

ACOUSTICS - THE LAST WORD?

On May 14, the long-awaited (if not eagerly awaited) Ramsey Committee Report was released. For readers of EOC, there are no major surprises. The HSC acoustics experts were wrong, the report says unequivocally, and the "shots" were recorded a minute after the assassination. Because of the limited press coverage, I am reprinting key excerpts from the report in this issue, with some instant analysis.

Later issues will include other reactions and press reports. (Please send clippings, as usual.) Very few copies were made available in Washington last Friday, and I don't know how to order copies from the NAS. What I have now is a "next to final" draft. If you really want all 123 pages quickly, I'll make a copy for \$6.50 plus the postage of your choice (1.5 pounds).

You would be convinced by this report if you shared two beliefs with the Ramsey Committee: first, that it is "unlikely" that "an elaborate and risky substitution of forged evidence would have been made," and, second, that the non-acoustical evidence does not provide a substantial reason for believing that a shot from the grassy knoll was likely.

I am a bit surprised that the Ramsey Report (RR) is not more thorough, given the many delays and the reports that all the loose ends were being tied down. Alvarez told me that there are no loopholes left, and that they just nailed Barger, but I disagree. I don't think the question of tampering was dealt with adequately. Also, I was told to expect that major flaws had been found in the BBN/W&A work. While various errors are alleged, the net result seems to be the reduction of the 95% probability (for a match to the knoll shot) to 78% at the very lowest. (There is an unsettling revelation: the knoll shot originally detected by BBN is just the last half of the knoll shot analyzed by W&A, but that does not invalidate the W&A analysis.)

I expect that tampering (and not just rerecording) will turn out to be the only way to reconcile the shots with the timing information produced by Steve Barber's observation of the Decker crosstalk. The RR deals with the Decker message match extensively, and I think conclusively. (I didn't need to be convinced; others did.) A clever technical analysis of the interaction between the automatic gain control and the heterodyne tones establishes that the crosstalk is real, not the result of acoustical coupling during rerecording.

The RR deals in some detail with various rerecording hypotheses in which the crosstalk was moved, accidentally or deliberately, to overlay the shots. I agree that such hypotheses are very unlikely. However, the report does not explicitly consider if the shots were moved over the Decker message. It simply dismisses in one sentence deliberate alteration for a reason unrelated to the shots or the Decker message, "such as to cover up a broadcast of an embarrassing remark." (P. 84) The Panel's treatment of this admittedly complex hypothesis (which I told them about; see 4 EOC 1, p. 1, and 3 EOC 7, p. 2) is not good enough for me. The RR does not deal with the apparently anomalous 57-Hz hum, or the suspect messages to Tippit. There is no reference to the missing early Secret Service copy of the Dictabelts (even though one panelist was from the Treasury Department).

To establish that the belt studied is the original, the RR relies in part on Doris Schwartz's identification of the date in her handwriting. (Gary Mack says that the Panel asked Bowles to show a photo of the notation to Schwartz.) The Panel trusts the Dallas authorities more than I do. The RR notes that Dictabelt substitution would have been irresponsible, given "both the importance of the case and the well known police requirement not to destroy evidence." There's probably a police rule against letting prisoners get shot in the basement, too.

Relying in part on Bowles's memory of the voice-actuation setting, the RR has no trouble making the Decker and Bellah messages line up in time by postulating Channel 2 pauses totalling 46 seconds. I hear that Barger rejects this argument.

Do errors in the BBN/W&A analysis invalidate the claim that shots were found? The RR notes that even if the HSC had been right to claim a probability of 5% that the match was caused by random noise, it was wrong to assert a 95% probability of a knoll shot without specifically considering the probability of alternate causes.

The RR is very terse about such alternatives; non-random noise is mentioned, but the associated probability is not even estimated. A "dishonest card dealer" analogy implies that the panel did not believe any prior (non-acoustical) evidence for a knoll shot. The grassy knoll witnesses, of course, are unmentioned.

The RR corrects the 95% probability on the knoll shot down to 78%, conceding that its method "may be unduly conservative" - i.e., the adjustment may be too big. The report calls 78% "not at all impressive in contrast to" 95%, which is an arguable subjective opinion; 78% is still reasonably impressive evidence that an anomaly exists - a real shot at the wrong time. I'm fairly confident that the adjustment is in fact unjustifiably "conservative." (Don't quote me yet - I plan to check with a statistician.)

