone anterior to this line, with the absence present to a point approximately equivalent to where the coronal suture on the right side should be.

There is a fracture fragment inferior to the absent bone, with the corner of the fragment extending down to the parietal squamosal suture, and this fragment is displaced from its normal position as indicated by overlap of the infero and posterior aspects of the fracture fragment. There is a faint line extending inferiorly from the superior aspect or vertex of the skull towards this fragment, which I feel is probably a shadow caused by avulsed scalp and is not explained by absent bone although it projects essentially over the central portion of the absent parietal calvarium that is evident.

The absent bone in the parietal region apparently includes some fragment from the left parietal region, since the fracture seems to cross the midline where there is some lucency, and presumably part of the sagittal suture and sagittal sinus is absent.

The right orbital rim is also fractured laterally, and the roof of the orbit is fractured on the right side, as is the inferior orbital rim, indicating that there is an unstable orbit.

There are a number of metallic fragments extending anteriorly from the inner table of the skull at a point approximately 6cm antero-superiorly from the previously described imbedded metallic fragment. These fragments extend inferoanteriorly across the entire skull and actually project (on other images that I have seen) in a fashion that suggests that the the large fragment is outside the intracranial space. Presumably this represents a metallic fragment in the scalp, although this cannot be accurately determined from this particular examination.

There is some air in the subarachnoid space of the spinal canal, and also apparently in the temporal lobe sulci in the middle fossa, presumably on the right side, but since the fracture is open to the subarachnoid space, this is not at all surprising.

CONCLUSION: There is an extensive comminuted, open, explosive calvarial fracture which seems to radiate in various directions as described above from a central point which is located in the right parietal bone, 3cm from the midline and about 9 or 10cm from the external occipital protuberance. There is absence of a part of the calvarium, beginning near the impact point and extending anteriorly to the coronal suture, with absence of a significant amount of bone in the right parietal and presumably a small amount of left parietal region. There is a displaced fragment or fragments in the right frontal and parietotemporal region, with some overlap of the bone. There is a significant fracture in the frontal region extended into the right orbit and frontal sinus. The fractures also extend, from the posterior impact point, into the occipital bone on both sides.

I neglected to describe in the text of this report an extensive fracture which extends inferolaterally from the impact point toward the left side which probably reaches the temporal bone or at least the mastoid region after crossing a goodly portion of the occipital bone there. It seems apparent that explosive impact occurred in this calvarium. It also seems reasonable to assume that the exit point is near the coronal suture on the right side, about 5 or 6, or perhaps slightly more, cm above the pterion. It is not possible to totally explain the metallic fragment pattern that is present from some of the metallic fragments located superiorly in the region of the parietal bone, or at least projecting on the parietal bone, are actually in the scalp. The frontal view does not give much help in this regard and it is impossible to work this out completely.

I have also reviewed the films numbered 8, 9 and 10, which are of the thoracic region. In addition, I reviewed a film taken at Doctor White's office on Park Avenue in New York, in 1960.

Evaluation of the pre-autopsy film shows that there is some subcutaneous or interstitial air overlying the right C7 and T1 transverse processes. There is disruption of the integrity of the transverse process of T1, which, in comparison with its mate on the opposite side and also with the previously taken film, mentioned above, indicates that there has been a fracture in that area. There

is some soft tissue density overlying the apex of the right lung which may be hematoma in that region or other soft tissue swelling.

Evaluation of the post-autopsy film shows that there is subcutaneous or interstitial air overlying C7 and T1. The same disruption of T1 right transverse process is still present.

On the film of the right side, taken post-autopsy, there are two small metallic densities in the region of the C7 right transverse process. These densities are felt to be artifact, partly because of their marked density, because there is a similar artifact overlying the body of C7, and because these metallic-like densities were not present on the previous, pre-autopsy film. Therefore, I assume that these are screen artifacts from debris present in the cassette at the time that this film was exposed.

OPINION: There is evidence of interstitial air on the pre-autopsy film, and evidence of a right T1 transverse process fracture, both on the pre-autopsy and post-autopsy film. The fracture fragments are not significantly displaced. I do not feel that there is any evidence of foreign body on these films, and that the small metallic density mentioned above, overlying the C7 transverse process region, is actually an artifact.

DOD/mhw

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Office of the Chairman
Department of Radiology
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The University Hospital / 901 Twenty-Third Street, N.W. / Washington, D.C. 20037

December 22, 1978

Mr Kenneth Klein
US House of Representatives
Select Committee on Assassinations
House Annex #2
Washington DC 20015

Dear Mr Klein:

In light of the recent revelations concerning the alledged acoustical evidence of a fourth shot in the Kennedy assassination in 1963, Doctor Michael Baden and I reviewed the appropriate x-ray films and photos.

After careful perusal of all of the material, I must say that I see no evidence to support any belief that a second shot struck President Kennedy's skull. It seems that the drawings that were produced, after our previous work, are correct. In fact, we were even more convinced after this perusal that the bullet that entered President Kennedy's head in the right posterior aspect actually exited in the right frontal region, at the midportion of the coronal suture, just as is shown on the drawings. There are no additional fragments that cannot be explained by this posteriorly entering missile, and some x-ray and photographic evidence of metallic deposition and beveling seems to strongly confirm the fact that the right frontolateral injury is secondary to an exit wound at that location.

Careful consideration was given to the fact that the fourth shot may have come from the "grassy knoll" and visualization of the course that such a bullet would have to take tends to completely rule out any additional missile striking President Kennedy from the right side. We then considered all of the possibilities and came to the conclusion that the only possible occurence would have required President Kennedy's head to have been tilted to the left side, that is, with the right ear elevated and the left depressed, to a level

of about 22° off horizontal, if the bullet were to travel a horizontal path on a level with President Kennedy's upper skull. Any additional degrees of angulation required by an assessment of the height of the grassy knoll in relation to Mr Kennedy's head would have to be added to the above mentioned 22°, in order to justify our potential explanation that a tangential blow might have been struck to the right top of Mr Kennedy's skull at about the same time the posterior missile entered. In other words, if the grassy knoll would require a downward pathway of 15° off the horizontal, the head would have to be tilted approximately 37° to the left at the time of impact. If the films of Mr Kennedy's head at the time of impact do not show such a tilt, I think that it is completely reasonable to assume that there was no possible head wound from the right side. As mentioned above, all of the other analysis totally supports this conclusion, that is, that there was no second bullet wound in Mr Kennedy's skull. I hope that this is a clear statement and that these impressions and opinions will be useful to you in the upcoming considerations.

Thank you very much for the opportunity to participate.

Sincerely,

David O Davis, MD
Professor and Chairman
Department of Radiology

DOD/mhw

Addendum E

Memorandum of J. Lawrence Angel, Addressed to "JFK Skull Review Committee" of the Forensic Pathology Panel, Dated October 24, 1977

OPTIONAL FORM NO. 10
5010-104

UNITED STATES GOVERNMENT

Memorandum

002838

TO : JFK skull review committee DATE: October 24, 1977

FROM : J. Lawrence Angel

SUBJECT: Study of pictures and X-rays of bone fragments related to those of JFK

The writer of this report is Curator of Physical Anthropology at the Smithsonian Institution (since 1962) and Professorial Lecturer in Anatomy and Anthropology Departments of the George Washington University and in Forensic Sciences Department of the Johns Hopkins School of Public Health (in connection with a seminar in Forensic Anthropology). He received his A.B. from Harvard in 1936 and his Ph.D. from Harvard University in 1942. He taught at the universities of California and Minnesota and from 1943-1962 taught in the Anatomy department at the Jefferson Medical College, Philadelphia, leaving as Professor of Anatomy and Physical Anthropology. For some years before leaving he served as consultant in Surgical Anatomy at the U.S. Naval Hospital in Philadelphia, specializing in the head and neck. He has studied hundreds of skeletons for law enforcement agencies in the past 15 years and thousands of archeological skeletons.

In order to approximate the position of 2 major loose fragments it is necessary to define the gap seen in Xrrays (especially # 1 and 2) and photographs (especially #44 transparency and photograph) of the head and skull of JFK now kept at the National Archives. This gap where bone is missing along the top and right side of the skull vault extends from just behind obelion (area of the parietal foramina) forward almost to the frontal bosses anteriorly. From the radiopaque lump behind obelion which with cracks appears to mark the bullet entry the left margin of the gap goes forward just to the right of the sagittal suture to a region of major fracture just behind vertex where the margin moves about 1 cm to the left of the midline. From here the margin extends diagonally forward to the left to a curved area about 5 cm above the left orbit and about 5 cm from the midline. The anterior

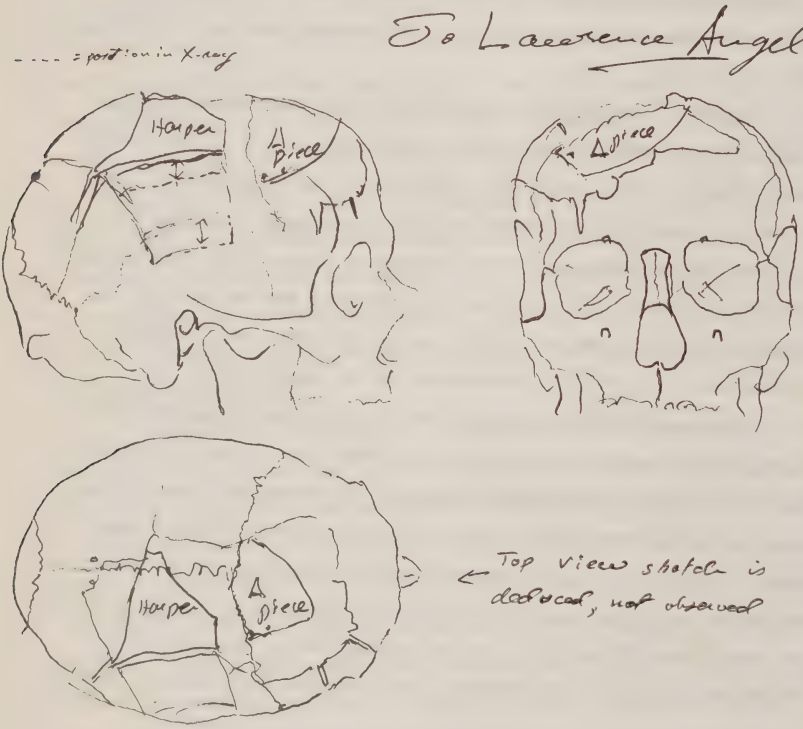
edge of the gap crosses to the right, stepping down about the midline to a level 5 cm above nasion and then sloping down to an area where there is an almost semicircular lacuna about 35 mm above the middle of the right orbit. To the right of this a vertical crack extends down to the orbit (an area of discoloration, apparently subcutaneous, appears of the lateral photograph of JFK around the frontomalar angle of the right orbit). From a level about 4 cm above the frontomalar angle the bone margin extends backward on the right side, with another V-shaped crack in front of the coronal suture. Behind this point the whole antero-inferior quarter of the right parietal lies loose. Its upper border was about 5 cm above the squamous suture but in X-ray #2 it appears shifted downward about 1 cm. From the point where it met the posterior half of the right parietal a big crack extends back and down, and the posterior boundary of the gap goes backward and upward to the starting point just to the right of obelion.

X-rays 4, 5, and 6 show a large piece of skull vault, clearly frontal bone with an apparent jagged line indicating coronal suture, about 7 to 8 cm long. The apparent inferior (right) border is 6 cm long and at the irregular right/angle which it makes with the jagged (coronal) border are several radiopaque marks (part of bullet?). The third (anterior) edge of the fragment is curving. This large fragment appears to be the upper part of the frontal bone, extending more on the right than on the left, and leaving spaces both in front and to the right. The two smaller fragments in X-rays 4, 5, and 6 are insufficient to fill these gaps.

The Harper fragment photographs show it as a roughly trapezoidal piece, 7 x 5.5 cm in size, coming mainly from the upper middle third of the right parietal bone. Near its short upper edge vascular foramina on the inside and a faint irregular line on the outside indicate sagittal suture. Its postero-inferior pointed angle appears to fit the crack in the posterior section of the right parietal and its slightly wavy lower border can fit the upper edge of the loose lower section of right parietal. Its upper short border, on the left of the midline near vertex, may meet the left margin of the gap. Behind it there appears to be a large gap and in front a narrow one.

The entrance of the bullet appears to have been just below obelion and 18 mm to the right of the midline (X-rays 1 and 2). From here radiopaque fragments appear along an expanding track almost parallel to Frankfort and sagittal planes. The exit area through the right frontal above the boss can account for the small semicircular notch 35 mm above the right orbit, the radiopaque mark near this, and at the upper right part of the track can explain the radiopaque markings on the triangular frontal fragment just in front of the coronal suture above stephanion.

The two big loose fragments of skull vault, from upper frontal and parietal areas, more on the right than the left side, do not articulate with each other and leave three appreciable gaps unfilled.



Addendum F

Report on the Soft X-Ray and Energy Dispersive X-Ray Analysis of the Clothing of John F. Kennedy and John B. Connally Prepared by Southwestern Institute of Forensic Sciences, Dallas, Tex., Dated February 1, 1978

SOUTHWESTERN
INSTITUTE OF FORENSIC SCIENCES
AT DALLAS
5230 Medical Center Drive
Dallas, Texas 75235

TELEPHONE 638-1131
AREA CODE 214
REPLY TO:
P.O. BOX 35728

Office of the Director

February 2, 1978

005090

Mr. Donald A. Purdy, Jr.
Staff Counsel
Select Committee on Assassinations
U.S. House of Representatives
3331 House Office Building, Annex 2
Washington, D.C. 20515

Dear Mr. Purdy:

Enclosed are the following:

1. The report concerning the examination of J.F.K. and J.B.C. clothing.
2. The soft x-ray films
3. The polaroid photographs of the oscilloscope display.

I trust that you will distribute the report to the several members of the Committee. I have discussed it with Doctor Davis already and also am sending a letter regarding it to Doctor Loquvam.

I must stress that there are no duplicates of the polaroid photographs or the x-ray films.

As I recall it it was the understanding that Dallas County would be reimbursed for the film used. How do you want me to make the bill read and to whom should it be addressed? Also, I am anxious to reimburse one of the members of the Institute for the extensive time he put into the analysis of the clothing. As I recall it, I was to bill you for one or two days of my consultation time. Then I can reimburse him for that. Is this satisfactory with you?

Before you set the meeting date in March I would hope that you might contact each of the medical consultants individually. I believe Doctor Davis has something planned for the first or second weekend in March.

Sincerely yours,

Charles S. Petty

Charles S. Petty, M.D.
Chief Medical Examiner

CSP:jf
d

Soft X-ray & Energy Dispersive X-ray Analyses of Clothing

J.F.K. and J.B.C.

11/10/77 and 11/15/77

Southwestern Institute of Forensic Sciences at Dallas

Charles S. Petty, M.D.
Director

Report of 2/1/78

This report details the analyses performed on the clothing of J.F.K and J.B.C. As described in other reports of the Committee of Medical Consultants, the clothing of both J.F.K. and J.B.C. were visually examined at the National Archives on 16 September 1977. Following this preliminary examination, the decision was made to bring the clothing to the Southwestern Institute of Forensic Sciences at Dallas, there to subject the clothing to examination by two different scientific techniques:

1. Soft x-ray (SX)
2. Energy dispersive x-ray (EDX)

Accordingly, the clothing of J.F.K. and J.B.C. were brought to Dallas and the analyses were conducted on two different days, 10 November 1977, and 15 November 1977. The analyses would have been completed on the first day, but one aberrant result obtained during the analysis of the J.B.C. clothing caused me to want to repeat the analysis by EDX. This was done on 15 November 1977, thus the two analysis dates are explained.

Explanation of analytical techniques:

1. Soft x-ray (SX)

This technique employs x-radiation at low energy (10 kilovolts and 2 milliamps). With such low energy, particulate and other material can easily stop x-ray penetration and thus be made visible on the x-ray film. As an example, very tiny metallic fragments, powder particles, and even the weave of textiles can be visualized. This technique cannot be achieved when using ordinary (clinical) x-ray equipment because the energy output of such equipment is much too high.

2. Energy dispersive x-ray (EDX)

This technique measures the radiation characteristic of different (chemical) elements when excited by an x-ray source. Thus one element can be distinguished from another, or sorted out from a group of elements. Elements such as lead, copper, zinc, etc. are metallic and heavy and are easily detected and identified by this technique.

3. These two different techniques were chosen because:

a. Both are non-destructive, that is, the garments analyzed are not altered, or destroyed.

b. Soft x-ray can be readily employed to locate particles of interest (if any) which may then be analyzed using energy dispersive x-ray. In other words, the first technique is used to scan the area of interest and the second can then be employed to focus upon minute areas.

Format of results:

1. Soft x-ray (SX)

Actual x-ray films are attached to this report and should be referred to so as to make the explanation more understandable.

a. Film #1, J. F.K..

Two different garment views are shown. Both are of the shirt. One view is of the defect area in the back of the shirt, the other shows the two defects in the front of the shirt. The weave of the fabric is easily discerned. The defects show clearly. Clearly shown, also, is the area from which fabric was removed from the back

defect for spectrographic analysis (F.B.I. Laboratory).

b. Film #2, J.F.K.

Two different garments are shown: the back of the coat, and the four-in-hand necktie. In the former the defect shows up well; in the latter, the rub or graze shows less well but can be discerned.

c. Film #1, J.B.C.

Two views of the shirt, showing well both the back and front defects.

d. Film #2, J.B.C.

Two garments are shown: the French cuff area of the shirt, and the thigh area of the trousers. The defects are easy to see.

e. Film #3, J.B.C.

There is one view of the shirt wth the back defect well shown.

f. Film #4, J.B.C.

Two views of the coat are included: one shows the defect in the front, the other showing the right coat sleeve.

g. Film #5, J.B.C.

Two views of the coat are included: one shows the right front defect, the other the right back defect.

2. Energy dispersive x-ray (EDX)

Two different formats are included: a numerical report which represents the number of counts per 100 seconds for the element which is being analyzed. Thus, the higher the count, the more

of that particular element is present. The other type of report is in the form of polaroid photographs of the oscillograph recording of the 100-second count result for a given element.

a. J.F.K. clothing: nine polaroid photographs are attached.

b. J.B.C. clothing: fourteen polaroid phtographs taken 11/10/77, and five polaroid photographs taken 11/15/77 are attached.

All of the polaroid photographs are attached only to illustrate the type of oscillograph representation found, and not to replace the numerical results reported below which are complete. The polaroid photographs alone cannot be used from which to calculate the numerical results.

The numerical results of the EDX analyses are as follows:

a. J.F.K. - analysis date: 11/10/77

Garment	Area	Copper	Lead	Iron	Chromium	Bromine	Zinc
Coat	Defect	874*	478	3302**	7410		
	Control	346	245	431	6561		
Shirt	Back defect	148	201	N.A.	N.A.		
	Collar	255	81	N.A.	N.A.	293	
	Tail	136	35	N.A.	N.A.		
	Rt.front defect	494†	307	N.A.	N.A.		
	Lt.front defect	166	139	N.A.	N.A.		
Tie	Graze	231	70				3872
	Control	240	104				3746

Notes:

* This is a borderline count, indicative of only a trace of copper.

** Area stained by blood. This accounts for iron present.

†This is a borderline count, indicative of only a trace of copper.

b. J.B.C. - analysis date 11/10/77

Garment	Area	Copper	Lead	Iron	Chromium
Coat	Rt.sleeve control	142	143	212	3498
	Rt.sleeve defect	184	125	239	3470
	Rt.back control	327	127	305	8603
	Rt.back defect	437	190	620	8895
	Rt.front control	9281*	106	103	N.A.
	Rt.front defect	4529**	208	4833†	N.A.
Shirt	Front control	198	11	153	
	Front defect	324	136	610	
	Back control	193	0	162	
	Back defect	185	58	371	
	Cuff control	128	5	160	
	Cuff defect	157	107	196	
Trousers	Control	230	113	5421	
	Defect	270	90	5557	

c. J.B.C. - analysis date 11/15/77

Coat	Rt.front defect		
	Several layers	3005††	0
	One layer	4532††	0
	Above Rt.front defect	550	0
	Below Rt.front defect	411	0
	Without lining	420	0
	With lining	64§	0

Notes:

* This is aberrant count as proven by repeat analyses five days later.

** Indicative of copper present in quantity.

† Blood stains still detectable accounting for iron present.

†† Indicative of copper. Confirms **.

§ Negative. Confirms suspicions of aberrant count as noted in * above.

Discussion:

The two types of non-destructive analyses were undertaken to:

1. Determine if any particles of missiles still remained on the clothing.

2. To analyze the missile fragments, if any, and to define the elemental nature of them.

3. To see if any correlation might be made between the elements found and missile behavior after striking J.F.K. and J.B.C.

In regard to J.F.K. clothing:

At the periphery of the defect in the back of the shirt some very tiny particles of foreign material are seen on the SX film, but no copper or lead were found by EDX.

On the coat in the area of the defect and on the shirt in the area of the right front defect, the EDX gave a borderline count for copper. Iron, apparently from the blood stain was detected about the defect in the coat.

In regard to J.B.C. clothing:

It should be noted that the clothing had been subjected to dry cleaning at some time after the shootings. The validity of results may therefore be questioned.

One aberrant result, unexplained, possibly due to a misrecording of data or a temporary malfunction of the instrument (EDX) or perhaps an ephemoral contamination, was encountered. Re-analysis of the questioned area proved the aberrance. Copper was found in quantity in the region

of the defect in the right front. The results would indicate that the apparent borderline copper analysis is due to the lining containing some copper. Iron, apparently from blood, was still detectable near the right front defect in the coat, despite dry cleaning.

The anlytical results are of interest, because there is proof of very little fragmentation of the missile (missiles) as it (they) passed through the person(s) of J.F.K. and J.B.C. Indeed, the only indication of copper in any quantity was in the region of the front defect of the coat of J.B.C. The term "in quantity" means only that copper was found in clearly detectable amounts by the use of the EDX equipment. The actual amount is very small, and the absence of particulate material on the SX film is not surprising.

I will not discuss further the relationship of these results to speculation or theory, but I would expect that the committee of Medical Consultants will be able to make good use of this information in helping to form a cohesive explanation of the assassination and attempted assassination.

Charles S. Petty, M.D.
Medical Consultant

Addendum G

REPORT OF THE PHYSICAL EXAMINATION OF GOVERNOR JOHN R. CONNALLY—MEMORANDUM BY MICHAEL M. BADEN, M.D., TO THE HOUSE SELECT COMMITTEE ON ASSASSINATIONS, DATED SEPTEMBER 6, 1978

Memorandum

To: Gary Cornwell, Esq.
From. Michael Baden, M.D.
Date: September 6, 1978.
Re Physical examination of Governor John Connally.

Pursuant to your arrangements I met with Governor Connally on September 6, 1978, at 2:05 p.m. in room 772 of the Mayflower Hotel in Washington, D.C. Also present were Mrs. Connally; Mr. Julian Reed, an associate of the Governor who had been with him on the day of the assassination of President Kennedy; and Mrs. Ida Jane Ross of your staff.

The Governor was very cooperative, but rushed, to catch a plane.

On removing his shirt, it was readily apparent that at the site of gunshot perforation of the upper right back there is now a 1⅛-inch long horizontal pale well healed scar that is up to ⅜-inch wide centrally, with a lateral border slightly lower than the medial border (about 5 degrees). The medial margin is one-half inch superior to and five-eighths inch medial to the apex of the right posterior axilla. The lateral border is 6 inches to the right of the midline of the back and 4¾ inches below the shoulder line.

There is a thin vertical surgical scar 1 inch long in the right midback region, 3 inches below and 3 inches to the left of the above described horizonal scar; approximately 20 degrees from the longitudinal with the upper border more medial.

The exit wound scar is in the right front chest 1 inch below the central nipple line and has been incorporated in a surgical scar that is 9½ inches long that extends from 3 inches to the right of the midline, 1 inch beneath the nipple line and proceeds superiorly to the right upper posterior axillary area.

Positioning the Governor while erect in the anatomic posture shows the missile track to proceed from back to front, downward at approximately a 45° angle to the horizontal and slightly medially at approximately a 10° angle for a distance of 12½ inches through the body.

Examination of the right wrist shows the gunshot wound of entrance to be incorporated into a well-healed surgical scar on the lateral aspect of the distal forearm slightly dorsally and extending to the wrist; there are well healed fine surgical scars on the ventral aspect of the wrist horizontally and longitudinally.

The examination was completed at 2:25 p.m.

Addendum H

Report on the X-Ray Back Scatter and Scanning Electron Microscopy and Energy Dispersive X-Ray of Tissues of John B. Connally, Prepared by Southwestern Institute of Forensic Sciences, Dallas, Tex., Dated August 29, 1978

X-ray Back Scatter with Scanning Electron Microscopy

and

Energy Dispersive X-ray of Tissues of J.B.C.

8/24/77 and 8/28/77

Southwestern Institute of Forensic Sciences at Dallas

Charles S. Petty, M.D.
Director

Report of 8/29/78

Special analyses using scanning electron microscopy equipment fitted with x-ray back scatter detector and energy dispersive x-ray were undertaken on the tissues which had been removed from the right wrist and the left thigh of John B. Connally at the time of debridement on 11/22/63. The surgical pathology report signed by Vernie A. Stembridge, M.D. is numbered S63-6750. The description is of three specimens and the microscopic examination of the three slides made from these three specimens.

Doctor Vernie A. Stembridge was contacted by me and delivered to me not only the three microscope slides prepared from the specimens removed from John B. Connally, but also the remaining tissue embedded in paraffin which had still been preserved.

The three microscope slides were examined and no evidence of metallic fragments was noted either by direct observation or by seeing evidences of tearing of the tissue which might have occurred as a result of the nicking of the microtome knife due to contact with metallic fragments that would occur during the preparation of the microscope slides.

The paraffin blocks containing the tissues from the debridement were then subjected to energy dispersive x-ray analysis. No evidence of copper lead, zinc, or nickel was found.

After preparation the paraffin blocks containing the tissues removed at the time of debridement and still remaining following the preparation of microscope slides were subjected to analysis using a scanning electron microscope fitted with a low angle detector for x-ray back scatter. No copper, lead, zinc, or nickel was found by means of this analysis.

It should be noted that the analyses undertaken were completely nondestructive and the tissues contained in the paraffin blocks and the microscope slides themselves have been retained, awaiting further instructions regarding disposition.

Charles S. Petty, M.D.
Medical Consultant

Addendum I

Interviews conducted by the House Select Committee on Assassinations staff and/or the medical consultants with: Dr. J. Thornton Boswell, Dr. C. James Carrico, Dr. Norman Chase, Dr. James J. Humes, Dr. Marion T. Jenkins, Dr. John K. Lattimer, Dr. Malcolm O. Perry, Dr. Jack Reynolds, Dr. William B. Seaman, Dr. Robert R. Shaw, and Dr. George T. Shires.

Not included: Dr. Pierre A. Finck and Dr. John H. Ebersole were deposed by the select committee on March 11, 1978.

Interview of Drs. James J. Humes and J. Thornton Boswell by the Forensic Pathology Panel, Subpanel of Doctors had not Reviewed the Autopsy Materials Previously

NATIONAL ARCHIVES

September 16, 1977.

Physicians present were: Dr. Coe, Dr. Davis, Dr. Baden, Dr. Humes, Dr. Boswell, Dr. Petty, Dr. Rose, Dr. Levine, Dr. Loquvam, and Dr. Angel.

Staff members present were: Gary Cornwell, Kenneth Klein, Andy Purdy, Jim Conzelman, Lillian Johnson, and Chellie Mason.

L. Johnson. First, I'd like to ask everyone to state their name clearly, distinctly as possible for the record please.

G. Cornwell. Well, just for her purposes, do you want to tell her what your names are—she doesn't know all of you—so that she can make a record of who's asking, or whatever, so that we would have the names.

Dr. Baden. The principal speakers would be Dr. Petty, Dr. Humes, and Dr. Boswell; you have those. I think anybody else who talks will identify themselves to you and to the doctors.

G. Cornwell. And, the man who just spoke to you is Dr. Michael Baden. The only statement that I wish to make in advance is that Dr. Humes and Dr. Boswell have come here voluntarily, not by subpena, and simply because the other doctors thought there was some information that might be of assistance to them in their deliberations. We have decided that because of that fact, that it was the doctors' request that they come, and Dr. Humes and Dr. Boswell have come voluntarily, the staff will ask no questions, and you all just proceed as you see fit.

Dr. Humes. I'd like to comment that we're pleased to be here and I for one welcome the investigation and I hope that it will ultimately, through all facets of it, erase the doubts that exist in the public's mind, the minds of Congress and others. Any help we can give, we are delighted to do so.

G. Cornwell. Thank you very much, and I'm sure that's not only the staff's but all the doctors here sentiments exactly.

Dr. Baden. I would just like to thank Dr. Humes and Dr. Boswell for coming here on such short notice to help in our interpretations.

Dr. Petty. I'll use your last names so that it will come out right in the record rather than your first name, Dr. Humes, we, all of us here, are forensic pathologists, and we've all been faced with the same problems you were faced with on the night of the autopsy; we know perfectly well what pressures you were under, and this is in no way critical of anything that was done; we're only interested in certain information which we hope you have stored up in your association tracks and will be able to give us to help unravel some of the mystery and mystique that surrounded this thing. First of all, let me start with the question that was on the lips of everyone here and that is, did you or didn't you look at the adrenals?

Dr. Humes. I would ask, you—did that bear, or does that bear, on your investigation of the event that took place that night?

Dr. Petty. No; all we were wondering was—we noticed that that was noticeably absent from the autopsy report.

Dr. Humes. Since I don't think it bore directly on the death of the President, I'd prefer not to discuss it with you doctor.

Dr. Petty. All right. Fine. If you prefer not to, that's fine with me. We were just curious because normally we examine adrenals in the general course that the autopsy, as we undertake it. OK, so——

Dr. Humes. I'd only comment for you that I have strong personal reasons and certain other obligations that suggest to me that it might not be preferable.

Dr. PETTY. All right. Second, did you ever see a piece of bone which was picked up apparently at the site of the assassination, retained for some period of time, and then submitted to the FBI?

Dr. HUMES. No; the only extra piece of bone brought to us then—that was contained in the casket that brought the President to us—was a piece of bone that was brought to us later on that evening; and the time, as you imagine, I wouldn't wish to guess, but I would have guessed it was midnight or 1 o'clock in the morning, Jay, something like that.

Dr. PETTY. And there are X-rays of that?

Dr. HUMES. Yes.

Dr. PETTY. We have X-rays of that; I think there are three fragments of bone actually, one large and two small.

Dr. HUMES. Those were the only other fragments I've ever seen.

Dr. PETTY. Well, we have photographs of a piece of bone that was retrieved from Dealey Plaza—is that the name of it——

Dr. HUMES. Yes.

Dr. PETTY. By a premedical student, as I understand it, a fellow by the name of Harper; it was retained for some time and then eventually found its way into the chain of evidence, and what I think the basic question is that we are asking—could this showing photographs—and this is a 1 to 1 photograph—could this have been missing from President Kennedy's skull or not?

Dr. HUMES. In my opinion it could because there was far insufficient bone to close the calvarium area. In fact, we spent many hours using rubber dam and other artificial materials to do that.

Dr. PETTY. Yes, this photograph that we're showing you is a color photograph of a fragment allegedly recovered by a Mr. Harper at the site of the assassination, and it contains a ruler in it, and it's a 1 to 1 color photograph of the fragment. The fragment is no longer available as we understand it.

Dr. HUMES. I comment further, Dr. Petty, that it's approximately the size, I would think, if you would compare it, with the photographs of that, larger than other fragments that were brought to us.

Dr. PETTY. I don't know how much distortion there is in this X-ray of the larger of the fragments that was brought to you.

Dr. HUMES. We are looking at X-ray No. 4 which is of three bony fragments, and our comment is that the color photograph that you show us of a fragment we did not see sort of approximates in size the fragments that were represented that evening, and to further restate, there were sufficient fragments missing that that fragment could have been.

Dr. PETTY. So even though this fragment picked up by Harper, measuring some 2½ inches in greatest dimension, even that fragment could have been put into the vacant areas in the scalp area as you've reconstructed it.

Dr. HUMES. Correct.

Dr. PETTY. Well, that's the major question I think that we wanted to have answered at this time. The second question or questions, series of questions, revolve about these photographs here which are Nos. 44 and 45. There may be a clearer one than this—was the clearer one in black and white? These are the color photographs, Nos. 44 and 45, and this area which I'm pointing to with my finger here seems to be an area which is almost semicircular in shape and appears to have beveling to the outside of the skull. Now, what we really want to know is where was this located, and in order to give you a chance to show it, where would this be on this skull here that I'm showing you?

K. KLEIN. Doctor, the photograph that you are referring to is what number?

Dr. PETTY. Nos. 44 and 45.

K. KLEIN. The particular one you're talking about now is?

Dr. PETTY. 44.

K. KLEIN. 44.

Dr. PETTY. And this is shown more clearly on the black and white photographs Nos. 17 and 18, probably best in No. 17, and I'm putting my finger on the same spot.

Dr. HUMES. Well, to the best of my recollection, and I regret that these photographs are so poorly marked, this was in the right parietal region approximately here.

Dr. PETTY. Could it have been forward of the suture line—what do you call it?

Dr. BADEN. Coronal.

Dr. PETTY. Could it have been anterior to the coronal suture line? Now these are our major questions on this.

Dr. HUMES. To state what the problem was, the basic problem was, as we reflected the scalp, various fragments of bone, some fell into the cranial cavity, some came to the table, some adhered to dura and so forth, that it was in—that it was on the right side, that it was parietal frontal, there's no question. Now, to tell you was it anterior to the coronal suture or not, I can't tell you unless that's a coronal suture in that photograph.

Dr. PETTY. Well, we would think perhaps this gap on photograph 26, this gap that is tending down toward the President's right ear—this V-shape directed toward the President's right ear—is the same as this V-shape gap——

Dr. BOSWELL. I believe it is.

Dr. PETTY. On your black and white No. 18.

Dr. BOSWELL. The scalp was so torn and lacerated that we never had to do any dissection there. The scalp was just laid over, and I believe that this is the scalp laying over here, as I interpret this; this is the shoulder down here.

Dr. PETTY. Cheek and shoulder.

Dr. BOSWELL. Yeah, and, that this is just laid down, like so, without having done any dissection or anything.

Dr. PETTY. So this would be the right temporal area?

Dr. BOSWELL. Now whether this was prior to or after removal of the brain tissue, I don't know.

Dr. HUMES. It would be after.

Dr. BOSWELL. I'm not sure that we haven't—that the head isn't back in such manner. I think that is probably taken just to show the magnitude of the wound.

Dr. PETTY. Yes, you're talking about color photograph No. 44 now. Well then, if I may ask one further question along this line, you will note on color photograph No. 26, just ahead of this V-shaped notch, there is a hank of hair which obscures everything, and the question that I'd like to propose now is, is that hank of hair obscuring this externally beveled portion of bone that we see in black and white No. 18?

Dr. HUMES. All I could tell you is that it could, Dr. Petty. It could have because these obviously in time were taken—these black and white photographs, both 18, were taken temporally that evening at a later hour than was this color photograph No. 26, in this case.

Dr. BOSWELL. These two are essentially identical though.

Dr. PETTY. Which two, would you just identify them for the——

Dr. BOSWELL. No. 44 color and No. 17 black and white. These are almost identical, and I would assume that one was taken with one camera and then the other one with another camera at the same time.

Dr. HUMES. What? The color negative may have been developed, may have been printed black and white, Jay. Looks more like that to me.

Dr. BOSWELL. Might have been. So they may be actually the same photograph.

Dr. HUMES. I think they are.

Dr. PETTY. That was the major question that we had because we're trying to establish if we can identify the point of outshoot of one or both of the fragments to the best of our analysis.

Dr. HUMES. One or both of what fragments?

Dr. BADEN. The bullet fragments.

Dr. PETTY. To the best of our analysis, we could not place which side of the coronal suture line—we couldn't place whether this is on the anterior side of the coronal suture or whether it's on the posterior side of it.

Dr. BADEN. The X-ray you took of the fragment that you received does show a suture line on it, so that's helpful in——

Dr. HUMES. Yeah. See, we felt that this area, this one semi-circular area on X-ray No. 4, quite likely was at least in part the other side of a circle; that was our interpretation of this fragment, and I don't think even that would have been quite complete.

Dr. PETTY. Well, we were wondering if maybe the new fragment which was picked up by Harper might make that circle complete somewhere if it's possible. Now, we don't know where this fragment is at this point.

Dr. HUMES. I don't see anything with quite the circumferential margins of these other——

Dr. PETTY. I am showing you now—I don't know if these photographs are marked, are they? This is a black and white enlarged photograph of Harper's fragment labeled number No. 9 or No. 6—I can't tell you which it is.

Dr. BADEN. It's No. 9.

Dr. PETTY. Probably No. 9. And this would be the internal surface of the fragment, and then on the other photograph which is the external surface, we were just wondering if this could help put a periphery or help complete the periphery of the gap there?

Dr. HUMES. Caused by the missile egressing the coronal wall?

Dr. PETTY. That is correct.

Dr. HUMES. I don't think so. I don't think any of the borders of this fragment to me would coincide with this type of a wound of exit.

Dr. PETTY. I see what you're driving at.

Dr. HUMES. One could almost imagine it to be elliptical, slightly elliptical or circular or which ever way. Might be hard to put any of the margins of this fragment there.

Dr. BADEN. How about the lateral skull film with regard to the location of that? Is that not helpful to you?

Dr. BOSWELL. It is somewhat helpful, yes. You want to throw that one up?

Dr. BADEN. While you are looking at that and for the record, Dr. Boswell, when you had discussed No. 44 color, the stenographer wanted to get down whether you said that the shoulder and cheek were visible in the photograph?

Dr. BOSWELL. Yes, shoulder and cheek.

Dr. DAVIS. Well, you can see why we say that the fragment that you show us could have helped to close the wound and still have room for more.

Dr. PETTY. I'm now looking at No. 2, X-ray No. 2. Is this the point of entrance that I'm pointing to?

Dr. HUMES. No.

Dr. PETTY. This is not?

Drs. HUMES and BOSWELL. No.

Dr. PETTY. Where is the point of entrance? That doesn't show?

Dr. HUMES. It doesn't show. Below the external occipital protuberance.

Dr. PETTY. It's below it?

Dr. HUMES. Right.

Dr. PETTY. Not above it?

Dr. BOSWELL. No. It's to the right and inferior to the external occipital protuberance.

Dr. PETTY. O.K. All right. Let me show you then color photograph No. 42, which then is the——

Dr. HUMES. Precisely coincides with that wound on the scalp.

K. KLEIN. Could you describe that point that you just made?

Dr. HUMES. That's an elliptical wound of the scalp which we described in our protocol. I'm quite confident. And it's just to the right and below by a centimeter and maybe a centimeter to the right and maybe 2 centimeters below the midpoint of the external occipital protuberance. And when the scalp was reflected from there, there was virtually an identical wound in the occipital bone.

K. KLEIN. And what number photograph is that?

Dr. HUMES. Forty-two.

K. KLEIN. Forty-two.

Dr. PETTY. Then this is the entrance wound. The one down by the margin of the hair in the back?

Dr. HUMES. Yes, sir.

Dr. PETTY. Then this ruler that is held in the photograph is simply to establish a scale and no more?

Dr. HUMES. Exactly.

Dr. PETTY. It is not intended to represent the ruler starting for something?

Dr. HUMES. No way, no way.

Dr. PETTY. What is this opposite—oh, it must be, I can't read it—but up close to the tip of the ruler, there you are two centimeters down.

Dr. BOSWELL. It's the posterior-inferior margin of the lacerated scalp.

Dr. PETTY. That's the posterior-inferior margin of the lacerated scalp?

Dr. BOSWELL. It tore right down to that point. And then we just folded that back and this back and an interior flap forward and that exposed almost the entire—I guess we did have to dissect a little bit to get to——

Dr. HUMES. To get to this entrance, right?

Dr. BOSWELL. But not much, because this bone was all gone and actually the smaller fragment fit this piece down here—there was a hole here, only half of which was present in the bone that was intact, and this small piece then fit right on there and the beveling on those was on the interior surface.

Dr. PETTY. Then was this below the tentorium or above the tentorium on the inside? Do you recall?

Dr. HUMES. Everything was so disrupted, I'm not sure.

Dr. BOSWELL. Well, the dura was completely—as you can see here—was completely destroyed practically, and I don't think there were any markings that were really very adequate to see where it was related to the tentorium. I don't see a picture.

Dr. PETTY. It happens to be on 42, a fine line going to—is that fine line going to the area you identify as the——

Dr. HUMES. That's an artifact of some kind.

Dr. PETTY. Fine.

Dr. HUMES. Right there (pointing to photograph No. 42).

Dr. PETTY. Now, if it goes in at the point indicated below the external occipital protuberance, then it is going to go in about at the tentorium.

Dr. HUMES. At the tentorium, I'm saying, Dr. Petty. Approximately, but you see——

Dr. BADEN. I think the record should reflect that Dr. Angel just arrived and is being greeted.

Dr. COE. Dr. Humes, looking at photograph No. 46, I am curious to know whether this destruction you feel is a postmortem artifact in removing the brain, or was part of this, was caused by the bullet you think perhaps? You have a junction between the cerebellum and the——

Dr. HUMES. No; well, I think it was partly caused by the bullet.

Dr. COE. It was?

Dr. HUMES. It was great—it was a tearing type of disruption that basically had to go back to our description. The corpus collosum was torn, was it not Jay? And the midbrain was virtually torn from the pons.

Dr. COE. Thank you all.

Dr. HUMES. Now don't misinterpret me that the missile necessarily passed through there because it was a great——

Dr. COE. But it must have come fairly close in there.

Dr. HUMES. Could have, yeah.

Dr. PETTY. Mark from the point of view where it entered.

Dr. HUMES. Yes, sir.

Dr. BADEN. Pursuing the question Dr. Coe has been asking, I am looking at photograph No. 50 of the brain, the dorsum of the brain. Question has arisen relative to a purple object in the right frontal cerebral region as being a foreign object. Do you have any thoughts you can give us about that object? And here is No. 46, which is the undersurface of that same area.

Dr. HUMES. I strongly suspect that this foreign object is something that was placed on the table in an attempt to elevate this portion of the brain so it wouldn't be as much out of focus. I think you're looking at a defect in brain substance because, you know, if you try and take a picture with a surgical specimen or what have you, and different portions of it are at different levels—I think we made an attempt. That certainly was not present in the brain, and I interpret that we took some object that was immediately available in the room and placed it under the brain in an attempt to bring the right cerebral hemisphere somewhat closer in level to the left for the photograph.

Dr. BADEN. You are completely satisfied—and Dr. Boswell—that there was no foreign object in this area?

Dr. HUMES. Absolutely, unequivocally, without question.

Dr. BOSWELL. Yes.

Dr. PETTY. Dr. Angel, we have two photographs here representing what appears to be a skull fragment which was recovered by one Harper at Dealey Plaza some little time after the assassination took place. We would like very much to have your expertise in identifying where this particular fragment of skull might have arisen, that is, what part of the head bone it came from?

Dr. ANGEL. Well, it's clearly parietal bone, side left or right is not so easy. You can see one, two, or three markings for meningeal vessels on the inner surface. This is the same——

Dr. PETTY. This is the same thing blown up there, both sides are shown.

Dr. ANGEL. Shown very clearly, as well as some blood vessels entering—the damage on the outside looks as though there's still some perifernium the hairing on the outside, but I'm not really sure about that, it's got a ragged edge there. I don't think I can say anything really much sharper than that; my feeling is that it was on the outside and that it's—oh—around here.

Dr. PETTY. Around where?

Dr. ANGEL. Around this area here, below the parietal bone and directly above the sagittal suture. I, at first I could see marks of sagittal suture here, but I don't think that's it.

Dr. BADEN. We also have the negatives from which these were made.

Dr. ANGEL. Well, excuse me—it doesn't seem to show on the inside. I'm puzzled.

Dr. PETTY. Now, they want us to record which photographs you're examining again. And these once again for the record are photographs of the segment or fragment of bone picked up by Harper at Dealey Plaza.

Dr. BADEN. Right, and photograph Nos. 13 and 8 and the two color prints are being examined by Dr. Angel at this time.

Dr. ANGEL. Are you sure that's suture edge there?

Dr. BOSWELL. Yes. We're not sure; we ask for your advice.

Dr. DAVIS. That's why you're here, sir.

Dr. BADEN. Would you like to see the kodachromes?

Dr. ANGEL. I'm not sure that isn't simply a broken edge.

Dr. BADEN. I'm sorry we don't have a better way of viewing them.

Dr. HUMES. There's an X-ray view box, Dr. Angel; might help.

Dr. ANGEL. No; I don't think those things are going to help. See, I don't think you can have this be the coronal suture because then you would certainly have the entry of a branch of the meningeal artery, some remnant of that tree going up there along it. And I thought these were intermediate posterior branches of middle meningeal going up the side of the parietal here—I would have interpreted the piece as fitting here and I would have looked here for a trace of lambdoid suture. Now this inner surface is broken away. Perhaps that could be the very edge of the coronal suture on the right, but of course I don't know what damage the skull showed and whether this has to be—but I'm not supposed to know this.

Dr. BADEN. No, Dr. Angel; feel free to discuss this with Dr. Humes who did the autopsy. He'd be delighted to——

Dr. ANGEL. Is there a defect on the right that this would fit into?

Dr. HUMES. Good, Dr. Angel. Yes.

Dr. COE. Yeah. There's a picture right there in color that would show you the extent of the——

Dr. HUMES. Could you put that lateral view of the skull up again for Dr. Angel's benefit? Dr. Angel, there was a massive defect of the skull from the right, and there was a portion of the right parental-temporal bone still attached to the skull. Where is the picture? Here—at one margin—and later on in the evening——

Dr. PETTY. Let me identify this for everybody here. This is color photograph No. 44.

Dr. HUMES. There was what we interpreted to be an exit wound, in the location to which I point. The bone that would correspond and complete that circle or ellipse, that might have been made by that exit wound, was missing at the time we began the examination. Later on that evening, several hours into the evening, we were presented with another fragment of bone, not the one that you are examining now, and that fragment had a corresponding semicircular defect which almost completed this, what we interpreted to be an exit wound, but not quite. And we never had the privilege of examining the fragments or photographs of this fragment that you now examined until this afternoon, and I was unaware of its existence until about 3 weeks ago.

Dr. PETTY. This is a fragment that arrived quite a while later in a Nieman-Marcus box.

Dr. HUMES. It never arrived to our knowledge. Dr. Angel, I draw your attention to the view box where you get some comprehension of the size of the defect.

Dr. BOSWELL. These are all slightly different views, slightly different. They are all different pictures, so that I'm not sure.

Dr. ANGEL. No; I don't think—don't know if that makes any major difference——

Dr. PETTY. Dr. Angel, let me show you also this X-ray film of the three fragments that were separate and detached from the body which had been X-rayed here. One of these three fragments—the larger of the three—is the one that apparently helped complete a portion of an outshoot wound, is that correct, Dr. Humes?

Dr. HUMES. That was our opinion, Dr. Petty.

Dr. PETTY. You may want to put these together and have this up here too. One further question, Dr. Angel. There seems to be a suture line here on this larger of the three fragments.

Dr. ANGEL. Yes; that seems to be quite clear.

Dr. PETTY. Could that be the coronal suture?

Dr. ANGEL. I would have guessed that it might be. Again, I don't see any meningeal vessel markings, but if this exit wound is here and the coronal suture is going up like that, that's conceivable.

Dr. PETTY. Well, I think the question that we all have is whether this is anterior to the coronal suture or posterior to it.

Dr. ANGEL. Oh, there was damage that far forward?

Dr. PETTY. I believe so. I think the damage is quite apparent here in the lateral view of the skull by X-ray.

Dr. ANGEL. Yes, that's right.

Dr. BADEN. And also on X-ray No. 1, the anterior-posterior view, right side.

Dr. ANGEL. Right. Well, this then could be frontal perfectly well. It doesn't show the meningeal markings, and that's what made me unhappy about it being, well—photo makes more sense—in that case the exit wound must be not very far above the right or near the right pterion, I would think.

Dr. BADEN. For the record, Dr. Angel you're viewing photographs Nos. 8 and 13 of bone and X-rays Nos. 1, 3, and 6 at the X-ray view box.

Dr. ANGEL. Now, that seems to have a little portion of that circle on it and the rest of that circle on this photograph.

Dr. PETTY. No. 44. Dr. Humes could probably tell more where that is than I can. This is the right cheek as I understand it, is that correct, Dr. Humes? And this then is the right shoulder and the flap turned back at the time of the autopsy?

Dr. HUMES. Yeah.

Dr. ANGEL. Well, this must be well forward then on the frontal bone, I was interpreting it as being—this itself as being near the pterion.

Dr. BADEN. Yet here is the gap.

Dr. HUMES. That is not frontal bone where that semicircle is—it's either temporal or parietal bone, Dr. Angel.

Dr. ANGEL. I don't see how it can be. That's what it looks like to me.

Dr. HUMES. That's exactly what it is.

Dr. ANGEL. In that case, I'm puzzled by the missing bone here and the angles. Is this to be placed more like this? Now this piece could fit on here and the parietal piece could fit behind that, this piece could.

Dr. PETTY. The Harper piece could be fitted posterior and slightly lateral is that what you're saying?

Dr. ANGEL. This is what I'm saying, yes, perhaps.

Dr. PETTY. Now, this is photograph No. 26, and it seems to show the pieces more as they were first viewed and to orient this photograph and the photograph No. 44.

Dr. BOSWELL. It's hard to do, Dr. Petty

Dr PETTY. It's hard to do. But this is more or less what you're looking at, isn't it?

Dr. ANGEL. I think so, yes. I thought perhaps this was a little more tilted.

Dr. PETTY. Well, perhaps like that

Dr. HUMES. Negative, I don't think that's true.

Dr. ANGEL. What's bothering me is what part of the flesh is that?

Dr. PETTY. That's the cheek, the right cheek.

Dr. ANGEL. If that's the right cheek then it can't be—has to be more or less.

Dr. PETTY. Yeah.

Dr. ANGEL. It's really hard to be sure, square this with the X-ray which shows so much bone lost in this right frontal area.

Dr. PETTY. Well, I think there may be more bone apparently lost than is actually lost in the X-rays. We don't know when those X-rays were taken. Dr. Humes, do you by chance know at what phase of the autopsy the X-rays were taken? Were these taken before the brain was removed or after?

Dr. HUMES. Yes. All of the X-rays were taken before any manipulations were performed.

Dr. BOSWELL. Some of the bone fragments though, are partially extruded, as we see in X-ray No 1.

Dr. HUMES. Some of them were adhered to partially torn scalp.

Dr. BOSWELL. Which accounts for some of the missing bone.

Dr. ANGEL. It's hard to do that—jigsaw puzzle—that's all I can say. I was looking somewhere here for a temporal line, and I can't see any clear indication of it. And that should be running up like that, and so it's hard for me to put these two——

Dr. PETTY. We believe that in photograph No. 44 the V-shaped notch here is the same as the V-shaped notch that you see in photograph No. 26. This then would give you the angle at which these two photographs should correspond and that would seem to fit pretty well.

Dr. ANGEL. So, in that case this exit wound is really in the frontal—its in front of that notch there—it's in the frontal, see what I mean, it would have to be about here.

Dr. PETTY. Would that suture line help at all?

Dr. ANGEL. Yes, this—if that's as it looks, like the piece of frontal bone that fitted here like that, and the wound is about here, that would fit.

Dr. BADEN. Now, would this be below the hairline, because this appears above the hairline?

Dr. ANGEL. It would have to be above the hairline.

Dr. BADEN. At this point?

Dr. ANGEL. Uh-huh. In that case this fragment here of parietal could very easily fit back here, looks like there's another fragment in here. See what I mean.

Dr. PETTY. Well, it's terribly fragmented, and we can't really reconstruct it.

Dr. BOSWELL. No, you can't recall—that's perhaps this piece of parietal, that sharp edge there could conceivably have fitted on here behind this fragment—looks as though it's the front part, front lower part, anterior-interior portion of the right parietal.

Dr. ANGEL. I would interpret this as being, originally, as being roughly the middle of the right parietal, and I still think so.

Dr. PETTY. Our ultimate question is, do you think this could well be part of the skull of the late President, referring now to the Harper piece?

Dr. ANGEL. Yes.

Dr. PETTY. And you think it would fit also, don't you, Dr. Humes?

Dr. HUMES. Yes. I have great difficulty in orientation of Nos. 44 and 45, Dr. Petty, and I share your problem, and I'd like to spend some time with it, but I have great difficulty.

Dr. ANGEL. So do I. I wish the hair were not obscuring that notch because I think that's where it has to be. If that V is the same as this, it has to be somewhere around here.

Dr. BADEN. The hairline would be where the skull fragment is missing?

Dr. ANGEL. It's not too—that would be just about at the hairline or just above it—and then in front of the temporal line, which I couldn't see, that was what was bothering me. And I couldn't see any temporal line here, and if the temporal is—if this is really the forehead, this scalp directed down as it ordinarily would be, then that makes sense.

Dr. PETTY. I believe it is the forehead, and the scalp is reflected down.

Dr. ANGEL. Yeah. I think that makes sense.

Dr. PETTY. Dr. Humes, would you buy that here is the scalp of photograph No. 44 and reflected down over the face? Right here?

Dr. HUMES. Yes.

Dr. PETTY. And that this then really could very well be the frontal portion?

Dr. HUMES. Right. Now I'm much happier. I will buy that completely. That's where that was.

Dr. PETTY. OK, well—this makes more sense to me.

Dr. HUMES. We reflected the scalp here. This is the exit wound where I thought it was. This is the back of his head here. This is the back of his shoulder.

Dr. PETTY. These two are lined up just about right now. See, this notch is pointing in the same direction here, and this would be in the frontal area and anterior to the coronal suture in all probability.

Dr. HUMES. Right.

Dr. PETTY. Do you see that, Dr. Davis? That this then would be in the frontal bone and anterior to the coronal suture?

Dr. DAVIS. Which I think is consistent with the X-rays, the lateral films, and fits in with our interpretation.

Dr. PETTY. Now, may I ask you one other question on this X-ray, Dr. Humes. Here is a view taken, I assume, with the radiation point above the face and the film behind the back of the head.

Dr. HUMES. Not being a radiologist, I presume that.

Dr. PETTY. If that's true, then the least distorted and least fuzzy portion of the radiopaque materials would be closest to the film, and we would assume then that this peculiar semilunar object with the sharp edges would be close to the film and therefore represent the piece that was seen in the lateral view——

Dr. HUMES. Up by the eyebrow.

Dr. PETTY. No. Up by the—in the back of the skull.

Dr. BADEN. Could you state the numbers of the two X-rays that you're talking about?

Dr. PETTY. Yeah. I'm sorry, I keep forgetting these numbers. We're looking at roentgenogram Nos. 1 and 2. The first is an anterior-posterior view of the head, the second is a lateral view, and we're trying to establish whether this particular sharp-edged radiopaque defect is close to the back of the skull or close to the front of the skull.

Dr. HUMES. I can't be sure I see it in the lateral at all, do you? Do you see it?

Dr. BOSWELL. Yes, right here.

Dr. PETTY. Were these fragments that we see recovered at all?

Dr. BOSWELL. No; they were not.

Dr. PETTY. I can understand why they weren't.

Dr. BOSWELL. I think there were three or four tiny little pieces, and I think those are here in the Archives.

Dr. HUMES. The X-ray, as you know, doesn't tell me how large that was or what its bulk or mass was. Most of the fragments that we recovered were grains of sand-type fragments.

Dr. BOSWELL. Yeah, millimeter or so.

Dr. HUMES. I don't recall them of that size.

Dr. PETTY. So that placing the outshoot wound in the right frontal bone toward the coronal suture is probably about where it was.

Dr. HUMES. Uh-huh.

Dr. PETTY. Joe Davis, you have questions, I think, about the inshoot area, don't you?

Dr. DAVIS. Well, in terms of the inshoot, my impression when I first looked at these films was that the inshoot was higher, and I equated that with the lesion in photograph, I believe it was No. 26, color photograph—well, it's 43—and I interpreted—which one is this?

Dr. BADEN. This is No. 42.

Dr. PETTY. We were wondering if that had been the inshoot.

Dr. HUMES. No, no, That's no wound.

Dr. DAVIS. Because in No. 42 I interpreted that as a wound, and the other, lower down in the neck, as just being a contaminant, a piece of brain tissue.

Dr. HUMES. No, that was a wound, and the wound on the skull precisely coincided with it.

Dr. DAVIS. Now it was a tunnel——

Dr. HUMES. Yeah, tunnel for a way.

Dr. BOSWELL. Yeah, it's longer than it is wide, and tunneled along and actually under here, and then at the actual bone defect was above the——

Dr. HUMES. And this photograph No. 45, I am quite convinced, is an attempt to demonstrate that wound, and not a very successful one I'm afraid, because I can't for sure pick it out. This, I believe, was taken looking down at the inside—looking close to the posterior cranial fossa.

Dr. BOSWELL. And what we see here is a lot of red and fragments of bone.

Dr. COE. Dr. Humes and Dr. Boswell, have you discussed these photographs with the other pathologists who have previously gone over this with you?

Dr. HUMES. I have not.

Dr. BOSWELL. I went over the photographs with Humes.

Dr. COE. Because at least there's already one of them right—I had the impression that they apparently thought—I was just curious as to——

Dr. HUMES. Our written description clearly, I think, indicates that point right there.

Dr. COE. But they describe, some of them, the entrance they feel being 10 centimeters above the occipital proturberance.

Dr. PETTY. Well, there have been all sorts of changes from the original—I mean, right and left and up and down.

Dr. COE. No. That's why I was interested in whether they had discussed it with the pathologists or whether the pathologists had been interpreting entirely from the photographs when they made the statement.

Dr. PETTY. So, on photograph No. 42, then, down right at the hairline, right at almost in the midline, is the inshoot wound, and this photograph is not taken with the inshoot wound centered in the photograph, but rather the posterior extension of the scalp tear is the subject of the photograph.

Dr. HUMES. Again, to be sure that it was related to the gentleman's head rather than focusing specifically on a wound, no I don't think we took the photograph specifically at that site, do you, Jay?

Dr. BOSWELL. No.

Dr. PETTY. And, you say, Dr. Boswell, that the bullet entered the skin and that the wound in the skull was a little above that.

Dr. BOSWELL. Right.

Dr. PETTY. Because apparently the bullet had tunneled a little under the skin and then that corresponds with the diagram that I saw which showed a point on the back of the body, the diagram with an arrow pointing upward and slightly to the left.

Dr. HUMES. You caught—I don't know what you are referring to.

Dr. BADEN. Could I interrupt 1 second? Dr. Angel has to go at this point, but in summary, you are pointing to the skull. The X-rays and the photographs and the X-ray of fragments of bone that was taken by Dr. Humes during the autopsy would indicate that the exit perforation is where?

Dr. ANGEL. Along in here I think, above the temporal line, and that triangular fragment I think would fit from—just short of the fragment down to the edge of the exit perforation and then across this way, fitting in as sort of a triangle in the upper part of the frontal—so I think that's the best fit that I could estimate from seeing the X-rays.

Dr. BADEN. And this would place the exit gunshot wound just anterior and almost incorporated into the lateral aspect of the coronal suture line.

Dr. ANGEL. A little in front of it, yes.

Dr. BADEN. Then it's slightly in front of and just superior to the temporal bone.

Dr. ANGEL. Apparently above the hairline. His hairline was fairly low; he wasn't getting bald like me. So, I think an exit wound about there would fit, then, the fragment that you have.

Dr. BADEN. Just anterior to the coronal suture line?

Dr. ANGEL. Just anterior to the coronal suture line, yes. Well above pterion, far above pterion near the point where the temporal line crosses the coronal suture.

Dr. BADEN. Do you have a name for it?

Dr. ANGEL. Stephanion.

Dr. BADEN. I think we should also record that Dr. Angel graciously came over at a moment's notice to help us with these interpretations, and we're most grateful.

Dr. ANGEL. Thank you very much, doctor.

Dr. PETTY. Dr. Boswell, this is the diagram that I was referring to a moment ago where the point of——

K. KLEIN. Could you identify in some way what it is?

Dr. PETTY. The face sheet of Dr. Humes' protocol.

K. KLEIN. OK.

Dr. PETTY. Which shows an inshoot wound on the back of the head and the arrow pointing upward and to the left—that just meant up.

Dr. BOSWELL. That just meant up. It wasn't intended to indicate direction or anything.

Dr. PETTY. And, do you know what this word is? It says "ragged," and the reproduction has lost something here. The next word I can't make out.

Dr. BOSWELL. I'm sorry, I can't either.

Dr. PETTY. OK, thank you very much.

Dr. COE. Dr. Boswell, was it the Clark commission or the Rockefeller commission?

Dr. BOSWELL. The physicians that you spoke with remember? Clark.

Dr. BADEN. Dr. Fisher and Dr. Moritz?

Dr. BOSWELL. Yes, right.

Dr. BADEN. At the break perhaps they can review the original notes and that will——

Dr. BOSWELL. "Ragged slanting" is what it says.

Dr. BADEN. And then we'll discuss that after the break.

[Coffee break.]

Dr. BADEN [continuing after the coffee break]. We were just discussing the original fact sheet document. Dr. Boswell, would you just explain what you wrote and what other people wrote on the front and back of that page?

Dr. BOSWELL. The weights of the organ are not written by me. Everything else on here is mine. All of the notes on the diagrams are mine, and this diagram on the back is mine, this and this.

Dr. BADEN. Could you explain the diagram on the back?

Dr. BOSWELL. Well, this was an attempt to illustrate the magnitude of the wound again. And as you can see it's 10 centimeters from right to left, 17 centimeters from posterior to anterior. This was a piece of 10 centimeter bone that was fractured off of the skull and was attached to the under surface of the skull. There were fragments attached to the skull or to the scalp and all the three major flaps. I guess the—I'm not sure in retrospect what I meant by that.

Dr. PETTY. May I ask you, Dr. Boswell, if this diagram depicts in anyway the same V-shaped notch that we saw on some of the color photographs, namely, and I have in hand, No. 27 here. Would this notch be the same as the notch that we see that points more or less toward the right ear?

Dr. BOSWELL. I believe so. And what this is meant to depict at this point, I don't know.

Dr. PETTY. Well, having gone through a lot of smashed skulls—injuries—I know precisely what you're grappling with.

Dr. HUMES. I think this—I would interpret this fracture through the floor of the orbit——

Dr. PETTY. Of the orbital cavity.

Dr. HUMES. Right. It was an explosion-type fracture.

Dr. PETTY. We also had a question about photograph number—is this 10 or is this 12?

Dr. BADEN. Twelve.

Dr. PETTY. This is the wound, right upper thoracic wall posterior. Is this small fragment of dark staining material simply blood?

Dr. BOSWELL. Blood, uh-huh.

Dr. PETTY. It's the one that's perhaps 4 or 5 centimeters below and to the left of the wound itself?

Dr. BOSWELL. Yeah. There was no damage there at all.

Dr. PETTY. Yes. This is the other photograph which is horribly blurred for reasons unapparent—this is photograph No 41—these two show the right anterior aspect of the head, neck and chest of the late President, and there is a notch which we see; it's very blurred and it really doesn't seem to be so much of a notch as a semicircular defect in the central portion of the—the inferior margin of this gaping wound. Is that what was considered to be a partial bullet wound?

Dr. BOSWELL. Of exit, yes. That was what we ultimately concluded, yes.

Dr. PETTY. The reason I specifically bring this up is that somebody somewhere along the line has changed this from the lower margin to upper margin, and we just couldn't see that.

Dr. HUMES. You see, Dr. Perry informed us that he went right through that wound to make his tracheostomy.

Dr. BADEN. We're talking about also photographs Nos. 13 and 14. Did—in further discussing the exit perforation through the tracheotomy, did you have occasion to explore in the neck area beyond what is in the protocol, beyond what the description was? As to what was injured?

Dr. HUMES. Well, the trachea, I think we described the irregular or jagged wound of the trachea, and then we described a contusion in the apex of the lung and the inferior surface of the dome of the right pleural cavity, and that's one photograph that we were distressed not to find when we first went through and catalogued these photographs, because I distinctly recall going to great lengths to try and get the interior upper portion of the right thorax illuminated—you know the technical difficulties with that, getting the camera positioned and so forth, and what happened to that film, I don't know. There were a couple of films that apparently had been exposed to light or whatever and then not developed, but we never saw that photograph.

Dr. BADEN. From the time you first examined them, that particular photograph was never seen?

Dr. HUMES. Never available to us, but we thought it coincided very neatly with the path that ultimately we felt that that missile took.

Dr. BADEN. Continuing with the path. There is present in the X-rays some opaque material to the right of the lower cervical spine which has been interpreted as being tiny bullet or bone fragments. Would the track, as you recall, be consistent with the missile striking a transverse process?

Dr. HUMES. Well, I must confess that we didn't make that interpretation at the time. I'm familiar with the writings of Dr. John Lattimer and of some reprints of his articles, and I'd have to go back and restudy it the way he has done. But as you can see from the point of entrance, it wasn't that far lateral. It could conceivably have nicked a—the edge of a transverse process.

Dr. PETTY. Now, it was tending further to the left as it went?

Dr. HUMES. Why sure, because it came out in the midline.

Dr. BADEN. Just for the record, you say it could have nicked?

Dr. HUMES. It could. I don't know.

Dr. PETTY. Can I go back to another interpretation which is very important to this committee? I don't really mean to belabor the point, but we need to be certain, as certain as we can be—and I'm showing you now photograph No. 15, and here, to put it in the record, is the posterior hairline or margin of the hair of the late President, and there, near the midline, and just a centimeter or two above the hairline, is an area that you refer to as the inshoot wound.

Dr. HUMES. Yes, sir.

Dr. PETTY. Also, on this same photograph is a ruler, and approximately 2 centimeters or so down the ruler and just to the right of it is a second apparent area of defect, and this has been enlarged and is shown to you in an enlargement, I guess No. 16, which shows you, right opposite the 1 centimeter mark on the ruler, this defect, or what appears to be a defect. I don't see the connection with the lacerated margin of the scalp anywhere.

Dr. BADEN. And No. 15 shows an enlargement of the lower area that's suggestive of an inshoot to you.

Dr. PETTY. And what we're trying to do is to satisfy ourselves that the bullet actually came in near the margin of the hair and not near the tip of the ruler as is shown in photograph No. 16.

Dr. HUMES. This is an enlargement from that other photograph, right?

Dr. HUMES. Dr. Boswell offered the interpretation that it might be an extension of a scalp wound. I don't share his opinion about that. I don't know what that is. No. 1, I can assure you that as we reflected the scalp to get to this point, there was no defect corresponding to this in the skull at any point. I don't know what that is. It could be to me clotted blood. I don't, I just don't know what it is, but it certainly was not any wound of entrance.

Dr. DAVIS. May I interject. I think perhaps it's time now for some correlations. We have here black and white copies of Zapruder film frames Nos. 311, 312, and 313. That's 313 at the moment when the head actually exploded, 311 and 312 being the position of the head immediately prior. We have these photographs here, and we have the lateral X-rays, X-ray No. 2. I think perhaps what we can consider is the problem of the tangential striking bullet which enters the head, tunnels—and that's already been testified to, and it seems reasonable—strikes the bone tangentially, fragments, and then one part of a fragment can skip out through the scalp again, which may explain this wound we see here in enlargement No. 16. Now the evidence for that on X-ray would be a trial of radiopaque spots which, with a magnifying lens, we can see in X-ray film No. 2 extending in an upward direction from the region of the external occipital protuberance, with the upper portion of this in an area where there's a large defect in the posterior parietal bone. Now, there is radiopaque material, some of which appears to be even exterior, at least in this view, with continuation of radiopaque fragments in the vertex part of the interior of the head, and also continues straight ahead, and I think there's some more down here in the mid-posterior area. So I think all of us who have done a fair number of investigations like this are well aware that a bullet can split into fragments and one fragment can be deflected outward, another fragment can be deflected inward and slightly upward, and even a third fragment can go straight. There's all sorts of things can happen with bullets when they strike in this manner. I think I can see radiopaque trails going up which could reconcile the testimony and opinion of Dr. Humes that this ma-

terial, this brain material, represents the loss of brain from the entrance site; and also it reconciles with his statement and also with Dr. Boswell's statement that there was tunneling; and I think it also fits in with Zapruder frames 311 and 312 immediately before 313, where the head explodes. in which in 311 and in 312 we see the President sitting, his chin is down, and it's hard to say which way the head is turned in this because these are black and white photographs and they are enlargements and they are slightly blurred. But it would be consistent, then, with the bullet striking, and we all recognize that this is fairly thick condensed bone, and that in itself would add to the propensity for a split bullet. So I'm advancing that as an investigative hypothesis for investigative opinion, for discussion at this time, to see if we can arrive at a consensus.

Dr. HUMES. I would like to comment further, from our point of view, that these enlargements which you have shown us now of these other photographs is the first time I have seen these enlargements; I have not seen them before.

Dr. DAVIS. These were just made up 2 or 3 days ago. Two days ago.

Dr. PETTY. May I make a comment on what you just said, Dr. Davis. The problem, as I see it, is that this may be in fact a tunneling situation, with the bullet scooting along the skull here or somewhere, and not entering the skull down below. Is that what you're saying now?

Dr. DAVIS. What I'm saying—what I'm inferring: in the absence of photographs and specific measurements, we could only conjecture as to how long the tunneling is, but I would envision this as a tunneling first and then entry into the skull.

Dr. LOQUVAM. Gentlemen, may I say something?

Dr. DAVIS. Yes.

Dr. LOQUVAM. I don't think this discussion belongs in this record.

Dr. PETTY. All right.

Dr. HUMES. I agree.

Dr. LOQUVAM. We have no business recording this. This is for us to decide between ourselves; I don't think this belongs on this record.

Dr. PETTY. Well, we have to say something about our feeling as to why we're so interested in that one particular area.

Dr. HUMES. Could I make a comment that I think would be helpful to you, and you can throw out anything I say or whatever? But I feel obligated to make a certain interjection at this point, having heard this theory which I hadn't heard from the committee because I didn't pay that much attention quite frankly. Our attention was obviously directed to what we understood and thought to be clearly a wound of entrance. If such a fragment were to have detached itself from the main mass of the missile, it would have to be a relatively small fragment because the size of the defect in the skull which approximated this point was almost identical with the size of the defect in the skin. Do you follow that line of reasoning?

Dr. PETTY. Yes, that makes sense. I mean, I've seen the same thing.

Dr. DAVIS. I've seen the same thing—bothers me a bit—part of that casing comes off.

Dr. COE. The reason we are so interested in this, Dr. Humes, is because other pathologists have interpreted the——

Dr. LOQUVAM. I don't think this belongs in the damn record.

Dr. HUMES. Well, it probably doesn't.

Dr. LOQUVAM. You guys are nuts. You guys are nuts writing this stuff. It doesn't belong in that damn record.

Dr. BADEN. I think the only purpose of its being in the record is to explain to Dr. Humes what——

Dr. LOQUVAM. Why not turn off the record and explain to him and then go back and talk again.

Dr. BADEN. Well, our problem is not to get our opinions, but to get his opinions.

Dr. LOQUVAM. All right then, keep our opinions off. Here's Charles and Joe talking like mad in the damn record, and it doesn't belong in it. Sorry.

Dr. BADEN. Dr. Humes, realizing our concerns, if there is anything that you or Dr. Boswell can say that can help clarify any further the entrance wound and track of the bullet in the head, we would be most appreciative.

Dr. HUMES. I think we're at a distinct disadvantage because, as I said, when we cataloged the photographs and numbered them, and spent half a day or day to do it, I'll confess to possibly even overlooking the area to which you gentlemen, and apparently someone else, has directed attention. I would not attempt to make an interpretation of what it represents because I can't at this point.

Dr. DAVIS. But at the time of the autopsy there was no defect in the scalp other than where the bone was gone.

Dr. HUMES. Right.

Dr. BADEN. When you say defect, you're talking about a defect of the wound of entry?

Dr. DAVIS. Right.

Dr. BOSWELL. Now, I'm sure that our record describes the tunneling of that wound of entry pretty well, at least as to length and distance beneath skin, doesn't it? I can't recall the description, but I'm sure it is there.

Dr. HUMES. I'm looking for the color photograph that coincides with No. 15—which one is it?

Dr. BADEN. 42 is one.

Dr. HUMES. Yeah. Whether this "defect" is a "defect", in my mind, I'm not sure. I'm not sure it's not some clotted blood that's lying on the scalp.

Dr. BADEN. What we're trying to do is to have your best opinions and recollections to deal with.

Dr. HUMES. Right.

Dr. BADEN. Now, and much of this goes toward the head wound and also the neck wound, is there anything further about the wound of the back that exits the neck that you can recall independently relative to what isn't in the record, as when you described the trachea. Do you remember anything about the carotid arteries or the carotid sheath area?

Dr. HUMES. It had to have passed medial to the right carotid bundle.

Dr. BADEN. Medial. And was there a lot of hemorrhage in that area?

Dr. HUMES. There was moderate hemorrhage in the soft tissues.

Dr. BADEN. In the area of the trachea and that side of the neck?

Dr. HUMES. Right.

Dr. BADEN. George, is there anything further you'd like to add?

Dr. LOQUVAM. No, I've said my piece.

Dr. HUMES. Show me by photograph where the external occipital protuberance is?

Dr. DAVIS. I can't show you where it is on this photograph to my satisfaction.

Dr. PETTY. Well, the thing that we found——

Dr. HUMES. Let me have the written notes to be sure that it's not in the transcription.

Dr. BADEN. Here's the written notes.

Dr. BOSWELL. May I have these, what we're working with, OK? This is on page 4——

Dr. HUMES. These are medical wounds——

Dr. PETTY. Comes after missile wounds, considerable amount of missile wounds, then you get it.

Dr. BOSWELL. Situated in the posteris scalp approximately 2 centimeters laterally to the right, is that what it says?

Dr. PETTY. That's right.

Dr. HUMES. Laterally to the right and slightly above the external occipital protuberance is a lacerated wound which I describe for your identification. You may wish to go back and look and add some corrections and whatever to this note.

There's another fact of this. Having completed the examination, others might be interested in this——

Dr. BADEN. Yes. We're in session, Joe.

Dr. HUMES. Having completed the examination and remaining to assist the morticians in the preparation of the body, we did not leave the autopsy room until 5:30 or 6 in the morning. It was clearly obvious that a committee could not write the report. I had another commitment for that morning, a little later, a religious commitment with one of my children. And so I went home and took care of that, slept for several hours until about 6 in the evening of the day after, and then sat down and wrote the report that's sitting before you now, myself, my own version of it, without any input other than the discussions that we thought that we had had, Dr. Boswell, Dr. Finck and myself. I then returned that morning and looked at what I had written—now wait, I'm a day ahead of myself—Saturday morning we discussed——

Dr. BOSWELL. Saturday morning we got together and we called Dallas.

Dr. HUMES. We called Dallas. See, we were at a loss because we hadn't appreciated the exit wound in the neck, we had been—I have to go back a little bit, I think for your edification. There were four times as many people in the room

most of the time as there are in this room at this moment, including the physician to the President, the Surgeon General of the Navy, the Commanding Officer of the Naval Medical Center, the Commanding Officer of the Naval Medical School, the Army, Navy, and Air Force aides to the President of the United States at one time or another, the Secret Service, the FBI and countless nondescript people who were unknown to me. Mistake No. 1. So, there was considerable confusion. So we went home. I took care of this obligation that I had. To refresh my mind, we met together around noon on Saturday, 11 in the morning, perhaps 10:30, something like that and——

Dr. BADEN. Now this is the day after?

Dr. HUMES. The day after, within 6 or 8 hours of having completed the examination, assisting Waller's and so forth for the preparation of the President's remains. We got together and discussed our problem. We said we've got to talk to the people in Dallas. We should have talked to them the night before, but there was no way we could get out of the room. You'd have to understand that situation, that hysterical situation that existed. How we kept our wits about us as well as we did is amazing to me. I don't know how we managed to do it as poorly or as well as we did under the circumstances. So I called Dr. Perry. Took me a little while to reach him. We had a very nice conversation on the phone in which he described a missile wound, what he interpreted as a missile wound, in the midline of the neck through which he had created a very quick emergency, as you can see from the photographs, tracheotomy incision. In effect destroying its value to us and obscuring it very gorgeously for us. Well, of course, the minute he said that to me, lights went on, and we said ah, we have some place for our missile to have gone. And then, of course, I asked him, much to my amazement, had he or any other physician in attendance upon the President, examined the back of the patient, his neck, or his shoulder. They said no, the patient had never been moved from his back while they were administering to him. So, the confusion that existed from some of his comments and the comments of other standby people in the emergency room in Dallas had been in the news media and elsewhere, so that added to the confusion. So, following that, and that discussion, and we having a meeting of minds as to generally what was necessary to be accomplished, and being informed by the various people in authority that our gross report should be delivered to the White House physician no later than Sunday evening, the next day, 24 hours later, or not quite 24 hours later. Not having slept for about 48 hours, I went home and rested from noon until 8 or 10 that evening, Saturday evening, and then I sat down in front of other notes on which I had made minor comments, handwritten notes.

I wrote the report which is present here. Now we also have here—and since it's in the record I want to comment about it—some comments that I destroyed, some notes related to this, by burning in the fireplace of my home, and that is true. However, nothing that was destroyed is not present in this write-up. Now, why did I do that? It's interesting, and I've not spoken of this in public. Not too long before this, I had had the experience of serving as an escort officer for some foreign physicians from foreign navies, who were being entertained and given a course of instruction in the United States. We had 20 or 30 of these chaps, and they used to come through every year or two, and I often was escort officer for them. They spent 5 weeks in Washington or 5 weeks in the field, then we went various places. We went to submarine bases and Marine Corps installations and naval training centers to teach them how physicians function in the American Navy. One of the places to which I happened to take them—and we tried to teach them a little Americana—I took them to Greenfield Village, which, as many of you know, Henry Ford set up adjacent to his former home in suburban Detroit, Dearborn. And in that location is a courthouse in which President Lincoln used to hold forth when he was riding the circuit, and these men were very impressed with that, and they knew who President Lincoln was and were impressed with his courthouse and many other things in Greenfield Village. But what I was amazed to find there, because I personally did not know it was there until I made that visit, was the chair in which President Lincoln sat when he was assassinated.

Somehow or other they got that chair out of Ford's Theatre, and Henry Ford got it into Greenfield Village, and it's sitting in this courthouse. Now the back of that chair is stained with a dark substance, and there's much discussion to this day as to whether that stain represents the blood of the deceased

President or whether it is Macassar. I don't know if you all remember what Macassar is. When people our age were young and you'd visit your grandmother, on the back of the sofa there were lovely lace doilies in the homes of many people. And if you recall what I'm speaking of—they were on the sofas and reclining chairs—and those lace doilies bear the name antimacassar. You could go to a store in this country and buy an antimacassar. They don't exist any more. And Macassar was a hair dressing that gentlemen wore in those days to keep their hair in place. And these officers were appalled that the American people would wish to have an object stained with the blood of the President on public display. And I was—it kind of bothered me a little bit—it still does, to this day. And here I was, now in the possession of a number of pieces of paper, some of which unavoidably, and in the confusion which I described to you earlier, were stained in part with the blood of our deceased President. And I knew that I would give the record over to some person or persons in authority, and I felt that these pieces of paper were inappropriate to be turned over to anyone, and it was for that reason and for that reason only, that, having transcribed those notes onto the pieces of paper that are before you, I destroyed those pieces of paper. I think I'd do the same thing tomorrow if I had a similar problem, because I felt they would fall into the hands of some sensation seeker.

Dr. BADEN. Is everything you had on the notes recorded in the holographic document before you, which is kept in the Archives, that you wrote at that time?

Dr. HUMES. Correct. Now, there are corrections and comments and changes of language in here. I think I'd have to go through them and with care to see if some of them are substantive or not substantive, and they are a result of meeting with Dr. Boswell and Dr. Finck on Sunday afternoon in the Naval Medical Center and going over them together. This document then was signed by all three of us, whereas in the part before some minor changes were made—maybe they—some of them sounded like we'd expressed an opinion, and we thought maybe that wasn't what should be done.

But in any event, this document then was signed by all three of us and, parenthetically in the middle of this preparation, other naval officers were not—no one was telling us anything. We did this strictly on our own. But in an adjacent room and awaiting the results of our efforts were other senior naval officers watching the television. And it was at that point, of course, that Mr. Oswald was assassinated or shot, and, in fact, we interrupted our work to try and figure out what that meant to us. So, in any event then, this document was typed up under my immediate supervision by a woman, secretary to the Commanding Officer at the Naval Medical Center, and I personally hand-carried the written document to the office of the White House physician about 6 on Sunday evening.

Dr. ROSE. Could the record reflect that Mr. Oswald's preliminary documents, also at a much later time, Mr. Ruby's documents, the preliminary ones, were similarly taken care of——

Dr. HUMES. I don't wish to apologize because I don't think that an apology is necessary, but I'd like for this document, for the record, to reflect exactly what happened, some place, as it did.

Dr. BOSWELL. As to the previous comment, I have frequently redrawn diagrams that might have gotten a spot of blood on them.

Dr. HUMES. Now, I didn't redraw Jay's, and don't ask me why, because it was, I guess it was because I didn't have another piece of paper and I didn't want to sit down and reproduce a drawing.

Dr. ROSE. Doctor, I apologize for doing it in the case of Mr. Oswald.

Dr. BADEN. Let the record note that the previous speaker, Dr. Rose, did perform the autopsies on Mr. Oswald and Mr. Ruby.

Dr. HUMES. OK. Now, the reason that we were referring to these photographs was some discussion between Dr. Petty and myself as to the verbalized location of the wound, what we interpreted as the wound of entrance, and my problem is that these are, to my recollection, my interpretation of what I saw. The problem that we have now, I think, in the photographs at least in part, may or may not explain the situation totally to everybody's satisfaction. The photographs do not clearly demonstrate where the external occipital protuberance is, and that's the only comment I could make Chuck about that. I feel, by looking at this photograph, that the wound was in fact below the external occipital protuberance and certainly no worse than lateral to it.

Dr. PETTY. Well, we have some interesting information in the form of the photographs of the brain, and if this wound were way low, we would wonder at the intact nature, not only on the cerebellum, but also on the posterior aspects of the occipital lobes, such as are shown in Figure 21. Here the cerebellum is intact, as well as the occipital lobes, and this has concerned us right down the line as to where precisely the inshoot wound was, and this is why we found ourselves in a quandary, and one of the reasons that we very much wanted to have you come down today.

Dr. HUMES. The photographs unfortunately are not three-dimensional, and that's part of the difficulty, I think.

Dr. DAVIS. Early, I was asking Dr. Boswell if he had had an opportunity at some previous time to meet with a group of pathologists such as ourselves. Forensic pathologists, and go over the photographs and all of this material together, to more or less get a consensus. And, correct me if I'm wrong, Dr. Boswell, it is your impression that this opportunity had never been previously afforded to yourself. How about you, Dr. Humes? Have you had this opportunity in the past?

Dr. HUMES. Absolutely not.

Dr. DAVIS. All right, so, basically, this is the first time that the original people who were there at the autopsy and saw things with their own eyes, wrote reports, have ever had an opportunity to sit down and view these pictures in the company of other pathologists. Now, there have been previously other forensic pathologists.

Dr. COE. That's why I asked if Dr. Boswell had a chance to talk with the Clark Commission pathologist.

Dr. BOSWELL. Well, I was here with him merely to identify photographs and X-rays and whatever other material they went over, and I did answer as many questions as I could, but there was no discussion at that time as to their opinions; they formulated those after I was away.

Dr. DAVIS. So basically, then, there has never been any free association of ideas, a jelling of ideas and clarification of small points that might be interpreted differently from one person to another. So this apparently is the first time a group has got together and sat down and hashed over the case as we so frequently do in our everyday practice.

Dr. PETTY. Dr. Boswell, you and I also were talking during the period when the machine was not actively recording, and you said something that interested me tremendously. May I hear from page 4 of the autopsy report. "Situated in the posterior scalp approximately 2.5 centimeters laterally to the right and slightly above the external-occipital protuberance, is a lacerated wound measuring 15 by 6 millimeters, and I believe you said that the 15 millimeter dimension represented, as you described it, tunneling of the bullet, and that's what you mean by tunneling?

Dr. BOSWELL. Yes.

Dr. BADEN. Now, continuing with that description that Dr. Humes wrote down, this handwritten report that you described, that particular measurement Dr. Petty referred to, is not indicated on the face sheet, whereas the wound in the shoulder is. Referring to the measurement of 2.5 centimeters laterally to the right and slightly above the external occipital protuberance—was that specific measurement present on your other notes that you utilized?

Dr. HUMES. Yes, sir.

Dr. BADEN. So that you did make that directly from notes taken at the time of the autopsy and then transcribed them?

Dr. HUMES. Right.

Dr. BADEN. Dr. Boswell, I think you may have covered this once before relative to the diagram that you made. The notation of the diagram on the front sheet shows an arrow going toward the left by the perforation near the external occipital protuberance. What does the arrow to the left mean?

Dr. BOSWELL. I think it was only meant to indicate "upward," not laterality at all.

Dr. BADEN. Not that it went to the left?

Dr. BOSWELL. Yes, right.

Dr. BADEN. Thank you.

Dr. LOQUVAM. Charles, would it be possible for Dr. Humes and Dr. Boswell to look at that picture executed to show the posterior cranial fossa? And if the two of them could possibly pick out the point of entrance—I know the picture is in poor focus——

K. KLEIN. Dr. Petty, when you locate the proper photographs could you repeat the question again, because I doubt that the machine would have picked it up.

Dr. PETTY. The question is, Could you, Dr. Humes, or Dr. Boswell, either one, from examination of the photograph purported to show the posterior cranial fossa locate the point of inshoot into the skull? Now we're looking at photograph No. 44.

Dr. BADEN. Is there a black and white of that?

Dr. DAVIS. I think there is; but I don't see it here.

Dr. HUMES. There is.

Dr. BOSWELL. Yes. What number is that?

Dr. HUMES. The black and white photograph is No. 17, the color is 44.

Dr. PETTY. Well, that not the one, I'm sorry. That's the exit wound. I want the one in the posterior cranial—could this be the one that you said earlier was looking down the posterior cranial fossa on the inside?

Dr. HUMES. That's the one right there.

K. KLEIN. And that's No. 45.

Dr. PETTY. Now, could you two possibly, thinking back 16 years, I know how difficult it is, but is there any way that you could show us where the entrance was in that wound?

Dr. BOSWELL. I don't believe it's depicted in that picture.

Dr. HUMES. How about here, Jay?

Dr. BOSWELL. Well, I don't believe so, because, as I recall, the bone was intact at that point. There was a shelf and then a little hole, came up on the side and then one of the smaller of the two fragments in that X-ray, when that arrived, we were able to fit that down there and complete the circumference of that bone wound.

Dr. HUMES. I don't remember that in that detail and I suspect—you see the background, there seems to be blue, with a blue towel placed beneath the head of the President, and I think that may be the wound right there.

Dr. PETTY. Can you orient this for us, Dr. Humes? I am a little confused on exactly—now is this picture oriented like that, or is it like this? Because if this is checked, this has to be posterior dorsal, so the wound has got to be somewhere where Dr. Humes has pointed, because the——

Dr. HUMES. But why would we go to the trouble of putting the ruler there, you see. This is reflected scalp.

Dr. PETTY. I think the biggest point in consideration here is that this is in focus here [pointing to upper scalp area in question] and this is not in focus here [pointing to lower area].

Dr. HUMES. Right.

Dr. PETTY. Therefore we must be looking specifically in that area.

Dr. DAVIS. Did the person who took the photographs ask you what to take or just took what he thought was——

Dr. HUMES. No no. He was directed.

Dr. BOSWELL. He was taking specific areas.

Dr. HUMES. A real problem.

Dr. BOSWELL. Yeah. I know.

Dr. HUMES. I don't think the photograph permits us to say with accuracy where it is. And recall again that we were not privileged to see these photographs until the date on the legend that comes with it, sometime in 1966.

Dr. BOSWELL. Three years.

Dr. PETTY. But the point of entry on the external surface of the body of the head is incidentally depicted in photograph 15 and shows near the margin of the photograph down toward the hairline of the President. And again here on No. 43 it shows the same thing.

Dr. HUMES. I object to your word "incidentally."

Dr. PETTY. Well, by that I mean it's not the subject of the center of the photographer's lens, it's way down toward——

Dr. HUMES. No, no. But you'd have greater difficulty localizing it, I submit to you, were it the same subject of the photographer's lens.

Dr. BADEN. That's true.

Dr. PETTY. I can understand that, sure.

Dr. BADEN. One of the considerations I had in looking at the film, Dr. Humes, relative to the interpretation I had, was that perhaps you were holding——

Dr. HUMES. Holding the scalp up, holding the head up.

Dr. BADEN. Holding the scalp and head up specifically so that the photographer could get that point.

Dr. HUMES. Not that point. That is not the case.

Dr. BADEN. That is not the case?

Dr. HUMES. Because I submit to you that, despite the fact that this upper point that has been the source of some discussion here this afternoon is excessively obvious in the color photograph, I almost defy you to find it in that magnification in the black and white.

Dr. BADEN. We're not trying to be argumentative. What we're trying to do is fully understand what you say and what you did.

Dr. HUMES. Nor I. Right. The gentleman was in the dorsal recumbent position on an autopsy table, not the greatest photographic position in the world, and we had to hold his head up. One of us is lifting the head, flexing the neck if you will, by holding the scalp, and to show the wound where it was in relation to the man's head.

Dr. BADEN. In reviewing this material earlier today, you made an ink notation on the skull that we have here, localizing the entrance perforation to the right of the external occipital protuberance—in reviewing the skull and marking at this time and having reviewing all of the films and incorporating our discussion, is that still a valid representation?

Dr. HUMES. Yes, I think so.

Dr. BADEN. Dr. Humes, this refers to the notation made on the skull. We are using it as an exhibit, and it is signed and initialed by you.

Dr. HUMES. I believe that that's a reasonable representation. I think that we were making an attempt, and, of course, we didn't have Polaroid in those days, like we might use now, to be sure that we had an image of what we wished, and its interesting how technology changes things. We were attempting in that photograph to demonstrate that wound, and I feel that we have failed to demonstrate the wound.

Dr. BADEN. Would it be fair to ask you Dr. Humes, if in the confusion that was put upon you, as you described earlier in doing the autopsy and taking photographs, it is mentioned in somebody's notes that at one point you had asked who was in charge in the autopsy room—whether that all has significance as to the extent of the autopsy. It has been interpreted that you were under certain directions prior to starting the autopsy.