The basic issue is whether the experts were right or wrong in claiming a shot from the knoll. I think that has not been finally resolved, and some additional information can be obtained easily. The RR says that no further work is called for. I would rather deal with the facts than with issues of due process, but one is led to ask if the HSC's findings got an adequately thorough review from the Ramsey Panel. If you want to argue that issue, it is certainly arguable.

The RR generally treats the BBN/W&A reports like exam papers to be graded. The experts are criticized for errors in the initial correlation analysis, which would be irrelevant if the work on the knoll shot had been indisputably correct. An apparent error in the number of windows is noted twice - once as if it balanced an FBI error - but the lay reader might not realize that without the error the W&A result would have been higher than 95%, not lower. Also, BBN's claim that the pattern of initial matches shows a microphone moving at the speed of the motorcade is criticized on technical grounds, but the net effect is to reduce the probability from about 99% to 93% - still impressive, although the RR doesn't say so.

The RR does not mention Barger's refined presentation of the correlations for the 3 "TSBD" shots, submitted to Ramsey in January. (4 EOC 1, p. 2) Like some other late suggestions, this information seems to be reflected only in a vague way in Appendix F, which lists possible but not recommended further work.

The exam-paper approach was not evenhanded. While the HSC experts lost points for small and arguably irrelevant answers, the FBI got almost full credit just for getting the right answer! (P. 32, below) The RR avoids saying if any of the FBI arguments were valid, and if the FBI actually did select the best Greensboro match. (The latter would have established the FBI's bad faith; did the panel even ask?)

The RR is selective in its attention to evidence beyond the BBN/W&A work. Matching and timing the crosstalk got much effort and many pages in the report. There is a whole appendix on the sirens; the report notes what McLain said about his movements, and even a last-minute call from Beilharz of the DPD (p. 94). Evidence which might have supported the HSC analysis seems to have gotten less attention: nothing on the photos which might show McLain's location in the Plaza or a subsequent delay in leaving, no attempt to match the W&A signal with the known noise on the tape, no W&A-like analysis of the other shots, and no revised knoll-shot probability which is not "unduly conservative."

Ramsey says the panelists started "with quite opposite views." In June 1979, Alvarez said he was "simply amazed that anyone would take such 'evidence' seriously." If any panelist was that strongly inclined towards the HSC analysis, you can't tell from the final report. By February 1981, the panel was unanimously unconvinced by the BBN/W&A analysis. We might soon learn more about the panel's work. The NAS will work on a "public access file," and Blakey has filed an FOIA action for some relevant FBI records.

The NAS cover letter cautioned AG Smith not to misinterpret the panel's "somewhat surprising conclusion," since they did not rule on a knoll shot or a conspiracy. The RR itself contains no such cautions, and doesn't dispute the JD claim that the opinions of the HSC experts were the only evidence of conspiracy. It even calls further work too costly without estimating costs. So, the JD will no doubt soon announce that, after due consideration of the NAS report, it has decided not to investigate any aspects of the JFK case. Congressional hearings of some sort are possible, but very unlikely.

TABLE OF CONTENTS

	PAGE
EXECUTIVE SUMMARY . . . . .	1
I. INTRODUCTION AND OVERVIEW . . . . .	3
II. DESCRIPTION OF STUDIES BY BRW AND WA . . . . .	8
III. EVALUATION OF BRW AND WA METHODOLOGIES AND CONCLUSIONS . . . . .	12
IV. TIMING EVIDENCE FROM MATCHING FEATURES . . . . .	18
IV-1. Sound Spectrograms . . . . .	20
IV-2. Analysis of Sound Spectrograms of Hold Everything . . . . .	23
IV-3. Timing of Channel I and Channel II Events . . . . .	27
IV-4. Possibility of Superposed Recordings . . . . .	30
V. EVALUATION OF THE FBI REPORT . . . . .	32
VI. POSSIBLE FURTHER STUDIES . . . . .	33
VII. CONCLUSIONS . . . . .	34
APPENDIXES . . . . .	35
APPENDIX A: CRITICISMS OF PROBABILITY CALCULATIONS . . . . .	35
A-1. Criticism of BRW Probabilities of 0.88, 0.88, 0.50 and 0.75 . . . . .	35
A-2. Criticism of BRW Certainty that Microphone Detected Sound of Gunfire . . . . .	37
A-3. Criticism of BRW/WA Probability of 0.95 for Shot from Grassy Knoll . . . . .	38
APPENDIX B: ANALYSES OF SOUND SPECTROGRAMS OF "HOLD EVERYTHING..." . . . . .	41
B-1. Time and Frequency Analysis . . . . .	41
B-2. Measurements of Easily Identified Frequency Ratios on Sound Spectrograms . . . . .	49
B-3. Alternative Time and Frequency Analyses of Sound Spectrograms . . . . .	52
B-4. Digital Calculations of Cross Correlation Between Channel I and Channel II . . . . .	57