Dr. HUMES. That was anecdotal. When we were informed that the President was going to be brought for an examination I put on a scrub suit and went to the vicinity of the morgue to await the arrival of the people accompanying the body. By this time, of course, it had become generally known, because when I left to come to the hospital I had no idea why I was even going over there, but by the time I speak of, it was on public radio and television, and crowds of people were gathering around the building in the vicinity of the loading dock adjacent to the autopsy room. There were beginning to arrive large numbers of people. And as I came out of the morgue in my scrub suit before the President's body arrived, there was a photographer, a press photographer roving around the corridors, and I didn't want to get in a personal altercation with him, so I walked out onto the loading dock where there was quite an accumulation of people, and I said, who's in charge here, and I meant of the crowd control as it were. And a gentleman standing no more than 3 yards from me informed me in a very loud voice that he was in charge. And I said who are you. And he said that he was the commanding general of the military district of Washington. I said fine, there's a photographer in there, and I don't think we'd like to have him present. And he dispatched, I think, a Marine captain to come and remove this person. I had no further conversation with this gentleman, nor did he direct me as to what I shou'd or shouldn't do.

Dr. BADEN. All right. During the course of the autopsy, and this has been a point that has been raised before. Did you feel directly or indirectly that somebody else advised you as to what the extent of the autopsy should be. Perhaps as far as leaving marks on the body, or making incisions, or as Dr. Petty brought up in the beginning, whether to look at the adrenal glands or not?

Dr. HUMES. Yes. There was no question but we were being urged to expedite this examination as quickly as possible, that members of the President's family were in the building, that they had refused to leave the premises until the President's body was ready to be moved; and similar remarks of that vein, which we made every effort to put aside and approach this investigation in as scientific manner as we could. But did it harass us and cause difficulty, of course it did how could it not?

Dr. BOSWELL. I don't think it interfered with the manner in which we did the autopsy.

Dr. HUMES. I don't either.

Dr. BADEN. I ask you this question in a sense that all of us here have been in similar positions of a lesser magnitude, when for one reason or another, the family doesn't want an autopsy, a full autopsy or whatever, so we appreciate the situation.

Dr. HUMES. It was stress. The main purpose of the examination, and of course the main purpose that we understood of the examination, was what happened to the President, what killed the President of the United States.

Dr. BADEN. Would you feel that you established——

Dr. HUMES. We established.

Dr. BADEN. Now, for example, not exploring the wound from the back to the neck, that was not done. I mean, cutting it open completely, that wasn't done specifically. Was that because somebody said don't do it?

Dr. HUMES. Now wait a minute, that wound was excised.

Dr. BADEN. The back wound?

Dr. HUMES. Yes, sir. The back of the neck, and there are microscopic slides of that wound.

Dr. BADEN. I see. The skin was taken out. And then was it——

Dr. HUMES. It was probed.

Dr. BADEN. Was it opened up?

Dr. HUMES. It was not laid open.

Dr. BADEN. Now, that was your decision as opposed to somebody else's decision?

Dr. HUMES. Yes, it was mine.

Dr. BADEN. With everything else going on at the time?

Dr. HUMES. Yes. Our collective decisions, I suppose.

Dr. BOSWELL. We had exhibited the midportion of the track and the chest by that time, and demonstrated the contusion on the apex of the lung and subpleurally, and we had at that point two points of the would and then subsequently the wound of exit.

Dr. HUMES. Pretty good course.

Dr. BADEN. The track definitely did not go through the pulmonary tissue?

Dr. HUMES. Negative.

Dr. BOSWELL. No.

Dr. HUMES. There was a contusion of the dome of the right side of the thorax and a contusion, as Dr. Boswell said, a retropleural contusion, and it was a contusion of the upper lobe of the lung.

Dr. BADEN. Retroparietal pleura. Now, you bring up another issue in which you can be of great help to us, because you say the microscopic slides. We apparently, it appears, will not be able to see the microscopic slides. Certainly at this time they are not available to us. Is there anything you can tell us about the microscopic evaluation and examination?

Dr. HUMES. I can't think of anything that would materially change anybody's opinion. The wound was similar to other bullet wounds that I have seen in the skin, sort of a charring effect of the margins and nothing particularly remarkable.

Dr. BOSWELL. No particulate matter.

Dr. PETTY. Do you know whether there was foreign material or——

Dr. BOSWELL. I don't remember.

Dr. BADEN. Would looking at your microscopic description refresh your memory?

Dr. BOSWELL. Sure.

K. KLEIN. Could we perhaps take 5 minutes and change the tape and the doctor's can look at their descriptions?

Dr. BADEN. Starting the record again at this point with a new tape, Dr. Humes and Dr. Boswell were about to refer to the microscopic findings that they noted.

Dr. HUMES. Yes. We were asked specifically about the skin wounds and was there any foreign particulate material in either of the skin wounds, and we refreshed our minds by looking at the brief microscopic report we made, and described in that sections of both the occipital and upper right thoracic wounds that were examined. They were essentially similar, and the only foreign material described were several bone fragments at the margins of the wound and the scalp, so we did not describe foreign particulate material, and I therefore presume it was not present.

Dr. PETTY. Earl, did you have any questions or comments?

Dr. ROSE. No.

Dr. PETTY. John?

Dr. BADEN. Is there anything that perhaps we haven't covered that might be of pertinence to the group?

Dr. HUME. No, I'm distressed with the confusion and allegations of complicity in some plot that we may have been engaged in, which of course is totally ridiculous. We operated under great difficulty. We operated under difficulty in testifying before the Warren Commission, because at that juncture we had not photographs or the X-rays available to us. We worked with an artist, a young medical illustrator who worked for us at the Naval Medical School, and he made a couple of schematic diagrams which have been widely publicized and came reasonably close to describing what our interpretation was of the path of the missiles that struck the President. If you want to try and dissect those in great detail, you'd have to recall that we were doing it from memory and he was doing it thirdhanded, at very best, and he was quite a young person and quite capable, I think, for his years and his experience. He did a pretty good job. Our interview with the Warren Commission, however—I think it's detailed, I'm sure, in the volumes—was reasonably exhaustive, and we had no difficulty with questions that were asked and really have not had any official contact with anybody else officially reviewing this material in the intervening years. From our point of view and that of any pathologist who is saddled with this kind of a responsibility, the peripheral things as to whence cometh the missile and where it went and various other things and so-called single-bullet theory has been, in part, attributed to us, and that's not of our doing. Our descriptions are of the anatomic abnormalities that we found. It did not seem inconsistent to us if this bullet exited the anterior neck of the President, it had to go somewhere, and the person who was sitting in front of him was the Governor, and if it didn't hit him, I for the world have no idea where it went. Those kinds of things are peripheral, but we've been sort of involved, or our names have been involved, with those kinds of conjectures that we really can't make any definite opinion about or scientific opinion about.

Dr. BADEN. But in essence you said, as you indicated before, your main goal at the time you did the autopsy was to determine what happened to the President, and the bottom line for you then, as it is now, having reviewed everything and discussed everything, essentially two gunshot wounds from behind struck the President.

Dr. HUMES. Correct.

Dr. BADEN. Now, there may be, as we're going over the photographs and X-rays and all, some room for discussion about precise points, but you feel the essential findings are two gunshot wounds from behind and from above, I take it, or just from behind?

Dr. HUMES. I think behind is probably the most one can say from the anatomic findings.

Dr. BADEN. And, apart from the tremendous pressures—nonspecific pressures—to get the things done rapidly, you didn't feel any specific pressure—knowing what the request of the families are in situations like this—to be as quick and brief as possible. You didn't perceive any specific constraint on you by an individual as to what you should or shouldn't do as far as the autopsy goes?

Dr. HUMES. Not as it pertains to the injuries to the President.

Dr. BADEN. Well, as pertaining to the whole autopsy. This is one of the things I'm concerned with in viewing the autopsy protocol. There are many organs in addition to the adrenal glands, that you don't specifically describe. Was that of your own judgment and temperament and emotion, or, more specifically, possibly from another source?

Dr. BOSWELL. There were no constraints. Initially Admiral Burkley said that they had caught Oswald and that they needed the bullet to complete the case, and we were told initially that's what we should do, is to find the bullet. Following the X-rays we realized that that was not possible, that there was no bullet there, except fragments, and at that point, Jim and Admiral Burkley discussed it, and it was at that point that he agreed that we should continue and do a complete autopsy, which we then did.

Dr. HUMES. Right.

Dr. BOSWELL. And that was the only constraint during the course of the autopsy, and that was immaterial as it turned out.

Dr. BADEN. I think it would be derelict for us not to afford you an opportunity to answer these questions, since this is the first discussion you're having among peers——

Dr. HUMES. No. It would be a mistake, it would be a mistake for anybody to interpret that any of this confusion under which we operated significantly interfered with our ability to make this examination, to take these photographs, to do the X-rays and so forth; no. Through the gigantic retrospectoscope, would one do everything exactly today as one did that evening, that's another question.

Dr. BADEN. But you did at some point consult with Admiral Burkley as to how far to go?

Dr. HUMES. Well, early on. His desire was, he's a physician, he's a family physician, he was the family physician to the President's family, his concerns were, I think, very understandable in light of the emotional attitude of the family. He was in hopes that the examination could achieve its goal in as expedient a manner as possible, which I think reasonably and accurately describes what he was——

Dr. PETTY. Does anybody have any other questions? I think we ought to, for the record, poll everyone.

Dr. BADEN. Yes. As we go around, this is the only opportunity Dr. Boswell and Dr. Humes have had to discuss this thing further, and we should make sure that there aren't any thoughts or issues that anyone has concerned that, in fairness to everybody concerned, haven't been discussed or have been left unclear. Dr. Earl Rose.

Dr. ROSE. No questions. Thank you very much.

Dr. BADEN. John Coe?

Dr. COE. No further questions. I'd also like to thank Dr. Humes and Dr. Boswell for appearing before us today.

Dr. BADEN. Dr. George Loquvam?

Dr. LOQUVAM. No questions except my sincere thanks to these two gentlemen.

Dr. BADEN. Dr. Davis?

Dr. DAVIS. No questions, but I again would like to thank them very much because I think that this has helped us and will probably help set the record straight in clarifying the issues that have been raised.

Dr. HUMES. I would at this juncture, if I might, interject one thing. It was reasonably easy to demonstrate, certainly verbally, if we didn't succeed in photographs, the wound of entrance in the posterior portion of the skull. It was not so easy to accurately locate the wound of exit because of the great disruption of the fragments and loss of tissue and bone in that area, so that we placed it a little behind or a little below or a little wherever in relation to what now we collectively may decide, after looking in a dispassionate, quiet manner, with X-rays and photographs and things that are available. I'm not a bit surprised, because X-rays No. 1 and No. 2 show you the massive defect, and it is kind of hard to pinpoint it in that massive defect. And these flaps were not firmly attached, they were bony fragments, floating around in the loose scalp.

Dr. PETTY. I have no further questions, but I think that we would have been remiss if we had not invited you to come down and give us a hand in trying to interpret the photographs. I think that any inquiry into photography, X-rays, and so forth ought to be accompanied with an on the level discussion between the people that were involved at the time and with the people that are reviewing, and I think this is just great to be able to establish some form of rapport which has been denied you, I might add, for some little time.

Dr. HUMES. Well, I would again comment for the record that we have acceded to any reasonable request from any responsible persons in this regard and have shunned any other types of discussion about this case. Well, I've gotten to know John Lattimer for other reasons. I know some of the things he's done, and I have had conversations with him. He's come and lectured and given a talk at our hospital, things of that nature, but as far as engaging in any other type of discussion, as you very well know Dr. Petty, we have not nor do we plan any such discussions we feel are inappropriate.

Dr. BADEN. Given this opportunity for all of us, is there anything further Dr. Humes or Dr. Boswell that you perhaps want to get into the record or that could be of assistance that we've left out? When 6 years from now we say, well, why didn't we discuss this or that, the record should be clear that you've been under our questioning now for 2 hours and 20 minutes.

Dr. HUMES. We're in no hurry, as I told Dr. Petty earlier, anything that would come up in the future after we leave that we can be helpful with, I would hope that you would provide us the opportunity to be of assistance.

Dr. BADEN. Dr. Boswell, anything?

Dr. BOSWELL. Nothing.

Dr. BADEN. One minor thing. Looking at the X-rays, there seem to be three of them that were taken after the body was eviscerated.

Dr. BADEN. Do you recall whether you took most of the X-rays prior to the autopsy?

Dr. HUMES. I can clarify that, because having not found a missile of any substance and having had experience in other locations, as anybody has, that bullets can do very strange things, we decided that we should take total X-rays of this gentleman to be certain that some bullet didn't travel down an extremity or go some other place. And it was at that juncture that we made the decision, because we've all had that disturbing experience to have a missile do some very strange things, so we probably had eviscerated the body before we took X-rays of the extremities for instance——

Dr. BADEN. Additional X-rays?

Dr. HUMES. Yes, whatever.

Dr. BADEN. I also want to thank you both tremendously, not only for being of help, but of being of instant help on such short notice.

K. KLEIN. And, finally, on behalf of the staff I also want to thank you both very, very much for coming down here.

[Note: The following was not transcribed.]

DR. BADEN. I definitely did ask Dr. Humes, following the transcription, whether any other post mortem X-rays were taken that he is aware of, other than those we showed him in possession of the Archives. He said definitely not, that these were the same X-rays of the President as he first saw them, and that he did not have X-rays taken of the peripheral part of the extremities, including the hands and feet.

Kennedy

005003

INVESTIGATION INTERVIEW SCHEDULE

1. Identifying Information:

Name Dr. C. James Carrico — Date Jan 11, 1978

Address Harbor View Medical Center — Place Harbor View Medical Center

City/State Seattle, Wash — Telephone _____

Date of Birth _____ — M or S _____

Social Security _____ — Spouse _____

Children _____

2. Physical Description:

Height _____ — Color Eyes _____ Hair _____

Weight _____ — Special Characteristics _____

Ethnic Group _____

3. Personal History:

a. Present Employment: _____

Address _____

Telephone _____

b. Criminal Record

1. Arrests _____

2. Convictions _____

4. Additional Personal Information:

a. Relative(s): Name _____

Address _____

b. Area frequented: _____

c. Remarks: _____

Andy Purdy Mark Flanagan

Investigator Andy Purdy and Mark Flanagan

Date January 23, 1978 Form #4-B

DATE: January 11, 1978

TIME: 2:55 p.m.

PLACE: Seattle, Washington
Harbor View Medical Center

STAFF PRESENT: Andy Purdy, Staff Counsel
Mark Flanagan, Staff Researcher

INTERVIEWEE: Dr. James Carrico

KEY: C - Dr. Carrico
P - Purdy/Flanagan

P: Dr. Carrico, we have just been discussing the events of November 22, 1963, and your treatment of President Kennedy and in some detail, the nature of the wounds for approximately the last hour. Is that correct?

C: That's correct.

P: For the record, could you please state what your present position is.

C: I'm Professor of Surgery at the University of Washington and Surgeon Chief at Harbor View Medical Center which is one of the University of Washington teaching hospitals.

P: How much experience in treating gunshot have you had since 1963?

C: One of my interests has remained the management of trauma and I would estimate I've seen roughly 60 to 75 gunshot wounds a year since that time.

P: Could you please describe the condition of President Kennedy when you first saw him in the Trauma Room at Parkland Hospital and begin in some detail, a description of those wounds and the work you performed.

C: When I first saw him, he could best be described as agonal, his color was ashen blue-gray, respiration, he did have spontaneous respirations, they were irregular, spasmodic and not very effective. The nurse reported that he didn't have a blood pressure. I listened to his chest very briefly. He had some irregular sounds which I interpreted as heart sounds. There was some urgency to establish that he had two obvious wounds, one in the anterior neck, just to the right of the trachea just below the larynx. From that wound was issuing foamy blood, mostly air, some blood with each attempt at respiration. The other wound was a fairly large wound in the right side of the head, in the parietal , occipital area. One could see blood and brains,both cerebell/um and cerebrum fragments in that wound. The area was the most urgent item and I successfully passed an oral, endotracheal tube by mouth. I noticed at that time probably some deviation of the trachea to the left, very slight, some modest amount of hematoma in the recesses to the right of the trachea. The/endotrachealtube was passed, the balloon was inflated, and we were able to then maintain adequate ventilation, although there was still some leak around the hole in the anterior neck. By that time, several other physicians had arrived, and I directed my attention to establishing more intravenous fluids,/and administration of fluids and medications while they continued to work on the .

I

P: Upon your first examination of the anterior neck wound, was there any material going in or out of that wound?

C: Air. You could tell there was air going in and out because the foamy material was issuing back and forth and you could hear the air going in and out.

P: Could you describe this movement of material as a bubbling effect -- what did that material consist of?

C: Mostly air bubbles of foamy blood.

P: In describing the foam that you saw when you placed the endotracheal tube, where was that foam coming from? Was it coming from between the vocal cords?

C: Yes it was coming up - there was some foam between his cords and a little bit of air coming out.

P: Could you describe as best you can how the wound in the anterior neck looked?

C: My total recollection of that wound was of a small, fairly circular wound, with material issuing from it. And that's really my total recollection.

P: Based on your examination of that wound, are you able to tell us anything about the direction in which whatever object caused the wound had been passing? Were you able to determine what the nature of the object had been which had caused the wound?

C: Not for sure.

]

P: What was your belief?

C: It looked like a bullet.

P: Was it your sense that it was a full bullet or a bullet fragment?

C: I would have no idea.

P: Was it your impression that the bullet that you felt had caused the wound had been traveling straight, was there a slight tumble, or was there a significant tumble to that bullet?

C: It's unlikely that there was any significant tumbling action because that would usually result in a larger wound, if that were in fact an exit. If it were an entrance wound / anyone could make no conclusions.

P: Based on your view of the wound, are you able to tell us anything about the angle through which the object passed through the President?

C: Not from my view, alone.

P: From what evidence are you able to make what determination about the angle?

C: Only that / There was some injury to the trachea behind it, so the thing must have been going front to back, rather than right to left. That's about all you could say.

P: And you said you weren't able to make a determination about the angle, so presumably that means you were not able to say that it was from lower to higher or from higher to lower?

C: That's correct. I couldn't make any guesses about that.

P: Before the Warren Commission, you were asked a question which detailed a number of characteristics of damage through the President's body of a missile. I'd like to explore that hypothetical to see which of this evidence, if any, you know from personal knowledge and what you may know other sources. You were told to assume that the missile passed through the body of the President, striking no bones, traversing the neck and sliding between the large muscles in the posterior aspect of the President's body through a faschia channel without violating the pleural cavity. Based on the evidence as you knew it, did you have independent knowledge of this fact ?

C: No.

P: I'll continue. But bruising only the apex of the right plural cavity. Did you have independent evidence that the apex of the right plural cavity was damaged?

C: No... at this point, we're beginning to get into an area where I could at least have some knowledge that was compatible with that.

P: What knowledge would that be?

C: That we saw the bruising, the hematoma beside the trachea. But I still didn't know whether the pleural was bruised or not.

P: Could the pleural have been bruised?

C: Yes, certainly.

P: I'll continue: But bruising only the apex of the right plural cavity and bruising the most aevical portion of the right lung. Did you have independent knowledge that the most aevical portion of the right lung was bruised?

C: No

P: Did you have any other evidence which would indicate that it might be or that it was likely that it was?

C: Again, that hematoma was in the area would be compatible with that, but certainly wouldn't indicate any lung injury.

P: And continuing: then causing a hematoma to the right of the larynx, which you described. As you said before the Warren Commission, I'll ask you now, was the appearance of the wound in the anterior neck consistent with those facts?

C: Yes, certainly it's consistent.

P: Could you please continue with a description of the treatment of the President after the insertion of the endotracheal tube.

C: After the endotracheal tube was inserted, as I said, the next step is to try to restore breathing -- an airway, then you try to restore the circulation. And we had adequate but not perfect ventilation. The next thing we tried to do was get the circulation going. There were already a couple of IV lines started by incisions in the ankle. Another one was being done in the arm. The President was getting fluids through those to try to get his blood pressure up. I don't know if blood had been started at that point or not. He was given some carto steroids, and Dr. Perry and Dr. Jones took over the primary management and I started

making sure that the IVs, etc. were running properly.

P: They were dealing with the primary management of what portion?

C: They were calling the shots. They were overall quarterbacking of his care, which basically consisted of trying to get vital signs, vital functions going, breathing going, circulation going, and assess how bad his head injury was.

P: What was your primary emphasis at that time. Would it be fair to say that you moved on from consideration of the airway problem to one of the circulation?

C: Yes.

P: What happened then in regard to the airway problem? What did Dr Jones and Dr Perry do?

C: The ventilation appeared to be adequate, we could not get adequate circulation. Their concern was that conceivably there was either, because there was still leakage around the trachea, that either the tube was not functioning entirely properly, or that there was some pneumothorax, some pleural injury. So they performed a tracheostomy to assure an adequate airway and instructed some other physicians to insert chest tubes to try to rule out the possibility of any tension in the thorax which could impair his circulation also.

P: What evidence did you obtain from the chest tubes?

C: Again, this is second-hand, I didn't do this. But, when the chest tubes were inserted, there was a small amount of blood,

and small amount of air, which could have resulted from the actual surgical manipulations or could conceivably have been commensurate or compatible with some very small pneumothorax or hemothorax. But basically the chest tubes did not show any signs of massive injury and did not in their insertion didn't improve the situation.

P: Did you have sufficient facts from which you could conclude that the pleural cavity was violated?

C: No, we did not.

P: Did you believe it was likely that the pleural cavity was violated?

C: We felt there was a high risk that it had been. After the chest tubes were inserted, we were sure that it was no longer potentially harmful to his life. But we still didn't know for sure whether it had been violated or not.

P: Do you have an opinion as to why there was leakage from the wound?

C: After the tube was inserted? I really don't. There are two fairly good possibilities. One is that the balloon was not completely through his trachea, either because it was not down quite far enough, or it was not blown up quite enough. Those are the two possibilities that would be most likely.

P: Why was President Kennedy given steroids?

C: Because we had, there had been an argument in the local papers a few weeks previously that raised the question of whether or

not he had adrenal insufficiency. If one does have adrenal insufficiency and is injured, then you need extra steroids.

P: If there any risk to giving the person extra steroids if they don't need it?

C: Very little. Virtually none. Matter of fact, the amount he was given is the amount that your or my adrenals would excrete in time of maximum stress.

P: How harmful would it be for a person with an adrenal insufficiency not to get steroids at a time like this?

C: Nobody really knows. The current medical opinion is that you need that adrenal support to respond to the stress. And without that kind of support, one could go into shock. If one really wants to get esoteric, you can argue about whether that's really true or not. But in general, the current medical practice would be to give them. And if one were going to do an operation on someone with adrenal insufficiency, you would give steroids prior to enduring the operation.

P: Did Dr. Berkeley give you any advice as to whether or not steroids should be given?

C: Sometime during the course of resuscitation, and I've honestly forgotten how far along, he came in, asked if the President had steroids or not, I answered something like - I've forgotten what. He handed me some vials and said, "give him these."

P: Did you give him those?

C: I handed those to the nurse, and said "go ahead and give them."

P: Did Dr. Berkeley say that President Kennedy was an Addisonian?

C: I don't recall him saying that. He just asked if he'd had / them or not and I answered in the affirmative.

P: Do you remember any discussion about whether he was an Addisonian?

C: I really did not hear any other discussion.

P: Did you witness the tracheostomy incision?

C: No, not directly.

P: Do you know why the tracheostomy incision was made?

C: Basically because there was concern that the ventilation through the endotracheal tube was conceivably not adequate. It was leaking and he wasn't doing well.

P: Did the procedure giving the tracheostomy incision give you a further look at the nature of the anterior neck wound of the President.

C: It did not give me any further look. I was not involved,

P: Did you see the anterior neck area subsequent to the tracheostomy incision?

C: No, I did not.

P: After the tube would be put into the tracheostomy incision, to what extent, if any, would a wound, or could a wound in that area be obscured?

C: Because of the nature of most tracheostomy tubes, the incision would almost totally be obscured. There is a flange over, near the mouth of the treacheostomy tube that covers most treacheostomy incisions.

P: Is it your recollection that this tube in question had such a feature?

C: I would almost be sure it did. That's from memory of tubes more than that specific technique used.

P: Did you have any evidence which would indicate that one of the President's transverse processes was fractured?

C: No, I didn't.

P: Did you have any evidence which would indicate that it was unlikely that this was the case?

C: No.

P: Would a fracture of the transverse process be inconsistent with a bullet exiting through the front of the neck as you've described the nature of the wound?

C: I don't think so. It's unlikely that a missile would have gone through the body of a transverse process and not have lost more energy than this thing apparently lost. But it certainly could have chipped one or nicked it or something like that, and not have made much difference.

P: Could you briefly describe for us the nature of the wound in the President's head?

C: The head wound was a much larger wound than the neck wound. It was five by seven centimeters, something like that, 2½ by 3 inches, ragged, had blood and hair all around it, located in the part of the parietal occipital region,

P: Could you just state in layman's terms the approximate place that would be.

C: That would be above and posterior to the ear, almost from the crown of the head, there was brain tissue showing through.

P: Would the neck wound, by itself, have been fatal?

C: No, I do not think so. I think that was a recoverable wound.

P: You think it was unlikely that it would have been fatal. Would the neck wound have permanently impaired the President's speech?

C: I don't believe so.

P: Would it have impaired the President's speech so that he could not have spoken in the Presidential limousine just after he was injured?

C: It would have made it difficult. There would have been an air leak from the trachea and it would have been difficult for him to speak in a natural fashion, with great effort he might have formed some words.

P: As one of the attending physicians, were you, was it inconsistent with normal procedure that you were not contacted by the autopsy surgeons?

C: Not really, because I was fairly far down the ladder, in being a resident. Dr Perry was above me, Dr Jones was above me. Had the autopsy been done by the forensic pathologist in Dallas, he would almost have certainly have consulted one of the attending physicians. When autopsies were done elsewhere, we ordinarily had requests for that, like you say what was routine.

P: Did you or any of the other doctors consider initiating a contact with the autopsy surgeons about what you had seen and done?

C: I did not. I don't know if any of the other doctors did or not. We did write our handwritten notes which we assumed would be transmitted with the President, either to the forensic pathothologist there or wherever. And, as I think of it, I'm not sure we were aware until some time later that they had not been.

P: Were you surprised that none of the attending physicians were in communication with the autopsy surgeons prior to the completion of the autopsy?

C: I don't guess surprised is the word. As I think back, trying to remember, I guess we assumed

(tape running while interview interrupted)

C: You asked me, was I surprised that the autopsy were not in communication with any of the attending physicians. As I say, I guess, I remember we assumed those written documents had gone to whoever was doing the autopsy, and had it been done by Dr. Rose. I think he would have contacted somebody. So I guess the best thing to say is that there was certainly limited information available to the guy who did the autopsy, and I think in general there would have been some contact, had the geography been a little closer.

P: Do you have any additional comments or points that you feel have been misstated in the record or you feel that should be cleared up, that you'd like to comment on at this time?

C: I don't believe so.

P: Do you have anything else you'd like to add to your descriptions of the wounds as you described them for this tape?

C: Only the fact that the thing we talked about earlier is that there's a big difference in what you look for for patient care and for forensics, and that we were looking for patient care. And you basically see what you look for, and we were not looking to try to determine whether this was an entrance or exit wound, anymore than we needed to know to try to determine what the life threatening complications or results of that injury might have been. So we didn't look to see where the missile came from, what it's direction was, whether it was an exit wound or not.

P: This taping session is now over. Time is 3:20.

OUTSIDE CONTACT REPORT F-34

DATE 2/27/78 TIME

I. Identifying Information:

Name Dr. Norman Chase Telephone

Address NYU Medical Center, New York

Type of Contact: __ Telephone
X Person

II. Summary of Contact:

Dr. Chase examined the JFK and Connally X-rays in the presence of Dr. Michael Baden, Mark Flanagan, and Andy Purdy. He made preliminary observations before we focussed his attention on particular areas of interest to the medical panel. JFK: Skull X-ray - The lateral skull X-ray indicated that the missile ". . .blew the top of the head off. . .striking with enormous power." The wound was massive, not the kind he would expect from a single, jacketed bullet hitting straight on; it was possibly tumbling or hit on an angle. The entry point was visible on the upper rear head. Regarding the anterior-posterior X-ray, Dr. Chase noted the large metal fragment prominent in the X-ray and said he believes it corresponds to the metal fragment in the rear of the head as evi-

II. Recommended Follow-up (if any):

Signature: Andy Purdy Mark Flanagan

Form #

dence on the lateral view. He said the frontal fragment would appear higher (than the aforementioned fragment) in the anterior view (and slightly left of center).

Dr. Chase said the head X-rays show extensive comminuted fractures of the calvarium. He said that while it is unclear exactly what happened to the top of the skull because of the extensive damage, he is sure that the skull was not perforated by a missile at any point below the one he designated as an entrance wound. When referred by Dr. Baden to the lower skull region and asked what his response would be if told that the autopsy surgeons believed there was a wound of entry there, he said he would say they were wrong.

He said the degree of damage to the skull and the fact that there was "little residual material" led him to believe the missile was jacketed. He said there is no evidence in the X-rays of a shot coming from the front or of more than one bullet striking the skull; for there to have been a second bullet, Dr. Chase said there would have to be another exit point in the skull or a bullet which was left behind (which entered the exit hole of the one bullet which entered in the upper rear of the head).

Regarding the circular temporal bone area, Chase said it appeared to represent normal skull thinning at that point but said there could be bone missing, noting the area was ". . .awfully luscent." When viewing a pre-assassination lateral skull X-ray, Dr. Chase said he believed there was

exit of bone from the temporal area, the zygomatic process (lateral view). He also noted fracture of the right orbit.

In the neck X-ray, Chase noted the presence of a metal fragment or artifact in the area of the transverse process--definitely not a bone fragment. The first rib appeared to be separated from the sternum but he had trouble noting specific evidence of a missile passing through the first or second rib. Air was noted in the subcutaneous tissue in this same region, caused by the passage of a missile and/or air entering the region due to the tracheostomy incision. He said the object present was not bone because it was too small and too dense; the little trail of dots near the fragment were believed to be artifacts. The object was about 1 mm x 2½mm--"very small." Chase said that if a break occurred in T-1 it was peculiar and had no displacement. He said that extra work on X-ray #9 might bring out this fragment in another view.

CONNALLY: Regarding the thigh X-ray, Chase said there was a metal fragment in the subcutaneous tissue and there was no fragment in the femur; the object thought to be such a fragment is artifact.

Regarding the chest X-ray, he said there was no evidence of pneumothorax. The fifth rib appears fractured in the post-operative X-ray but is not evident in the pre-op

(region of posterior axillary line or mid-axillary line). Soft tissue damage is evidenced by the presence of air and blood.

Dr. Chase had no recommendations for experts in forensic radiology.

Kennedy

INVESTIGATION INTERVIEW SCHEDULE 003974

Identifying Information:

Name Dr. Marion T. Jenkins
Address Parkland Hospital
City/State Dallas, Texas
Date of Birth
Social Security

Date 11/10/77
Place Parkland Memorial Hospital
Telephone
M or S
Spouse
Children

Physical Description:

Height
Weight
Ethnic Group

Color Eyes Hair
Special Characteristics

Personal History:

a. Present Employment:
Address
Telephone

b. Criminal Record
1. Arrests
2. Convictions

Additional Personal Information:

a. Relative(s): Name
Address

b. Area frequented:
c. Remarks:

Investigator Andy Purdy
Date 12/2/77 Form #4-B

SELECT COMMITTEE ON ASSASSINATIONS Kennedy

NAME Dr. Marion T. Jenkins Date 11/10/77 Time 4:50

Address Parkland Hospital Place Parkland Memorial Hospital

Dallas, Texas

Interview: By: Andy Purdy, Esq.

Dr. Jenkins (anesthesiologist) was one of the first doctors into the Parkland trauma room where the President was. He said the President's thick shock of hair largely covered up the head wound. However, Dr. Jenkins was positioned at the head of the table so he had one of the closest views of the head wound (believes he was " . . . the only one who knew the extent of the head wound.") His location was customary for an anesthesiologist.

Dr. Jenkins said he knew the President was non-resuscitable from his experience with many similar injuries (with the exception of the head injury). He noticed that blood gushed out of the head with each cardiac massage compression.

Dr. Jenkins said he bears the responsibility for the postponement in the determination that the President had expired. Because the President was his patient, he used an artificial respirator inspite of his professional determination that he was non-resuscitable.

Dr. Jenkins said he turned to a priest standing nearby and asked him what the Catholic Church's position is regarding what constitutes death and when the last rites must be adminis-

Interviewer Andy Purdy
(Signature)

Andy Purdy
(Name)

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tered. He was told they must be given within two hours of a medical determination of death.

Regarding the head wound, Dr. Jenkins said that only one segment of bone was blown out -- it was a segment of occipital or temporal bone. He noted that a portion of the cerebellum (lower rear brain) was hanging out from a hole in the right -- rear of the head.

During the emergency medical procedures, Mrs. Kennedy came in the room and gave Dr. Jenkins a piece of the President's brain. Mrs. Kennedy, the priest, and Dr. Jenkins were the last three people to leave the trauma room.

Dr. Jenkins attempted to explain (on his own initiative) Dr. McClelland's Warren Commission testimony that the President had a wound of the left temple. He said McClelland did not personally see the wound and misinterpreted Dr. Jenkins' feeling the President's left temple for a pulse as indicating there was a wound there.

KENNEDY

006133

OUTSIDE CONTACT REPORT

DATE 2/27/78 TIME 2:30

I. Identifying Information:

Name Dr. John Lattimer Telephone

Address Columbia Presbyterian Hospital, New York City

Type of Contact: __ Telephone
X Person

II. Summary of Contact:

Dr. Michael Baden, Mark Flanagan and Andy Purdy viewed a private slide and (brief) film presentation by Dr. John Lattimer concerning the Kennedy assassination-related work he has done and information he has accumulated.

Dr. Lattimer's presentation did not deviate from the substance of his articles. The movie was exceedingly brief and depicted experiments he had done firing Mannlicher-Carcano ammunition at filled skulls. In his test firings (at least those depicted) the skull went backward and to the left.

In addition to his review of the autopsy photos and X-rays, he has done repeated test firings of similar Mannlicher-Carcano ammunition. He believes the ammunition and rifle are exceedingly accurate and reliable. He postulates that the first shot occurred at Zapruder frame (Z)166 and was a miss

III. Recommended Follow-up (if any):

Andy Purdy Mark Flanagan

Signature:

deflected by a tree which broke up and/or imbedded itself in the street pavement. He believes the second shot occurred at about Z-220 and struck the President in the upper back, passing through him near the spine. Lattimer attributes the President's reaction (raising his arms coming from behind the sign) to an involuntary physical response caused by the shock to the spine (he cites "Cases of Injury to the Cervical Region of the Spinal Cord," 1889, by William Thornburn). He believes this second bullet caused the wounds to Kennedy and Connally. He indicated that the bullet which injured Connally "must" have passed through Kennedy first or the bullet would have had so much force that it would have passed through Connally's thigh (he believes the fragment was in Connally's femur). He said the "3 cm" wound in the thigh indicated a tumbling bullet, i.e., one which struck something else first (either JFK or a tree limb; latter not in alleged line of fire at Z-220). Asked hypothetically what inferences could be drawn if the Connally back wound was 1.5 cm, Lattimer said the bullet would have been tumbling. Lattimer said the only other cause of an elongated entrance wound would be a tangential bullet strike; however, he said a tangent strike on Connally would have caused horizontal elongation instead of the vertical elongation present on Connally. Lattimer's theory of 3 shots (with the first missing and burrowing into the pavement) accounts for the curb shot on the theory that it was a fragment from the head shot.

Lattimer has done no testing of bullet deflection by hitting trees; or of burrowing into pavement by such ammunition; or of simulation of the deceleration of a bullet which passed only through Connally to see if it would necessarily penetrate Connally's thigh.

Regarding his assertion that the vertical slit in JFK's shirt was because the bullet left him tumbling (and not merely characteristic of a bullet exit), Lattimer said he had neither seen nor done testing of this phenomenon.

Lattimer said there was an irregularity of bone in the vicinity of the transverse process which he believes represents generally that a missile passed through the area and, specifically, that there was a fracture of C-6 or C-7.

Lattimer believes the "single bullet" struck Connally's rib (as opposed to a "slap wound"), flattening the bullet scraping off a piece of lead which he believes is visible in the Connally chest X-ray.

Lattimer believes the wrist wound was caused by a slowly traveling bullet because of the nature of the wrist damage (much less severe than if a bullet had hit it first) and the minimal fragment displacement evident.

Regarding the Edgewood Arsenal testing, he said the simulation of the head shot was very similar to the damage he noted in JFK upon viewing the autopsy photos and X-rays. However, he said they incorrectly used the autopsy doctors' figure for the location of the head entry wound, which is about 4" lower than the wound as seen in the photos and verified in the X-rays. He expressed mild surprise that the incorrect entrance wound point still resulted in approximate skull damage.

Connally wound characteristics which indicated to Lattimer that the bullet struck something else include (in summary): elongation of entrance wound; Connally's wrist "was

only in position" to be struck at time of JFK wound; Connally was seated directly in front of JFK; the bullet which struck the thigh would have shattered it if it hadn't been significantly slowed by tumbling.

Lattimer said he doubted that a fragment from the JFK head shot could have wounded Connally's wrist because the damage was caused by a fragment of too substantial a size to have caused the extent of damage evident in the X-ray.

Dr. Lattimer indicated that he has spoken to the autopsy surgeon, but doesn't have interview notes or transcripts. He does not have an explanation for the discrepancy in the location of the entrance wound in the rear of the head, believing it resulted from poor measurement techniques by individuals not sufficiently schooled or experienced in forensic pathology. He believes the autopsy doctors would realize their mistake upon reviewing the photos and X-rays.

Dr. Lattimer also stated that he spoke to Dr. Gregory (Governor Connally's wrist surgeon) several times about the nature of the damage in the wrist. Dr. Gregory is deceased.

On other subjects Lattimer said: He knows the generic origin of the rifle strap used by LHO; LHO practiced dry-firing his rifle according to Marina; Ruby's pistol had a metal shroud covering the hammer to facilitate its being fired from within a pocket or under clothing (he showed a photo which purported to be of Ruby's gun); and Ruby's psychiatrist (Bromberg) told him Ruby had his pistol with him earlier in the weekend at the police station.

Dr. Lattimer also suspects that Ruby fired his pistol using his middle finger as a trigger finger. Lattimer says that this allows the index finger to steady the barrel, and is an indication of familiarity in firing weapons.

SELECT COMMITTEE ON ASSASSINATIONS F-4C

NAME Dr. Malcolm Oliver Perry Date 1/11/78 Time 4:40 p.m.

Address University of Washington Medical School Seattle, Washington Place Dr. Perry's office

Interview:

Dr. Malcolm Perry is currently a professor of Surgery at the University of Washington Medical School. He can be contacted at 206/543-3105. Andy Purdy and I interviewed Dr. Perry because of his participation in the medical treatment of President Kennedy at Parkland Memorial Hospital in Dallas, Texas.

Dr. Perry began the interview by stating that the intervening 14 years since the assassination have "not sharpened my recall." Dr. Perry then proceeded to relate his recollection of the wounds of President Kennedy and of the medical treatment the Parkland doctors administered to JFK.

Dr. Perry began by stating that one of the wounds that JFK had suffered was "about 1/3 of the way" up on the anterior aspect of the neck. Dark blood (a sign of insufficient oxygen) was oozing from the wound when Perry first observed JFK. Dr. Perry believes that the wound measured approximately 6-7 mm in size and was roughly round, although he couldn't state for sure since combating the two primary medical emergencies of restoring breathing and stopping bleeding prevented him from even taking the time to wipe

Interviewer Andy Purdy T. Mark Flanagan Jr.
(Signature)
Donald A. Purdy, Jr. / T. Mark Flanagan, Jr.
(Name)

Date Transcribed 1/30/78 mc by

the blood from the wound. Perry said that Dr. Jones, who was already treating JFK when Perry arrived, had inserted a tube down the trachea to facilitate breathing but that the air passage still seemed blocked. Due to this dilemma, Dr. Perry determined that a tracheotomy was necessary "then or never" and therefore made a transverse incision straight through the bullet wound on the anterior aspect of the neck at approximately the second or third trachea ring. While Perry performed this operation, Dr. Jones initiated I. V. treatment. At approximately this time, Drs. McClelland, Barter, and Peter arrived to assist in the treatment of President Kennedy.

Based on his examination of the trachea, Dr. Perry stated that the lateral wall of the trachea was damaged and had the characteristics of a penetrating rather than a blunt trauma. In the vicinity of the strap muscles, Dr. Perry observed some discoloration of the pleura; it looked like "it was bruised, with some blood" present. Perry stated that on the basis of this observation alone, that the blood could have been from the trachea or the lung. For this reason, other Parkland doctors inserted chest tubes into JFK's chest to help treat any possible injury

to the lungs. Perry then surmised that on the basis of the lateral wound to the trachea plus the skin wound on the anterior portion of the neck, that some type of pathway from a bullet was present but that the exact trajectory was very difficult to determine since bullets do not necessarily travel in straight paths, particularly if they are partially spent.

Perry followed this statement by saying that there was no discernible path. Further, at no time during his treatment of JFK was Perry aware of the wound in the President's upper back. Dr. Perry also stated that little bleeding was coming from this wound and that based on his observations, no major artery had been hit in this area.

Dr. Perry, an expert in arterial injuries, stated that the amount of blood loss or the degree of arterial injury can rarely be diagnosed through blood pressure and that a major artery can be struck without necessarily causing major blood loss.

Dr. Perry also mentioned that during his treatment of President Kennedy other Parkland doctors began cardiac massage which lasted approximately twenty minutes. At the conclusion of the cardiac massage, Dr. Kemp declared JFK dead.

Dr. Perry stated that the throat wound alone probably was not fatal and would not have prevented JFK from speaking.

Perry "looked at" the head wound "but didn't examine it." He believed the head wound was located on the "occipital parietal" region of the skull and that the right posterior aspect of the skull was missing. Dr. Perry did not detect or look for any possible entry wound in the rear of the head.

Dr. Perry stated that Dr. James Carrico, then a first-year resident, recalled that the President may have had Addison's Disease and therefore administered steroids to combat any possible shock that may have occurred. Dr. Perry also stated that steroid treatment tends to produce a sense of euphoria. Dr. Perry could not recall if Dr. Burkley, the President's physician, had also given the Parkland doctor steroids to administer to JFK.

Dr. Perry stated that after Dr. Kemp Clark had declared JFK dead, he proceeded upstairs to where other doctors were attending Governor Connally. He specifically aided Dr. Thomas Shires who was operating on Governor Connally's thigh wound. Dr. Perry's role in this treatment

was limited to determining whether the bullet had struck an artery. Dr. Perry stated that it had not.

Dr. Perry described the wound to Governor Connally's thigh as superficial. In regard to the fragment shown in the X-ray of Governor Connally's thigh, Dr. Perry stated that it appeared to be imbedded in the thigh. Perry stated that it is normal procedure not to remove fragments so long as they pose no harm (such as being very close to a major artery) since fragments themselves would not cause infections. What's harmful are the threads of cloth a fragment will sometimes carry into a wound when it travels through clothing.

After showing Dr. Perry a tracing from one of the autopsy photographs of the tracheotomy wound, Dr. Perry stated that the small half sphere in the bottom of the sketch along the perimeter of the incision was quite likely part of the bullet wound. He did say, however, that this irregularity could have been caused from the weight of the tracheal tube which can deform the perimeter of the incision.

This interview was concluded by a taping session concerning a concise description of JFK's wounds.

KENNEDY

006370

INVESTIGATION INTERVIEW SCHEDULE

1. Identifying Information:

Name Dr. Malcolm Perry Date 1/11/78

Address University of Washington Place Same

City/State Medical Center Seattle, Washington Telephone _____

Date of Birth _____ M or S _____

Social Security _____ Spouse _____

Children _____

2. Physical Description:

Height _____ Color Eyes _____ Hair _____

Weight _____ Special Characteristics _____

Ethnic Group _____ _____

3. Personal History:

a. Present Employment: _____

Address _____

Telephone _____

b. Criminal Record

1. Arrests _____

2. Convictions _____

4. Additional Personal Information:

a. Relative(s): Name _____

Address _____

_____

b. Area frequented: _____

c. Remarks: _____

Investigator Andy Purdy/Mark Flanagan

Date 1/11/78 Form #4-B

SELECT COMMITTEE ON ASSASSINATIONS

NAME Dr. Malcolm Perry Date 1/11/78 Time 5:45 p.m.

Address Place University of Washington Medical Center Seattle, Washington

Interview:

FLANAGAN: Staff members present are: Andy Purdy, Staff Counsel; Mark Flanagan, Staff Researcher. We are interviewing Dr. Malcolm Perry.

PURDY: Okay...and then, Dr. Perry, you could please acknowledge that we are taping you and that this is with your permission.

DR. PERRY: This is with my permission and I am here.

PURDY: This will all -- let the record show that we have just had a discussion which began approximately 4:30 -- this, of course, is Pacific time -- where we went through the chronology of events of November 22nd, 1963, which you were involved in, and your specific recollections about the treatment and the wounds. Is that correct?

DR. PERRY: That's correct.

* * * * *

PURDY: Dr. Perry, could you please state your present position.

PERRY: I'm Professor of Surgery at the University of Washington, vascular consultant and chief at Harbor View Medical Center.