[Commission on Physical Sciences, Mathematics, and Resources]  
[National Research Council]  
[2101 Constitution Avenue, Washington DC 20418]  
[National Academy Press, 1982]

TABLE OF CONTENTS  
(CONTINUED)

	PAGE
APPENDIX C: TIMING OF CHANNEL I AND II EVENTS . . . . .	60
C-1. Analysis of the Bowles Tapes . . . . .	60
C-2. Analysis of Tapes Made Directly from Original Records . . . . . [Excerpts from Bowles transcripts . . . . .]	67 70]
APPENDIX D: POSSIBILITY OF SUPERPOSED RECORDINGS . . . . .	81
APPENDIX E: SIREN SOUNDS . . . . .	89
APPENDIX F: POSSIBLE FURTHER STUDIES . . . . .	92
[Figure captions . . . . .]	96]
REFERENCES . . . . .	100
[Figures (18 pp.) . . . . .]	101] [PLH]

COMMITTEE ON BALLISTIC ACOUSTICS

- Norman F. Ramsey, Harvard University, *Chairman*
- Luis W. Alvarez, Lawrence Berkeley Laboratory, University of California
- Herman Chernoff, Massachusetts Institute of Technology
- Robert H. Dicke, Princeton University
- Jerome I. Elkind, Xerox Palo Alto Research Center
- John C. Feggele, Bell Telephone Laboratories, Holmdel, New Jersey
- Richard L. Garwin, Thomas J. Watson Research Center, IBM Corporation and Adjunct Professor of Physics, Columbia University
- Paul Horowitz, Harvard University
- Alfred Johnson, Bureau of Alcohol, Tobacco, and Firearms, National Laboratory Center, Department of the Treasury
- Robert A. Phinney, Princeton University
- Charles Rader, Lincoln Laboratory, Massachusetts Institute of Technology
- F. William Sarles, Trisolar Corporation, Bedford, Massachusetts

(The views expressed in this report do not necessarily represent those of the home institutions of the participants.)

C. K. Reed, Senior Advisor, Commission on Physical Sciences, Mathematics, and Resources  
Bertita E. Compton, Special Assistant, Commission on Physical Sciences, Mathematics, and Resources

The sound spectrograms show conclusively that the portion of the Channel I recording with the acoustic impulses also contains a weak recording on Channel II of cross talk from Channel II of a message broadcast approximately one minute after the assassination. The Committee has examined the possibilities that the Channel II cross talk might have been overrecorded at a later time on top of the Channel I acoustic impulses or that the Dictabelt examined was a copy with cross talk superposed during copying. The Committee concluded that such scenarios not only are highly contrived and unlikely but also are contrary to physical and acoustic evidence, such as the effect of Channel I heterodyne tones in suppressing cross talk from Channel II. This identification of cross talk between Channels I and II shows conclusively that the previously analyzed sounds were recorded about one minute after the assassination and, therefore, too late to be attributed to assassination shots. A similar conclusion is reached independently by the analysis of the times of the acoustic impulses and of intelligible cross talk between the two channels more than three minutes after the assassination. This analysis shows that the previously studied acoustic impulses were recorded after the motorcade was instructed to go to Parkland Hospital.

The Committee report lists a number of possible further studies of the Channel I recording and of related matters, but the Committee believes that the evidence against the acoustically conjectured grassy knoll shot is already so strong that the results to be expected from such studies would not justify their cost.

For these reasons and for others given in detail in the report, the National Research Council Committee on Ballistic Acoustics unanimously concludes that:

- The acoustic analysis do not demonstrate that there was a grassy knoll shot and in particular there is no acoustic basis for the claim of a 95% probability of such a shot.
- The acoustic impulses attributed to gunshots were recorded about one minute after the President had been shot and the motorcade had been instructed to go to the hospital.
- Therefore, reliable acoustic data do not support a conclusion that there was a second gunman.

EXECUTIVE SUMMARY

At the time of the assassination of President Kennedy the Dallas police recorded sounds from an open microphone; these sounds have been previously analyzed by two research groups at the request of the House Select Committee on Assassinations. Both groups concluded with 95% probability that the recordings contained acoustic impulses which provide evidence for the existence of a shot from the grassy knoll area of Dealey Plaza. On the basis of these reports and since shots definitely were fired from the Texas School Book Depository, the House Committee concluded that "scientific acoustical evidence establishes a high probability that two gunmen fired at President John F. Kennedy".

In response to a request from the Department of Justice, the National Research Council Committee on Ballistic Acoustics has over the past year studied these reports and the Dallas Police recording on which they are based.

Since the recorded acoustic impulses are similar to static, efforts to attribute them to gunshots have depended on echo analyses; but in these analyses desirable control tests were omitted, some of the analyses depended on subjective selection of data, serious errors were made in some of the statistical calculations, incorrect statistical conclusions were drawn and the analysis methods used were novel in some aspects and were untested at such high levels of background noise. Furthermore, some of the recorded background sounds, such as the delay in the sounds of police sirens, are not what one would expect if the open microphone had been in the motorcade. For these and other reasons discussed in the report, the Committee concluded that the previous acoustic analyses do not demonstrate that there was a grassy knoll shot. The Committee reached this conclusion prior to the availability of conclusive evidence (which we now describe) that the acoustic impulses were recorded on Channel I approximately one minute after the assassination.

Following a suggestion volunteered by Steve Barber of Mansfield, Ohio, that the acoustic impulses are overlapped by an almost unintelligible voice transmission on Channel I which might be identified as cross talk from Channel II, the Committee had sound spectrograms made of the appropriate portions of both channels. Copies of these sound spectrograms and analyses of them are included in Section V of the report.

(i)

NOTICE: The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the Councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The members of the Committee responsible for the report were chosen for their special competences and with regard for appropriate balance.

This report has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

I. INTRODUCTION AND OVERVIEW

\* \* \*

[4]

Copies of the BRSW, WA, and FBI reports were distributed to members of the Committee before its first meeting, both for study and to make possible the distribution of questions in advance to guests invited to meet with the Committee. On January 31 and February 1, 1981, the Committee met with James Berger and Francis Jackson of Bolt Beranek and Newman Inc., with Mark Weiss and Ernest Aschkensy of Queens College and with Bruce E. Koenig and others from the FBI Technical Services Division. Subgroups of the Committee have had many separate meetings and have carried out numerous individual studies, the results of which have been distributed to all members. The Committee as a whole met a second time on November 14-15, 1981. The Committee benefitted from numerous communications it received from various interested persons. In particular, the manuscript for "The Kennedy Assassination Tapes" by James Bowles, Communications Supervisor of the Dallas Police Department at the time of the assassination, and the cross talk identifications suggested by Steve Barber, a private citizen of Mansfield, Ohio, were of great help to the Committee. Burn Lewis and Ramesh Agarwal of the IBM Corporation assisted the Committee with the digitized studies of the recordings. The Committee would like to express its appreciation to all these people, as well as to Bruce Koenig and others of the FBI who assisted the Committee in producing crucial sound spectrograms.

In the first months of its existence the Committee studied the analytical techniques used by BRSW/WA. These techniques are briefly summarized in Section II of this report. As a result of these studies, Committee members found errors in the previous studies and faults of methodology, described in Section III. These faults were sufficiently serious that, by the end of the first Committee meeting, no member was

convinced by previous acoustic analyses that there was a grassy knoll shot.

The Committee agreed to continue its studies to challenge its own conclusion and to search for additional acoustic evidence. The Committee was greatly helped in its studies by the suggestion volunteered by Steve Barber that in the same tape position as the relevant acoustic impulses there was an almost unintelligible voice communication which he thought was cross talk from the Dallas Police Department Channel II, as recorded on a Gray Audiograph disk. On the day of the assassination, Channel I was primarily used for normal police activities and Channel II was used for the presidential motorcade. The quality of the recorded cross talk was so poor that the Committee could not conclude by listening to the recordings the two messages were the same. However, the Committee made sound spectrograms, copies of which are included in Section IV-1. As discussed in that section and in Appendix B, a number of different analyses of the sound spectrograms of those portions of the recordings (identified as the "hold everything..." segments) show conclusively that a segment of Channel II is recorded on the Channel I Diotabalt at the same location as the relevant acoustic impulses. From the Channel II recording it is clear that the message of concern was broadcast one minute after the assassination. Except for the unlikely possibility of an overrecording with two superposed recordings at different times on the Channel I Diotabalt, which is contrary to the evidence discussed in Section IV-4, this identification between the two channels shows that the sounds analyzed by BRSW/WA occurred one minute after the President had been shot and the motorcade had left Dealey Plaza.