PURDY: Could you please tell us what experience you've

Interviewer Andy Purdy Mark Flanagan
(Signature)
A. Purdy/M. Flanagan
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had with gunshot wounds since 1963.

PERRY: Well, happily, it hadn't been exactly the same, but I've had quite a bit and I remained after 1963 when I returned to Parkland and University of Texas Southwestern Medical School from California as an Assistant Professor of Surgery. I stayed there until 1974, and during that time I remained as Chief of Vascular Surgery at Parkland Hospital and the VA Hospital and had the opportunity to treat numerous traumatic wounds of all types -- gunshot, knife, blood trauma, and over the ensuing years up till 1974 around several hundred cases. And then subsequent to arriving here, and inasmuch as I run a trauma service at Harbor View Medical Center, I've had the opportunity to continue to treat traumatic wounds of all types -- probably, oh, several every month. I don't keep a compilation. Those figures are available in my records, of course, but I don't have it off the top of my head.

PURDY: Could you describe, generally, President Kennedy's condition when you entered the room and what treatment was under way.

PERRY: When I reached the emergency room at Parkland that day, the President had just been brought in and the initial resuscitation was under way. There were several people in the room -- the nurses and several doctors. And Dr. Jim Carrico, who was the first-year surgical resident in charge in the emergency room, was attempting to establish an airway. He had a laryngoscope in his hand and was attempting to get an endotracheal tube in. IV's were being started and the President's clothing was being removed to

permit us access to the limbs for intravenous fluids and resuscitation and placement of various catheters and tubes. He had agonal respiration. I attempted to feel for a pulse in the left groin and didn't feel one. And Jim said he had no blood pressure but that he was breathing. And he also apprised me at that time that there was a wound of the trachea that he could see through the laryngoscope, but he couldn't get the tube past it -- it was too far down. And I asked for a tracheostomy tray, and Betty Hinchcliffe, one of the nurses, had already prepared it, and I dropped my coat in a corner and put on some gloves and started to prepare to do a tracheostomy to get the airway. At that time I noted a wound in the anterior aspect of the neck in the lower third which was roughly round, exuding, very slowly, dark blood, partially obscuring its edges. The wound was somewhere, probably 4 to 6 mm in diameter. I did not have her wipe the blood off and inspect the wound and gave it a cursory glance while I was putting my gloves on and preparing the trache tray. I also asked at that time that several other doctors, specifically, McClelland, Baxter and Dr. Clark, be summoned from the medical school to come and help. And I asked Dr. Jones to start an IV, and Dr. Carrico, who was also busy with another IV at the same time, I think in the leg, as I recall it. And then I took the knife and I cut directly through the anterior neck wound in an attempt to secure control of the trachea and the tracheal injury that Jim had mentioned. I noticed a head injury, but I didn't examine it at that time, but I did see some evidence of brain tissue on the cart. I reached

the trachea and the strap muscles, which were bruised as I previously noted in my testimony before the Warren Commission, and at that time I secured the trachea with an Allis clamp and brought it up to the field and I saw the injury to the right lateral aspect of the trachea where it had been damaged and I cut into the trachea at that spot and started to place an intratracheal tube in. And about that time a set of hands came into field to help me, which later I identified as Dr. McClelland's, and we completed placing the tracheostomy tube into place and hooked him up to the respirator. Because there was some bruising and also some bubbly looking blood over there on the right seriatal pleura, upper portion of the chest, why I thought perhaps there might also have been a hemo- or pneumothorax accident. I asked Dr. Baxter to put in a right chest tube, which he did. And Dr. Jones put in a left one, I think, about the same time. And the respirator was going. I didn't see any other evidence of injury and there was very little bleeding because he had no obtainable blood pressure. There didn't seem to be anything else hitting the neck other than the trachea and some of the muscles on the looser radial tissue and the bruised apical pleura. About that stage, Dr. Clark had arrived and he told me that the electrocardiograph indicated that cardiac arrest had just occurred, and so we started closed cardiac massage. And we persisted with that until it became apparent that it was futile. And Kemp said, "well, it's too late to get him back," and so I quit.

And I looked at the head wound briefly by leaning over the table and noticed that the perietal occipatal head wound was largely evulsive and there was visible brain tissue in the macard and some cerebellum seen and I didn't inspect it further. I just glanced at it and I went on outside and later was summoned up to the operating room to help in the care of Governor Connally.

PURDY: Could you give us a characterization of the edges of the anterior neck wound?

PERRY: Yeah. I previously pointed out that they were neither ragged nor clean-cut. I suppose that's a misnomer because, actually, I didn't inspect it that well. What I meant to infer by that initial description was the fact that I couldn't see a clean punched wound; it was roughly round, the edges were bruised and a little blurred because, as I mentioned, there was several big drops of old blood, and some of it coagulated, of course, on and about the wound, so I didn't really inspect the margins carefully. I think the terms I used before was neither ragged nor clean-cut -- and that may not have been appropriate. I should have probably said I couldn't see 'em that well -- it might have been a better answer.

PURDY: You described the damage to the trachea as you saw it. Was there some further description you can give of damage? I think you stated previously, for example, that there were some bruises...

PERRY: Yeah, it's on the right lateral side of the trachea -- there was a laceration. But again, I don't remember exactly how I put that all these years ago, but it was on the right side of the trachea, and that it was incomplete, and I don't remember whether it was a third or a quarter of the circumference, and -- I can't remember exactly. There was a laceration. The bruising that I mentioned was in the apical pleura and the strap muscles. The trachea was clearly lacerated.

PURDY: You also stated prior to the taping that there was possibly some damage in the mediastenum?

PERRY: Mediastinum.

PURDY: Mediastinum?

PERRY: Yeah. That's that same area. The mediastinum is that area that's bounded by the lungs on each side, and the sternum in front, and the spine in the back. Contains the heart and all the great vessels and various structures.

PURDY: You described the use of the chest tubes to determine whether or not there was any pneumothorax or hemothorax...

PERRY: Let me...actually not to determine, Andy, but to treat. I didn't know whether there was or not. I surmised there might well be a hemothorax or pneumothorax because, not knowing the trajectory of the —of the missile, and when I saw the bruised apical pleura and there was some bubbly blood in that area, and I didn't know whether that blood had been frothed a little bit as a result

of air coming out of the trachea in our attempts to breathe for him or whether it was coming out of a lung. And as a result, since a tension pneumothorax or serious chest injury could have obviously been a serious problem, why we elected to put in a chest tube. But the chest tube, I later learned, was not necessary because the chest cavity was not violated -- but I didn't know that at the time. It wasn't done diagnostically; it was done therapeutically.

PURDY: How did you determine that the pleural cavity was not violated?

PERRY: Found that out later in the autopsy report.

PURDY: Was your feeling at the time that you finished your treatment that the pleural cavity had been violated or you...

PERRY: Didn't know -- didn't have any idea. I didn't -- we didn't do any more. After Dr. Clark and I decided that resuscitation failed, why I didn't do anything else, so I don't really know. I didn't find that out until some time later.

PURDY: What did your inspection of the anterior neck area disclose to you about the condition of major vessels in the area?

PERRY: Well, of course, that didn't tell me anything. As we discussed a little earlier, he had no blood pressure that was obtainable, and therefore, there was essentially very little bleeding. Even if he had had a major arterial injury, why he might have bled out and there wouldn't have been much; but there was no evidence of a major arterial injury. And the artery, the course that's closely applied to the trachea is the common carotid artery at that level. But it was not injured.

PURDY: Would President Kennedy have survived if he had only suffered the injury to the neck?

PERRY: Assuming the lack of complications, the odds are quite well and good that he would have. Occasionally, tracheal wounds are associated with subsequent stenosis and required repairs, but they generally--a wound such as this is usually survivable -- yes.

PURDY: To what extent, if any, would the President's speech have been impaired in the short or the long term?

PERRY: Well, this is again some of that conjecture that got me in a lot of trouble before, but I suspect very little. There's no reason why he couldn't talk with that particular injury that was temp...an artery -- that's not enough to keep him from talking. It was below the larynx and it wouldn't have been, constituted enough of an air leak so make him so breathless that he couldn't speak.

FLANAGAN: Dr. Perry, could you go over and describe the conversations that you subsequently had after treating the President at Parkland with Dr. Humes, the surgeon who performed the autopsy?

PERRY: Yeah. This won't be too accurate, Mark, because I found out, interestingly enough, that later I had my dates a little bit fouled up. They called me twice and I couldn't remember -- I didn't write 'em down. I've learned to keep better records since then, but -- and I didn't remember exactly when they called me and about what, but I was called twice back from Bethesda. And the conversation of the first one, as I recall, and I need, I should go back and look at my testimony in my notes here

and I haven't done that, I guess, I should have to find out exactly what we're talking about on that first one. But we discussed the thing and I told him about the tracheostomy wound and told him that I had cut right through the small wound in the neck. And Dr. Humes at that time had described that they had had a little difficulty tying up that posterior entrance wound -- as allegedly to be an entrance wound, I shouldn't get in this hot water -- that posterior wound with the -- couldn't find out where it went. And they surmised that during the cardiac massage and everything that perhaps the bullet had fallen out -- which seemed like a very unlikely event to me, to say the least. But at any rate, when I told him that there was a wound in the anterior neck, lower third, he said: "That explains it!" I believe that was the exclamation that he used -- because that tied together their findings with mine. Now there was a second call about the chest tubes, I think. And I believe that was the next day. I'm not sure of that. Maybe they called me twice that morning.

PURDY: At one point in your testimony, to help clear it up with you, you said that the calls came about 30 minutes apart.

PERRY: Was it twice in the same morning? It's possible. There should be something in the record of that. They had a record of it, Andy, and I just don't remember, you know. Between Friday and the President and Sunday and Oswald, and all those conferences and interviews, I got a little bit confused -- 'cause Saturday morning I was asked to come up to the hospital and talk to a whole bunch of people and so I was up there Saturday too. And I don't

remember -- but maybe it was two, both...

... Saturday was when they called?

PERRY: Yeah, twice.

FLANAGAN: I believe so.

PERRY: But they called twice. And they asked me about the chest tubes—or something to that effect. Was it chest tubes?

PURDY: Yeah. In your testimony you say that "the initial phone call was in relation to my doing a tracheotomy," and you informed them...

PERRY: ...that I'd cut right through the wound.

PURDY: Right. Do you remember whether or not there was any discussion in either of the calls about whether there had been any surgical incisions made in the President's back?

PERRY: I don't remember. I don't know why they would. He might have asked me, but I didn't even look at his back--so I wouldn't have known the answer to that if there had been. But I don't recall him asking that question. He might have asked -- I got asked so many questions along about that time, I don't remember who asked them. I didn't even look at Mr. Kennedy's back -- which was another thing I wish we'd have done.

FLANAGAN: One further question on these lines. To your knowledge, did the Bethesda Hospital or Humes -- did they ever receive any, for instance, handwritten notes that might have been taken by them...

PERRY: Should have.

FLANAGAN: ...I mean after the assassination.

PERRY: Yeah. You know, we -- yeah, that's a good question, too, Mark, because we all sat down afterwards and wrote out in our own -- as Li'l Abner would say, hand writ -- notes our recollection of what happened down there, knowing that we'd get a little fuzzy about it. And I think they got copies of those; I'm not sure of that, though. Those copies were available, because we made them available to the investigating committees, and I know our inspector and all the guys around here. We all wrote down some of them and they were available for everybody. I think several of the people from various investigating agencies looked at 'em. They made a bunch of copies and they should be widely circulated. Interestingly enough is the discrepancy between what people remember -- it's kinda like the blind men and the elephant -- that's what they remember. Dr. McClelland's and some of the others' are quite different from some of ours -- which I thought...

FLANAGAN: Is this normal procedure -- that Parkland Hospital would follow writing down...

PERRY: No. Normally, what we do -- well, normally, yes; but normally just one of us. Normally, the guy -- myself, for example, since I ostensibly was responsible for the surgery and the rest of it, normally the guy who's attending and who's doing the job writes a summary about it afterwards for the record. The reason all of us did was we thought it might be important -- more than the usual -- to have a good record. I'm not sure it served its purpose. I haven't read everybody's, but I've read some of them and I found they didn't correspond with what

I remembered.

PURDY: Do you remember any in particular?

PERRY: No, no, but I remember the stuff about Bob McClellands. We talked about that later because we talked about the thing in the temple. And we all kind of laughed about that but I just, you know, Bob was told when he joined in there and like me he didn't spend much time because he saw I needed help. And when he started helping me with the trache, he asked where he was shot. And somebody told him he was shot in the left temple and he accepted that as being true, when actually it wasn't true and I think Bob wrote that down -- or if he didn't write it down, he told somebody that, which was interesting. But, you know, you get naive and trustworthy and that's a bad way to be.

PURDY: As you recall, your testimony says that the second conversation you had with Dr. Humes was in regard to the placement of the chest tube for drainage of the chest cavity.

PERRY: It's interesting to me -- and I'm not being critical-- but it's interesting to me that the pathology report does not reflect that. The autopsy report said that those incisions were made to combat subcutaneous emphysema, which is not a -- in the current jargon -- a viable therapeutic technique.

FLANAGAN: What would have been a normal routine, if it existed at the time, after someone taken into emergency expired, and then you wrote up some reports...

PERRY: What do we usually do?

FLANAGAN: What would occur then with the reports, for instance?

PERRY: They'd go in the hospital records.

FLANAGAN: Hospital record with the forensic pathologist in the area that might examine the body...

PERRY: Yeah, they're all there. It all goes in the record. We'd write a narrative summary and I must say, if I may be a little bit immodest, I write mine right away. I'm very good about that sort of thing -- mainly because I found that if I do it right then, it's like an operative report. When I come out of the operating room I dictate the operative report right then because it gets progressively hazier. And I usually sit down and write it as soon as I finish. I write a short op. note anytime I do an operation on the chart. We prepare them right then. And that's what we would do. And that would become a part of the legal hospital record.

PURDY: To what extent, if any, did your observation of the nature of the President's wounds in the anterior neck convince you that a missile of some kind had gone through that area?

PERRY: Well, I suppose I could enumerate those, Andy. It's kinda like, you know, I can look at you and Mark and I tell -- I know which one's which without enumerating the features of your physiognomy. I've got a picture of you in my head now. Well, it's the same thing with this. When I looked at that -- there's an injury to the side of the trachea, there's a wound in the front of the neck, there's some concussive damage to surrounding organs -- these are the kind of things one sees with gunshot wounds in a blast injury and that sort of business. And with high velocity when you see a lot. Now the low velocity stuff -- it's often just a track, a wound track, with very little

concussive or blast injury. And this one was in between. There was evidence of some blast injury, but not like, say, one sees with a high velocity rifle like a 3006 or 223 or something. This is quite different.

PURDY: Did your observations of the nature of the wounds give you any information as to the possible trajectory of a missile through the President?

PERRY: No, I really can't say that. I can speculate again, and I did speculate about that -- but all I can say is if you were to tie up the wound in the neck, the wound in the trachea, and the strap muscle business, apparently something passed that way. And as I mentioned earlier, the pathway of bullets striking tissues of varying densities is not uniformly rectilinear -- it curves and moves with it -- and they may be deflected by what appears to be a relatively minor structure -- a tough fascia layer, a muscle layer, or something -- it may deflect the bullet, especially if it's down, if its energy's low and it's down near the bottom of its velocity curve, it may be deflected in travel for long distances in a circuitous fashion. So I think it's very chancey business to make conjectures about trajectory when you don't have the whole wound track exposed and you're just looking at two points. We never probe wounds, for example, that's ridiculous; it doesn't help you a bit. And you get all kinds of wounds in which you try to project where it went, and that's an exercise in futility, usually. So, I don't know where it went.

That may be more than you wanted to hear about that, I don't know.

PURDY: Do you have an opinion based on those two points that you described as to the origin of the missile that caused the damage?

PERRY: No, I don't, and the reason is that I didn't clearly identify either an entrance or an exit wound. In the press conference I indicated that the neck wound appeared like an entrance wound, and I based this mainly on its size and the fact that exit wounds in general tend to be somewhat ragged and somewhat different from entrance wounds. Now, this doesn't pertain, of course, in bullets that are deformable or in bullets that are tumblers, and many bullets, especially fired from the handguns and this sort of thing, tend to tumble, and as a result, they make keyhole injuries and various things. But in general, full jacketed bullets make pretty small entrance holes. And so I don't really know. I thought it looked like an entrance wound because it was small, but I didn't look for any others and so that was just a guess.

PURDY: Based on your observations of the wounds, was it more likely that the damage was caused by a missile or something like a small bone fragment?

PERRY: Oh, I think it's more likely to be a missile from that than bone fragment. The only reason I say that is that secondary missiles, which is what a bone fragment would be, generally don't attain the velocities that produce this sort of thing. They can, but usually would not at that level. Remember Governor Connally

had some secondary missile damage as a result of a bullet striking his fifth rib and the rib acted as a secondary missile. But that's not the usual and I think it's probably just...

PURDY: Is it possible that the missile which caused the wound in the anterior neck could have fractured the transverse process and still resulted in the type of wound that you saw?

PERRY: I suppose so. Again, you're asking me to make a lot of suppositions which get me in trouble, but I suppose so. If one had a fairly high velocity missile that was full jacketed, it would have enough remaining velocity to go on through after striking something, like a transverse process -- it could get on through. You're talking now about tangential wounds and thickness of bone and all this sort of thing, and we don't even know bullet types. So these things are possible, yes, but it doesn't seem very likely. But again, that's a guess and it's not worth any more than that -- than a guess -- on my part.

PURDY: Based on your experience with wounds in these intervening years, have you been able to draw any firmer or any different conclusions based on the nature of the wounds you recall?

PERRY: Do you want a short answer? Or a long answer?

PURDY: Like whatever answer you want to give.

PERRY: Okay, let me give you a medium answer, but with a qualified anecdote. The answer is no, I haven't. I haven't changed my mind about any of it and the reason is I have no new information. As I mentioned earlier, 14 years hasn't sharpened my

recall. I've told it as well as I can remember it. But I did it best when I was fresh -- and things change a little bit. But I was just telling you, just night before last I had a young lady shot with a 3006. We had a multitude of wounds in that young lady, and they were hard to explain. Her right humerus was shattered with an injury to the artery and the ulnar nerve was transected The whole back of her arm was blown off. She also had a fractured radius in the left arm with no injury to the artery. It was fractured and there was no fragments in that wrist. She also had a wound to her left neck area, and a fragment was in there. We had the devil's own time trying to figure it out and then later we found out what happened. She was shot, and with a 3006 hunting rifle, high velocity, which blasted her arm pretty good. The bullet hit the concrete, shattered, and those other two were secondary injuries from the fragments that got her arm and got her neck. But we didn't know that. And this is the kinda thing you can get into. So I don't know.

FLANAGAN: Dr. Perry, you mentioned earlier that after you had been down /in Trauma Room1 administering to President Kennedy that you then went over to see Governor Connally in the Operating Room -- I guess that's upstairs in Parkland Hospital.

PERRY: Second floor

FLANAGAN: Could you relate the scope of your involvement in treating Governor Connally?

PERRY: Yeah. When I left downstairs I went outside a minute and sat down and then they called and asked me if I'd come up to the OR where Dr. Shires was operating on Governor Connally's leg. Dr. Shaw and Dr. Gregory had been involved, of course, when we were working on chest and arms and this sort of thing. He had a penetrating injury of the left thigh, as I recall, kind of anterior-medial and so I went up and got a scrub suit, changed clothes, and went back to the OR -- which was my operating room, as a matter of fact, back in OR5 where I usually worked -- and Dr. Shires was looking at the wound. They'd incised the skin; and were looking at the thigh wound, and I just looked over his shoulder and agreed with their opinion that the wound was not serious, that it had not penetrated deeply into the leg, that the artery was not in danger, and that it wasn't necessary to expose the artery.

PURDY: Could you describe the approximate size and depth of the...

PERRY: No, Andy, I'm no help because the skin incision had been made and -- but the tissue looked fine. It didn't look like there was much of anything wrong with it. So, whatever it was, it was near spent, I suppose, or it was very minor because there was none of the type of thing one sees with any velocity in a missile, any significant velocity.

PURDY: Was it your opinion that it was a full bullet, part of a bullet, or a very small part of a bullet that caused the wound?

PERRY: Well, I don't know because there was so little wound I don't think I can say that -- but I was underwhelmed with what I saw, as the saying goes. It didn't look to me like much of a wound at all when we saw it. There wasn't much to it. Again, that's qualified because I didn't see the skin before...

FLANAGAN: What was the doctors' concern, if any, over the fragment that was in the thigh of Governor Connally?

PERRY: Well, the question came up whether that could possibly have come from a fragment that went zipping down through there and might have damaged some of the neurovascular bundle. As we indicated earlier, Mark, you're not really so concerned with the fragments themselves but what may be between where they began and where they ended. And inasmuch as where this wound was and the size and the scope of that fragment, we deemed it highly unlikely it caused any significant damage. And as I said, I was underwhelmed with the whole thing. I don't even know that that fragment wasn't there from before. I mean, we have no previous X-rays of that area. I guess it came then, but I've become a little more supicious in my older age and seen people that have injuries that you don't know about. I don't know how long that had been there. No controls.

PURDY: Dr. Perry, I think that finishes the formal questions we had and we wanted to give you an opportunity to expound on any aspects of the nature of the wounds that you didn't have sufficient time or any items which perhaps had been left unresolved by previous testimony.

PERRY: Yeah, I...

FLANAGAN: Suggestions or comments

PERRY: Yeah, I feel I've already cluttered up your tape with a lot of professorial homilies and aphorisms throughout the course of this thing and I'm sorry about that, but it, you know, you make this a stilted one but I hope not to. No, I don't have any other comments. I wish to hell I remembered a little better and I wish I could add something substantial to your investigation, but I fear that I have no new information. I wish I had not speculated as to where the wounds came from. As I said, after our operation on Mr. Oswald when I had the press conference, at that time I had a typed prepared statement of what I had done when I operated on him and I didn't answer any questions. I found that was a very -- much better way to do things. And there was no hypothetical questions, no suppositions -- a typed statement was handed out and I didn't get in a lot of group discussions about what might have been. But I don't have anything else to add. I don't have any new information.

PURDY: One final short question. Did you or any of the doctors consider initiating any communications with the autopsy surgeons prior to the completion of the autopsy?

PERRY: No, we didn't and perhaps we were remiss in not doing so. It might have been a good idea. We ordinarily do that, as you know, and your question is very germane to what's going on here because ordinarily if I have a patient that dies very recently I usually call the pathologist down and we'll talk about it before and usually I try to attend the autopsy if it's done at

a time when I'm not in the operating room because it's an important part of our ongoing education. We always learn something. And I always tell 'em what I'm worried about. And sometimes I even assist in the autopsy if it's a specific case where that I think perhaps that the patient I operated on and the the knowledge that we get from that is helpful. And perhaps we should have called Commander Humes. It would have helped a lot had we done that, but the circumstances in which Mr. Kennedy was removed from the hospital were precipative and abrupt, and most of us, quite frankly, weren't asked or consulted or anything about any of it and it was all just done. And as a result, we were essentially moved out of the area of environment and involvement and we assumed that that was it. And I -- perhaps that was our error. It'd been nice if we'd of talked to them before they started; I think we could have helped them a lot. And we probably should have initiated that ourselves, knowing what we knew.

PURDY: Thank you. Okay, Time is now 6:15. This taping session is over.

FACSIMILE - No. 003490

KENNEDY F-29

SELECT COMMITTEE ON ASSASSINATIONS

Name Dr. Jack Reynolds Date 11/9/77 Time 2:15 - 3:45

Address Parkland Hospital
Dallas, Texas

Place Dallas County Department of Forensic Sciences
Dallas, Texas
Dr. Charles Petty's office

Interview:

Dr. Reynolds was the radiologist who conducted the X-raying of the wounds of Governor Connally. He submitted nine Reports of Diagnostic X-ray Consultation pertaining to the examination of these X-rays. These reports occurred between 11-22-63 and 12-4-63. Andrew Purdy and myself interviewed Dr. Reynolds for two reasons:

(1) to determine if Dr. Reynolds had any additional comments or corrections to make concerning Gov. Connally's X-rays; and

(2) to show Dr. Reynolds the enhanced versions of Gov. Connally's X-rays.

Dr. Reynolds had no new revelations; his comments can be summarized as follows:

(these observations are based on the examination of the original and enhanced X-rays)

Interviewer Signature _____

Typed Signature T. Mark Flanagan, Jr.

Date transcribed _____

By: ____ Form #4

1) Wrist - After examining the original and the enhanced X-rays, Dr. Reynolds stated that there are at least four fragments of metal identifiable in Gov. Connally's wrist wound. Further, since these fragments are all volar to the wrist bones, this indicates that the missile traversed the wrist from the dorsal to the volar side. Dr. Reynolds stated that all of these fragments are extremely small in size; he stated that the actual size could possibly be ascertained but that the density and thus mass would remain unknown. Dr. Reynolds stated the /sic/ Gov. Connally's wrist suffered a comminuted fracture, which means fractured into three or more pieces. Dr. Reynolds also stated that he was not qualified to determine whether the missile struck the wrist directly or tangentially.

2) Thigh - Dr. Reynolds stated that only identifiable opacity exists in the thigh X-rays and that it definitely has metal characteristics. He stated that his 11-29-63 report, describing the location of this fragment as just beneath the skin in the region of the subcutaneous fat, is correct. The fragment is definitely not imbedded in the femur.

Place: Dr. Petty's Office
Dallas, Texas

3) Chest - Dr. Reynolds stated that the X-rays show two areas of abnormality within the fifth rib. One area shows approximately 10 cm of the fifth rib missing; the other area is a simple fracture which Dr. Reynolds feels resulted from the stress of a missile striking the area where the 10 cm is missing. Dr. Reynolds stated that no metal fragments are present.

After terminating the discussion of the substantive issues, Andy and myself advised Dr. Reynolds that he could contact us at anytime if he had any additional comments or questions regarding Gov. Connally's X-rays or the assassination generally.

Also present during this interview:

1) Dr. Charles Petty - Director of the Dallas County Dept. of Forensic Sciences
2) Dr. Robert R. Shaw - the thoracic surgeon who attended Gov. Connally.

OUTSIDE CONTACT REPORT

FEBRUARY 27, 1978.

I. IDENTIFYING INFORMATION

Name: Dr. William B. Seaman.
Telephone:———
Address: Columbia Presbyterian Hospital, New York City.
Type of Contact: Telephone.
X Person.
Contact By: Andy Purdy
Mark Flanagan

II. SUMMARY OF CONTACTS

Dr. Seaman examined the JFK and Connally X-rays in the presence of Dr. King, Dr. Michael Baden, Mark Flanagan, and Andy Purdy. He made his preliminary observation before his attention was focused on areas of particular interest to the medical panel.

JFK—Regarding the lateral skull X-ray, Dr. Seaman said pieces of metal were strewn in a track-like manner. Fractures were evident through the upper part of the right eye, including the top and bottom of the right orbit. The bottom of the frontal sinus was fractured. At the upper rear skull point of possible defect in the skull, Dr. Seaman said it could be an entrance wound and could not be a missile exit wound. He said he could not denote leveling of the skull at that point.

III. RECOMMENDED FOLLOW-UP (IF ANY)

He found inferences difficult to draw from the extensive damage to the top of the skull, which includes overlapping skull pieces. The lower head was fairly intact, with no evidence of entrance or exit in the region ("very unlikely"). The upper point (mentioned earlier), "suggests entry, but is not conclusive."

Regarding the neck X-ray, Dr. Seaman said there was a fragment-like object present near the transverse process which is too dense to be bone ("fairly confident"). He said the transverse process appears abnormal with air present (possibly by-pro of tracheotomy) calling it "* * * highly suspicious compared with the other side." He thinks he can "* * * see the fragment separate (also in No. 9), and concludes there is a possible fracture in C–7.

Connally—Wrist—Comminuted fracture with fragments. He was not sure if the fragments were on the entrance (volar) or exit sides. Dr. Seaman concludes from the spatial orientation that they are fragments of metal.

Thigh—Dr. Seaman denoted a fragment of metal in the subcutaneous tissue, characterized by a tail-like end which make it recognizable on both thigh X-rays and insures it is not bone. There is no metal fragment in the femur.

Chest—Dr. Seaman noted an area of consolidation and fluid in the right chest. In the fifth rib he noted a fracture and fragment of bone in the anterior axillary line with evidence of hemorrhage, and air in the axilla.

Regarding the possible existence of a higher fracture in the fifth rib, Dr. Seaman said he was a "little skeptical" of it as a fracture, because he couldn't see it fractured all the way as evidenced in a subsequent (even now) X-ray might provide more information about exactly what happened. Dr. Seaman found no evidence of metal fragments in the chest, and couldn't form an opinion as to the nature of the object visible on the left side.

Dr. Seaman had no one to recommend who is an expert in forensic radiology. He did say Dr. Juan Taveras, of Massachusetts General Hospital (Boston) is a skull expert who might have something to contribute.

SOUTHWESTERN
INSTITUTE OF FORENSIC SCIENCES
AT DALLAS
5230 Medical Center Drive
Dallas, Texas 75235

TELEPHONE 638-1131
AREA CODE 214
REPLY TO:
P.O. BOX 35728

005095

Office of the Director

February 2, 1978

Mr. Donald A. Purdy, Jr.
Staff Counsel
Select Committee on Assassinations
U.S. House of Representatives
3331 House Office Building, Annex 2
Washington, D.C. 20515

Dear Mr. Purdy:

At 1:05 p.m. on November 9, 1977 Robert R. Shaw, M.D. former Professor of thoracic surgery at Southwestern Medical School was interviewed in my office at the Institute of Forensic Sciences. Present at the time of the interview were Mr. Donald A. Purdy, Jr., T. Mark Flanagan, Jr., and of course Doctor Shaw and myself.

Doctor Shaw appeared to be a very healthy, enthusiastic man whose powers of recollection are excellent, although some of the observations that he related were obviously somewhat stereotype because of many previous interviews regarding the subject at hand. To a very marked degree the information and answers given by Doctor Shaw were similar to those reported in the article published in volume 60, January 1964 of the Texas State Journal of Medicine.

I shall attempt to condense what Doctor Shaw related to me at the time of the interview for ease of reading. I will put the report in the form of a series of very small paragraphs. You already have the original diagram made by Doctor Shaw illustrating the point of entrance and exit of the bullet in J.B.C. and also showing to the best of his recollection the actual size of both the entrance and exit wounds.

J.B.C. was lying on his back when first seen by Shaw. A 5 cm. greatest dimension wound was present just below the right nipple. It was irregular in shape, sucking and there was paradoxical motion noted.

Lateral to the scapula on the right posterior thoracic wall was a small wound.

Doctor Shaw debrieded the anterior wound.

There was a tunnel made by the missile in passing through the chest wall.

The bullet struck the fifth rib in a tangential manner and shattered approximately 10 cm. of the posterior and lateral aspect of the fifth rib. The serratus anterior muscle was torn and the fifth and sixth intercostal muscles were intact and the periostium of the rib was nearly intact.

Shaw removed more of the fifth rib to enter the chest wall. There was damage of the middle lobe of the right lung due to the impact upon the chest. It actually was ripped into two segments and there was a leak in the bronchus. The lower two thirds of the lower lobe of the right lung looked just like liver "just a bag of blood."

Shaw repaired the right middle lobe. It inflated well. There was not need to touch the lower lobe of the right lung except for a 1 cm. long rent in it. This was oversewn.

Shaw cut off approximately 5 cm. of the anteriorly placed chest tube and placed a posterior tube in the 8th interspace.

There was an obvious rent in the latissimus dorsi muscle. A Penrose drain was placed here.

The wound in the back was shaped as if the bullet had entered at a slight declination. Shaw probed through this wound with his finger and felt the Penrose drain that he had placed in the latissimus dorsi muscle.

In measuring the diagram made by Doctor Shaw at the time of this interview so the better to illustrate the size of the entrance and exit wounds, it is interesting that the entrance wound measurement taken from this diagram are 1.5 x 0.8 cm. with the long dimension in the longitudinal plane of the body (the long axis of the body) and that the exit wound is approximatley 5 cm. in greatest dimension.

At the conclusion of the interview Doctor Shaw signed the diagram this was witnessed by Purdy, Flanigan, and Petty, the original copy taken by Purdy.

Although conclusions are not called for, this being merely a report of an interview, it is obvious that Doctor Shaw is describing a wound of the chest which did not pass through the plural cavity but rather was more of a "slapping" wound.

Sincerely yours,

Charles S. Petty, M.D.

CSP:jf
d

SELECT COMMITTEE ON ASSASSINATIONS F-71

NAME Dr. Robert Shaw Date 11 9 77 Time 1:00

Address 7403 Villanova Place Dallas County Institute of Forensic Sciences, Dallas

Dallas, Texas 75225 214 691 6136 -- 214 752 3752

Date of Birth: 11/15/05

Interview:

Dr. Shaw arrived at the trauma room in which Governor Connally was being treated five minutes past his arrival. The residents (Drs. Boland, Duke, Giesecke) had done an excellent job.

The Governor's front chest had 5 cm. (obvious) wound of exit - paradoxical motions of chest were evident. There was a smaller tunneling wound in the back/chest. The bullet struck the 5th rib in a tangential way pushing it out, causing a fracture at a point farther up the rib (like a tree limb breaking from pressure exerted near its end). Bullet and rib fragments exited out the front of the Governor causing the larger exit hole.

Shaw said the lower 2/3ds of the Governor's lower lung lobe was like liver, full of blood and holes caused by secondary (bone) missile fragments. There was a rent in the latissimus dorci.

The rear entrance wound was not 3 cm as indicated in one of the operative notes. It was a puncture-type wound, as if

(continued)

Interviewer Andy Purdy
(Signature)

Andy Purdy
(Typed)

Date Transcribed 11/17/77 by

a bullet had struck the body at a slight declination (i.e. not at a right angle). The wound was actually approximately 1½ cm. The ragged edges of the wound were surgically cut away, effectively enlarging it to approximately 3 cm.

Wrist: The wrist wound had been described as a "comminuted" fracture, meaning (according to Dr. Shaw) it was "compounded" (I.E. in more than two pieces). The work on the wrist was primarily done by Dr. Gregory (deceased).

Dr. Shires did the work on the thigh wound.

In response to Dr. Petty's questions, Dr. Shaw provided the following:

1) The bullet entering the back did not strike dead on, hitting instead on a decline.

2) The entrance wound was olvode (see Dr. Shaw's drawing attached).

3) The shape of the entrance wound was consistent with a missile striking in a slightly downward trajectory. It is Dr. Shaw's opinion that the wound was not caused by a tumbling bullet (an inference drawn, explicitly, from his belief that a tumbling bullet would not have had sufficient force to cause the remainder of the Governor's wounds).

4) Dr. Shaw believes that the bullet which hit the Governor had not struck any other objects because of his conclusion that the bullet was not tumbling.

He does note that the entrance wound was longer along the vertical axis.

5) The bullet did not traverse the thorax; it was essentially "...a chest wall wound ...," with much of the damage to the Governor being caused by a "blast-like" effect which resulted from the bullet tangentially striking the fifth rib, turning pieces of it into secondary missiles.

6) He described the chest wound as a "slap wound" exerting an inward force on the body from the secondary fragments.

7) The blood found in the lung's lower lobe was from a tear in the middle lobe and contusion from the slapping effect of the bullet, as well as from the penetration of multiple rib fragments ("...it was very much like a blast injury ...").

8) The bullet did not traverse the lung; there was essentially a chest wall injury which involved the lung because of a blast injury effect ("...there was a bronchial tear in the middle lobe in addition to the rent...").

Dr. Shaw examined the original Connally X-rays and the enhanced copies. He could not detect any metal fragments in the chest or in the femur (thigh bone). The only metal fragment he denoted was a small one in the subcutaneous tissue in

in the thigh. He did notice the rib fracture in the chest X-ray, as well as rib pieces.

Dr. Shaw indicated that the enhanced X-ray of the fragment in the thigh convinced him that the object was metal because it has greater density than bone and the existence of a hook-like end of the object is more consistent with metallic than with bone characteristics.

Regarding press accounts that he felt the metal fragment was too heavy to have come from C.E.399, Dr. Shaw said he is not qualified to speculate as to the actual size or weight of the fragment in the thigh or those in the wrist (even though he admittedly did so before the Warren Commission 4 H 113). He did say he has never been satisfied that the bullet found on Governor Connally's stretcher had caused all of the Governor's wounds.

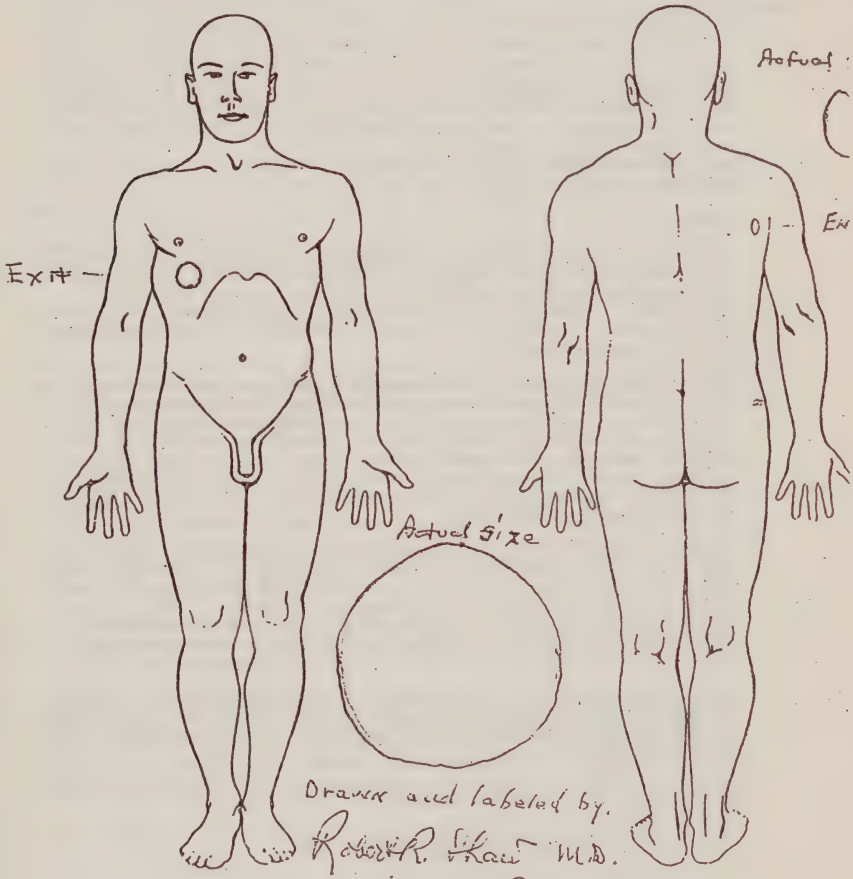
Shaw believes the "...bullet found on the limousine floor was more likely the one which went through Connally." He believes the bullet that went through the President's neck may have gotten caught in the Governor's clothing and another bullet struck the Governor causing his wounds.

Regarding the wrist wound, Shaw said he first thought the bullet entered through the volar aspect and exited the dorsum; he was later convinced by Dr. Gregory (and currently believes) that the exact opposite was the case.

THE SOUTHWESTERN INSTITUTE OF FORENSIC SCIENCES
AT DALLAS

Name_____ Autopsy No._____

Color_____ Age_____ Date_____



Drawn and labeled by.
Robert R. Haut M.D.
11/9/77 Witnessed by:
Donald A. Purdy, Jr.
Frank J. Chapman, Jr.

For protocol

SOUTHWESTERN
INSTITUTE OF FORENSIC SCIENCES
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005095

Office of the Director

February 2, 1978

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Staff Counsel
Select Committee on Assassinations
U.S. House of Representatives
3331 House Office Building, Annex 2
Washington, D.C. 20515

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The wound in the back was shaped as if the bullet had entered at a slight declination. Shaw probed through this wound with his finger and felt the Penrose drain that he had placed in the latissimus dorsi muscle.

In measuring the diagram made by Doctor Shaw at the time of this interview so the better to illustrate the size of the entrance and exit wounds, it is interesting that the entrance wound measurement taken from this diagram are 1.5 x 0.8 cm. with the long dimension in the longitudinal plane of the body (the long axis of the body) and that the exit wound is approximatley 5 cm. in greatest dimension.

At the conclusion of the interview Doctor Shaw signed the diagram this was witnessed by Purdy, Flanigan, and Petty, the original copy taken by Purdy.

Although conclusions are not called for, this being merely a report of an interview, it is obvious that Doctor Shaw is describing a wound of the chest which did not pass through the plural cavity but rather was more of a "slapping" wound.

Sincerely yours,

Charles S. Petty, M.D.

CSP:jf
d

KENNEDY

005009

INVESTIGATION INTERVIEW SCHEDULE

I. Identifying Information:

Name Dr. George Thomas Shires
Address _____
City/State _____

Date 1/9/78
Place New York Hospital - Rm. F739 East 74th Street New York City
Telephone _____

Date of Birth _____
Social Security _____

M or S _____
Spouse _____
Children _____

II. Physical Description:

Height _____
Weight _____
Ethnic Group _____

Color Eyes _____ Hair _____
Special Characteristics _____

III. Personal History:

a. Present Employment: Cornell Medical School
Address New York, New York
Telephone _____

b. Criminal Record
1. Arrests _____
2. Convictions _____

IV. Additional Personal Information:

a. Relative(s): Name _____
Address _____

b. Area frequented: _____

c. Remarks: _____

Investigator Andrew Purdy Mark Flanagan

KENNEDY

SELECT COMMITTEE ON ASSASSINATIONS

NAME Dr. George Thomas Shires Date 1/9/78 Time 11:40 a.m.

Address _____ Place New York Hospital
East 70th Street
New York City
Room F739

Interview:

Dr. Shires was interviewed by Mark Flanagan and Andy Purdy, with assistance from medical consultant Dr. Michael Baden.

Dr. Shires initially recapped the events leading up to and comprising the medical treatment of Gov. John Connally. Dr. Shires said Dr. Shaw was a thoracic surgeon, so he worked on the wound to the torso; Dr. Gregory was an orthopedist, so he worked on the wrist; and Dr. Shires worked on the thigh wound. Dr. Shires arrived after the other work had already begun, coming from a Western Surgical Association meeting in Galveston, Texas.

Dr. Shires said his work on the thigh was "...largely an exploration to insure that there was no vessel damage." Dr. Shires said the only significant wound in the thigh was a missile tract. He says he merely did a debridement. When asked if the thigh wound could have been caused by a secondary fragment, Dr. Shires said you "...can't tell anything from the size or shape of the wounds as to whether or not it is an entrance or exit wound." He said that when dealing with fragments, there are many unknowns and variables and that it's hard to differentiate fact from fiction.

Interviewer _____
(Signature)
A. Purdy/M. Flanagan Mark Flanagan
(Name)

Date Transcribed 1/20/78 by am
(In

Dr. Shires said the wound was small and that the thigh had very little damage and did contain a metal fragment. Dr. Shires was asked about his Warren Commission testimony that noted a peculiarity in the nature of the wound; namely, that the tissue damage seemed more significant than the size of the fragment present. He said that it is difficult to determine how the fragment entered. He said "...all you can say is that a tangential wound occurred." He said that there are a large range of possibilities for what happened. Significantly, Dr. Shires said the main issue he was seeking to resolve by the examination of the thigh was whether the missile could have hit a major vessel. He said it did not, and that he did not physically pursue the fragment that was there because it was "...not medically significant." Dr. Shires said he was able to determine that the fragment was in the thigh bone from his examination of the original Connally X-rays.

At this time, we showed Dr. Shires the three original thigh X-rays and the enhancements of these X-rays. Dr. Shires said that it doesn't make any difference whether the metal fragment is in the femur or just under the skin with regard to the issue of whether there was a full bullet striking the thigh or a fragment of a bullet. He said the wounds were probably caused by a tangential hit. He said a tangential wound could have sent the fragment anywhere into the thigh. Dr. Shires noted that on the enhancement of the thigh the

item in the bone looks more like an artifact than when he examined the original. He was open-minded about the possibility that the fragment could have been just under the skin, but preferred to reiterate his initial impressions that the fragment was in the thigh bone. Dr. Shires said that while they explored the entire track of the missile, they were not "...exploring it as a track..."; rather they were "...exploring the wound looking for a big missile injury." Dr. Shires said he found little hemorrhage, so he felt it was likely that a high velocity missile did not pass through the skin causing the wound.

Dr. Shires' recollections of the treatment conducted and the nature of the thigh wound was then tape-recorded.

TRANSCRIPT OF INTERVIEW OF DR. G. THOMAS SHIRES

Introduction to tape:

DATE: January 9, 1978

TIME: 3:55 P.M.

PLACE: Dr. G. Thomas Shires' Office
Cornell Medical School
New York, New York

Dr. Shires is Chief of Surgery, Cornell Medical School

INTERVIEWERS PRESENT: Donald A. Purdy, Jr., Staff Counsel
T. Mark Flanagan, Staff Researcher

CONSULTANT: Dr. Michael Baden (also persent)

Dr. Shires consented to taping of session.

ABBREVIATION CODE: P - Purdy
F - Flanagan
S - Shires
B - Baden

P: Okay, Dr. Shires, we have just had a general discussion of events leading up and the surgery that you performed on Governor Connally on November 22, 1963, and then had a discussion of the specific nature of the wound to the thigh which you operated on, and you have examined the original X-rays of the thigh wound and enhancements of those X-rays, is that correct?

S: Right.