A second demonstration of the same conclusion involves a more obvious and later instance of cross talk between the two channels: no sound spectrograms are needed to identify the "Do you want...Stemmons" sections on both channels. This analysis is discussed in Section IV-3 and Appendix C. By tracing time backward from that match on both channels, the Committee found that the President received his mortal shot at least 30.9 seconds before the impulses analyzed by BRSW/WA. The uncertainty in the exact timing discrepancy arises from the fact that the Channel I recorder operated continuously, whereas the Channel II recorder operated

... hospital, the presidential motorcade encountered a complex pattern of underpasses, roads and ramps as it approached the entrance to Stemmons Freeway. But there is no trace of a siren sound in Channel I during this interval of time. This initial long absence of any indication of siren sounds, followed by the pattern of loud and clear sounds of several sirens passing by, suggests that the radio transmitter with the stuck button was not part of the presidential motorcade. This radio transmitter may have been on a motorcycle parked somewhere, perhaps, as suggested by James Bowles, at the Police Command Post near the Trade Mart, where it would be natural for there to be adjacent police radios tuned to different channels, thus accounting for the instances of cross talk described in Section IV. The problems associated with both the presence and absence of siren sounds are discussed in further detail in Appendix E.

The concluding two sentences of the BRSW report state: "The probability of obtaining just one match by chance in any of 180 independent tries is equal to  $5.3 \times 10^{-2}$ , or about 5%. Therefore, the probability that they obtained their match because the two matched patterns were due to the same source (gunfire from the knoll) is about 95%." The WA report concludes with a similar statement. Such statements do not allow for the existence of hypotheses alternative to the two primarily considered (the hypothesis of gunshots or the hypothesis of impulses randomly located according to a Poisson distribution in relevant sections of the Dictabelt). Various reasonable alternative hypotheses include non-white (non-Poisson) noise or other typical noise and static distributions which are ordinarily lumped together in time and which thereby may give a higher correlation with the non-random distributions of test shot echoes. Furthermore, even if the only alternative to impulses from a gunshot were the hypothesis of randomly located impulses, a single observed result whose P value under the random location hypothesis is 5% does not imply a 95% probability that there was gunfire from the knoll (the P value or significance level in current statistical theory is the probability, assuming the hypothesis to be true, of observing data as or more extreme than what actually is observed). The situation is analogous to that in a card game where the significance level for the dealer to receive three aces is  $P = 0.04$  but 3 aces going to the dealer on the first deal does not by itself indicate a 95.6% probability that the dealer is dishonest if there were no prior reason for suspecting him of cheating. The issue of the probability of gunshots is one of posterior probability and is discussed further in Appendix A-3.

intermittently and was supposed to stop after 4 seconds of silence. So in all cases when the Channel II recorder was inoperative, the "missing time" must be added to the "at least 30.9 seconds" noted previously. The Committee's two quite different techniques for determining the length of time between the real assassination and the one deduced from the study of sounds on the Channel II tape can, of course, be brought into agreement, at one minute, by the reasonable assumption that the Channel II recorder was not operating for a total of 44 seconds in a section of the recording in which the recorder operated for 206 seconds and in which there are many places where there are 3 to 6 seconds of recording silence. The recorder may have stopped during some of these times and it definitely did stop for 2.9 seconds during one of them.

It is important to note that this second timing method cannot be brought into agreement with the timing demanded by the BRSW/WA analysis unless one assumes that there are backward skips totaling 30.9 seconds on the analyzed playbacks of Channel II or that there is overrecording; the tapes show no evidence of the backward skips required by the BRSW/WA analyses. For the timing method based on the "hold everything" analysis, the recorded impulses could come from assassination shots only if there were accidental or intentional overrecording. The Committee investigated possibility of overrecording by microscopic examination of the grooves on the Dictabelt, by examining the effects of heterodynes on the intensities of the sound spectrograms and by examining the possibilities by which overrecording could have occurred and then have been hidden, either accidentally or on purpose. These investigations are reported in Section IV-4 and Appendix D. For the reasons discussed there, the Committee concluded that the BRSW/WA timing could not be made compatible with the observed Channel I and Channel II cross talk.