P: Okay. I want to ask you about the thigh wound. Specifically in your report of November 22, 1963, as I read to you previously, you described the wound as follows:

"There is a one centimeter punctate missile wound over the juncture of the middle and lower third, medial aspect, of the left thigh. X-rays of the thigh and leg reveal the bullet fragment which was embedded in the body of the femur in the distal third."

P: Is that a correct statement of your understanding of the wound in the Governor's thigh, and what the X-rays of that wound reveal?

S: Right.

P: I have here a report of November 29, 1963, prepared by Dr. Jack Reynolds, who was a radiologist at that time, where he also described the thigh wound. He said as follows:

"...There is, however, one density which remains constant on both films and appears to lie beneath the skin in the region of the subcutaneous fat in the medial aspect of the thigh."

He also said that this density lies

"...15.2 centimeters above the distal end of the medial femoral condyle on the AP film and on this film, lies 8 millimeters beneath the external surface of the skin. It is 6.25 centimeters medial to the femoral shaft."

Now, obviously there is a difference in terms of the location of the metal fragment. Do you believe that the metal fragment was in the thigh bone itself or do you believe Dr. Reynolds is correct, saying it's in the region of the subcutaneous fat? Or do you believe it could be either way?

S: I think it could be either way. The wound in the skin was described as a tangential wound, which means that it was larger than a direct entry of the fragment wherever it might be located, would have generally made. Therefore, the tangential nature, the long nature of the wound could have been made by the fragment on a tangent to the skin, then entering subcutaneous or bone, or it could have been made by a larger missile with a fragment coming off and lodging

in subcutaneous tissue or bone. So, I think that it could be either. Medically, the fragment was not sought. Because medically the reason for exploration of the wound was to make certain there was no injury to adjacent structures, primarily artery and vein, and none was seen. No search was made for the fragment as it generally is not, in a wound of this nature where the indication is to determine surrounding injury, so that the fragment could have been either place.

P: Did you have occasion to explore the region between the location where Dr. Reynolds said the fragment was located and the bone itself to see if there was, in fact, damage there?

S: Right. Looking for a vessel or other structure injury.

P: And, as you stated, you did not find any such injury?

S: No.

P: And it is your feeling that that does not necessarily preclude the fact that there could have been some damage there, in other words, that the fragment could have actually been in the bone itself?

S: Right. It could have been damaged. But this is a small fragment and in wounds like this, you never really look for the fragment, you're looking for significant injury that might do subsequent harm. And none was found.

P: In other words, you were not trying to remove that fragment?

S: That's right; that's right. Nor even search for it. You're searching for injury to vital structures, not for

a fragment itself.

P: Does your examination of the enhancements of the Connally X-rays affect, at all, however slight, your impression as to whether or not the metal fragment was located in the bone itself or just under the skin?

S: With the artifacts that are over the bone, I think it's very difficult to tell. On the anterior, correction, on the lateral view, it appears that the most likely defect would appear opposite bone. On the other hand, on the anterior-posterior view, it would appear it could either be bone or subcutaneous tissue. I can't really say with certainty.

P: But, either way, it is your belief that your description of the possible causes of the wound in the thigh are still as plausible as before you considered the possibility of the metal fragment being located just under the skin?

S: Exactly, I think the reason the nature of the wound was described as tangential was that it was too large for a right angle fragment or a right angle bullet to have made this, with no more evidence on X-ray of fragments than there were. So that a bullet could have hit it at an angle and left the wound, leaving the fragment behind, or the fragment could have been at such an angle that it caused a linear tangential wound in the skin and then dived either subcutaneously or in the bone, but I don't think you can preclude either possibility.

P: So you're saying the wound could have been caused by either that small fragment evident in the X-ray or by a full bullet which deposited that fragment?

S: Exactly.

P: What, if anything, can we conclude from the nature of the wound of the thigh about the velocity of the bullet, or the size of the bullet?

S: Nothing definitive. In general, a high-velocity large wound will have, will leave more evidence of tissue damage. You would conclude that in general this wound showed no evidence of large-mass, high-velocity injury at any depth at all. Again, this can be, this can be in error. For example, extremely high-velocity small calibre injury can leave a tremendous amount of damage. A large calibre low velocity injury can leave a tremendous amount of damage, so there are in the injury spectrum, it's very hard to say from the nature of the wound anything more than it's less likely that there was a large-mass, high-velocity tissue injury, less likely.

P: And in layman's terms, that means you believe that it is not likely that a high-mass, high-velocity bullet struck this thigh without first being slowed down by hitting something else?

S: I can't say that. I just don't know. I think it's, from the wound, you can say that it's less likely that a high-velocity, high-mass injury penetrated very far.

P: I see.

B: Well, let me just, to recapitulate, is there anything in your review of the original X-rays of the femur which Mr. Purdy brought from Washington today, which you reviewed, the original procedure, inconsistent with the report that Mr. Purdy read to you by Dr. Reynolds?

S: No, nothing inconsistent.

B: And, do you have an opinion or do you feel it fair to ask an opinion on the basis of the injury in the thigh and on the basis of what you knew in general about Governor Connaly, since you were the chief of service at the time, consistent or inconsistent with the wound in the chest, wrist, and thigh coming from the same missile?

S: There's nothing inconsistent about that, no.

B: They could have all happened from the same, a single missile?

S: They could.

P: Well, furthermore, can you state that it is likely that those wounds were caused by the same missile?

S: No.

P: Okay. And as the middle point between likely and anything not inconsistent with, can you say that it's unlikely that they were caused by the same missile?

S: Can I say it's unlikely they were caused by the same missile?

P: All those wounds in Governor Connally.

S: No. I mean I can't say that either way, because a tangential injury, let's assume that it was not a fragment for a moment, tangential injury could be made by any size, shape or velocity missile, and still leave a fragment and give exactly what was given here, so that I can't say that it's likely or unlikely that that bullet had been somewhere else first.

P: Did you have the opportunity to sufficiently examine the other wounds of Governor Connally to draw a conclusion as to whether those wounds, as well as the wounds in the thigh, were caused by the same bullet, or was your examination just confined to the thigh wound?

S: No, mine was just too late for that because the thoracotomy and the exploration of the arm were already underway, so I never really saw an existing wound. What I saw was a surgical wound. Attempt to repare the damage that had been done, so that's why I really, you know, can't give an opinion about it at all.

F: Well, Dr. Shires, before concluding the tape, do you have anything at all you would like to add, not only pertaining to the medical evidence of Governor Connally, but any other area at all in connection with the investigation of the assassination? Do you have any comments you would like the (something) to have at this time?

S: No, nothing that I know of has happened, you know, since the day of the assassination that would have changed our opinion from what we recorded with the attorneys at the time,

in terms of additional knowledge or subsequent developments in the care of the patient or any of that sort of thing. Realizing that our testimony was given I guess several weeks after the episode, a good many days, so that the general patient care, the fact that the Governor got well and so on had already occurred, so we really, I guess, wouldn't expect anything subsequently to have happened that would have changed anything we gave as depositions at that time, when it happened. Maybe a pertinent negative, I don't know. We didn't, we haven't learned anything subsequently that would have changed what we said.

P: Dr. Shires, from the nature of the thigh wound and your examination of the X-rays, do you believe that the metal fragment today would be in pretty much the same location or would it possibly have exited the body?

S: Now?

P: Yes.

S: I have no idea, I really don't. Perhaps you can answer this better than I can.

B: Well, I would just, my impression would be that unless it were taken out in the process of debredment, which Dr. Shires did, it was so small it could be taken out without noticing it.

S: (In background, uhum). Right; without knowing it.

B: Then it would have stayed in and be there; it wouldn't have worked it's way out, unless there was an infection or something.

S: I agree with that. It may well have been removed in the

course of the exploration because it is a tiny fragment and as I say, medically, what you're looking for is adjacent structure injury, not the fragment itself, so it could well have been, could well have come out as a part of the exploration. If not, I would assume, like you, that it would still be there. You leave fragments all the time in wounds and by and large, and there are notable exceptions, but by and large, they're there forever, for years and years, and cause no difficulty at all. That's one reason we don't chase the fragments so to speak. Now, when infection occurs usually it was carried in at the time of the injury, and came off organisms that were on the clothing or the skin and generally speaking, if there is to be infection and exclude that fragment, it will occur fairly soon. On the other hand, we've seen them years later develop infection around a fragment and exclude it. So it can always happen, many, many years later. But, as far as I know, that's not happened to him and I would assume it was either, came out in debredment, or would still be there on X-ray.

P: Was the exploration of the thigh wound sufficient that if the metal fragment was located in the femur itself, it might have come out during the surgical procedure? Did you explore that far in? (S: Poss..)

S: We weren't looking for the fragment, but again, in an exploration of a wound, it's possible. Because, you know, saying it is in a femur is what, for example, whether this was on the surface or, you really can't tell

because the films weren't made for that purpose. That was not the reason for the X-rays. So it could well have come out as part of the exploration.

B: I think just for the record, while we have the opportunity, if you can mention to the best of your recollection how the track looked when you got into it, how the wou d on the skin looked and the track looked as far as..

S: Just very, very minimal damage. Really minimal tissue damage.

B: Not much bleeding?

S: Right. Right.

B: And you explored down to the, looked at the blood vessels...

S: Right.

B: without necessarily seeing a hemorrhagic track?

S: That's right. Minimal damage, which I think we described in there as very minimal.

B: The other point about...

P: If I could ask how large was it? Do you think the one centimeter in your report is an accurate description of how large the wound in the thigh was?

S: That's what I said.

B: That's the depth of the track, Andy?

S: No. The tangential wound.

B: Tangential wound. One centimeter.

S: I described...

B: On the skin surface.

S: Right.

B: The other thing I thought would be of value is just a brief recollection that we discussed briefly before, about exactly where you were when this happened, how you, the time it took you to get to the operating room?

S: As to why I got in sort of after the others were in progress?

B: That's, yes, where you, as chief of service were, and when.

S: Yeah, the meeting of a national surgical organization, the Western Surgical Association, was meeting in Galveston, as it happened that year. This organization meets in different cities all over the country each year, and after giving a paper at that meeting that morning, I got a telephone call from Dr. Shaw, who's a thoracic surgeon, that operated on the Governor, telling me what had happened, about the President and the Governor, and saying that they were, that they had three areas of injury and they were beginning to operate on the one that was the most pressing, which was the thoracic injury, and hoped I could get back and shortly after that, some calls were made in Galveston and the Air Force actually picked me up and took me back to Dallas. So when I got to the oeprating room, the first, the President had already, body had already been removed and the two other procedures were well along, the thoracic and the orthopaedic procedure, and then this third procedure was started to make certain there was no significant vessel injury.

B: The other part about it, would you have any comment for the record, as to your recollection about the forensic

pathological aspects of what happened as far as the removal of the body, and...

S: Not firsthand, it was all resolved, hearsay. In talking to the pathologist, he thought the autopsy should have been done by him there at the time and apparently made his feelings well-known to them.

B: This was the forensic pathologist..

S: There, at the hospital..

B: Who was..., at the hospital..

S: Dr. Reynolds, who really thought that it should be done immediately, and apparently it was decided, superceded and the body was taken to Washington.

P: Any other comments or questions? (Pause)

F: Is everything over now at this time?

P: Yeah. Just...

F: The time is now 4:14. This taping session has been concluded.

Addendum J

Letter From Michael M. Baden, M.D., Concerning Identification of the X-Rays Examined at the National Archives, January 19, 1979

The City of New York

DEPARTMENT OF HEALTH
OFFICE OF CHIEF MEDICAL EXAMINER
520 FIRST AVENUE, NEW YORK, N.Y. 10016
Telephone: 212-684-1600

MICHAEL M. BADEN, M.D., *Chief Medical Examiner*

January 19, 1979

Mark Flanagan, Esq.
Select Committee on Assassinations
U.S. House of Representatives
Washington, D.C. 20515

Dear Mr. Flanagan,

Pursuant to our discussions, a statement should be contained in the Forensic Pathology Panel report concerning the x-rays examined at the National Archives. These x-rays were identified and verified to the Panel by Dr. John Ebersole as the same x-rays that he had taken before and during the autopsy of President John Kennedy; that they show the same findings now as then; and that none are missing, none have been added and none have been altered. Further, the x-rays were independently and individually confirmed by comparison to pre-existing x-rays obtained from the John F. Kennedy Library.

Red adherent numbers were affixed to each x-ray for identification purposes by Dr. Ebersole, which are the numbers referred to below. At the time the x-rays were taken the following Hospital identification marker was used:

21296
US NAVAL HOSPITAL
NNMC BETHESDA MD
F 11 22 63

1- Skull: anterior-posterior view
2- Skull: right lateral view (Dr. Ebersole advised the Panel that he placed the penciled lines present to obtain anthropomorphic measurements)
3- Skull: left lateral view
4-, 5-, 6- 3 separately received skull bone fragments with no identification marker present
7- abdomen: after autopsy was begun
8- right chest and arm: after autopsy was begun
9- Chest: anterior-posterior view-prior to autopsy
10- Left chest and arm: after autopsy was begun; identification marker not present
11- lower chest and upper abdomen - after autopsy was begun; identification marker not present
12- Knees and thighs
13- Pelvis: before autopsy
14- Pelvis: after autopsy was begun

Sincerely,
Michael M. Baden
Michael M. Baden, M.D.

MMB:mr

REFERENCES

(1) FBI report, DL 100–10461, Warren Commission Document No. 205, pp. 153–154.
(2) Ibid.
(3) Letter from J. Edgar Hoover, Director, FBI, to J. Lee Rankin, General Counsel, the President's Commission, Mar. 23, 1964.
(4) See reference 1, pp. 153–154.
(5) Ibid.
(6) Letter from Frank Scott, photographic evidence panel, to House Select Committee on Assassination, June 13, 1978.
(7) Autopsy protocol, John F. Kennedy, U.S. Naval Medical School, Nov. 22, 1963, A63–272, p. 3 [hereinafter cited as autopsy protocol].
(8) Autopsy descriptive sheet, U.S. Naval Medical School, A63–272, Nov. 22, 1963.
(9) See reference 1, pp. 153–154.
(10) See reference 3.
(11) *Report on soft X-ray and energy dispersive X-ray analysis of the clothing of John F. Kennedy and John B. Connally*, Southwestern Institute of Forensic Sciences, Dallas, Tex., Charles S. Petty, M.D., director, Feb. 1, 1978 (JFK Document No. 005090), [hereinafter soft X-ray report], see addendum F to this report.
(12) Autopsy protocol, p. 3.
(13) Id. at p. 4.
(14) Testimony of Dr. Malcolm O. Perry, hearings before the President's Commission on the Assassination of President Kennedy, (Washington, D.C.: U.S. Government Printing Office, 1964), Volume III, p. 368, (hereinafter Perry Testimony, III Warren Report, 368).
(15) Staff interview of Dr. Malcolm O. Perry, Jan. 11, 1978, House Select Committee on Assassinations, p. 1 (JFK Document No. 006370).
(16) Id. at p. 2.
(17) Staff interview of Dr. Malcolm O. Perry, Jan. 11, 1978, taped segment, House Select Committee on Assassinations, p. 15 (JFK Document No. 006370).
(18) The President's Commission on the Assassination of President Kennedy. Commission exhibit No. 392, vol. XVII, p. 4.
(19) Staff interview of Dr. C. James Carrico, Jan. 11, 1978, House Select Committee on Assassinations, p. 3 (JFK Document No. 005003).
(20) Ibid.
(21) Testimony of Dr. James J. Humes, hearings before the President's Commission on the Assassination of President Kennedy, (Washington, D.C.: U.S. Government Printing Office, 1964), volume II, p. 363 (hereinafter Humes testimony, II Warren Report 363).
(22) Staff interview of Dr. William B. Seaman, Feb. 27, 1978, House Select Committee on Assassinations, p. 2 (JFK Document No. 006132).
(23) Autopsy protocol, pp. 4–5.
(24) Id. at p. 5.
(25) Ibid.
(26) Letter and notes from Pierre A. Finck, M.D., USA, Chief, Military Environmental Pathology Division and Chief, Wound Ballistics Pathology Branch, Armed Forces Institute of Pathology, to Brig. Gen. J. M. Blumberg, MC, USA, Director, Armed Forces Institutes of Pathology, Feb. 1, 1965, regarding personal notes on the assassination of President Kennedy, p. 3 (JFK Document No. 006165).
(27) Autopsy protocol, p. 6.
(28) See reference 17, p. 7.
(29) Id. at pp. 6–7.
(30) Id. at p. 9.
(31) Ibid.
(32) Testimony of Pierre A. Finck, M.D., Criminal District Court, Parish of Orleans, State of Louisiana, *State of Louisiana* v. *Clay L. Shaw*, afternoon session, Feb. 24, 1969, vol. II, p. 118–119 (JFK Document No. 002036).
(33) Autopsy protocol, p. 4.
(34) Ibid.
(35) See reference 26, p. 2.
(36) Autopsy protocol, p. 4.
(37) See reference 26, p. 2.

(38) Memorandum from J. Laurence Angel to JFK Skull Review Committee, Oct. 24, 1977, p. 2 (see addendum E to this report).
(39) Id. at p. 3.
(40) Dissenting view to forensic pathology panel report, Cyril H. Wecht, M.D., J. D., Oct. 23, 1978, p. 4 (see part VI to this report.)
(41) Ibid.
(42) Statement by Dr. G. M. McDonnel to House Select Committee on Assassinations, Mar. 8, 1978, enclosure No. 1.
(43) Memorandum from Dr. David O. Davis, professor and chairman, department of radiology, George Washington University Hospital, to T. Mark Flanagan, House Select Committee on Assassinations staff member, Aug. 23, 1978, p. 3. (JFK Document No. 010958).
(44) Autopsy protocol, p. 4.
(45) Ibid.
(46) Supplementary report of autopsy No. A63-272, President John F. Kennedy, Dec. 6, 1963, p. 1 [hereinafter supplementary report].
(47) Autopsy protocol, p. 4; supplementary report, p. 1; Humes testimony, II Warren report 355–356.
(48) Supplementary report, p. 1.
(49) Id. at p. 2.
(50) Autopsy protocol, p. 6.
(51) See reference 26, p. 2.
(52) Autopsy protocol, p. 3.
(53) Memorandum pursuant to a Department of Justice request to examine the X-rays and photographs to determine whether they are consistent with the autopsy report, from James J. Humes, M.D., J. Thornton Boswell, M.D., and Pierre A. Finck, M.D., Jan. 26, 1967, p. 5. (Note: This is a blank letterhead memorandum.)
(54) Autopsy protocol, p. 5.
(55) Supplementary report, p. 2.
(56) Letter from J. Edgar Hoover, Director, FBI, to J. Lee Rankin, General Counsel, the President's Commission, Apr. 16, 1964, Warren Commission No. 827.
(57) See Reference 11, pp. 6–7.
(58) Parkland Memorial Hospital operative record, John B. Connally, surgeon: Robert Shaw, M.D., Nov. 22, 1963, p. 1.
(59) Staff interview of Dr. Robert R. Shaw, House Select Committee on Assassinations, Nov. 9, 1977, pp. 2–3.
(60) Memorandum from Michael M. Baden, M.D. to Gary Cornwell, Esq., Sept. 6, 1978, regarding the physical examination of Governor John Connally, p. 1.
(61) See Reference 58, p. 1.
(62) See Reference 60, p. 2.
(63) Parkland Memorial Hospital, report of diagnostic X-ray consultation, Connally, John G., Nov. 22, 1963, J. Reynolds, M.D., reporting physician.
(64) Ibid.
(65) See Reference 58, pp. 1–2.
(66) Staff interview of Robert R. Shaw, M.D., House Select Committee on Assassinations, Nov. 9, 1977, p. 1.
(67) Letter from Charles S. Petty, M.D., director, Southwestern Institute of Forensic Sciences, Dallas, Tex., to Donald A. Purdy, Jr., staff counsel, House Select Committee on Assassinations, Feb. 2, 1978, p. 2 (JFK Document No. 005095).
(68) See Reference 60, p. 2.
(69) Parkland Memorial Hospital operative record, Gov. John Connally, surgeon: Dr. Charles Gregory, Nov. 22, 1963, p. 1.
(70) Parkland Memorial Hospital surgical pathology report, Connally, John G., lab. No. S63-6750, Nov. 25, 1963, pathologist: Vernie A. Stembridge, M.D.
(71) See Reference 69, p. 1.
(72) Id. at p. 1.
(73) See Reference 70.
(74) See Reference 60, p. 2.
(75) Parkland Memorial Hospital, report of diagnostic X-ray consultation, Nov. 22, 1963.
(76) FBI report, Nov. 30, 1963, file DL 89-43, Special Agent J. Doyle Williams.
(77) FBI report, Nov. 23, 1963, file DL 89-43, Special Agent J. Doyle Williams.

(78) Parkland Memorial Hospital operative record, Connally, John B. [sic], Surgeon: Dr. Shires, Nov. 22, 1963.
(79) See Reference 70.
(80) Staff interview of Dr. George Thomas Shires, House Select Committee on Assassinations, Jan. 9, 1978, pp. 1–2 (JFK Document No. 005009).
(81) Id. at pp. 2–3.
(82) Parkland Memorial Hospital, report on diagnostic X-ray consultation, Nov. 22, 1963.
(83) Supplementary report of films of Gov. John G. Connally, dated Nov. 22, 1963, Parkland Memorial Hospital, Jack Reynolds, M.D., Nov. 29, 1963.
(84) X-ray back scatter with scanning electron microscopy and energy dispersive X-ray of tissues of J. B. C., Southwestern Institute of Forensic Sciences at Dallas, Charles S. Petty, M.D., director, Aug. 29, 1978, p. 1 (JFK Document No. 011167).
(85) Beyer, J. C., and Coates, J. B., "Wound Ballistics" (Washington, D.C.: Office of the Surgeon General, Department of the Army, 1962).
(86) Alvarez, Luis W. "A Physicist Examines the Kennedy Assassination Film," "American Journal of Physics," vol. 44, No. 9, September 1976.
(87) Lattimer, John K., Lattimer, John, and Lattimer, Gary. "An Experimental Study of the Backward Movement of President Kennedy's Head," "Surgery, Gynecology, and Obstetrics," 1976, vol. 142: 246–254.
(88) Nichols, John (personal communication to committee, 1978).
(89) Supplementary report, p. 1.
(90) Sherrington, C. S. "Experiments in Examination of the Peripheral Distribution of the Fibers of the Posterior Roots of some Spinal Nerves." Philos. Trans., 1898, 190B, 45–186 (introduces the term "decerebrate rigidity").
(91) Testimony of Cyril H. Wecht, M.D., J.D., Sept. 7, 1978, hearings before the House Select Committee on Assassinations, 95th Congress, 2d sess. (Washington, D.C.: U.S. Government Printing Office, 1979), vol. I, p. 347.
(92) See Reference 53, p. 1.
(93) Ibid.
(94) Clinical record, authorization for post-mortem examination, U.S. Naval Hospital, Bethesda, Md., Nov. 22, 1963.
(95) Ibid.
(96) See Reference 53, p. 1.
(97) Humes testimony, II Warren report 348.
(98) Ibid.
(99) Id. at p. 349.
(100) Vernon's Ann. Tex. Statutes, Code of Crim. Proc., Art. 49.
(101) Id. at Art. 49.01.
(102) Ibid.
(103) Ibid.
(104) Ibid.
(105) Id. at Art. 49.03.
(106) Record of Inquest, Dallas County, Tex., Nov. 22, 1963.
(107) Ibid.
(108) Ibid.
(109) Ibid.
(110) Tex. Crim. Pro. Code Ann. tit. , art. 49.03 (Vernon).
(111) Certificate of Death, Dallas County, Dallas, Tex., Dec. 6, 1963, Theran Ward, Justice of the Peace.
(112) See reference 97, p. 348.
(113) Ibid.
(114) Ibid.
(115) See reference 26, p. 17.
(116) See reference 32, pp. 117–118.
(117) See reference 26, p. 17.
(118) Id. at p. 3.
(119) Id. at p. 4.
(120) Id. at p. 17.
(121) 18 U.S.C.A. § 1751 (1965) (West).
(122) 18 U.S.C.A. § 351 (1971) (West).

REPORT OF THE FIREARMS PANEL

Select Committee on Assassinations
U.S. House of Representatives
Ninety-fifth Congress
Second Session

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Introduction*

(1) From the outset, the Kennedy assassination task force of the Select Committee on Assassinations believed that a complete scientific examination of all firearms evidence** was essential to its investigation. The committee wanted to address the many questions that had arisen over the last 15 years about the firearms and firearms identification in the cases of President Kennedy, Dallas Police Officer J. D. Tippit, and Lee Harvey Oswald. The primary concern was to conduct a thorough examination of all the evidence, though some items, such as Jack Ruby's revolver, were less relevant. The committee chose this approach in part to see if any new investigative leads would develop.

Background

(2) Within an hour after President Kennedy was shot at approximately 1:12 p.m. central standard time (CST) (*1*) on November 22, 1963, Deputy Sheriff Luke Mooney discovered three expended cartridge cases on the floor near a window at the southeast corner of the sixth floor of the Texas School Book Depository.(*2*) The cartridge cases were turned over to the FBI on November 23, 1963.(*3*)

(3) At 1:22 p.m.,(*4*) Deputy Sheriff Eugene Boone and Deputy Constable Seymour Weitzman discovered a bolt-action rifle equipped with a telescopic sight, also on the floor of the sixth floor of the book depository, but near the northwest corner.(*5*) Neither handled the rifle, but at the time Weitzman described it as a 7.65-millimeter caliber German Mauser.(*6*) (It was subsequently determined to be a 6.5-millimeter caliber Mannlicher-Carcano Italian military rifle.(*7*)) It was removed from the depository by Lieutenant Day and remained in his possession until it was released to the FBI at 11:45 p.m., November 22, 1963.(*8*)

(4) When found, the Mannlicher-Carcano contained one unfired 6.5-millimeter caliber copper-jacketed, military-type cartridge, manufactured by the Western Cartridge Co. The cartridge was removed from the rifle by Capt. J. Will Fritz where the rifle was found.(*9*)

(5) Later that day, the rifle's six-round cartridge clip was removed by Lieutenant Day in the Dallas Police Crime Laboratory.(*10*)

(6) While the officers were collecting evidence in the book depository, Officer J. D. Tippit was shot and killed in the Oak Cliff section of Dallas several miles away.(*11*) Four expended .38 special caliber cartridge cases were found at the scene of the murder.(*12*) Two of the recovered cartridge cases were manufactured by the Western Cartridge Co., the other two by Remington-Peters.(*13*) All four were delivered to the FBI laboratory on November 30, 1963.(*14*) Four .38

*Materials submitted for this report by the firearms panel were compiled by HSCA staff members Jim Conzelman and Whitney Watriss.

**A glossary of technical terms can be found at the end of this report.

special caliber bullets were later removed from Tippit's body during his autopsy. They were given to the FBI laboratory on March 16, 1964.(*15*)

(7) Lee Harvey Oswald was arrested as a suspect in the Tippit shooting shortly before 2 p.m.,(*16*) November 22. Apprehended after a scuffle in the Texas theater, he was carrying a Smith and Wesson revolver modified to fire .38 special caliber ammunition.(*17*) Four cartridges were found in the cylinder of the revolver and turned over to the FBI laboratory by the Dallas police on November 30, 1963.(*18*) Two cartridges were found to be of Western Cartridge Co. manufacture, two of Remington-Peters.(*19*) Five Western .38 special caliber cartridges were found in Oswald's trouser pocket and also were given to the FBI laboratory by the Dallas police on November 30, 1963.(*20*)

(8) At approximately 1:55 p.m.(*21*) on November 22, a virtually intact bullet was found on a stretcher in the emergency area of Parkland Memorial Hospital by Nathan Burgess Pool, an employee of Otis Elevator Co., and D. C. Tomlinson, power plant engineer of Parkland Hospital.(*22*) Tomlinson handed the bullet to a Secret Service agent standing by the door to the emergency entrance.(*23*) The bullet was delivered to the FBI laboratory in Washington, D.C., that same day.(*24*) The Warren Commission eventually designated this bullet Commission exhibit 399 (CE 399), and concluded that it had caused all of Governor Connally's wounds after passing through the President's neck.(*25*)

(9) Other items of evidence were later recovered. Four lead-like fragments were removed from Governor Connally's wrist (*26*) and delivered to the FBI laboratory on November 23, 1963.(*27*) During the President's autopsy at Bethesda Naval Hospital, three fragments were removed from his brain; (*28*) they were subsequently delivered to the FBI laboratory on November 23, 1963.(*29*) Four more fragments were recovered from the Presidential limousine: the nose portion of a metal-jacketed bullet, found on the right side of the front seat by the Secret Service; (*30*) the base portion of a metal-jacketed bullet, found on the floor next to the right front seat by the Secret Service; (*31*) two lead-like fragments found on the rug underneath the left jump seat by the FBI; (*32*) and lead residue taken from the inside of the windshield by the FBI.(*33*) This evidence was turned over to the FBI laboratory for analysis on November 22, 1963.(*34*)

(10) In addition to these other items, the Warren Commission obtained the bullet recovered by the Dallas police after an attempted assault on General Walker in Dallas on April 10, 1963.(*35*) It was delivered to the FBI laboratory on December 4, 1963, for analysis.(*36*) Although the Commission concluded that Oswald fired the bullet, the FBI laboratory could not conclusively identify it with the Mannlicher-Carcano rifle.

(11) An item of evidence that the Warren Commission did not consider was the .38 special caliber Colt Cobra revolver recovered from Jack Ruby at the time of his apprehension in the basement of the Dallas Police Department by Detective L. C. Graves.(*37*) The revolver had never been sent to the FBI laboratory, but had remained in the possession of Dallas District Attorney Henry Wade, pending

Jack Ruby's trial. (*38*) At the conclusion of the trial, the revolver was given to the administrator of Jack Ruby's estate, Jules Mayer, (*39*) from whom the select committee obtained it.

(12) The whereabouts of the expended cartridge case found in the Ruby revolver and the bullet removed from Lee Harvey Oswald at his autopsy are unknown. According to William Alexander, assistant district attorney for the city of Dallas, the cartridge case and bullet were presented as evidence at Jack Ruby's trial; their disposition by the court is unknown. (*40*) The committee contacted the Dallas Police Department and Jules Mayer to locate them, but to no avail.

(13) The Warren Commission relied on FBI facilities for the firearms identification. (*41*) It concluded from the FBI tests that the stretcher bullet and the larger fragments of the base and nose of the bullet found in the limousine had been fired from the Mannlicher-Carcano rifle recovered from the Texas School Book Depository. (*42*) The remaining fragments removed from the limousine, Governor Connally's arm and President Kennedy's brain were too minute for any type of microscopical examination. Spectrographic and neutron activation analysis were conducted on all fragments, allowing their elemental composition to be compared. Although they were found to be of similar metallic composition, (*43*) the FBI laboratory was unable to determine whether the nose and base fragments originated from the same or different bullets. (*44*) The firearms examination also revealed that the three expended cartridge cases found in the book depository had been fired in the Mannlicher-Carcano rifle. (*45*)

(14) Regarding the bullet fired at General Walker, the FBI was unable to identify it with the rifle found on the sixth floor of the depository due to its mutilated condition, (*46*) although it had the same physical characteristics as the bullet of the cartridge found in the chamber of the Mannlicher-Carcano rifle and other Mannlicher-Carcano ammunition. (*47*)

(15) Regarding the evidence from the Tippit shooting, the bullets removed from the officer's body could not be positively identified with Oswald's revolver. (*48*) The FBI firearm experts found that the characteristics engraved on the bullets fired by the revolver were erratic. (*49*) The FBI experts were unable to identify a correspondence among their own test-fired bullets, even though they were documented as being fired from the same revolver. (*50*) The cartridge cases found near Tippit's body were, however, identified as having been fired in Oswald's revolver. (*51*)

(16) All exhibits, with the exception of the items relating to the Oswald shooting death, were given to the National Archives, from which the select committee obtained them.

(17) Two additional items, unavailable to the Warren Commission, were considered by the committee as possibly relevant to its inquiry. The first was a bullet fragment found in 1974 near the triple overpass in Dealey Plaza by Richard Lester. (*52*) Lester turned it over to the FBI on December 1, 1976, requesting that an analysis be conducted to determine if it might be connected with the assassination. (*53*) The FBI laboratory obtained from the National Archives the bullets test-fired in the Mannlicher-Carcano rifle in 1963, and on July 28, 1977,

examined the bullet fragment and compared it to the Mannlicher-Carcano test-fired bullets.(*54*) The laboratory determined that both the Lester bullet and the test-fired bullets were 6.5 millimeter caliber, but the Lester bullet was found to be a jacketed, softpoint or jacketed, hollow-point sporting bullet, whereas the Mannlicher-Carcano bullet was to be a full metal-jacketed, military-type. Although the rifling impressions were similar, four lands and grooves, right twist, the widths of the land and groove impressions were found to vary by about 0.01 inch. The individual identifying characteristics were found to be different. Thus, the laboratory concluded that there was no indication the Lester bullet had been fired from the Mannlicher-Carcano rifle.(*55*) The laboratory returned the test-fired bullets to the Archives(*56*) and the fragment to Lester at the completion of its examination.(*57*) The select committee obtained the bullet from Lester on November 10, 1977.(*58*)

(18) The second item of evidence was a bullet fragment found in 1967 by Rich Haythorne, who was working as a roofer on top of the Massey Roofing Co. building in the 1200 block of Elm Street, about eight blocks from the Texas School Book Depository(*59*) (the building is no longer there). It had remained in the possession of Haythorne's attorney, Bill Mason, until he sent it to the committee on April 20, 1977.(*60*)

(19) Critics of the Warren Commission have used the firearms evidence to cast doubt on its conclusions. Illustrative of the issues that have been raised are the following:

(20) Edward J. Epstein, in "Inquest", contends that more bullet fragments were found in Governor Connally's body than could have been left by the CE–399 bullet that the Commission concluded caused all his wounds.(*61*)

(21) Mark Lane, in "Rush to Judgment," and others claim that the CE–399 bullet could not have remained virtually intact after causing the Governor's many severe wounds.(*62*)

(22) In "They've Killed the President," Robert Sam Anson contends that the telescopic sight on the Mannlicher-Carcano rifle was mounted for a left-handed person.(*63*) Since Oswald is right-handed, it is doubtful that he could have fired the shots in the requisite amount of time. (*64*)

(23) Sylvia Meagher, in "Accessories After the Fact," questioned Oswald's ability to fire the Mannlicher-Carcano accurately because of the rifle's "hair trigger."(*65*) She cited the testimony before the Warren Commission of Ronald Simmons of the Ballistics Research Laboratory, Department of the Army, that it was difficult for experts when test-firing the rifle to become accustomed to the drag in the trigger.(*66*)

(24) Josiah Thompson, in "Six Seconds in Dallas," questioned whether the cartridge cases recovered on the sixth floor of the depository were in fact fired in the Mannlicher-Carcano.(*67*) He alleged that two of the cartridge cases had markings indicating that they had been loaded into a weapon at least twice—and not necessarily into the Mannlicher-Carcano. He further claimed that the third cartridge case was dented such that it could never have been fired in any rifle.(*68*)

(25) Finally, some critics, including Mark Lane, were suspicious because of Weitzman's initial misidentification of the Mannlicher-Carcano rifle as a 7.65-millimeter caliber German Mauser.(*69*)

(26) In light of the criticisms of the Warren Commission's treatment of the firearms evidence, such as those mentioned above, and as part of its obligation to investigate fully the events surrounding President Kennedy's assassination, the select committee decided to convene a panel of experts to reexamine the firearms evidence.

Selection of the Panel

(27) In April 1977, the select committee sought recommendations for membership for the panel from the Association of Firearm and Tool Mark Examiners, the Forensic Science Foundation and the American Academy of Forensic Sciences. Candidates were to be leading firearms experts who had had no prior affiliation with either the King or the Kennedy assassination cases.*

(29) A list of 27 experts was proposed. Five were eliminated initially: three were current or past employees of the FBI; one had authored material on the firearms evidence; and one was unable to undertake the project.

(30) The remaining 22 prospects were asked to submit resumes, with information on past affiliations with the case and opinions about the assassination or the firearms evidence. Eighteen responded, 10 of whom did not want to be considered or did not meet the committee's criteria.

(31) The following five experts were chosen to serve on the panel:

(32) *John S. Bates, Jr.*—Senior firearms examiner in the New York State Police Laboratory at Albany. He has been a lecturer at the New York State Police Academy, New York State Municipal Police Training Council, and various community colleges.

(33) Bates is a member of the Association of Firearm and Tool Mark Examiners, serving as secretary since 1973. In that year, he received the association's Distinguished Member Award. He has written numerous professional articles.

(34) *Donald E. Champagne.*—Firearm and tool mark examiner with the Florida Department of Criminal Law Enforcement in Tallahassee for the past 10 years. He served in the crime detection laboratory of the Royal Canadian Mounted Police in Ottawa, Ontario, for 15 years, and he has lectured extensively at the Canadian Police College and other law enforcement agencies.

(35) Champagne is president and a distinguished member of the Association of Firearm and Tool Mark Examiners. He is a member of the Southern Association of Forensic Scientists and the Canadian Society of Forensic Science.

(36) *Monty C. Lutz.*—Firearm and tool mark analyst with the Wisconsin Regional Crime Laboratory in New Berlin. He has been the chief firearm and tool mark examiner for the U.S. Army.

(37) Lutz is a past president of the Association of Firearm and Tool Mark Examiners. He has been named a distinguished member of the

*The same panel members were also to examine the firearms evidence in the King assassination case.

association. He has lectured at colleges and law enforcement schools across the country and is the author of numerous professional publications. He received a B.S. in criminal justice from the University of Nebraska.

(38) *Andrew M. Newquist.*—Special agent and firearm, tool mark and latent fingerprint examiner for the Iowa Bureau of Criminal Investigation.

(39) Newquist is a distinguished member and past president of the Association of Firearm and Tool Mark Examiners and currently serves on its executive committee. He is a member of the International Association for Identification and a lecturer at the Iowa Department of Public Safety.

(40) The panel conducted its examination at the facilities of the Metropolitan Police Department firearm identification section, Washington, D.C. Assigned as liaison to the panel and working closely with it as technical assistant was George R. Wilson, senior firearms examiner, Metropolitan Police Department, Washington, D.C., a position he has held for 9 years. The laboratory, which he established, was the first in the department's history.

(41) Wilson is second vice president of the Association of Firearm and Tool Mark Examiners. In 1974, he received the association's Distinguished Member Award. During his 25-year tenure with the Metropolitan Police Department, he has been awarded over 30 commendations for outstanding and meritorious performance of duty.

(42) Photographic services were provided by police photographer Gary R. Phillips of the Metropoltian Police Department's photographic services section.

The issues addressed

(43) The panel was asked to address a number of issues concerning three categories of firearms evidence:

(44) —That relating to the shooting of President Kennedy and Governor Connally, which includes the Walker bullet and the bullet found in 1974 by Richard Lester;

(45) —That relating to the shooting of Tippit; and

(46) —The Ruby revolver (the bullet that killed Oswald and the expended cartridge case were not located).

The issues were as follows: In the Kennedy case:

(47) —Was the cartridge reportedly found in the Mannlicher-Carcano rifle in fact loaded into that rifle?

(48) —From which direction was the impact which damaged the windshield of the Presidential limousine?

(49) —Were the three expended cartridge cases found on the sixth floor of the Texas School Book Depository fired in the Mannlicher Carcano rifle?

(50) —Was the bullet found at Parkland Hospital fired from the Mannlicher-Carcano rifle?

(51) —Was the bullet nose portion found on the right side of the front seat of the Presidential limousine fired from the Mannlicher Carcano rifle?

(52) —Was the bullet base portion found on the floor beside the right front seat of the Presidential limousine fired from the Mannlicher-Carcano rifle?

(53) —Were the bullet nose portion and the bullet base portion found in the Presidential limousine components of the same bullet?
(54) —Was the bullet recovered from the residence of General Walker fired from the Mannlicher-Carcano rifle?
(55) —What are the nature and characteristics of the 6.5 millimeter caliber Mannlicher-Carcano rifle and ammunition with respect to power and impact?
(56) —Could the Mannlicher-Carcano rifle have been fired with a high degree of accuracy even though it has been described as having a "hair trigger"?
(57) —Would the dent on the mouth of one of the three expended cartridge cases found on the sixth floor of the Texas School Book Depository prevent the bullet from being fired in the Mannlicher-Carcano rifle, or any other rifle? Can it be determined whether these cartridge cases had been chambered on more than one occasion?
(58) —Does the method of mounting a scope on a rifle affect or have any influence on whether the rifle can be fired by a left-handed individual?
(59) —The Warren Commisison found that the stretcher bullet weighed 158.6 grains when recovered and assumed its original weight before firing to have been 160–161 grains. Is it possible that the bullet sustained a weight loss of only 1.4 to 2.4 grains during the wounding of President Kennedy and Governor Connally?
(60) —Could a 6.5-millimeter caliber Mannlicher-Carcano rifle be easily mistaken for a 7.65-millimeter caliber German Mauser rifle? What are the obvious differing characteristics, if any?
(61) —Was the bullet found in 1974 by Richard Lester near the Texas School Book Depository fired from the Mannlicher-Carcano rifle?
(62) —Could the iron sights found on the Mannlicher-Carcano rifle be used with a high degree of accuracy and operability, as compared with the telescopic sight?
(63) —Do rifles using smokeless powder emit smoke discernible to the eye when fired?
(64) The issues the committee asked the panel to address in the Tippitt shooting were as follows:
(65) —What are the dimensional differences between a .38 S. & W. caliber cartridge and a .38 special caliber cartridge? Can a .38 special caliber cartridge be inserted in a weapon chambered for a .38 S. & W. caliber cartridge? Would this cause the side of the cartridge case to split, as happened with one of the cartridge cases test-fired by the FBI in Oswald's revolver?
(66) —Were the four cartridge cases recovered from the scene of the Tippit murder fired in the revolver recovered from Oswald when apprehended?
(67) —Were the four bullets recovered from Officer Tippit's body fired from the revolver recovered from Oswald when apprehended?
(68) —Of the four expended cartridge cases found at the scene of the Tippit murder, two were of Western Cartridge Co. manufacture, two of Remington-Peters. The autopsy of Tippit, however, revealed three bullets of Western Cartridge Co. manufacture and one of Remington-Peters. Can the panel formulate an opinion about this dis

crepancy? Is it possible to determine which bullet came from each particular cartridge case?

(69) The issues the committee asked the panel to address in the Oswald shooting were as follows:

(70) —Are there any characteristics which are easily identifiable of Jack Ruby's revolver? Does it have a "hair trigger"?

(71) —What can the panel determine from an examination of the Ruby evidence?

(72) During the course of its investigation but after the panel had completed its work in Washington, D.C., the committee obtained a bullet which had been found in 1967, by Rich Haythorne on top of the Massey Roofing Co. building in Dallas. The committee asked George R. Wilson, the panel's technical assistant who was with the police department in Washington, D.C., to determine if the Haythorne bullet had been fired from the Mannlicher-Carcano rifle.

(73) Wilson described the bullet as jacketed, soft-point and .30 caliber; its class characteristics were six lands and six grooves, right twist. The bullet weighed 149.3 grains. It was consistent with Remington-Peters ammunition.

(74) Wilson concluded that the physical characteristics of the bullet were different from those of Mannlicher-Carcano ammunition, as well as from the rifling characteristics of the Mannlicher-Carcano rifle. Therefore, the bullet definitely was not Mannlicher-Carcano ammunition and was not fired from the Mannlicher-Carcano rifle.

Procedures and equipment

(75) The panel conducted its examination at the firearm identification section of the Washington, D.C. Metropolitan Police Department. These facilities were conveniently located to the National Archives and the select committee's offices, and they were made available by Police Chief Maurice J. Cullinane and firearms section supervisor George R. Wilson.

(76) The firearms panel met on November 12, 1977, at the National Archives to conduct a cursory examination of the evidence stored there. On January 30, 1968, the panel and its technical assistant met with representatives of the select committee at the Washington, D.C., Metropolitan Police Department firearm identification section. The following procedures were adopted at that time:

(77) —The panel members would jointly conduct visual and microscopical examinations of the evidence in the possession of the select committee and the National Archives. Each examiner would submit an independent worksheet to the select committee on each item of evidence examined.

(78) —The panel would jointly determine the operability of the Mannlicher-Carcano rifle, the Oswald revolver and the Ruby revolver. Each firearm would be test fired to obtain bullets and cartridge cases for comparison purposes.

(79) —A joint firearms panel report would be submitted to the select committee at the completion of all examinations.

(80) The panel was to conduct visual and microscopical examinations, as necessary, on each item of evidence. A summary of general principles follows.

(81) A cartridge, or round of ammunition, consists of a cartridge case, primer, powder and bullet. The primer contains a detonable mixture and fits into the base of the cartridge case, which contains powder. The bullet, constructed of lead or a lead core encased in a stronger metal jacket, fits into the mouth of the cartridge case. A bullet is fired by placing the cartridge in the chamber of a firearm. The cartridge base rests against a solid support, called a breech or bolt face. When the trigger is pulled, the firing pin strikes the primer, igniting the detonable mixture, which in turn ignites the powder in the cartridge case. The combustion propels the bullet through the barrel.

(82) The bore (inside of the barrel) of modern firearms is "rifled" with spiral grooves in it to give bullets fired through it a spinning motion for flight stability. The raised portions between the grooves are called lands. The number, width and direction of twist of the lands and grooves are called the class characteristics of a barrel.

(83) In addition to the class characteristics, the components of every firearm, such as the barrel, firing pin and breech face, bear distinctive microscopic characteristics. While the class characteristics are common to all firearms of a given model and manufacture, an individual firearm's microscopic characteristics differ from all other firearms, regardless of model or manufacture. These distinctive markings, usually referred to as individual identifying characteristics, are produced initially by the manufacturing tools, which change microscopically during operation and vary from one firearm to another. Further individual identifying characteristics are produced as the firearm is used, during its disuse, and as a consequence of maintenance or the lack of it.

(84) When a firearm is discharged, the individual identifying characteristics of its barrel, as well as its class characteristics, are engraved on the bearing surface of the bullet. The individual identifying characteristics of the firing pin and breech or bolt face are impressed on the base or primer of the cartridge case at the time of firing. Using a comparison microscope, an expert can compare the markings with those produced on a similar cartridge test-fired in the same firearm. If the patterns of the microscopic markings are sufficiently similar, it can be concluded that both cartridge cases were fired in the same firearm. Microscopical examination of other firearm components and the markings they produce may also demonstrate such things as whether a cartridge was ever loaded into a particular firearm or was loaded into a firearm more than once. It is also possible, through comparative microscopical examinations, to determine whether two bullets were fired from the same firearm.

(85) In its examinations, the panel used the following equipment:

(86) —Two American Optical forensic comparison microscopes, model K1453, serial Nos. 328 and 277, with fluorescent and incandescent lighting, fiber optics, photographic unit and 10X eyepieces and objectives. One had a combined magnification of 12X, 20X, and 40X, the other 20X, 40X, and 80X.

(87) —American optical low power binocular microscope with a zoom lens of 0.7 to 3 power and 10X eyepiece.

(88) —Mico model 5100 balance with a 1,000-grain capacity.

(89) —Slocomb "Speedmike" direct readout micrometer.

(90) —Brown and Sharpe stage micrometer for air gap measuring.

(91) —Horizontal water recovery tank.
(92) —Horizontal cotton waste recovery box.
(93) —6.5-millimeter caliber Mannlicher-Carcano cartridges with full metal-jacketed bullets of Western Cartridge Co. manufacture. These were test fired by the panel in CE 139 and designated panel Kennedy T–1—T–4. (See Figs. 1 and 2.)

(94) Additional 6.5-millimeter caliber Mannlicher-Carcano cartridges were used, unfired, for loading and unloading in the rifle to obtain class and individual identifying characteristics produced in that process.

(95) Strict security measures were observed throughout the examinations. Public access to the firearms evidence at the National Archives was denied during this time.(*70*) A member of the Archives staff accompanied the evidence while it was examined at the Archives or removed and examined at the laboratory. The panel's materials—photographs, photomicrographs, test-fired bullets and cartridge cases—were secured in a safe in the firearm identification section at the District of Columbia Metropolitan Police Department.

Findings and Conclusions of the Firearms Panel Concerning the Kennedy Assassination

(96) The findings and conclusions were prepared by staff of the House Select Committee on Assassinations based on material submitted by the panel members. The panel has read and accepts those findings and conclusions.

KENNEDY SHOOTING

Evidence examined

(97) The following evidence was examined in connection with the shooting of President Kennedy.

(98) CE 139(*71*)—One 6.5-millimeter caliber, bolt-action repeating rifle, Mannlicher-Carcano Model 1938, serial number C2766. Attached was an Ordnance Optics, Inc. 4X telescopic sight and an adjustable black leather strap.* (See figs. 3A and 3B.)

(100) A visual examination of the rifle revealed pitting, rust and copper oxidation to test-firing, which the panel believed should be removed prior to test-firing. Accordingly, a dry cloth patch was pushed through the bore.

(101) The telescopic sight was attached to a mount, which itself was attached to the left side of the rifle. Mounting facilities were not provided at the time of manufacture. Also attached to the rifle were standard iron sights, placed on the rifle at the time of manufacture.

(102) The rifle was test-fired by all panel members, using 6.5-millimeter caliber ammunition of Western Cartridge Co. manufacture. Two bullets were test-fired into a horizontal water recovery tank. Further tests were conducted by loading four cartridges into the CE 375 cartridge clip and inserting it into the magazine of the rifle. The cartridges were worked through the rifle's mechanism and ejected without being fired. When the last cartridge was chambered, the cartridge clip remained in the magazine instead of falling out as it is designed to do.

(103) *CE 141.*—One 6.5-millimeter caliber cartridge of Western Cartridge Co. manufacture, found in the CE 139 rifle. (See fig. 4.)

(104) *CE 351.*—One damaged automobile windshield removed from the Presidential limousine. (See fig. 5.)

(105) *CE 399.*—One fired 6.5-millimeter caliber full metal-jacketed bullet, found on a stretcher in the emergency area of Parkland Hospital. The bullet weight was found to be 157.7 grains.(*72*) In the same box as the bullet was a tiny fragment, which was too small to weigh or otherwise examine. (See figs. 6A and 6B.)

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*The CE 139 rifle was physically examined and found to be operable. It had not been properly cleaned, maintained or lubricated. The rifling of the barrel was four lands and four grooves, right twist. The magazine was a non-detachable box, clip-fed type, with a 6-cartridge capacity. The trigger pull was determined by the panel to be approximately 3 pounds.

(106) *CE 542.*—One 6.5-millimeter caliber, bolt-action repeating rifle, Mannlicher-Carcano model 1938, serial No. UC5209. Attached was 4 × Ordnance Optics, Inc., telescopic sight and an adjustable black leather strap. The strap is consistent in length, design, and construction with the strap on the CE 139 rifle. The rifle was purchased by the FBI in order to compare the method of mounting the telescopic sight. (See fig. 7.)

(107) *CE 543.*—One expended caliber 6.5-millimeter cartridge case of Western Cartridge Co. manufacture, recovered from the sixth floor of the Texas School Book Depository. (See figs. 8A and 8B.)

(108) *CE 544.*—One expended 6.5-millimeter caliber cartridge case of Western Cartridge Co. manufacture, recovered from the sixth floor of the Texas School Book Depository. (See fig. 9.)

(109) *CE 545.*—One expended 6.5-millimeter caliber cartridge case of Western Cartridge Co. manufacture, recovered from the sixth floor of the Texas School Book Depository. (See fig. 10.)

(110) *CE 557.*—Two expended 6.5-millimeter caliber cartridge cases of Western Cartridge Co. manufacture, test-fired by the FBI laboratory in the CE 139 rifle for purposes of comparison with CE 543, CE 544, and CE 545. (See Warren Commission hearings, vol. 17, p. 249).

(111) *CE 567.*—The nose portion of a 6.5-millimeter caliber metal-jacketed bullet found on the right side of the front seat of the Presidential limousine. (See fig. 11.)

(112) *CE 569.*—The base portion of a metal-jacketed bullet found on the floor beside the right side of the front seat of the Presidential limousine. (See fig. 12.)

(113) *CE 572.*—Two fired 6.5-millimeter caliber full metal-jacketed bullets, test-fired by the FBI from the CE 139 rifle and designated as K1A and K1B*. (See fig. 13.)

(114) *CE 573.*—One 6.5 millimeter caliber metal-jacketed bullet recovered from the residence of General Walker in April 1963 after an attempted assault. (See fig. 14.)

(115) *CE 575.*—One brass cartridge clip with a six-cartridge capacity, stamped "SMI 952," removed from the CE 139 rifle. (See fig. 15.)

(117) *CE 840.*—Two lead-like fragments** recovered from the rug underneath or in the area which was underneath the left jump seat of the Presidential limousine.(*73*) The panel found that each fragment weighed 0.5 grain. Because of their minute size, no further examinations were conducted on this exhibit. (See fig. 16.)

(118) *CE 841.*—One round metal box containing lead residue recovered by the FBI from the inside surface of the windshield of the Presidential limousine. Because of the small size of the sample, further examinations were not conducted. (See hearings before the Warren Commission, vol. 17, p. 840.)

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*The two test-fired bullets were used as standards for comparison with the class characteristics on CE 399, found on a stretcher at Parkland; with those on CE 567, the bullet nose portion found in the limousine; and with CE 569, the bullet base portion found in the limousine.

**The FBI originally recovered three particles. In 1970, an independent researcher brought to the attention of the National Archives that one of the three fragments was missing. The Archives has been unable to locate it.

(119) *CE 842.*—Four lead-like fragments. The smallest was identified as having come from Governor Connally's arm. The panel found that the largest fragment weighed 0.3 grain. The other fragments were too small to weigh. Because of the small size of the fragments, no further examinations were conducted on this exhibit. (See fig. 17).
(121) *CE 843.*—Three lead-like fragments removed from President Kennedy's brain during the autopsy. The largest weighs 0.6 grain; their combined weight is 0.7 grain. Because of the small size of the fragments, no examinations were conducted on this exhibit. (See fig. 18.)
(122) *CE 853.*—One fired 6.5-millimeter caliber full metal-jacketed bullet, fired through a goat at the request of the Warren Commission to ascertain the characteristics of the bullet on penetration and its subsequent loss of velocity. The panel found that fruitful examination of this bullet was not practical. (See hearings before the Warren Commission, vol. 17, p. 819.)
(123) *CE 856.*—One fired 6.5-millimeter caliber full metal-jacketed bullet, test-fired through a cadaver's wrist at the request of the Warren Commission to ascertain the characteristics of the bullet on penetration and its loss of velocity on impact. The panel found that fruitful examination of this bullet was not practical. (See hearings before the Warren Commission, vol. 17, p. 850.)
(124) *CE 857.*—One fired 6.5-millimeter caliber full metal jacketed bullet, test-fired into a skull at the request of the Warren Commission to ascertain the characteristics of the bullet on penetration. The panel found that the jacket had been separated from the core. The panel also found that fruitful examination of the bullet was not practical. (See hearings before the Warren Commission, vol. 17, p. 851.)
(125) *Lester Bullet.*—One fired metal-jacketed soft or hollow point bullet found in 1974 by Richard Lester about 500 yards from the Texas School Book Depository and 61 paces east of the triple overpass abutment. (See fig. 19.)

Findings and Conclusions

Was the CE 141 cartridge reportedly found in the CE 139 rifle in fact loaded into that rifle?

(126) The CE 141 cartridge was compared with the panel's unfired test cartridge No. 4, which had been loaded into the rifle and removed. The panel found a correspondence between the individual identifying characteristics produced by the magazine follower and the loading ramp of the CE 139 rifle on the CE 141 cartridge case and the panel's unfired cartridge. (See fig. 20.)
(127) In the Mannlicher-Carcano rifle, the loading ramp consists of a concave ramp located at the front edge of the magazine. It permits smooth insertion of the cartridge into the chamber. When a cartridge is chambered by moving the bolt forward, the front portion of the cartridge case slides up the loading ramp as it leaves the magazine. The loading ramp is a machined-steel surface and can engrave individual microscopic identifying characteristics on the cartridge case. Similarly, the magazine follower, which raises the cartridges, also may engrave individual microscopic identifying characteristics on the last cartridge in the magazine.

From which direction was the impact which damaged the CE 351 windshield of the Presidential limousine?

(128) The CE 351 windshield, made of two layers of laminated, tinted glass, has two separate fracture areas. (See fig. 5.) In the first (I), the point of impact is located 13⅜ inches down from the top edge and 22⅞ inches to the right of the left edge (the measurements were made from the front side of the windshield). No fractures were noted on the inside surface of the glass. On the outside surface, some fracture lines radiated out from the point of impact. The presence of fracture lines on the outside is indicative of a foreign object striking the windshield from the inside. (74)

(129) The second area (II) is located to the left of the first. No point of impact was found.

(130) Two lines, one radiating from each area, now connect at one point. This condition occurred after the panel's examination, but before the windshield was photographed. The additional fracture lines could have been caused by jolting the windshield during its removal from its exhibit case for photographing.

Were the three expended cartridge cases (CE 543, CE 544 and CE 545) found on the sixth floor of the Texas School Book Depository fired in the CE 139 Mannlicher-Carcano rifle?

(131) The panel compared microscopically the three expanded cartridge cases (CE 543, CE 544, and CE 545) with the two cartridge cases test-fired by the FBI (CE 557) and the four cartridge cases (Kennedy T–1 to T–4) test-fired by the panel in the CE 139 rifle.

(132) The panel found correspondence among the individual identifying characteristics made by the firing pin and bolt face on the cartridge cases. (See Figs. 21A, B, C, and D.)

(133) The panel found, in addition to the above impressions, three sets of striations on the head of the CE 543 cartridge case. The marks were not found on any of the other 6.5-millimeter caliber cartridge cases. The origin of the marks could not be established.

(134) The panel concluded that all three cartridge cases had been fired in the CE 139 rifle.

Was the CE 399 bullet found at Parkland Hospital fired from the CE 139 Mannlicher-Carcano rifle?

(135) The CE 399 bullet is a 6.5-millimeter caliber full metal-jacketed, lead core bullet with a weight of 157.7 grains. The class characteristics engraved on it are four lands and four grooves, right twist.

(136) The panel found the physical characteristics of CE 399 to be the same as those of the bullet portion of the CE 141 cartridge found in the Mannlicher-Carcano rifle's chamber.

(137) CE 399 was microscopically compared with the two bullet test-fired by the FBI (CE 572) in the CE 139 rifle. Based in a correspondence of individual identifying characteristics, the panel concluded that CE 399 was fired through the same firearm barrel as the FBI testfired bullets. (See fig. 22A and 22B.)

(138) Next, the panel compared CE 399 with bullets it test-fired in the CE 139 rifle. The panel was unable to identfy its test-fired bullets

with the CE 399 bullet. The panel attributed this to changes in the bore caused by repeated firings of the rifle by the FBI and the Infantry Weapons Evaluation Branch of the U.S. Army to test its accuracy, (*75*) as well as to deterioration of the surfaces because the rifle had not been properly cleaned, lubricated, and maintained. For the same reasons, the panel was unable to identify its test-fired bullets with those of the FBI. The panel's test-fired bullets also could not be identified with each other, probably as a consequence of the poor condition of the barrel.

Was the CE 567 bullet nose portion found on the right side of the front seat of the Presidential limousine fired from the CE 139 Mannlicher-Carcano rifle?

(139) CE 567 is the nose portion of a damaged 6.5-millimeter caliber full metal-jacketed, lead core bullet. The weight of the exhibit is 41.5 grains. The class characteristics on the jacket are four lands and four grooves. The panel could not determine the direction of twist.

(140) The panel found the physical characteristics of this bullet fragment to be the same as the bullet portion of the CE 141 cartridge found in the chamber of the CE 139 rifle. When it compared CE 567 with the two CE 572 bullets test-fired by the FBI in the CE 139 rifle, it noted a correspondence among the individual identifying characteristics. (See fig. 23A and 23B.)

(141) The panel concluded that all were fired through the same barrel.

(142) The panel also compared CE 567 with bullets it test-fired in the CE 139 rifle. The panel was unable to identify its tests with CE 567. The panel attributed this to changes in the bore caused by repeated firing of the rifle by the FBI and the Infantry Weapons Evaluation Branch of the U.S. Army to test its accuracy, (*76*) as well as deterioration of the surfaces because the rifle had not been properly cleaned, lubricated, and maintained. For the same reasons, the panel was unable to identify its test-fired bullets with those of the FBI. The panel's test-fired bullets also could not be identified with each other, probably as a consequence of the poor condition of the barrel.

Was the CE 569 bullet-base portion found on the floor beside the right front seat of the Presidential limousine fired from the CE 139 rifle?

(143) CE 569 is a base portion of a damaged 6.5-millimeter caliber full metal-jacketed, lead core bullet. The weight of 20.6 grains. The rifling impressions on the jacket are four lands and four groves, right twist. The physical characteristics of this bullet are the same as the bullet portion of the CE 141 cartridge found in the chamber of the CE 139 rifle.

(144) The panel microscopically compared this bullet jacket with the two bullets (CE 572) test fired by the FBI from the CE 139 rifle. Correspondence of individual identifying characteristics was found on CE 569 and the FBI test-fired bullets. (See figs. 24A and 24B.)

(145) The panel concluded that the CE 569 was fired through the same barrel as the FBI test-fired bullets.

(146) Next, the panel compared CE 569 with bullets it test fired in the CE 139 rifle. The panel was unable to identify its tests with the

CE 569. The panel attributed this to changes in the bore caused by repeated firings of the rifle by the FBI and the Infantry Weapons Evaluation Branch of the U.S. Army to test its accuracy,(77) as well as to deterioration of the surfaces because the rifle had not been properly cleaned, lubricated, and maintained. For the same reasons, the panel was unable to identify its test-fired bullets with those of the FBI. The panel's test-fired bullets also could not be identified with each other, probably as a consequence of the poor condition of the barrel.

Were the CE 567 bullet nose portion and the CE 569 bullet base portion found in the Presidential limousine components of the same bullet?

(147) The panel was unable to determine whether CE 567 and CE 569 were components of the same bullet. The panel weighed and measured the fragments and found their combined weight and length did not exceed that of a single-fired projectile. Nevertheless, the panel could not match the two fragments physically because a considerable portion of the bullet jacket was absent.

(148) Both bullet fragments were examined for cannelures. The panel found only one cannelure present; it was on the base portion of the CE 569 bullet.

Was the CE 573 bullet recovered from the residence of General Walker fired from the CE 139 rifle?

(149) CE 573 consists of a damaged 6.5-millimeter caliber full metal-jacketed, lead core bullet. The weight of this exhibit is 147.1 grains. The class characteristics are four lands and four grooves, right twist. (See fig. 14.)

(150) The panel compared this bullet microscopically with the FBI's and its own test-fired bullets. Correspondence among the class characteristics was found on all bullets. No significant correspondence was, however, found among the individual identifying characteristics. Conversely, gross differences were not found.

(151) The panel concluded that because of the damage to CE 573 caused by impact and penetration, it could not be identified or eliminated as having been fired from the CE 139 rifle.

What are the nature and characteristics of the 6.5-millimeter caliber Mannlicher-Carcano rifle and ammunition with respect to power and impact?

(152) The 6.5-millimeter caliber Mannlicher-Carcano rifle is a bolt-action military rifle used as the standard service rifle by the Italian military from 1891 to 1945. It was chambered for a 6.5-millimeter caliber Mannlicher-Carcano cartridge. It was comparable to the service rifles of other nations at that time. These rifles include the U.S. model 1903 Springfield and 1917 Enfield, chambered for the .30–06 Springfield caliber cartridge; the British .303 Enfield, chambered for the .303 British caliber cartridge; the German 8-millimeter Mauser, chambered for the 8-millimeter Mauser caliber cartridge; and the Japanese Arisaka, chambered for both the 7.7-millimeter Arisaka caliber cartridge and 6.5-millimeter caliber Japanese Arisaka cartridge. The standard military factory statistics for these cartridges are:(78)

Cartridge	Bullet weight (grains)	Muzzle velocity (feet per second)	Muzzle energy (foot per pound)
.30–06 Springfield	150	2, 990	2, 980
.303 British	174	2, 440	2, 310
8-millimeter Mauser	154	2, 880	2, 835
7.7-millimeter Japanese Arisaka	175	2, 400	2, 237
6.5-millimeter Mannlicher-Carcano	162	2, 296	1, 902
6.5-millimeter Japanese Arisaka	156	2, 060	1, 460

Could the CE 139 rifle have been fired with a high degree of accuracy even though it has been described as having a "hair trigger"?

(153) The trigger pull of CE 139 is approximately 3 pounds, not considered average for most military rifles. At the same time, it cannot be called "a hair trigger." Technically, a hair trigger requires an extremely light pull, normally measured at 16 ounces or less. Furthermore, the panel's examination of CE 139 disclosed that, as in most military weapons, it has a two-stage trigger that requires some movement of the trigger before the sear mechanism is engaged, allowing the weapon to fire.

(154) It is the opinion of the panel that the CE 139 does not have a hair trigger that would affect accurate aiming and firing.

Would the dent on the mouth of CE 543, one of the three expended cartridge cases found on the sixth floor of the Texas School Book Depository, prevent the bullet from being fired in the CE 139 Mannlicher-Carcano rifle, or any other rifle? Can it be determined whether these cartridge cases had been chambered on more than one occasion?

(155) Figure 8B shows a dent on the mouth of the CE 543 cartridge case which Josiah Johnson, a critic of the Warren Commission, said would prevent CE 543 from being fired in any rifle.(*79*)

(156) It is the opinion of the panel that the dent on the mouth of the CE 543 cartridge case was produced when the cartridge case was ejected from the rifle. This condition was duplicated during test-firing of the CE 139 rifle by the panel. (See fig. 2.) The dent had nothing to do with loading the bullet during the manufacturing process, nor is it the type of deformation expected if the case were stepped on.

(157) There was no evidence in the form of multiple extractor or ejector marks on the cartridge case to indicate that it was chambered in the rifle more than once. This also applies to cartridge cases CE 544 and CE 545.

Does the method of mounting a scope on a rifle affect, or have any influence on whether the rifle can be fired by a left-handed individual?

(158) There is no such thing as a left- or right-handed telescopic sight. The location of a telescopic sight on a rifle is determined not by whether it is to be shot left-handed or right-handed, but rather by such factors as receiver design, cartridge case ejection direction and bolt handle travel pattern. On CE 139, the telescopic sight is mounted on the left side of the receiver because of the vertical bolt handle travel pattern and the split receiver (see fig. 1). Because this rifle has a right-

handed action, a telescopic sight cannot be mounted on the right side of the receiver.

(159) The position of the bolt in a bolt-action rifle, that is, right- or left-handed action, is the factor that influences ease of operation, rather than the placement of the telescopic sight. A left-handed action would be difficult for a right-handed individual to operate, and conversely, a right-handed action would be difficult for a left-handed individual to operate.

The Warren Commission found that the CE 399 stretcher bullet weighed 158.6 grains (80) when recovered and assumed its original weight before firing to have been 160–161 grains. Is it possible that the CE 399 bullet sustained a weight loss of only 1.4 to 2.4 grains during the wounding of President Kennedy and Governor Connally?

(160) Because of manufacturing variations, all bullet weights are approximate, and it is not possible to determine the exact weight loss of a fired bullet without knowing its exact weight prior to firing. Nevertheless, it is possible that the weight loss from friction, pressure and intense heat during the firing process, and the weight loss caused by impact and penetration, would not have exceeded the range of 1.4 to 2.4 grains. The panel was, however, unable to render a definite opinion.

Could a 6.5-millimeter caliber Mannlicher-Carcano rifle be easily mistaken for a 7.65-millimeter caliber German Mauser rifle? What are the obvious differing characteristics, if any?

(161) In the opinion of the panel, a Mannlicher-Carcano rifle could very easily be mistaken for other military rifles of its general type, including the 7.65-millimeter caliber German and other model Mausers.

(162) At one time, bolt-action rifles like the German Mauser, the Argentine Mauser (which is made in Germany) and the Mannlicher-Carcanos were the standard military weapons of most countries. Although manufactured in many different calibers and models, all have the same general characteristics—right-hand action (bolt mechanisms), a full-length wooden stock covering most of the barrel, a sling attachment, bayonet mounting lugs and a generally rough and dull appearance. In the absence of a complete examination, almost any such bolt-action military rifle could be confused with a Mannlicher-Carcano rifle. (See figs. 1, 2, and 25.)

(163) Further, the caliber of a rifle cannot be determined merely by looking at it. For example, the bore of the 7.65-millimeter caliber German Mauser, or other 7.65-millimeter caliber rifles, is only 0.05 inches larger than the 6.5-millimeter caliber Mannlicher-Carcano. Even if a knowledgeable individual identified a particular rifle after a cursory examination, it is unlikely that the caliber could be readily established without further examination.

Was the bullet found in 1974 by Richard Lester near the Texas School Book Depository fired from the CE 139 Mannlicher-Carcano rifle?

(164) The panel found the Lester bullet to be the base portion of a metal-jacketed, softpoint or hollowpoint bullet. It weights 52.7 grains and is consistent in diameter with 6.5-millimeter caliber bullets. The rifling impressions are four lands and four grooves, right twist.

(165) The panel found that the physical characteristics of this bullet were different from the CE 399 bullet recovered at Parkland Hospital and the CE 567 and CE 569 bullet fragments recovered from the Presidential limousine. When the panel compared the bullet microscopically with the CE 572 FBI test-fired bullets, it noted gross differences among class characteristics. As a result, the panel concluded that this bullet was not fired through the same firearm barrel as the FBI test-fired bullets.

Could the iron sights found on the CE 139 Mannlicher-Carcano rifle be used with a high degree of accuracy and operability, as compared with the telescopic sight?

(166) The iron sights found on CE 139 are the standard, fixed sights placed on the firearm at the time of manufacture at the military arsenal. On CE 139, a block of metal is attached to the area immediately in front of the chamber area. A V-shaped notch in this piece of metal acts as the rear sighting alinement device. The sighting is made by lining up the front sight in the notch of the rear sight. A fixed sight cannot be adjusted for windage or elevation.

(167) The 4X scope mounted on this particular weapon is designed so that the cross hairs move from the center position when adjusting for windage or elevation. Hence the shooter is not always looking dead center through the scope.

(168) It is the opinion of this panel that an individual could attain better accuracy using the iron sights than the scope under the circumstances involved in Dealey Plaza.

Do rifles using smokeless powder emit smoke discernible to the eye when fired?

(169) When a cartridge is fired, the propellant is not completely consumed or burned. Due to this, residue and smoke are emitted. During the test firing of CE 139 by the members of the panel, in October, some smoke was observed coming from the muzzle of the weapon.

TIPPIT MURDER

Evidence examined

(170) CE 143—One .38 special caliber Smith and Wesson revolver, Victory model, serial No. V510210, seized from Oswald when he was apprehended in the Texas theater. (See figs. 26A and 26B.)* The barrel is rifled with five lands and five grooves, right twist. The cylinder has a six-cartridge capacity.

(172) The CE 143 revolver had been altered to accept .38 special caliber ammunition and presumably to allow easier concealment, as follows:

1. The barrel had been shortened from the muzzle end to its present length of 2¼ inches.
2. The muzzle end had been recrowned.
3. The cylinder had been rechambered from .38 S. & W. caliber to accommodate .38 special caliber cartridges.
4. The front sight had been reset.

*The panel found the revolver to be in good operating condition. It can be fired single action or double action. The trigger pull was measured at about 3½ pounds single action and 10¼ pounds double action.

5. The "U.S. Property" markings located on the left side of the top strap had been partially obliterated.
6. The lanyard swivel and ring had been removed and the hole filled with metal.

(173) CE 143 was test-fired four times by the panel into a horizontal water recovery tank, using two Western Cartridge Co. .38 special caliber cartridges with 158-grain, copper-coated (Lubaloy), lead, round-nose bullets, and two Remington-Peters .38 special caliber cartridges with 158-grain, plain lead, round-nose bullets.

(174) *CE 518*—Four cartridges found in the CE 143 revolver. Two cartridges, designated Q78 and Q79 by the FBI, are Western Cartridge Co. .38 special caliber cartridges with copper-coated (Lubaloy), lead, round-nose bullets. The other two, designated Q80 and Q81 by the FBI, are Remington-Peters .38 special caliber cartridges with plain lead, round-nose bullets.* (See fig. 27.)

(175) *CE 587*—One Western Cartridge Co. .38 S. & W. caliber cartridge with a copper-coated (Lubaloy), lead, roundnose bullet, acquired by the FBI and used as a standard. (See hearings before the Warren Commission, vol. 17, p. 264.)

(176) *CE 588*—One Western Cartridge Co. unfired .38 S. & W. caliber cartridge case and one unfired .38 caliber copper-coated (Lubaloy), lead, round-nose bullet, weighing 145.1 grains and measuring 0.635 inch long, acquired by the FBI. Both were used as standards. (See hearings before the Warren Commission, vol. 17, p. 264.)

(178) *CE 589*—Assembled and disassembled cartridges—one Remington-Peters .38 S. & W. caliber cartridge with a plain lead, roundnose bullet measuring 1.20 inches long overall; one Remington-Peters unfired .38 S. & W. caliber cartridge case measuring 0.763 inch long and one unfired .38 S. & W. caliber plain lead, round-nose bullet measuring 0.661 inch long. The FBI used these as standards. (See hearings before the Warren Commission, vol. 17, p. 264.)

(179) *CE 590*—Assembled and disassembled cartridges—one Western Cartridge Co. .38 special caliber cartridge with a copper-coated (Lubaloy), lead, round-nose bullet measuring 1.530 inches long; one unfired Western Cartridge Co. .38 special caliber cartridge case measuring 1.150 inches long; and one .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet measuring 0.730 inch long. The cartridges and components in this exhibit were used by the FBI as standards. (See hearings before the Warren Commission, vol. 17, p. 264.)

(180) *CE 591*—Assembled and disassembled cartridges—one Remington-Peters .38 special caliber cartridge with a plain lead, roundnose bullet measuring 1.550 inches long overall; one unfired Remington-Peters .38 special caliber cartridge case measuring 1.150 inches long; and one .38 caliber plain lead, round-nose bullet measuring 0.730 inch long. The FBI used these as standards. (See hearings before the Warren Commission, vol. 17, p. 264.)

(181) *CE 592*—Five Western Cartridge Co. .38 special caliber cartridges with copper-coated (Lubaloy), lead, round-nose bullets, found

*The panel's visual and microscopic examinations revealed no markings that could be attributed to any attempt to discharge them in a firearm.

in Oswald's trouser pocket, designated Q82 through Q86 by the FBI.* (See fig. 28.)

(183) *CE 594.*—Four expended cartridge cases retrieved from the scene of the Tippit murder, designated Q74 through Q77 by the FBI. Q75 and Q76 are .38 special caliber of Western Cartridge Co. manufacture; Q74 and Q77 are .38 special caliber of Remington-Peters manufacture. (See fig. 29.)

(184) *CE 595.*—Two cartridge cases test-fired by the FBI in the CE 143 revolver—one Winchester Repeating Arms .38 special caliber designated K3 by the FBI** and one Western Cartridge Co. .38 special caliber, designated K3 by the FBI. (See fig. 30.)

(185) *CE 602.*—One .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet, and one damaged, brass-colored button with the lettering "city of Dallas." The bullet and button were removed from the body of Officer Tippit. The bullet is consistent with Western Cartridge Co. manufacture. The class characteristics are five lands and five grooves, right twist. The weight is 155.4 grains. (See fig. 31.)

(186) *CE 603.*—One .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet removed from the body of Officer Tippit. The bullet is consistent with Western Cartridge Co. manufacture. The class characteristics are five lands and five grooves, right twist. The weight is 155.1 grains. (See fig. 32.)

(187) *CE 604.*—One .38 special caliber lead, round-nose bullet removed from the body of Officer Tippit. The bullet is consistent with Remington-Peters manufacture. The class characteristics are five lands and five grooves, right twist. The weight is 154.7 grains. (See fig. 33.)

(188) *CE 605.*—One .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet removed from the body of Officer Tippit. The bullet is consistent with Western Cartridge Co. manufacture. The class characteristics are five lands and five grooves, right twist. The weight is 152.8 grains. (See fig. 34.)

(189) *CE 606.*—Two bullets test-fired by the FBI in the CE 143 revolver, as follows: One .38 special caliber lead, round-nose bullet consistent with Winchester Repeating Arms manufacture; and one .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet consistent with Western Cartridge Co. manufacture. (See hearings before the Warren Commission, vol. 17, p. 271.)

(191) *Panel Tippit T–1—T–4.*—T–1 and T–2: .38 special caliber cartridges of Remington Cartridge Co. manufacture, with lead bullets (see figs. 35A, 35B, and 35E); T–3 and T–4: .38 special caliber cartridges of Western Cartridge Co. manufacture with copper-coated (Lubaloy), lead, round-nose bullets (see figs. 35C, 35D, and 35E).

(192) All cartridges were test fired by the panel into a horizontal water-recovery tank.

Findings and Conclusions

What are the dimensional differences of a .38 S. & W. caliber cartridge and a .38 special caliber cartridge? Can a .38 special caliber

*The panel's visual and microscopic examination revealed no markings which could be attributed to any attempt to discharge them in a firearm.

**The panel found a split in the side of the Winchester Repeating Arms cartridge case. (See fig. 30.)

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cartridge be inserted in a weapon chambered for a .38 S. & W. caliber cartridge? Would this cause the side of the cartridge case to split, as happened with the CE 595 cartridge case test fired by the FBI in Oswald's revolver?

(193) A .38 S. & W. caliber cartridge and the .38 special caliber cartridge differ in the diameter of the neck, head and rim, and in length. The standard dimensions are: (*81*)

[In inches]

	.38 S&W	Average	.38 special	Average
Diameter neck	0. 375–0. 386	0. 380	0. 372–0. 378	0. 375
Diameter head	. 379–. 386	. 381	. 372–. 379	. 376
Diameter rim	. 424–. 441	. 433	. 424–. 444	. 434
Length	. 725–. 794	. 760	1. 120–1. 168	1. 144

(194) The .38 S&W caliber cartridge is approximately 0.005 inch larger in neck and head diameters, 0.001 inch smaller in rim diameter, and 0.384 inch shorter in case length. (*82*)

(195) Overall length of the .38 S&W caliber cartridge is approximately 1.20 inches. Overall length of the .38 special caliber cartridge is approximately 1.55 inches. (*83*)

(196) A revolver designed and manufactured to accept a .38 S&W caliber cartridge cannot fire a .38 special caliber cartridge without modification. One common method of modification is rechambering the cylinder.

(197) The panel noted that one of the FBI test-fired cartridge cases was split on the side. The panel attributed this split to one or more of the following factors: (1) The oversized chamber on the CE 143 revolver; (2) a weak cartridge case sidewall; or (3) excessive chamber pressures. During the panel's test firing of the CE 143 revolver, one test cartridge case split in a similar manner, which it attributed to the same possible causes.

Were the four cartridge cases (CE 594) recovered from the scene of the Tippit murder fired in the CE 143 revolver recovered from Oswald when apprehended?

(198) The panel microscopically compared the four CE 594 cartridge cases with the two CE 606 cartridge cases test-fired by the FBI and the four cartridge cases test fired by the panel in the CE 143 revolver. The panel found correspondence among the individual identifying characteristics produced by the firing pin and breech face. The panel concluded the four CE 494 cartridge cases were fired in the CE 143 revolver. (See figs. 36 A, B, C, and D and 36E.)

Were the four bullets recovered from officer Tippit's body (CE 602 through CE 605) fired from the CE 143 revolver recovered from Oswald when apprehended?

(199) The panel conducted microscopical examinations and comparisons of the four bullets recovered from Tippit's body (CE 602 through CE 605), the two bullets test fired by the FBI (CE 606), and the four

bullets (Tippit T–1 through T–4) test fired by the panel in the CE 143 revolver.

(200) The panel found correspondence among the class characteristics on all the fired bullets. Nevertheless, no significant correspondence was found among the individual identifying characteristics of CE 602 through CE 605 and the test-fired bullets. Conversely, no gross differences were found. The finding was inconclusive because of the extensive damage to the bullets recovered from Tippit's body. The panel attributed this to the effects of impact, penetration and wiping. Portions of the bearing surfaces of the CE 602 through CE 605 bullets also showed indications of gas erosion, which is caused by the hot gases produced by the burning of the propellant powder. The panel attributed this to the firing of either undersized bullets through the CE 143 barrel or the barrel of the revolver having become oversized due to wear and deterioration.

(201) The panel's two test-fired lead bullets could be identified with each other, as could its two test-fired copper-coated (Lubaloy) lead bullets. The lead and the copper-coated bullets could not, however, be identified with one another. The panel attributed these differences to variations in the composition of bullet surface materials.

(202) Due to the inconsistent markings on the recovered bullets and on all the test-fired bullets, the panel concluded that the CE 602 through CE 605 bullets could not be conclusively identified or eliminated as having been fired from the CE 143 revolver. (See figs. 31, 32, 33, 34, 35A, 35B, 35C, and 35D.)

Of the four expended cartridge cases found at the scene of the Tippit murder, two were of Western Cartridge Co. manufacture, two of Remington-Peters. The autopsy of Tippit, however, revealed three bullets of Western Cartridge Co. manufacture and one of Remington-Peters. Can the panel formulate an opinion about this discrepancy? Is it possible to determine which bullet came from each particular cartridge case?

(203) The two expended .38 special caliber cartridge cases (CE 574—Q75 and Q76) of Western Cartridge Co. manufacture and three of the recovered .38 special caliber copper-coated (Lubaloy) lead bullets (CE 602, CE 603, and CE 605) are components of Western Cartridge Co. ammunition. The two expended Remington-Peters cartridge cases (CE 594—Q74 and Q77) and the recovered .38 special caliber lead bullet (CE 604) are components of Remington-Peters Co. ammunition.

(204) The panel concluded that they were all components of factory-loaded ammunition. Visual and microscopical examination of the recovered cartridge cases revealed no evidence of reloading. It is logically assumed that cases and bullets of the same manufacture could have originated from the recovered cartridge cases and bullets, but the panel can render no opinion beyond this. There is no known scientific procedure that can conclusively relate a fired bullet to an expended cartridge case.

(205) The panel offers two possible explanations for the discrepancy:

1. One Western cartridge case was not recovered or is missing, and one Remington-Peters lead bullet missed Officer Tippit and also was not recovered.
2. One Western cartridge case was not recovered or is missing, and one fired Remington-Peters cartridge case was in the revolver prior to the Tippit shooting.

(206) Inasmuch as the panel's examinations were related to physical evidence only, a hypothesis to account for the discrepancy regarding the recovered cartridge cases and bullets is speculation. (See figs. 24, 31, 32, 33, and 34.)

OSWALD MURDER

Evidence examined

(207) *Jack Ruby Revolver.*—A .38 special caliber Colt Cobra revolver, serial No. 2744–LW, recovered from Jack Ruby at the time of his arrest in the Dallas Police Department basement on November 24, 1963. (See figs. 37A and 37B.)*

(209) *Panel Ruby T–1 through T–6:*

—*Ruby T–1 and T–2*—Two .38 special caliber cartridges of Remington-Peters manufacture, with 158-grain, plain lead, round-nose bullets, test-fired in the Ruby revolver into a horizontal water recovery tank. (See fig. 38A.)

—*Ruby T–3 and T–4*—Two .38 special caliber cartridges of Western Cartridge Co. manufacture, with 158-grain, copper-coated (Lubaloy), lead, round-nose bullets, test-fired in the Ruby revolver into a horizontal water recovery tank. (See fig. 38B.)

—*Ruby T–5 and T–6*—Two .38 special caliber cartridges of Remington Arms Co. manufacture, with 130-grain, full metal-jacketed, round-nose bullets, test-fired in the Ruby revolver into a horizontal water recovery tank. (See fig. 38C.)

Findings and conclusions

Are there any characteristics which are easily identifiable on Jack Ruby's revolver? Does it have a "hair trigger"?

(210) There was nothing out of the ordinary about Jack Ruby's revolver except that it had a hammer shroud, which is an attachment that covers most of the hammer of a weapon. The purpose of a shroud is to prevent the hammer from snagging on clothing. It was impossible to determine if the shroud was installed at the factory.

(211) The trigger pull was found to be slightly above the maximum weight specified by the factory; the revolver, therefore, cannot be said to have a "hair trigger."

What can the panel determine from an examination of the Ruby evidence?

(212) The panel members conducted a microscopical examination and comparison of the cartridge case and bullet components of two of its test-fired cartridges (Panel Ruby T–5 and T–6). Based on the correspondence among the individual identifying characteristics produced by the breech face and firing pin, the panel concluded that the cartridge cases could be identified with each other. Regarding the bullet components, they could also be identified with each other, based on the correspondence of individual identifying characteristics.

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*The panel physically examined the revolver and found it to be in good operating condition. It can be fired single action or double action. The trigger pull was measured at approximately 5 pounds single action and 10½ pounds double action, slightly above the maximum weight specified by the factory. The barrel is rifled with six lands and six grooves, left twist. The cylinder has a six-cartridge capacity.

(213) Photomicrograph and microscopical comparisons of the panel's test-fired cartridge cases and bullets with those connected with Oswald's murder were not conducted. As noted earlier, the bullets that killed Oswald and the expended cartridge case recovered from the Ruby revolver were not located by the committee. This evidence was presented at Jack Ruby's trial, but its ultimate disposition was unknown. The panel recommended that an appropriate examination be conducted on this evidence if and when it is located.

SUMMARY AND CONCLUSIONS

(214) The CE 139 Mannlicher-Carcano military rifle was found by the panel to be operable. It was in generally poor condition because of a lack of proper cleaning, maintenance or lubrication. Although the trigger pull was found to be light, the panel concluded it was not a "hair trigger." The mounting of the telescopic sight on the left side of the rifle was done as a matter of necessity because the bolt action is on the right side.

(215) As to the misidentification of the rifle as a German Mauser, many bolt-action military rifles are so similar in profile that misidentification may occur.

(216) After examining the CE 141 cartridge found in the chamber of the CE 139 rifle, the panel concluded that it had in fact been worked through the action of that rifle from the magazine.

(217) The three expended cartridge cases found on the sixth floor of the depository building were compared microscopically by the panel with the FBI test-fired cartridge cases and those test-fired by the panel in the CE 139 rifle. Based on a correspondence of individual identifying characteristics produced by the firing pin and bolt face, the panel concluded that all three were fired in the CE 139 rifle.

(218) In the opinion of the panel, the dent on the mouth of the CE 543 case (one of three found on the sixth floor) was made by the CE 139 rifle during ejection. The panel duplicated the dent when it test-fired the rifle.

(219) The panel found no evidence of multiple extractor or ejector marks on the cartridge cases which would indicate that they had been chambered on more than one occasion.

(220) The panel compared microscopically the CE 399 stretcher bullet with the two bullets test-fired by the FBI (CE 572) in the CE 139 rifle. Based on a correspondence of individual identifying characteristics, the panel concluded that CE 399 was fired from the same barrel as the FBI test-fired bullets.

(221) The panel then compared microscopically the bullets it test-fired in the CE 139 rifle with the FBI test-fired bullets and with the CE 399 stretcher bullet. The panel was unable to identify its test-fired bullets with those of the FBI or with the CE 399 bullet, nor could the panel's test-fired bullets be identified with each other. The panel attributed the results to one or more of the following factors:

1. Repeated test-firing of the CE 139 rifle, which had caused extensive changes in the rifling characteristics within the barrel, or
2. Deterioration of rifling surfaces within the barrel of the CE 139 rifle over an extended period of time because of a lack of proper cleaning, maintenance, and protective lubrication.

(222) The panel compared the CE 567 bullet fragment (nose portion) and the CE 569 bullet fragment (base portion), both found in the limousine, with the two FBI test-fired bullets (CE 572). Based on a correspondence of their individual identifying characteristics, the panel concluded that CE 567, CE 569, and the two FBI test-fired bullets were all fired through the same barrel. Again, the panel was unable to identify these bullets and fragments with its own test-fired bullets. The panel was unable to determine if CE 567 and CE 569 originated from the same bullet.

(223) The CE 573 Walker bullet was compared microscopically with the FBI test-fired bullets. A correspondence of class characteristics was found, but a correspondence of individual identifying characteristics was not found. Conversely, no gross differences were noted. The panel concluded that the Walker bullet was too damaged to allow conclusive identification of the bullet with a particular firearm.

(224) Because of their minute size, microscopic examinations were not performed on the following: CE 840—lead-like fragments found in the limousine; CE 841—lead residue removed from the limousine's windshield; CE 842—four lead-like fragments removed from Governor Connally's wrist; and CE 843—three lead-like fragments removed from President Kennedy's brain during his autopsy at Bethesda Naval Hospital.

(225) The panel concluded from its examination of the bullet fragment found near the depository building by Richard Lester in 1974 that it was not fired through the same barrel as the FBI test-fired bullets and that its physical characteristics were different from the CE 399 stretcher bullet and the CE 567 and CE 569 bullet fragments found in the Presidential limousine.

(226) The panel found the CE 143 Oswald revolver to be in good operating condition. The trigger pull was not considered exceptionally light and could not be considered a "hair trigger." The revolver had been altered; changes included the shortening of the barrel and the modification of the chamber to accommodate .38 special caliber cartridges.

(227) The panel compared microscopically the four expended cartridge cases found at the scene of the Tippit murder (CE 594) with the cartridge cases test-fired by the FBI and by the panel in the CE 143 revolver. Based on the correspondence of individual identifying characteristics produced by the breech face and firing pin, the panel concluded that all four cartridge cases were fired in the CE 143 revolver. The panel also examined the five cartridges found in Oswald's pocket after his arrests (CE 592). No marks were found that could be attributed to an attempt to discharge them in a firearm.

(228) The panel noted that one of the FBI test-fired cartridge cases was split on the side. The panel attributed this split to either an oversized chamber, a weak cartridge case sidewall, excessive chamber pressure, or some combination of these factors. One of the panel's test-fired cartridge cases split in a similar manner during the test-firing of the CE 143 revolver.

(229) The panel examined the four bullets removed from the body of Officer Tippit during his autopsy. All four had sustained considerable damage from impact, penetration, and wiping. CE 604 was found

to be consistent with Remington-Peters manufacture, while CE 602, 603, and 605 were found to be consistent with Western Cartridge Co. manufacture. A correspondence was found among the number of lands and grooves and direction of twist of all four bullets, but no significant correspondence among individual identifying characteristics was found when the Tippit bullets were compared with bullets test-fired by the FBI or the panel in the CE 143 revolver. Consequently, the panel was unable to conclude that the Tippit bullets were fired from the CE 143 revolver. Conversely, the panel was unable to eliminate the bullets as having been fired from the CE 143 revolver.

(230) The Tippit bullets, the FBI, and the panel test-fired bullets all showed variations in their individual identifying characteristics, which commonly result from firing under-sized bullets in a barrel or the firing of normal-sized bullets in a firearm that has become oversized due to wear and deterioration.