Features of the recorded sounds, especially the siren sounds, strongly suggest that the open microphone was not in Dealey Plaza at the time of the assassination, even though the BRSW/WA analysis required it to be there and, in fact, identifies the open microphone explicitly as on the motorcycle of Officer McLain.

In addition to the above misinterpretations, the BRSW/WA calculation of the P value for the hypothesis of random pulse location is incorrect. There are several errors of which the most serious is the failure to allow in the probability calculations for the fact that the location of the shooter in the WA analysis was adjusted to maximize the number of coincidences. These errors are discussed in Appendix A, where it is shown that, with these corrections and a conservative adjustment, a significant level as high as  $P = 0.223$  can be obtained for the hypothesis of random location; this value is much less impressive than the BRSW/WA value of 0.05. Furthermore, as discussed previously, even if it were granted that the hypothesis of randomly located impulses on relevant portions of the tape were in serious doubt, it would not follow that the alternative of gunfire from the grassy knoll was convincing. All plausible alternatives to both of these hypotheses would have to be eliminated, and no convincing effort has been made in this direction.

The analyses reviewed above and in Appendix A lead the Committee to the following conclusions about the probability analyses of BRSW/WA.

- (1) The conclusion of a probability of 0.5 of a shot from the grassy knoll on the basis of the BRSW analysis is invalid as is also the conclusion of a probability of 0.95 for such a shot on the basis of the WA analysis.
- (2) There are several inaccuracies.
- (3) Except for a rather conservative alternative analysis given in Appendix A, the data do tend to cast doubt on the hypothesis of random impulse locations according to a Poisson process.
- (4) Alternative hypotheses to a random Poisson process and a shot should have been examined as possible explanations of the coincidences. These might invoke the nature of the bursts of noise prevalent during the period under study and a consideration of other possible non-Poisson distributions.

There are some valid arguments in support of the BRSW/WA conjecture that the impulses may be due to a gunshot from the grassy knoll. The selected impulses fit better than randomly the echo patterns of the test

shots, the trajectory of the microphone inferred from the BRSW analysis is reasonable for a microphone attached to a motorcycle, and some interpretations of photographic evidence are consistent with a motorcycle being in approximately the correct location. However these points are not strong since there are many ways in which static like impulses can be nonrandom, unreasonable microphone trajectories were rejected, there were many motorcycles in the area and the impulse and echo selection procedures used by BRSW could affect the results.

For the reasons given above, in Section VI and in Appendixes A and F, no member of the Committee on Ballistic Acoustics was convinced last Spring by the arguments given that there was a grassy knoll shot. The members of the Committee reached their initial negative conclusion prior to the availability of the sound spectrograms and event timings discussed in Section IV and Appendixes B and C, so this negative judgement was in no way a result of the subsequent evidence that the portion of the tape containing the relevant acoustic impulses was recorded about one minute after the assassination. With the added evidence in Section IV, there is now a conclusive case against the impulses studied by BRSW/WA being associated with a shot that contributed to the assassination of President Kennedy.

#### V. EVALUATION OF THE FBI REPORT

[P. 32, in full]

Although the Committee agrees with the "Findings" in the November 19, 1980, FBI report<sup>4</sup>, it disagrees with one of the arguments used to justify the Findings. It considers invalid the criticism of the WA report on the basis of the high value of the binary correlation coefficient found by the FBI for a match between the supposed grassy knoll shot and one of the recorded gunshots in the unrelated later shootings at Greensboro, North Carolina. Although the FBI obtained a high value of the correlation coefficient, that value was not nearly so significant as the one obtained by WA, which involved many more "time windows" (90 windows were used although this number was erroneously reported as 45 on page 76 of the BRSW report) and 39 Greensboro shots were available from which the most favorable could be selected. Although the Committee considers this particular FBI argument against the BRSW/WA report to be invalid, the Committee, for the reasons discussed in this report, agrees with the FBI conclusions.

(2) The likelihood of scenarios for overrecording

[82]

Although there is good reason to believe that the belt examined was the original one, the Committee also considered the possibilities that the belt examined might itself have been a later copy of an earlier Dictabelt with a double recording, in which case the physical examination would not show evidence of superposed recordings, or might have been a copy substituted for the original with the "hold everything..." superposed while copying. To explain in one of these ways the presence of the "hold everything..." phrase except by deliberate intent would require an incredible array of accidents, each of which is highly unlikely. For such accidents to have occurred immediately following the assassination, the Dictabelt would have had to be knocked backward by just one minute of recording time, this unprecedented accident would have had to occur within the first minute following the assassination, it would have had to occur in a manner to leave no acoustic evidence, and in addition someone irresponsibly would have had to copy the Dictabelt, counterfeited the identification writing, substitute the new Dictabelt for the old one, and throw away the original, despite both the importance of the case and the well known police requirement not to destroy evidence.