(231) The panel took note of a discrepancy between the brand of the bullets removed from Tippit's body and the brand of the cartridge cases found at the Tippit murder scene. Three of the recovered bullets were of Western Cartridge Co. manufacture, the fourth of Remington-Peters manufacture. Of the four recovered cartridge cases, however, two were of Western Cartridge Co. manufacture and two were of Remington-Peters manufacture. The panel gave two possible explanations. First, one Western cartridge case was not recovered and one Remington-Peters bullet missed Officer Tippit and also was not recovered. Second, one Western cartridge case was not recovered, and one Remington-Peters cartridge case was in the revolver prior to the Tippit shooting. The panel noted that its function was to examine the physical evidence as presented by the select committee. Hypotheses about the discrepancies in the physical evidence were beyond its scope of responsibility.

(232) The Jack Ruby revolver, which was seized from him at the time of his apprehension in the basement of the Dallas Police Department, was examined by the panel and found to be in good operating condition. The trigger pull was measured and found to be in the normal range; the revolver did not have a "hair trigger."

(233) The barrel of the Ruby revolver is rifled with six lands and six grooves, left twist. The only thing out of the ordinary is that the revolver has a hammer shroud, which protects against snagging on clothing. There was no way to determine if the shroud was put on the revolver at the factory.

(234) The panel could not conduct a microscopical examination of the fatal bullet or the cartridge case from which it originated because the evidence has not been located. The panel suggested that such an examination be conducted when and if the evidence is found.

Recommendations of the firearms panel

(235) The panel found that the firearms evidence had not been maintained in proper condition. It strongly recommended that the firearms evidence—cartridges, cartridge cases, bullets and fragments—be permanetly sealed. More specifically:

1. All foreign material should be removed from the exhibit with a mild solution of saline or hemosol.

2. After cleaning, they should be handled with cotton gloves to prevent oxidation from body fluids.
3. They should then be sealed in airtight plastic containers.

(236) With respect to the rifle and revolver, the panel recommended that:

1. The foam rubber packing material in their storage cases should be removed and replaced with nonmoisture absorbing partitions.
2. The storage cases should have small ventilation holes drilled in them to prevent condensation.
3. The rifle and revolver should be cleaned and lightly oiled or protected with a silicone compound. All future handling should be done with clean cotton gloves.

(237) The cleaning and sealing of the evidence could appropriately be done by the firearms panel.

ILLUSTRATIONS

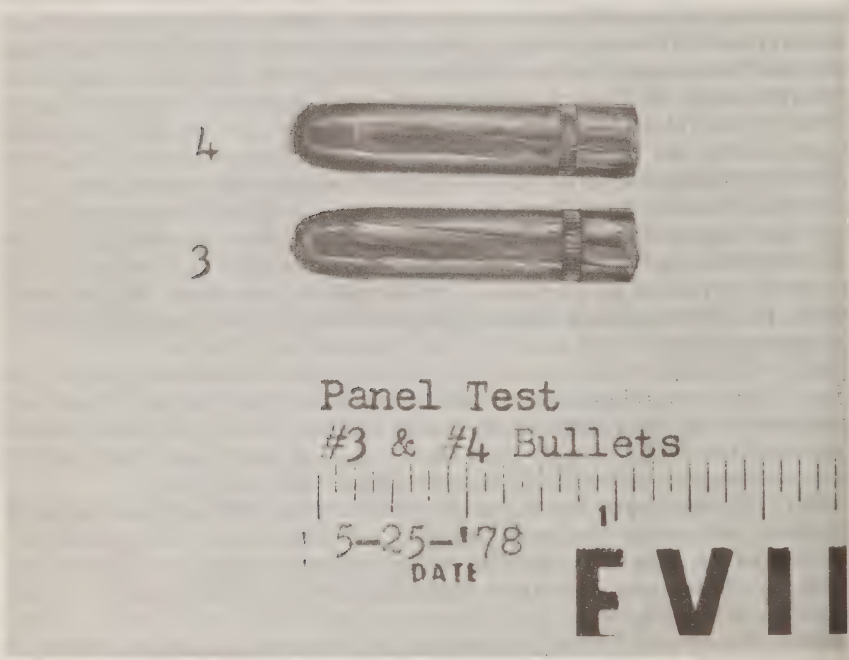


FIGURE 1.—Panel test-fired bullets from the CE 139 rifle.

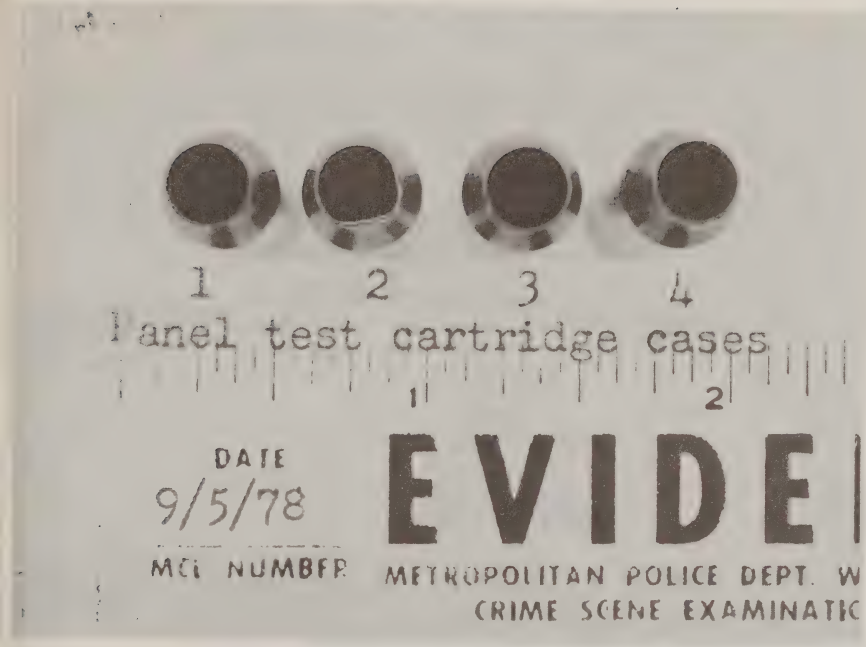


FIGURE 2.—Cartridge cases test-fired in the CE 139 rifle by the panel. Note the dent on the mouth of case No. 2, similar to the dent on the CE 543 cartridge case (see fig. 8B).



FIGURE 3A.—The CE 139 6.5-millimeter caliber Mannlicher-Carcano rifle, serial No. D2766, right side.



FIGURE 3B.—The CE 139 6.5-millimeter caliber Mannlicher-Carcano rifle. serial No. D2766, left side.



FIGURE 4.—CE 141, a 6.5-millimeter caliber cartridge of Western Cartridge Co. manufacture, found in the chamber of CE 139 rifle.

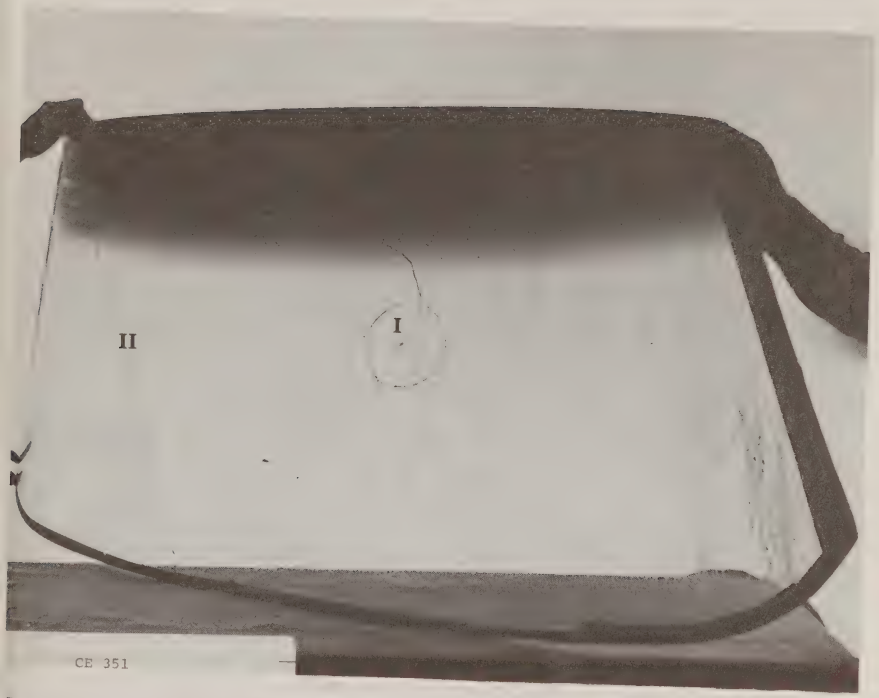
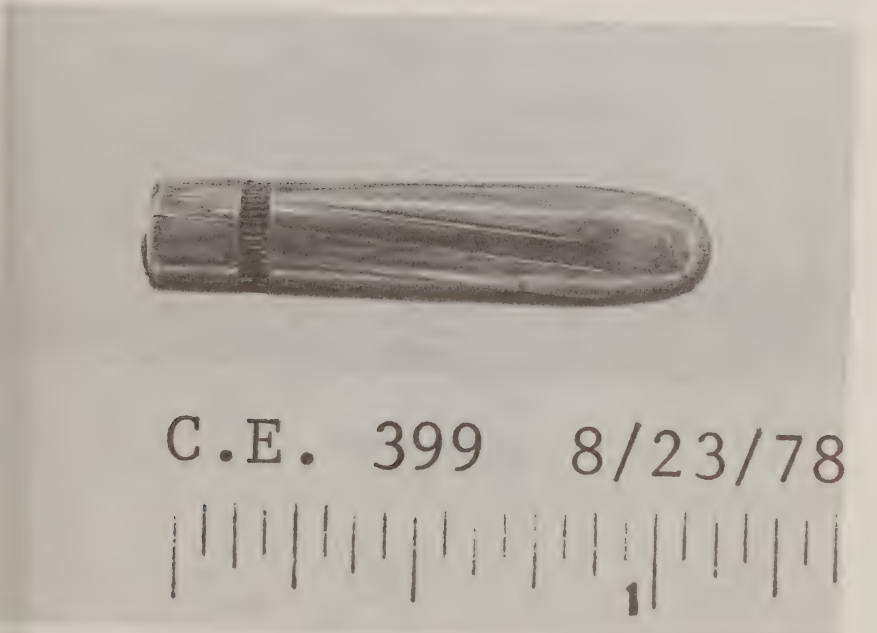


FIGURE 5.—Damaged CE 135 windshield removed from the Presidential limousine, front view.



IGURE 6A.—CE 399, the fired 6.5-millimeter caliber full metal-jacketed bullet found on a stretcher in the emergency area of Parkland Memorial Hospital. side view.

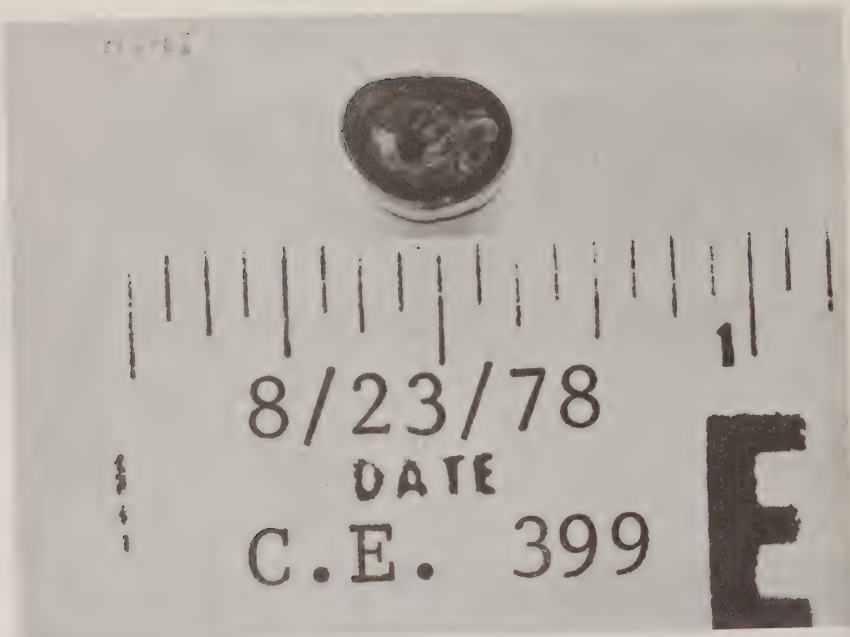


FIGURE 6B.—CE 399, the fired 6.5-millimeter caliber full metal-jacketed bullet found on a stretcher in the emergency area of Parkland Memorial Hospital, view of the base portion, showing distortion.



FIGURE 7.—CE 542, a 6.5-millimeter caliber Mannlicher-Carcano rifle, serial No. UC 5209, purchased by the FBI for comparison purposes.

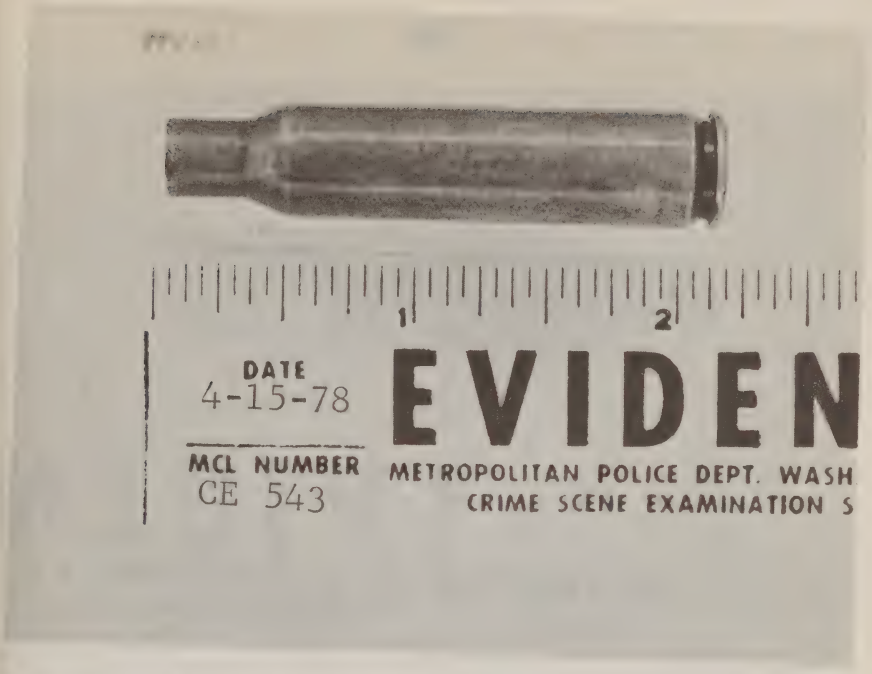


FIGURE 8A.—CE 543, one of three expended 6.5-millimeter caliber cartridge cases of Western Cartridge Co. manufarture, recovered from the sixth floor of the Texas School Book Depository, side view.

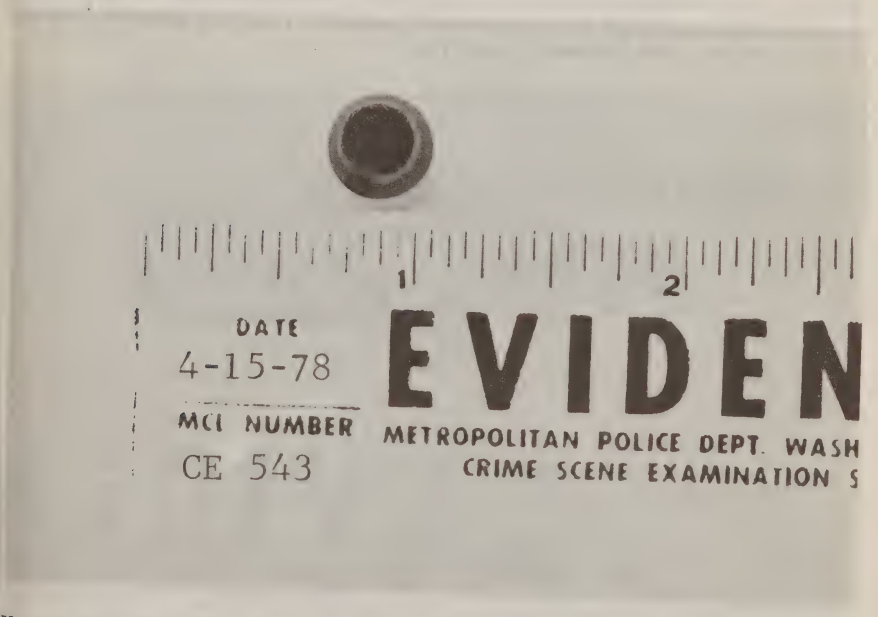


FIGURE 8B.—CE 543, one of three expended 6.5-millimeter caliber cartridge cases of Western Cartridge Co. manufacture, recovered from the sixth floor of the Texas School Book Depository, top view. Note the dent on the mouth of the case.

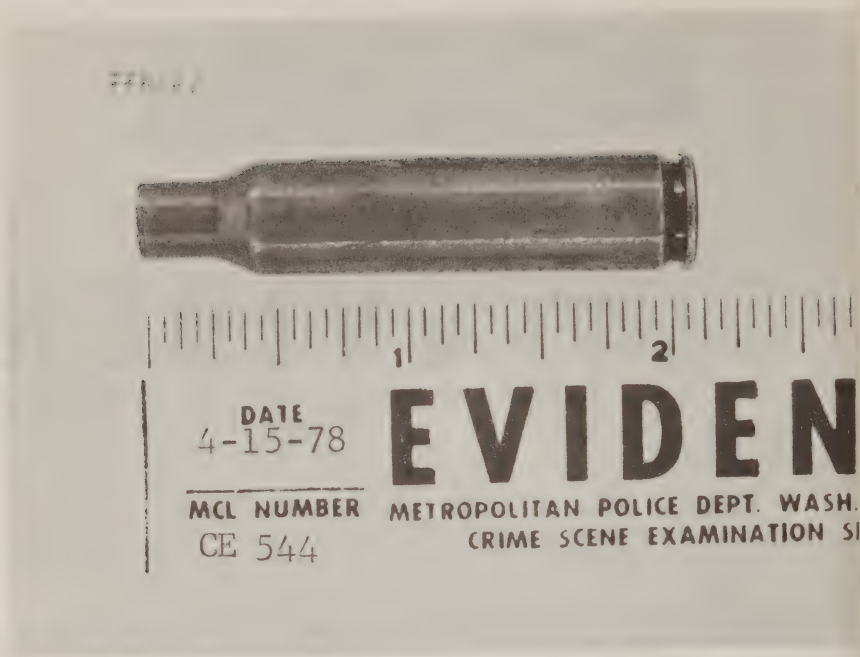


FIGURE 9.—CE 544, one of three expended 6.5-millimeter caliber cartridge cases of Western Cartridge Co. manufacture, recovered from the sixth floor of the Texas School Book Depository, side view.

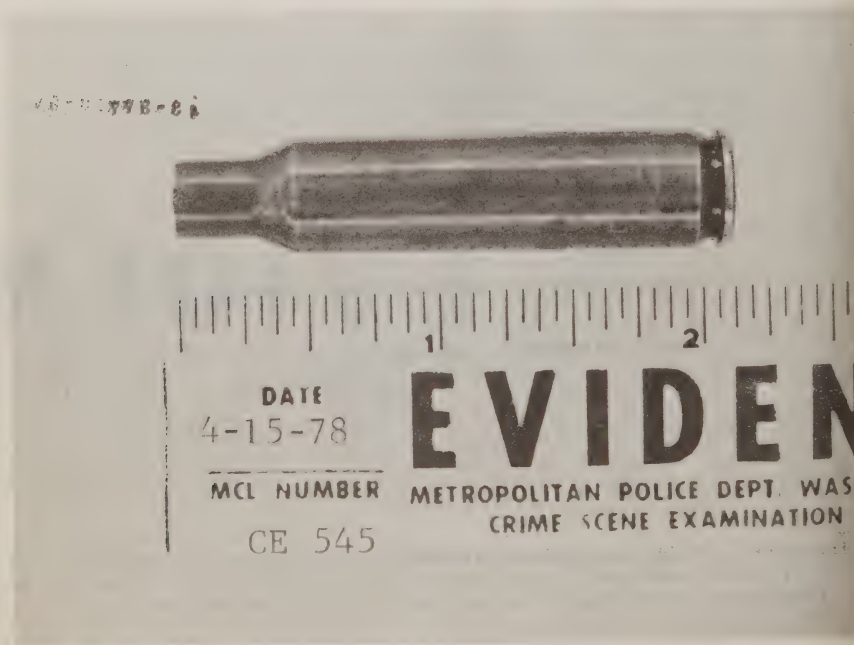


FIGURE 10.—CE 545, one of three 6.5-millimeter caliber cartridge cases of Western Cartridge Co. manufacture, recovered from the sixth floor of the Texas School Book Depository, side view.

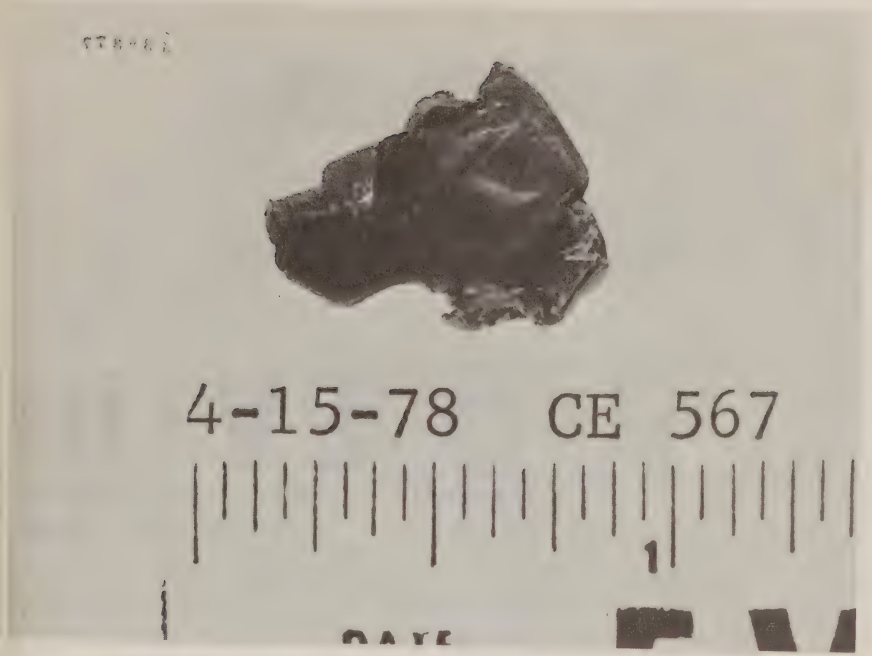


FIGURE 11.—CE 567, the nose portion of a fired 6.5-millimeter caliber metal-jacketed bullet found on the right side of the front seat of the Presidential limousine.

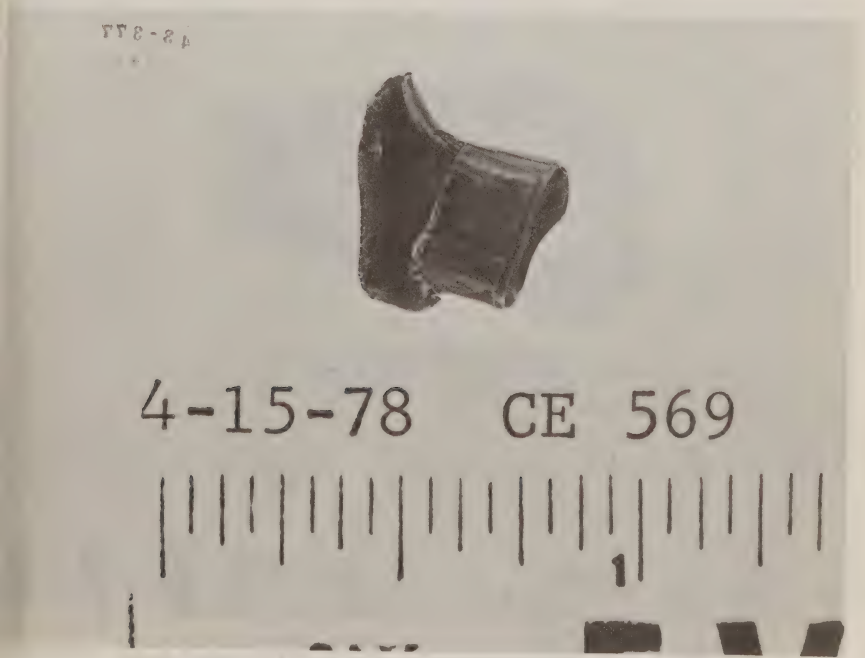


FIGURE 12.—CE 569, the base portion of a fired 6.5-millimeter caliber metal-jacketed bullet found on the floor next to the right front seat of the Presidential limousine.

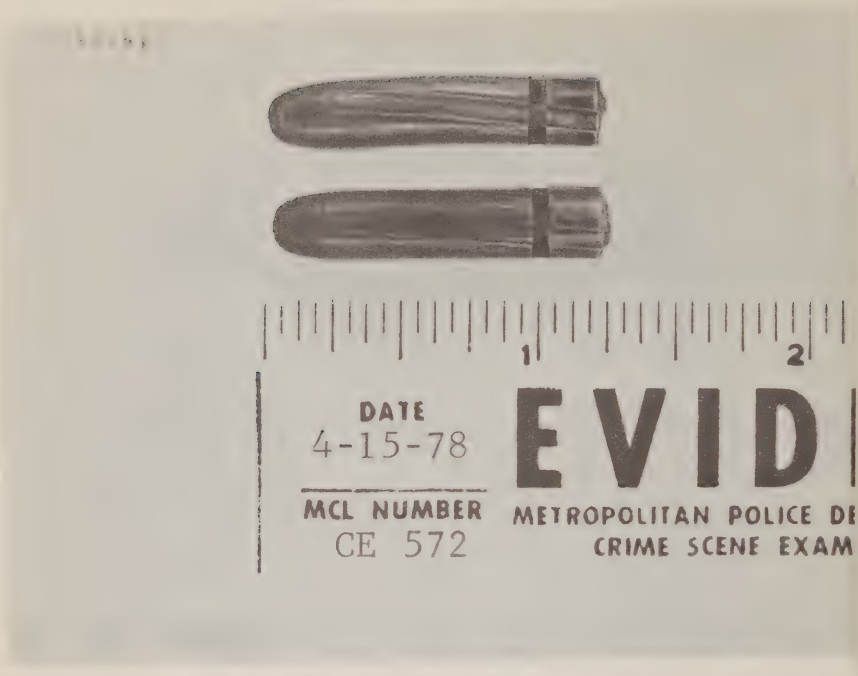


FIGURE 13.—CE 572, two fired 6.5-millimeter caliber full metal-jacketed bullets, test-fired by the FBI from the CE 139 rifle and designated as K1A and K1B.

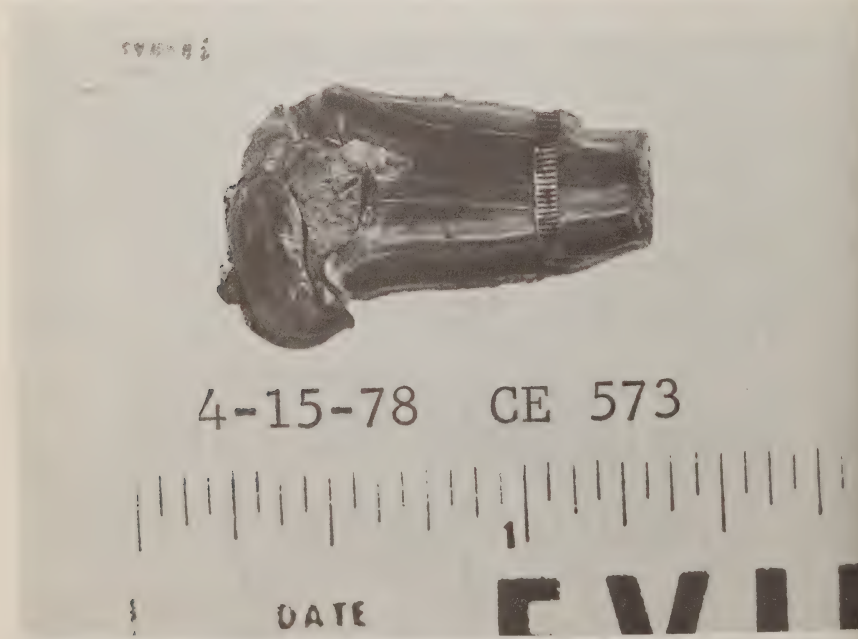


FIGURE 14.—CE 573, the 6.5-millimeter caliber metal-jacketed bullet recovered from the residence of General Edwin Walker.

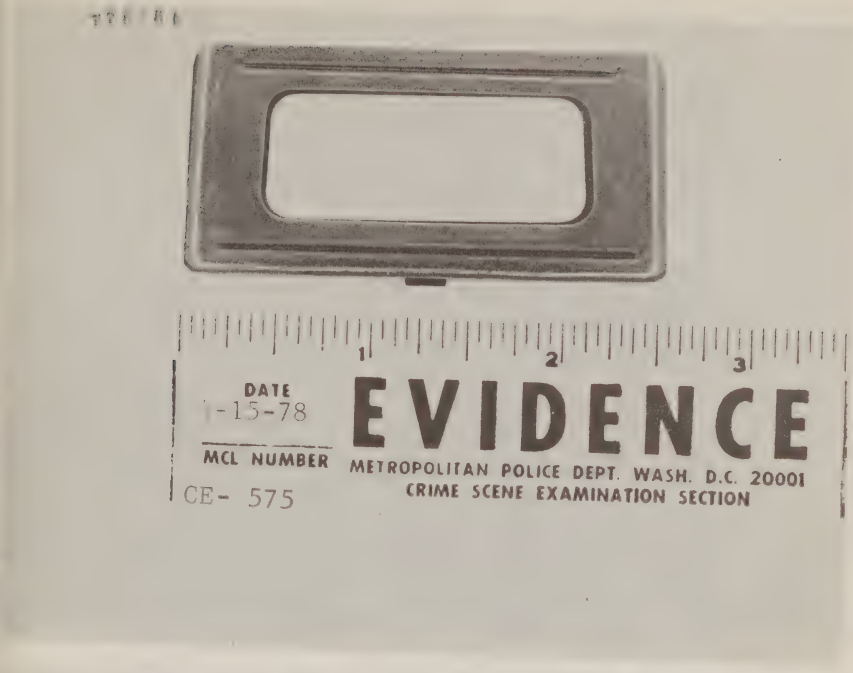


FIGURE 15.—CE 575, the brass cartridge clip removed from the CE 139 rifle.

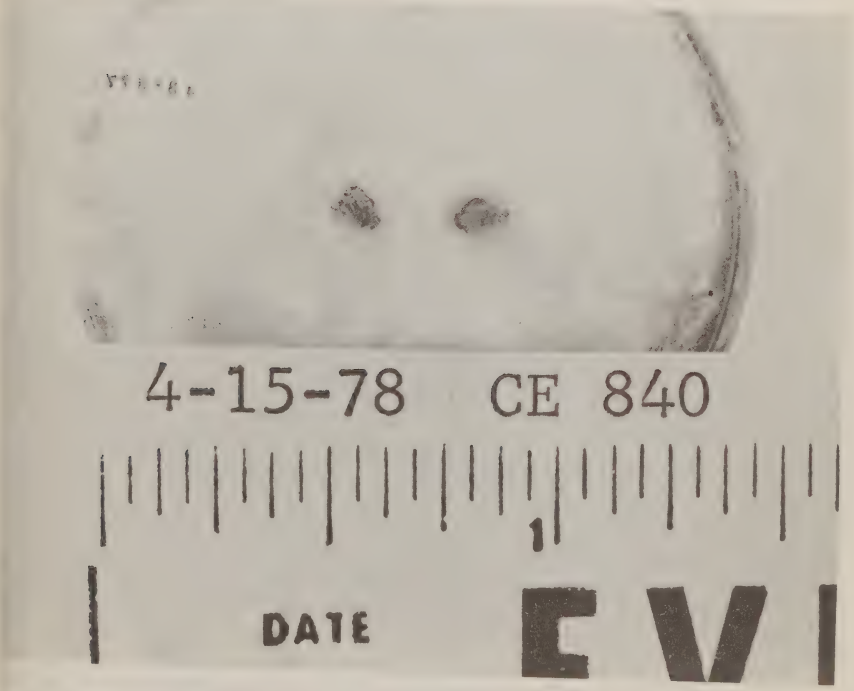


FIGURE 16.—CE 840, two lead-like fragments found underneath the left jump seat of the Presidential limousine.

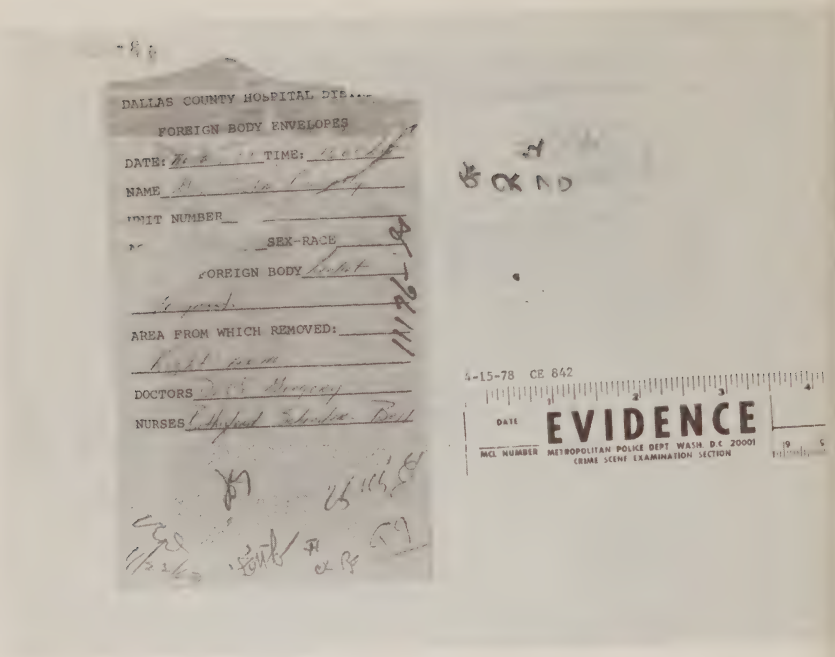


FIGURE 17.—CE 842, four lead-like fragments, removed from Governor Connally

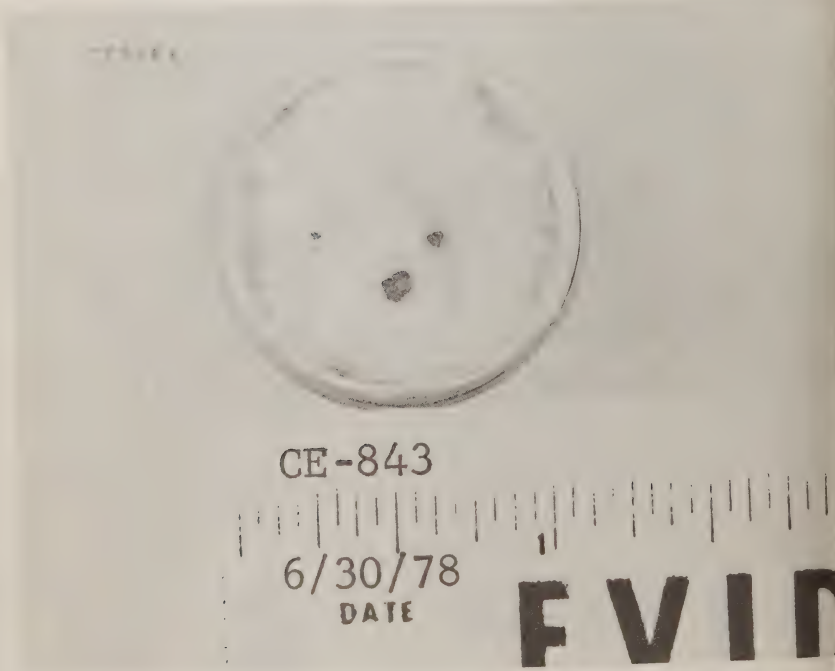


FIGURE 18.—CE 843, three lead-like fragments removed from President Kenned brain during the autopsy.

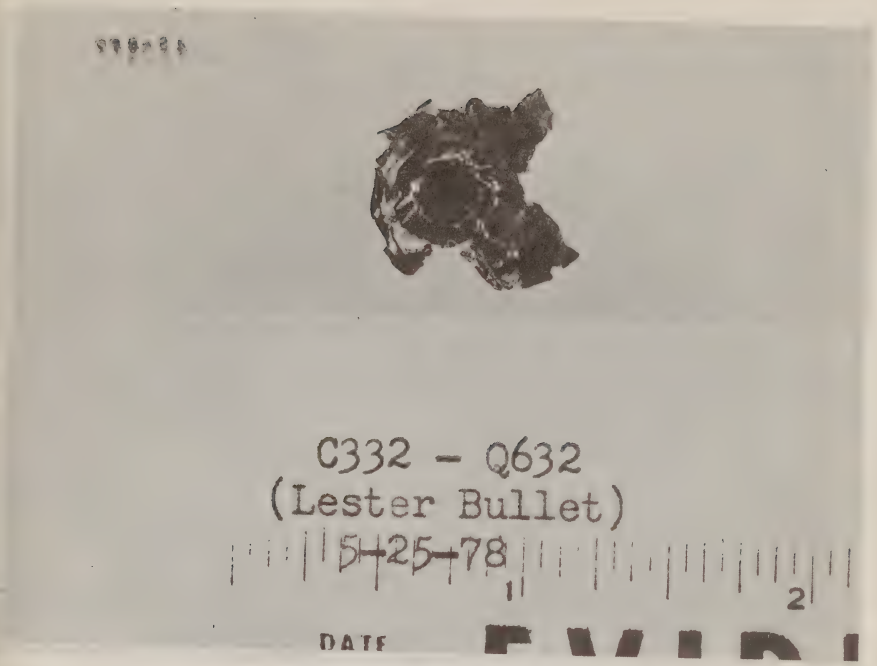


FIGURE 19.—The Lester bullet, a fired soft- or hollow-pointed, metal-jacketed bullet found in 1974 by Richard Lester about 500 yards from the depository near the Triple overpass.

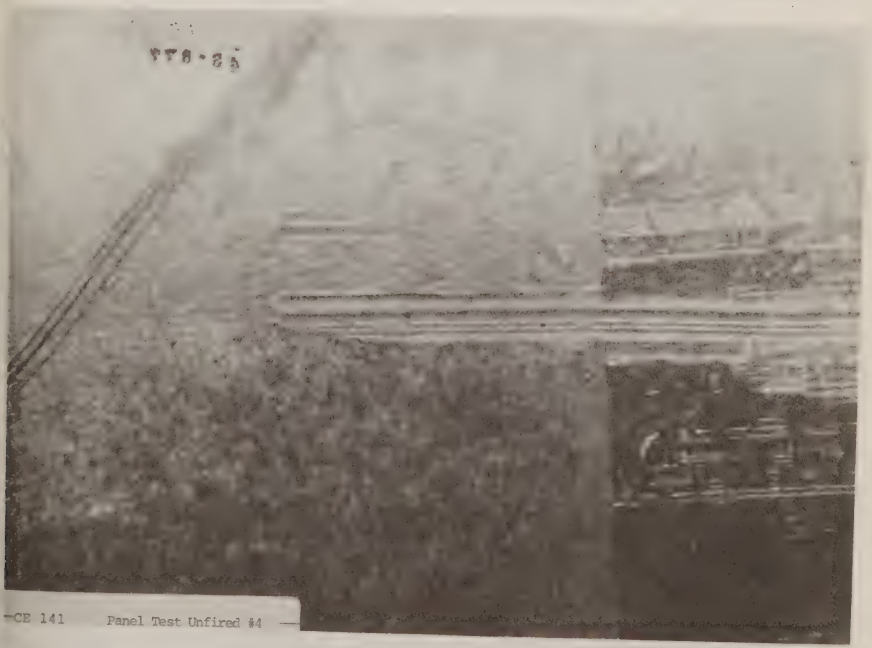


FIGURE 20.—Photomicrograph showing the correspondence between the individual identifying characteristics on the side of the CE 141 cartridge (L) and on panel unfired test cartridge No. 4 (R), produced by the magazine follower of the CE 139 rifle.



FIGURE 21A.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 543 cartridge case (L) and on panel Kennedy T–1 (R), produced by the firing pin of the CE 139 rifle.



FIGURE 21B.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 543 cartridge case (L) and those on the panel Kennedy T–3 (R), produced by the extractor of the CE 139 rifle.

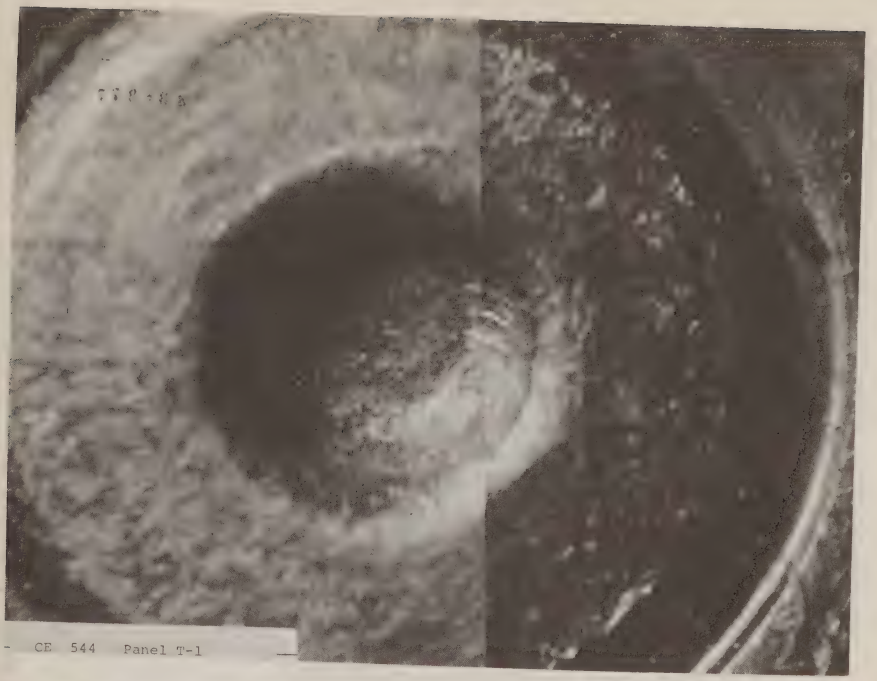


FIGURE 21C.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 544 cartridge case (L) and those on panel Kennedy T–1 (R) produced by the bolt face of the CE 139 rifle.



FIGURE 21D.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 545 cartridge case (L) and those on panel Kennedy T–3 (R), produced by the bolt face of the CE 139 rifle.



FIGURE 22A.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 399 bullet (L) and those on CE 572–K1A bullet (R), test-fired by the FBI in the CE 139 rifle.



FIGURE 22B.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 399 bullet (L) and those on the CE 572–K1A bullet (R), test-fired by the FBI in the CE 139 rifle.

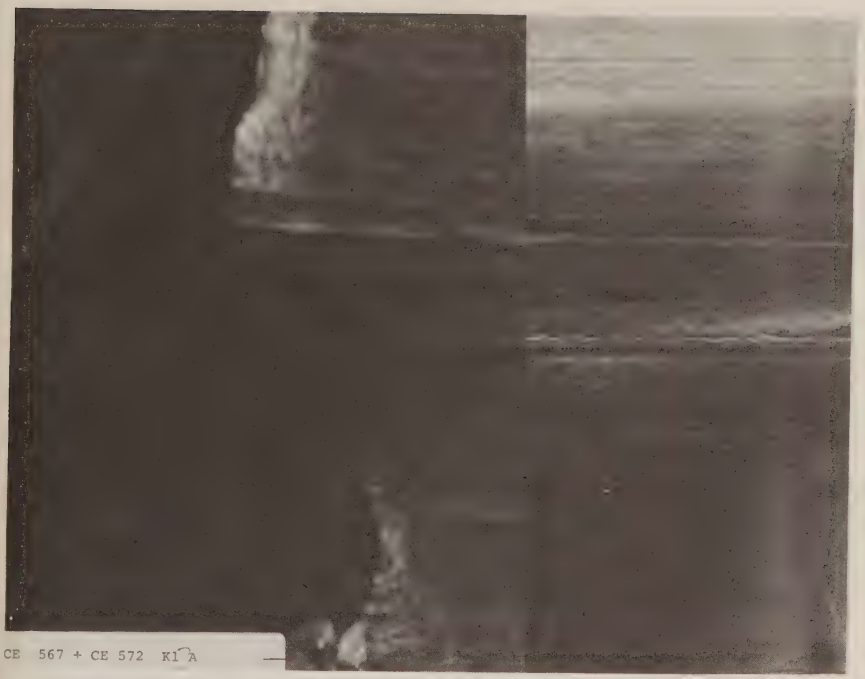


FIGURE 23A.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 567 bullet fragment (L) and those on CE 572–K1A (R), test-fired by the FBI in the CE 139 rifle.



FIGURE 23B.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 567 bullet fragment (L) and those on CE 572–K1B (R), test-fired by the FBI in the CE 139 rifle.



FIGURE 24A.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 569 bullet fragment (L) and CE 572–K1A bullet (R), test-fired by the FBI in CE 139 rifle.