Comparable difficulties confront the hypothesis that there was an accidental superposed recording at a later time. In that case, the Dictaphone playing potential evidence of a presidential assassination would have had to be carelessly set to record instead of listen, and a recording of Channel II at the same time would have had to be playing accidentally in the background. In addition the Channel II playing would have had to be set accidentally to the very narrow range that could indicate incompatibility; if the setting had occurred one minute earlier it would have produced no problem and one minute later it would have been detectable as an impossible timing. The double recording would have had to continue at least two minutes to account for the cross talk discussed in Appendix C. Further, there would have had to be an irresponsible substitution of a copied Dictabelt, with counterfeited written identification and a subsequent loss of the original, to obscure physical evidence of a double recording. For all this to occur by accident again seems highly unlikely. Similar difficulties face the hypothesis that the original Dictabelt was copied to another Dictabelt, that the cross talk was picked up during the copying, that the second Dictabelt was accidentally substituted for the original, and the original was destroyed.

[83]

There are comparable difficulties in attributing the presence of the "Hold everything..." message to a deliberate superposed recording and a deliberate effort to conceal this action. It is particularly difficult to believe that within the first minute after the assassination someone deliberately knocked backward the Dictabelt to confuse the interpretations of the transmission from the open microphone. No one knew in advance, or even at the time, that there was to be an accidentally open microphone or where it might be located. No one could tell in advance how much to displace the Dictabelt to assure that the next transmission of cross talk between Channels I and II would be exactly superposed on the assassination. No one knew in advance there were impulses that would years later be interpreted as assassination shots or that the cross talk between the two Channels would eventually be interpreted at an even later time. Anyone who substituted a copy of the tape to hide the physical evidence of a superposed recording, and who counterfeited the written identification exposed himself to a serious risk of being caught in exchange for a potential benefit that was remote and unlikely to materialize.

Similar difficulties are presented by the hypothesis that the "hold everything..." message was deliberately added at a later time. Since the message appears on the original Dictabelt and on a copy made by James Boyles in March 1964, the deliberate superposed recording would have had to be made before this date, long before the BRSH/WA analysis indicated there might be information worth confusing. It could not be apparent in advance that the "hold everything..." expression would ever be correctly interpreted. The person deliberately faking this evidence and then substituting a new recording with a counterfeited identification for the original one faced a large chance of being caught in exchange for only a very small chance that the deception would be either necessary or helpful. It seems equally unlikely that such an elaborate and risky substitution of forged evidence would have been made for any other reason, such as to cover up a broadcast of an embarrassing remark.

In summary, all the possible scenarios by which a copied Dictabelt with a forged identification could have been substituted for the original seem highly unlikely.

(3) Compatibility of "hold everything..." timing with other firmly established evidence. [ \* \* \* ]

[84]



APPENDIX F

POSSIBLE FURTHER STUDIES

This Appendix is written in response to the Committee's assignment to recommend the kinds of tests, analyses, and evaluations needed to obtain better information from the recordings. However, the existence of this Appendix should not be misinterpreted as a Committee recommendation that these tests and analyses should be carried out. If there were to be further studies of the Dallas Police Department Channel I recording in the hope of demonstrating the validity of the conjectured shot from the grassy knoll, the information listed below could be sought.

1. The original Dictabelt could be studied more extensively for possible evidence either for or against the possibilities of the Dictabelt being a copy or containing superposed recordings. No evidence favoring either of these possibilities has so far been found in a physical examination of the belt or in studies of the recording. Further studies could include a careful search on the original belt for a second hum at about 60 Hz which would characterize a copy and an examination of the 60 Hz signal for continuity and possible indications of interceptions. Such studies, however, will now be difficult and may require the construction of a special drum playback machine for the shrunken and stiffened Dictabelt which now causes marked flutter when it is played back on the normal machine.

2. With the information on the timing of the Channel I recording provided by the cross correlation between Channels I and II discussed in Section IV, the Channel I recording could be examined more carefully for the existence of possible shots in the portion of the recording that corresponded to the time of the assassination (between 65 and 95 seconds on

the BRSW time scale). However, it is unlikely that evidence for shots will be found in that region, since the noise level was much higher there and that portion of the recording has already been examined by BRSW, as described on page 35 of the BRSW report, and no impulse patterns identifiable as gunfire were found; furthermore, there is some evidence that the open microphone was not in the motorcade.

3. There could be an independent analysis following generally the VA procedure but applied to all four of the conjectured shots. In the case of the conjectured grassy knoll shot, it would be of interest to see if the P value for the hypothesis of random locations of impulses cast doubt on that hypothesis. Analysis by the VA method of the impulses attributed to the three Texas School Book Depository shots would be a test both of the method and of this attribution, which contradicts the evidence that the relevant impulses occur approximately one minute after the assassination. If these impulses do fit the hypothesis of three shots, is the open microphone trajectory the same as in the BRSW studies and does it fit with the best limits that can be photographically inferred?

4. The BRSW analysis of the three shots attributed to the Texas School Book Depository could be repeated with a well defined, normalized, and objective selection process for the impulses and echoes to see if the indications of three shots associated with a reasonable microphone trajectory persisted when the unnormalized and subjective selection of impulses and echoes was eliminated.

5. Attempts could be made to see if the reliability of the analyses could be improved by utilizing the availability of amplitude information even though it is recognized that amplitude information can sometimes be misleading. Acoustic spectra and logarithmic Fourier transform studies might help. Unfortunately, one cannot deal with the Dictabelt recording as a faithful reproduction of the sound pressure at the microphone due to the distortion of the radio and recording systems, which include automatic gain control, so it will be difficult to untangle the distortion effect in retrospect.

6. Independent analyses could be made of the probabilistic calculations both by BRSW/WA and by the present committee, with a critical review of the hypotheses on which the calculations are based. The studies could include the investigation of alternative hypotheses such as other sources of non-random impulse locations and studies of prior and posterior probabilities.

7. A study could investigate means for confirming that the open microphone was actually in Dealey Plaza. This study could examine the recording for the presence and absence of sounds of crowds, the lateness of siren sounds, the possibility of detecting a Doppler shift in the siren sounds, study of the motorcycle sounds to determine if they indicated speeds compatible with the course of the motorcycle presumed by BRSW/WA to have the open microphone, identification of the kind of motorcycle from its sound, spectral analysis, ADC effects, etc. Bowles' reports that Officer Molain, after hearing recordings of Channels I and II stated that there was "no way" that his mike could have been the one stuck open. As the present report was about to be printed, Officer Leslie Bellherz (who was not in Dealey Plaza at the time of the assassination) told the Committee chairman by telephone that there was a "good possibility" that his microphone may have been the one stuck open. Additional testimony could be obtained as to the location of the open microphone and attention should be given to the many questions raised in the report of James C. Bowles, including those on the microphone location.

8. A detailed analysis could be made of the interpretation of the more than 200 millisecond time displacement between the conjectured shots of the BRSW and the VA studios.

9. The Zapruder film could be analyzed further to see if the apparent incompatibility between the conjectured shots and the data inferred from the camera's angular accelerations can be removed.

10. Clear objective procedures for the selection of the impulses should be used, and they should be well described. The publication of the results should be sufficiently clear and in sufficient detail to permit an effective outside scientific appraisal.

11. The sources of several extraneous sounds on the Channel I tape could be investigated further to see if their identification could determine the location of the microphone. One such sound is the bell-like tone that occurs about 8 seconds after the conjectured grassy knoll shot. Another is the phrase differently identified by various listeners as "All right Chaney," "All right Jackson" or "I'll check it" that occurs approximately 10 seconds before the impulses conjectured by BRSW/WA to be due to a grassy knoll shot.

12. An effort could be made to localize the motorcycle accurately to test with the narrowest possible limits the compatibility between the photographic and acoustic evidence on motorcycle location.

13. The consistency of the 60 Hz hum on Channel I with the voice time reports could be tested, provided Channel I is shown to be recorded without interruptions for a sufficiently long time that the implications are not importantly affected by the large possible errors in the time reports, which are based on several different and unsynchronized time indicators.

Although the Committee has made no effort to determine the cost of the above investigations, it would be considerable. As discussed in Sections III, IV and VII, the Committee considers the evidence against the BRSW/WA conjectured assassination shot already to be so strong that the expected results of such investigations would not justify their cost.