FIGURE 24B.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 569 bullet fragment (L) and the CE 572–K1B bullet (R), test-fired by the FBI in the CE 139 rifle.



FIGURE 25.—A 7.65-millimeter caliber Argentine Mauser rifle, Model 1891.



FIGURE 26A.—CE 143. Oswald's .38 special caliber Smith and Wesson revolver, Victory model, serial No. V510210, right side.

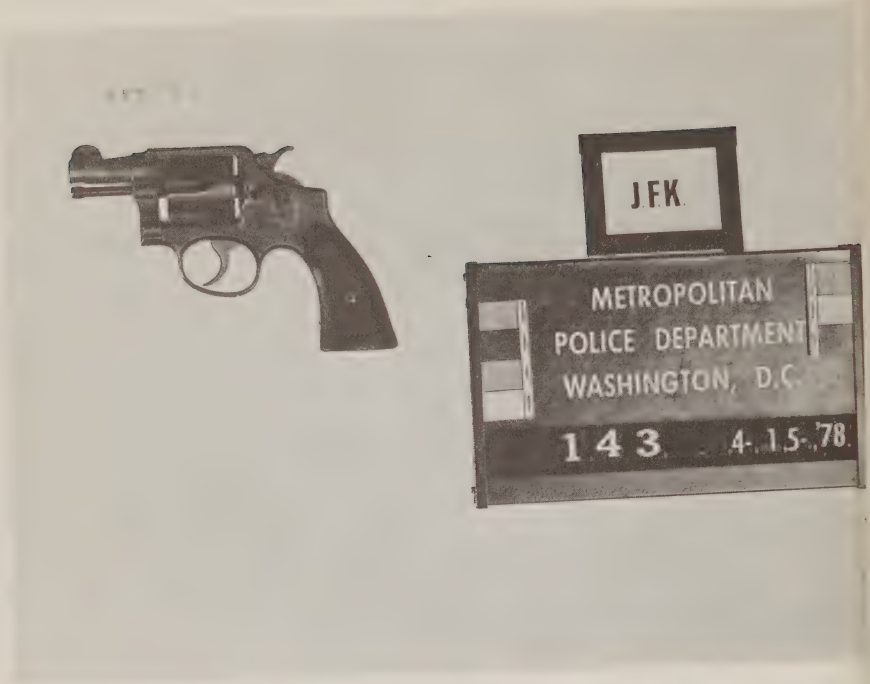


FIGURE 26B.—CE 143, Oswald's .38 special caliber Smith and Wesson revolver, Victory model, serial No. V510210, left side.

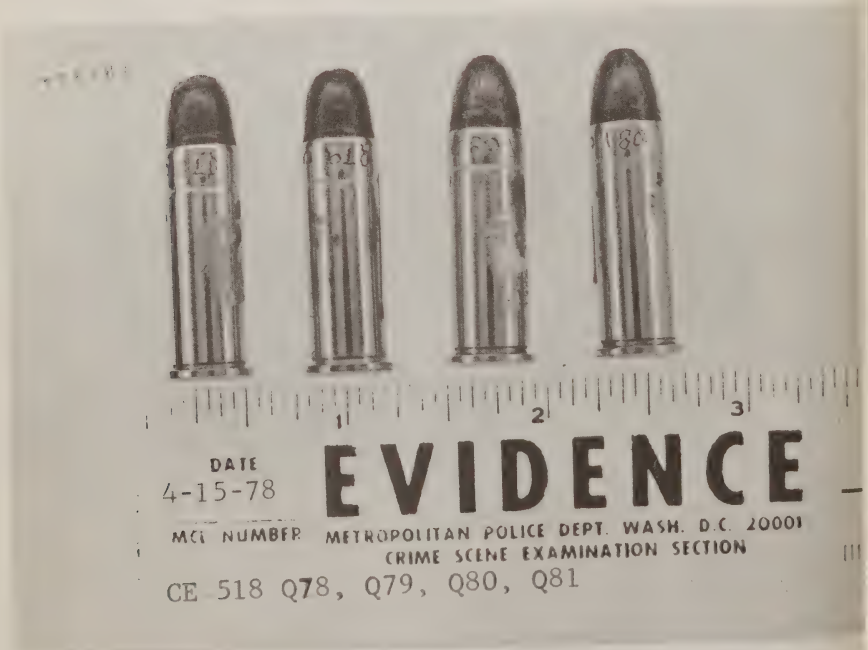


FIGURE 27.—CE 518, four .38 special caliber cartridges, designated Q78–Q81 by the FBI, found in Oswald's revolver. Q78 and Q79 have copper-coated (Lubaloy), lead, round-nose bullets; Q80 and Q81 have plain lead, round-nose bullets.

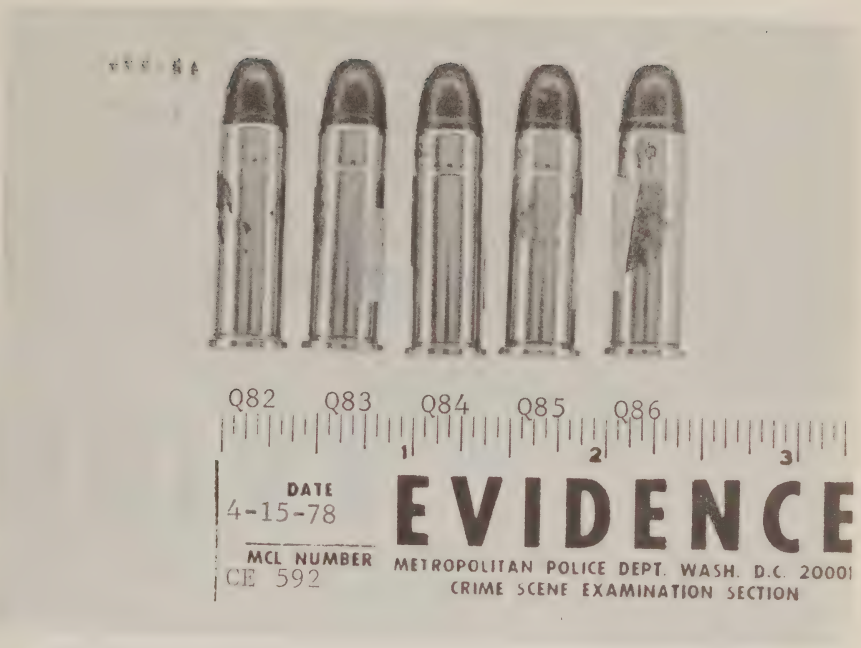


FIGURE 28.—CE 592, five .38 special caliber cartridges of Western Cartridge Co. manufacture, with copper-coated (Lubaloy), lead, round-nose bullets, designated Q82–Q86 by the FBI. The cartridges were found in Oswald's trouser pocket.

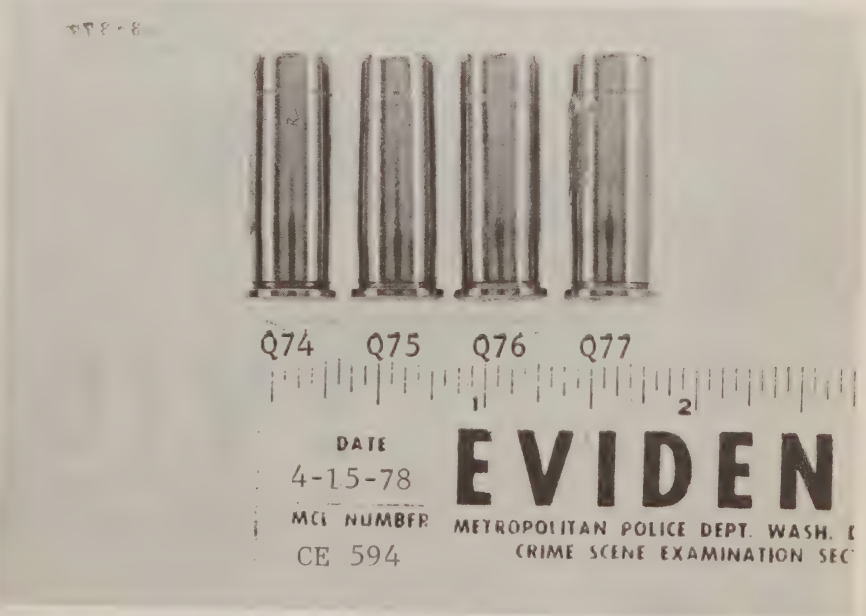


FIGURE 29.—CE 594, four expended cartridge cases recovered from the scene of the Tippit murder, designated Q74–Q77 by the FBI. Q75 and Q76 of Western Cartridge Co. manufacture, Q74 and Q77 are of Remington Arms manufacture.

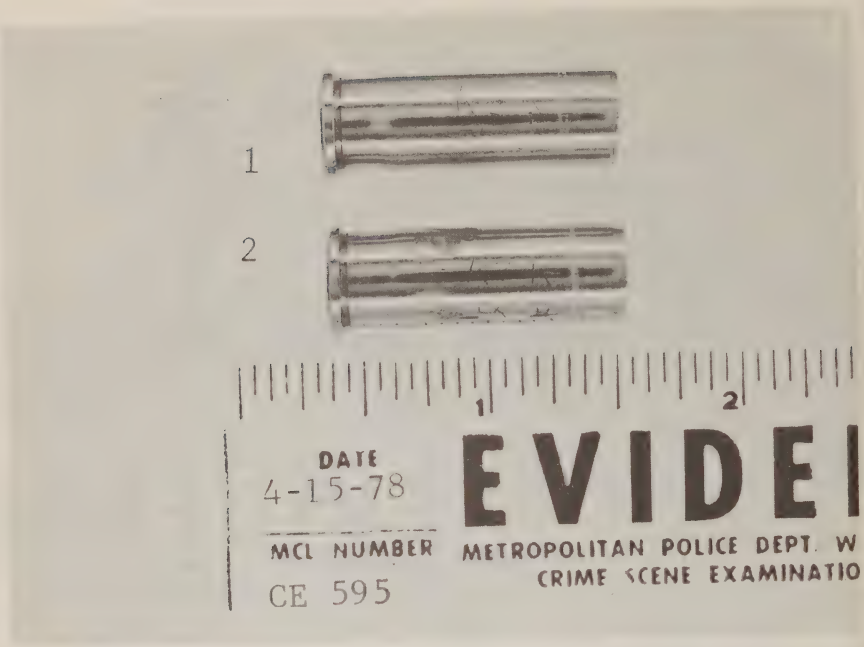


FIGURE 30.—CE 595, two cartridge cases, test-fired by the FBI in the CE 143 revolver. K3–1 is .38 special caliber of Winchester Repeating Arms manufacture. K3–2 is of Western Cartridge Co. manufacture; it has a split in the side, at the point of the bulge along the top side of the case.

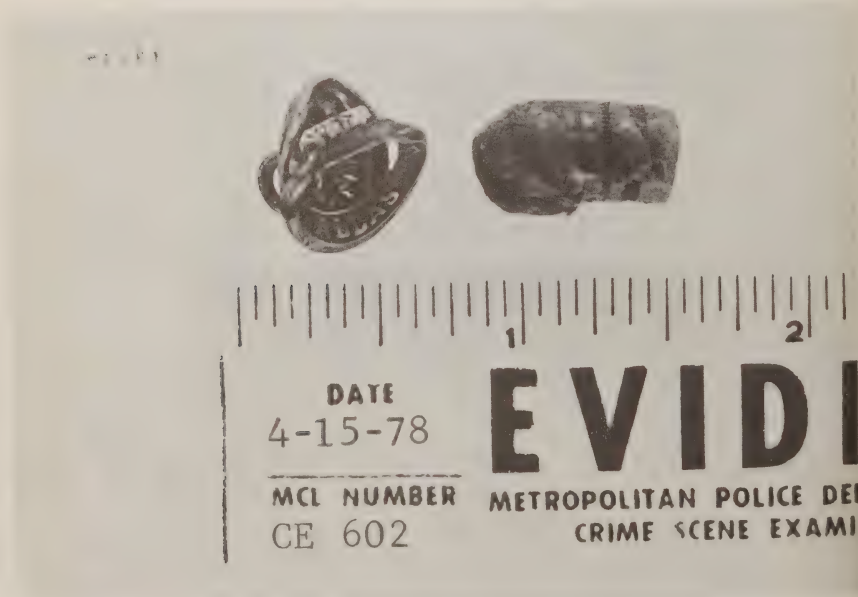


FIGURE 31.—CE 602, one .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet, and one damaged brass-colored garment button with the lettering "City of Dallas," removed from the body of Officer Tippit. The bullet shows impact damage caused by striking the button and Officer Tippit's body.

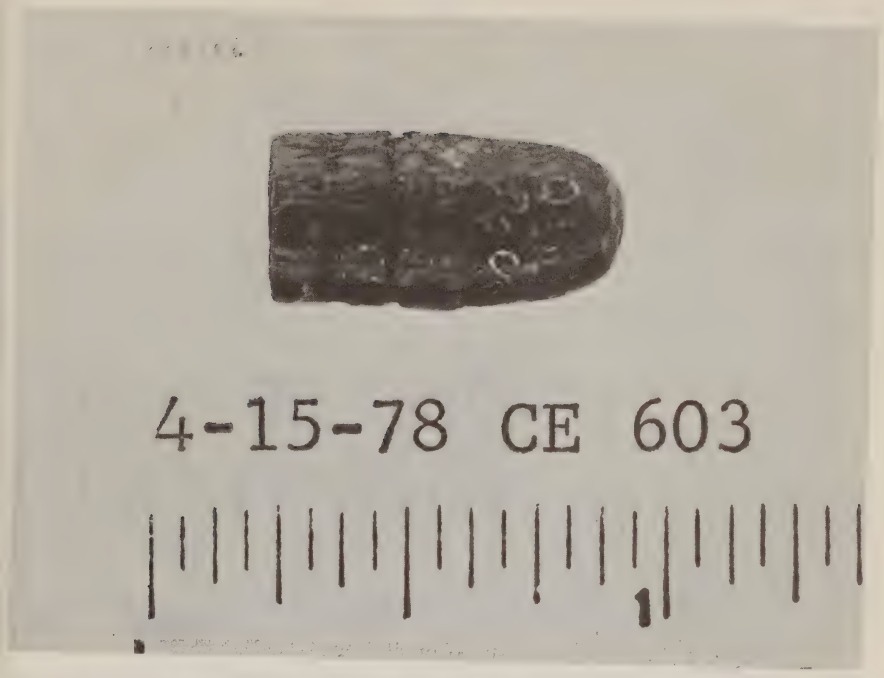


FIGURE 32.—CE 603, one .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet, removed from the body of Officer Tippit.

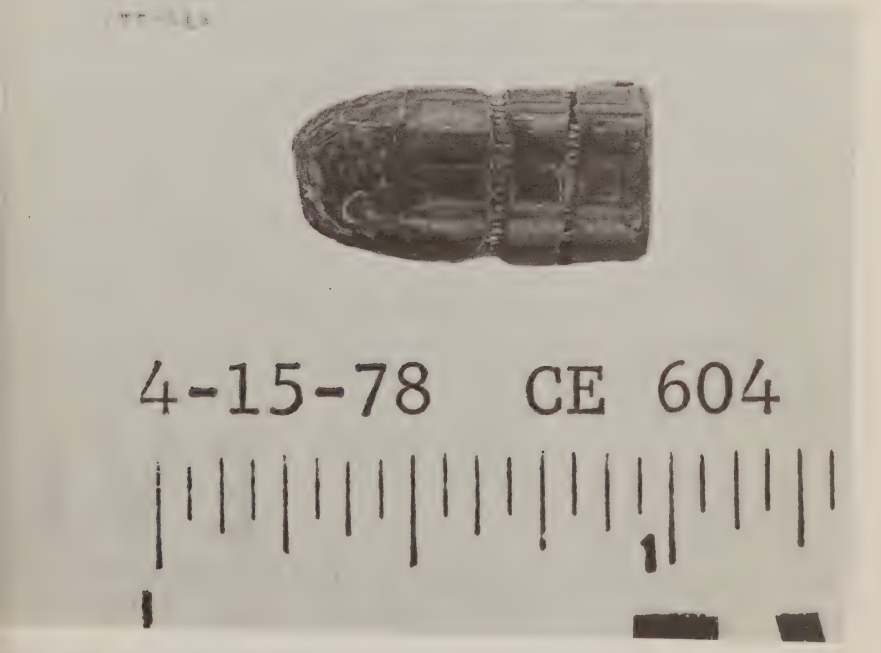


FIGURE 33.—CE 604, one .38 special caliber lead, round-nose bullet, removed from the body of Officer Tippit.

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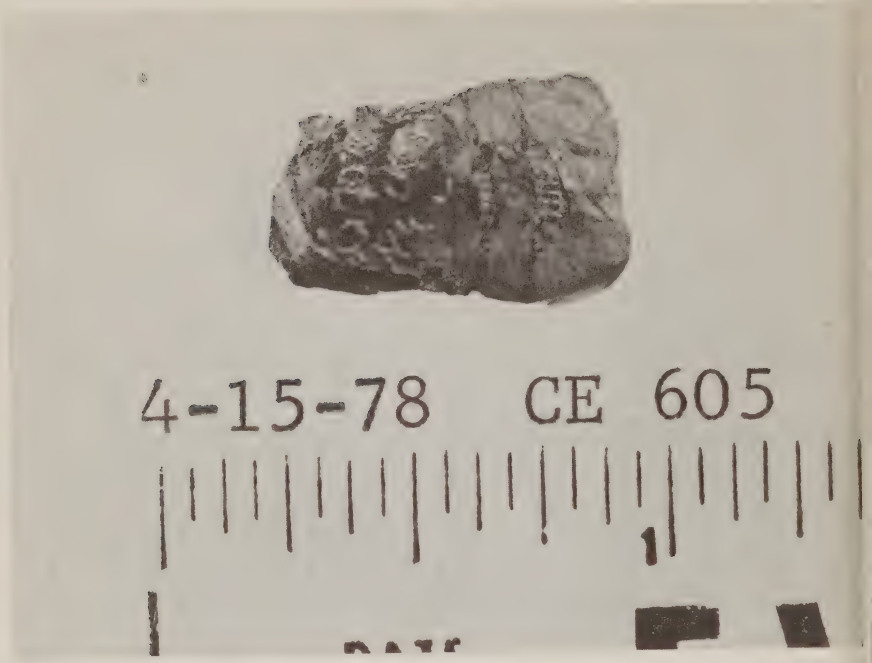


FIGURE 34.—CE 605, one .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet, removed from the body of Officer Tippit.



FIGURE 35A.—Panel Tippit T–1: One .38 special caliber lead bullet of Remington-Peters manufacture, test-fired from CE 139 by the panel into a horizontal water recovery tank.

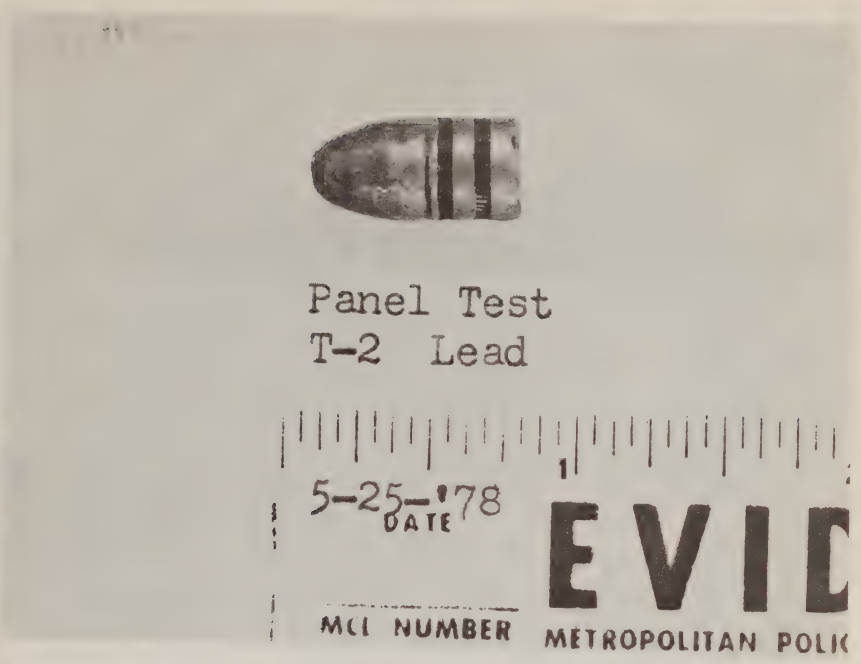


FIGURE 35B.—Panel Tippit T–2: one .38 special caliber lead bullet of Remington-Peters manufacture, test-fired from CE 143 by the panel into a horizontal water recovery tank.

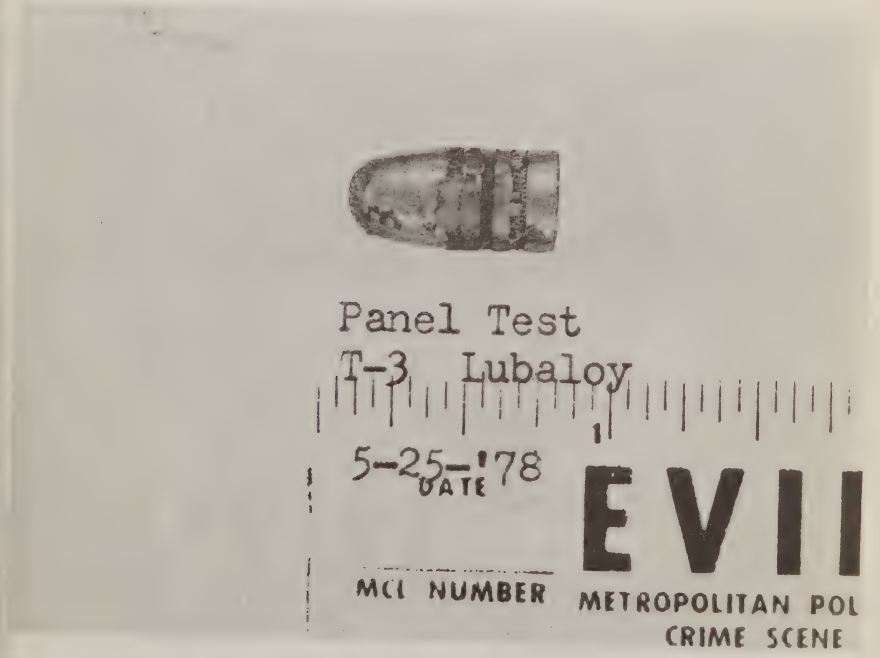


FIGURE 35C.—Panel Tippit T–3: 1 .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet of Western Cartridge Co. manufacture, test-fired from CE 143 by the panel into a horizontal water recovery tank.



FIGURE 35D.—Panel Tippit T–4: 1 .38 special caliber copper-coated (Lubaloy), lead, round-nose bullet of Western Cartridge, Co. manufacture, test-fired from CE 143 into a horizontal water recovery tank.

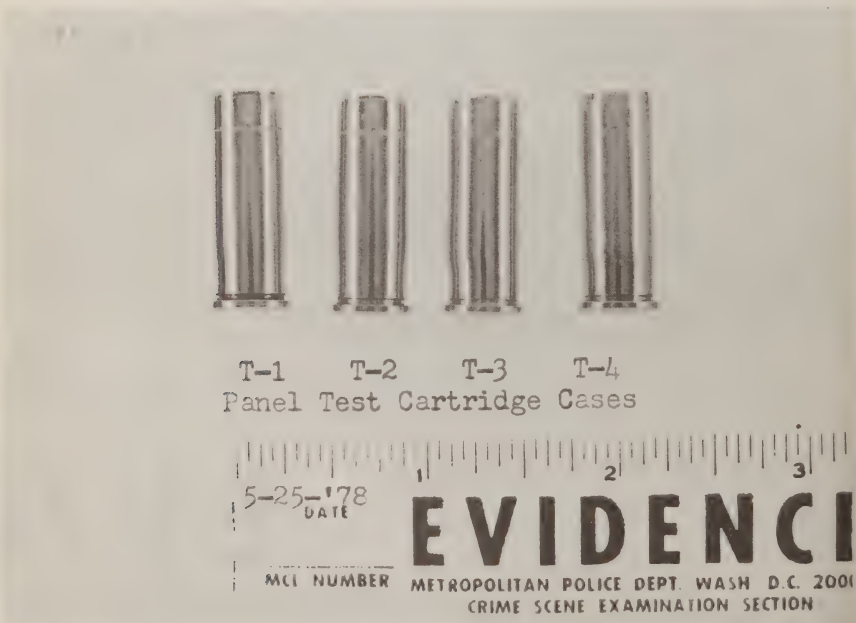


FIGURE 35E.—Panel Tippit T–1—T–4: Four expended .38 special caliber cartridge cases. Tippit T–1 and T–2 are of Remington-Peters manufacture: Tippit T–3 and T–4 are of Western Cartridge Company; all are fired in the CE 143 revolver.

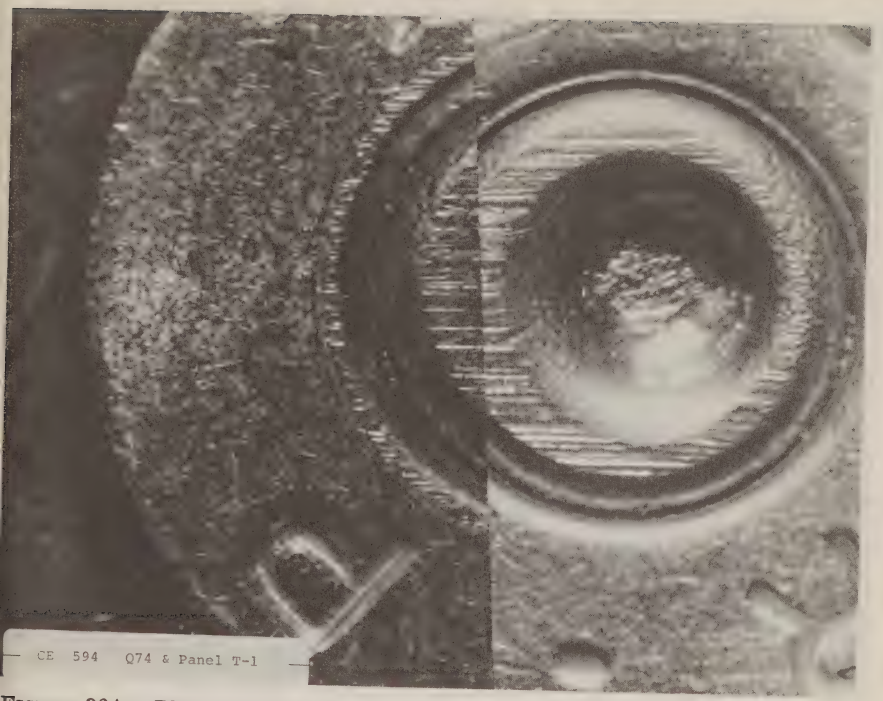


FIGURE 36A.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 594 (Q74) cartridge case (L) and the panel Tippit T–1 cartridge case (R), produced by the breech face of the CE 143 revolver.



IGURE 36B.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 594 (Q75) cartridge case (L) and the panel Tippit T–1 cartridge case (R), produced by the breech face of the CE 143, revolver.

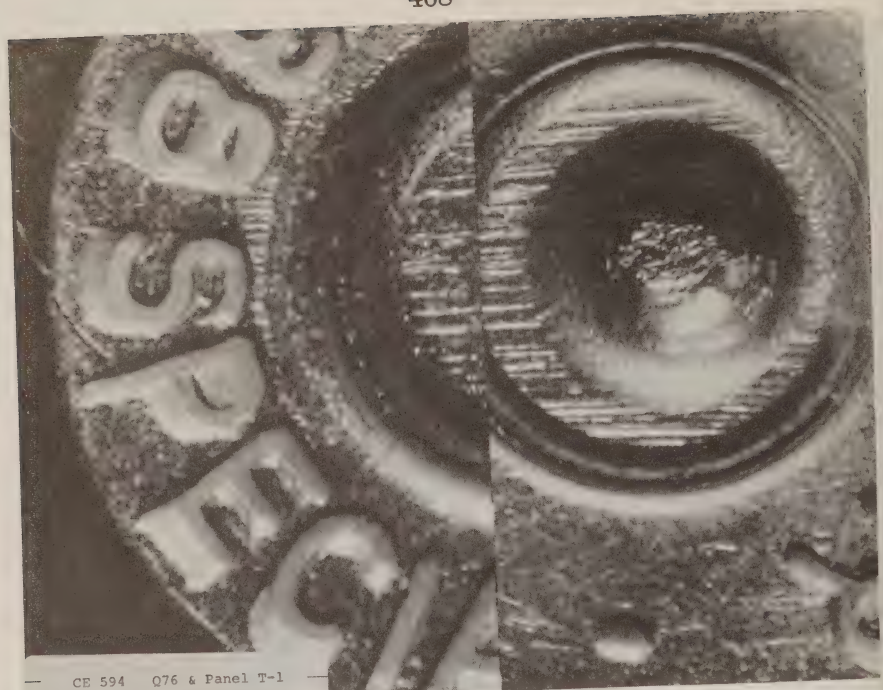


FIGURE 36C.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 594 (Q76) cartridge case (L) and the Tippit T–1 cartridge case (R), produced by the breech face of the CE 143 revolver.



FIGURE 36D.—Photomicrograph showing the correspondence between the individual identifying characteristics on the CE 594 (Q77) cartridge case (L) and the panel Tippit T–1 cartridge case (R) produced by the breech face of the CE 143 revolver.

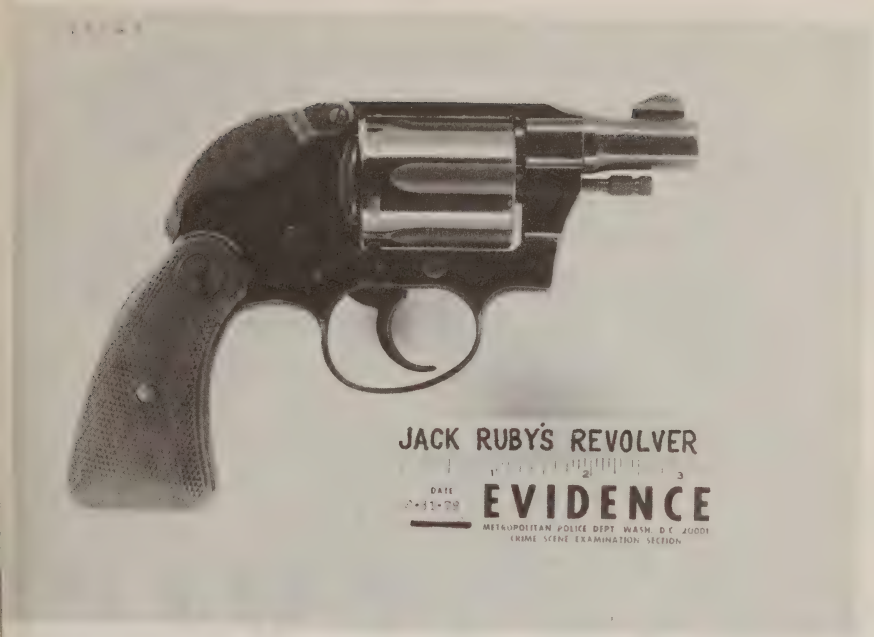
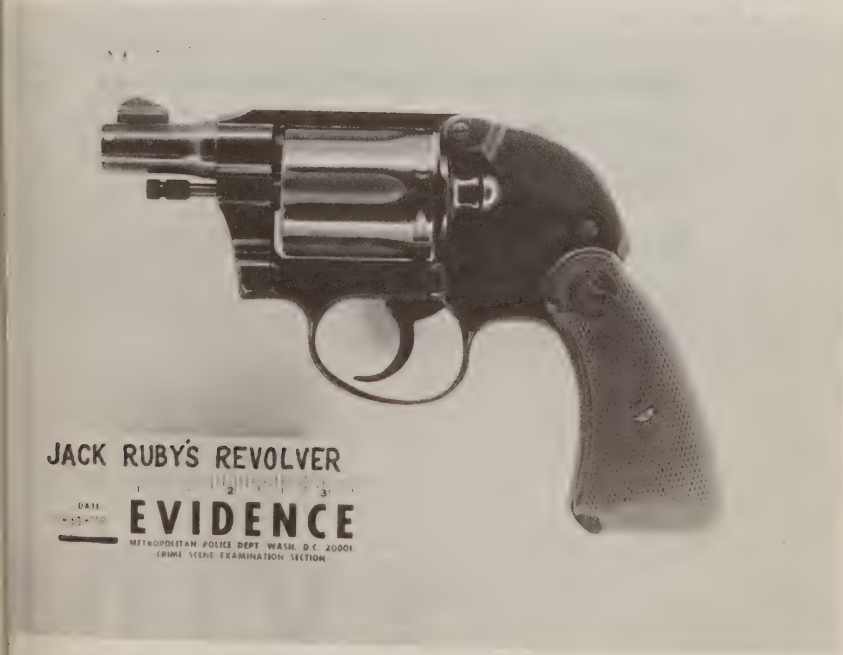


FIGURE. 37A.—Ruby's .38 special caliber Colt Cobra revolver, serial. No. 2744 LW, right side.



GURE 37B.—Ruby's .38 special caliber Colt Cobra revolver, serial No. 2744, LW, left side.

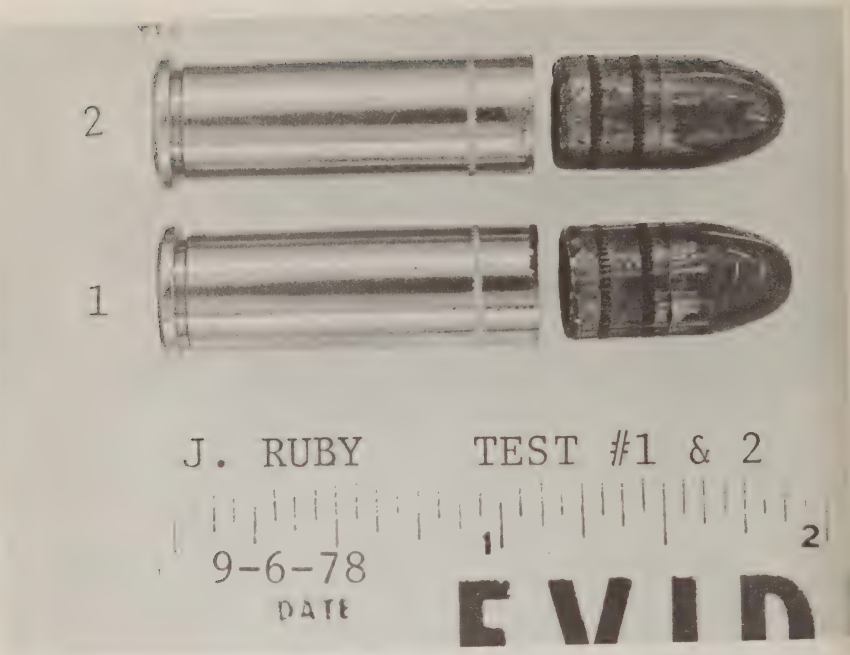


FIGURE 38A.—Panel Ruby T–1 and T–2: Two .38 special caliber cartridges of Remington-Peters manufacture, with 158-grain, lead, round nose bullets, test-fired by the panel from Jack Ruby's revolver into a horizontal recovery tank.

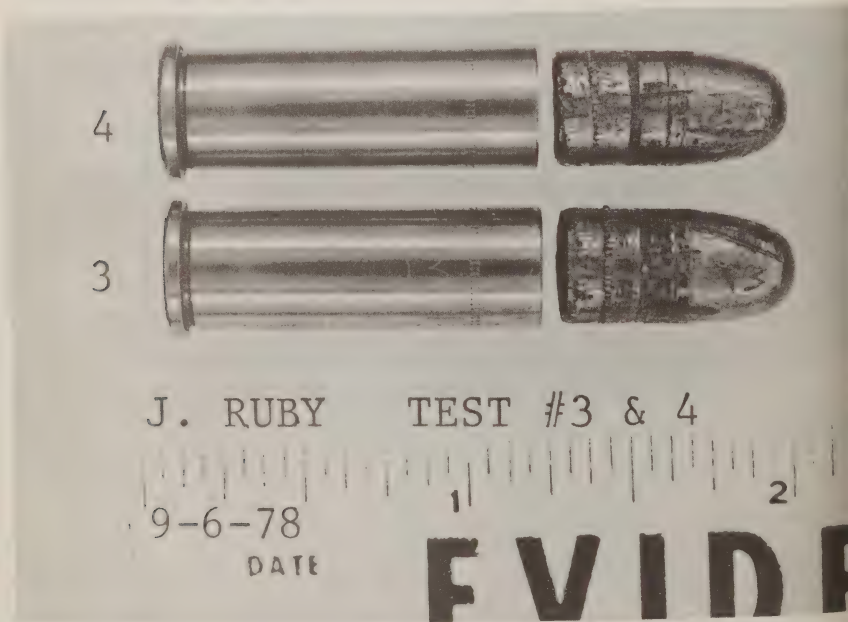


FIGURE 38B.—Panel Ruby T–3 and T–4: Two .38 special caliber cartridges of Western Cartridge Co. manufacture, with 158-grain, copper-coated (Lubaloy), lead, round nose bullets, test-fired from the Jack Ruby's revolver into horizontal recovery tank.

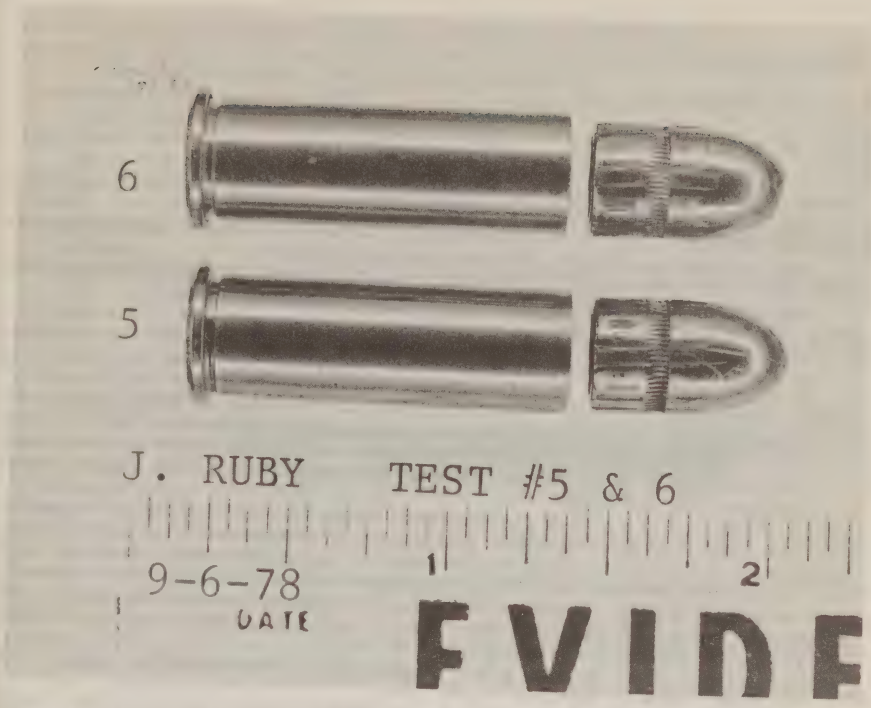


FIGURE 38C.—Panel Ruby T–5 and T–6: Two .38 special caliber cartridges of Remington Arms Co. manufacture, with 130-grain, full metal-jacketed, round nose bullets, test-fired by the panel from Jack Ruby's revolver into a horizontal water recovery tank.

GLOSSARY

Action: The heart of any firearm. It consists of the receiver, bolt or breech block, feed and firing and unloading mechanisms.

Bearing Surface: That part of the outside surface of a bullet which comes in contact with the rifling as it passes through the barrel.

Bolt Face: That portion of a rifle's bolt which engages the cartridge case head and from which the firing pin protrudes when the rifle is fired.

Bore: The interior of the barrel of a firearm.

Breech Face: In revolvers, the area of the frame which supports the cartridge case head and through which the firing pin protrudes when the revolver is fired.

Breech Face Impressions: When a cartridge is fired, the burning gases exert pressures that force the base of the cartridge back against the bolt or breech face. When this occurs, the tool marks that are present on the bolt or breech face are imprinted on the flat areas of the contacting surfaces of the primer and cartridge case base.

Bullet: That part of a cartridge intended to be fired from the barrel of a firearm. It is usually composed of lead, plated lead or lead encased in a metal jacket.

Cannelure: A knurled or plain ring around the bearing surface of a bullet, used to hold surface lubricant, retain the bullet in the cartridge case or identify the type or weight of bullet. Cannelures may also be found on cartridge cases.

Cartridge: A complete assembly of a round of ammunition consisting of the case, primer, propellant powder, and bullet.

Cartridge Case: That part of a cartridge which holds the bullet, primer, and propellant powder together.

Cartridge Clip: A device for holding a number of cartridges to permit their easy insertion into a magazine. The Mannlicher-Carcano clip remains in the magazine until after the last cartridge is fed into the chamber, at which time it is designed to fall through the bottom opening of the magazine.

Chamber: In a rifle, the rear portion of the barrel, designed to hold and support a cartridge. In a revolver, it is also the recess cut into the cylinder to hold each cartridge.

Chambering: The manual or mechanical process of feeding a cartridge into the chamber of a firearm.

Comparison Microscope: A scientific instrument designed to allow the similarity, or dissimilarity, of individual identifiyng characteristics of two bullets or two cartridge cases to be observed at the same time.

Cylinder: A rotating cartridge container in a revolver.

Double Action: The mode of firing a revolver in which the hammer of the firearm is cocked and released by a single pull of the trigger.

Eject: The act of throwing the expended cartridge case clear of the action during the firing process.

Emission Spectrography: Allows the metallic composition of samples to be compared so that the possibility of common origin can be determined. This is done by subjecting the material to intense heat and comparing the color of gases emitted.

Extract: The process of withdrawing an expended cartridge case or unfired cartridge from the chamber of a firearm, either by mechanical or manual means.

Firearms Identification: A study of firearms, bullets, cartridge cases and other ammunition components with the purpose of identifying those ammunition components as having been fired from, or in, a particular firearm to the exclusion of all other firearms.

Firing Pin: That part of a firing mechanism which strikes the primer.

Firing Pin Impression: The indentation caused by the firing pin striking the primer of the cartridge case.

Gas Erosion: The wear caused by the action of the hot propellant powder gases on the bearing surface of a bullet.

Grooves: The depressed areas between the lands of a rifled barrel.
Horizontal Cotton Recovery Box: A box, filled with cotton material, designed to recover fired bullets in an undamaged condition.
Horizontal Water Recovery Tank: A metal, water-filled tank designed to recover fired bullets in an undamaged condition.
Individual Identifying Characteristics: Unique reproducible microscopic marks which can be used to identify a fired bullet or expended cartridge case with a particular firearm.
Lands: The raised areas between the grooves of a rifled barrel.
Loading Ramp: A device that aids in guiding a cartridge into the chamber of a firearm.
Magazine: A device, either separate or integral to the firearm, in which cartridges are held in position to be fed into the chamber of the firearm.
Magazine Follower: (In footnotes).
Microscopic Examination: An examination of evidence which is enhanced by the use of scientific instruments.
Muzzle: The forward end of the barrel where the bullet exits.
Neutron Activation Analysis: A method of nuclear elemental analysis in which samples are irradiated to make their various elements detectable by radioactive measurement. The elemental composition of the activated samples is then compared to determine the probability of common origin.
Photomicrograph: Photograph taken through a microscope.
Primer: The ignition part of a cartridge.
Rechambering: The process of altering the dimensions of a chamber to accommodate other cartridges.
Recrowning: The process of restoring the rounded contour to the muzzle after the barrel has been shortened.
Reset: (See footnotes).
Rifling: The spiral lands and grooves in a barrel which impart spin or rotation to the bullet stabilizing it in flight.
Rifling Class Characteristics: The number, width and direction of twist of the lands and grooves in a barrel.
Sear Mechanism: The part or device designed to hold the firing mechanism in a cocked position until released by pressure on the trigger.
Secondary Missiles: Objects put in motion due to the impact of a bullet.
Single Action: The mode of firing a revolver that requires that the hammer be manually cocked before it can be fired.
Spectrographic Analysis: See "Emission Spectrography".
Striations: Minute grooves, ridges or scratches normally running parallel with each other that are caused by an abrasive action.
Tool Mark: Characteristics of a surface imparted to a softer surface when they come in contact under pressure and motion. Tool marks may be impressed or engraved.
Trigger Pull: The amount of force, expressed in pounds, required to release the firing mechanism.
Twist: The spiral direction of lands and grooves in a rifled bore, expressed as right or left.
Visual Examination: Examination of evidence without the assistance of a scientific instrument; also referred to as macroscopic examination.
Wiping: The removal of some of the fine microscopic scratches on a bullet, particularly the lead variety, as it enters and passes through fabric, heavy tissue and muscle.

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(7) WCH, vol. 24, p. 228.
(8) WCH, vol. 4, p. 260.
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(15) Id. at p. 474.
(16) Id. at p. 301.
(17) Ibid.
(18) Id. at p. 460.
(19) Id. at p. 459.
(20) Id. at p. 460.
(21) WCH, vol. 3, p. 301.
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(25) Warren report, pp. 88 and 93.
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(30) Id. at p. 67.
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(34) WCH, vol. 3, p. 435.
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(37) WCH, vol. 13, p. 8.
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