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REBUTTAL TO RAMSEY: an independent researcher's critique of the NAS Committee on Ballistic Acoustics

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Preface

Although this critique is written for other researchers and laypersons, the subject matter deals with the disciplines of acoustics and statistics. Therefore, I have had to compromise by sometimes using scientific wording unfamiliar to the layperson in order to strengthen or clarify a point addressed to the scientific community and yet other times oversimplify, draw analogies, or omit scientific notation. A thorough working knowledge of the basic facts of the assassination of President Kennedy and of the issue of the acoustical analysis done for the House Select Committee on Assassinations(HSCA) is a prerequisite for understanding this critique.

Summary

A police escort motorcycle's radio, which was stuck in the transmit mode while accompanying President Kennedy's motorcade through Dealey Plaza in Dallas, Texas on November 22, 1963, transmitted the sounds of the gunshots which killed JFK and wounded Gov. Connally to the Dallas Police Department where they were recorded on a Dictabelt. One of the shots originated from the grassy knoll. The Report of the National Academy of Sciences which refuted that fact is invalid due to bias, improper applications of method, careless errors, and deliberate misrepresentations of fact.

History

Under contract by the HSCA, the firm of Bolt, Beranek, & Newman(BB&N) analyzed a tape recording of the JFK motorcade in Dealey Plaza and found 4 possible shots. The most controversial was the shot from the grassy knoll, which would imply that a conspiracy was involved. Because BB&N could only state the probability for that shot was 50%, HSCA asked acoustics experts Weiss and Aschkenasy (W&A) to refine the data on that shot in order to reduce the uncertainty either way. W&A stated with a 95% confidence that the impulse on the DPD tape recording was a gunshot fired from the grassy knoll. The HSCA relied quite heavily on that conclusion in issuing its finding of a conspiracy.

The U.S. Justice Department (DOJ), instead of then investigating the conspiracy, attempted to discredit the HSCA findings. Its first attempt using the FBI bugging experts failed due to the lack of competence in the necessary disciplines. DOJ then had to assign the National Academy of Sciences (NAS) the task of discrediting the HSCA's acoustical findings. To be sure of the outcome, only government connected scientists, most with ties to the intelligence community, were selected and they worked in total secrecy without any challenge from independent researchers. It was hoped that their prestige would end the debate and their mandate was only to discredit the acoustical analysis of the HSCA, not to find the truth. The budget they were given was so limited that they could not do the necessary tests beyond those needed to discredit the HSCA. The DOJ was highly successful. It's been over a year since the issuance of the NAS Report and not one scientist has dared challenge it. It's a national disgrace for a country which prides itself on freedom of thought that the challenge has to come from an ordinary blue-collar worker, rather than the scientific community.

Areas of criticism

I. Secrecy

The NAS committee worked in total secrecy without dialogue with critics. I had written to them on December 1, 1980 suggesting several solutions and points that had to be addressed. Not only did they ignore them, they didn't even acknowledge my letter. Phone calls went unanswered. If this treatment was typical, it shows a bias that is unmistakable. Many of their glaringly obvious errors could have been avoided simply by accepting help from outside researchers.

To me, the most shocking aspect of their report is that no one had the courage to accept responsibility. You'll notice that throughout this paper, I attribute all the committee's actions to Ramsey. This is not an ad hominem argument. This is primarily by default as he chaired the committee, but also because the members who actually did the work would not claim responsibility for their contributions. To guess from appearances, it would seem that the entire committee met only a few times, pro forma, and that the bulk of the work was done independently by one biased, pro-Warren Commission, CIA-contract consultant with the help of his blindly loyal students. I even doubt that the individual members took the time to read and understand the work. We'll probably never know due to the extreme secrecy imposed by the NAS. Little more of substance was accomplished than Luis Alvarez could have done on his own. The most amazing aspect of this charade is that it is almost unheard of in the scientific community, except in totalitarian regimes, that one biased researcher publish his work unattributed under the cover of a government-supported agency and then refuse to defend it or present any counter-arguments to its critics. This is not merely scientific arrogance, it is truth by fiat. I suppose that we should next expect the NAS to declare that the world is flat.

Another example of the secrecy is the fact that Ramsey did not release copies of the evidence along with the report so that someone else could try to duplicate their results. For instance, one of the major points of the NAS thesis is that Jesse Curry's message,"Go to the hospital." occurred at least 20 seconds before the shots that were identified by BB&N/W&A. They based that on a tape recording provided by DPD Capt. Bowles. Given the fact that NAS and the DOJ have kept the tape secret, how do we know that someone didn't splice in 30 seconds of Lawrence Welk music in order to pad it? It certainly doesn't match the tape that I have and I doubt that it matches the tape that was given to the HSCA. Withholding of raw data is the first indication that the researcher has something to hide.

II. Transcripts

As other researchers have pointed out , there have never been accurate transcripts prepared of the DPD tapes. Ramsey made no exception to that rule, relying on DPD Capt. Bowles' latest disinformation. There is a wealth of information on the tapes themselves if anyone just takes the time to transcribe all the sounds on the tapes, even the silences. Most inaccuracies on the Bowles transcripts are simply negligence such as not bothering to mark repeats, or note the source of a transmission, etc. Sometimes Bowles intentionally rewrote a transmission to correct grammar or omit pauses in order to keep his fellow officers from looking like country bumpkins. Most such editing is inconsequential to the timing of the tapes. Yet there are some which led Ramsey to draw false conclusions.

On channel 2 there are several repeats due to wear of the Audograph record which added time to the apparent duration during playback. When comparing timing between the two channels, several seconds must be deducted from ch. 2's timing (see timing chart) to account for those repeats. Between Jesse Curry's, "Go to the hospital." and 190's, "You want me to still hold this traffic..." which is crosstalked to ch. 1 and recorded simultaneously, there are 6 repeats, only 4 of which were deducted by Ramsey. The other two he might have missed, because the transcripts did not accurately record them. Repeat 2 was of the dispatcher's message, "Parkland has been notified. 12:32.". Ramsey did not consider it a repeat, because only one word was repeated, "notified", which would not be of sufficient duration to be a period of rotation of the record. Yet, if Bowles had simply noted both times at which the "notified" appeared, he would have noticed immediately that there were 3.4 seconds between them, which is the correct time for a repeat. The mechanics of this repeat will be discussed in a further section.

Repeat 4 is the most blatant example of error caused by Bowles transcripts. Ramsey considered it not to be a repeat on the basis that not enough words were repeated to

equal a period of rotation. He based that conclusion on Bowles transcription of the messages between Deputy Chief Lumpkin and Chief of Police Curry. In Bowles version, Lumpkins' question ends with the words, ".....men I have with me?", then Curry breaks in with, "Just go on to Parkland Hospital with me. Just go on to Parkland.". Period. Actually, the "with me." was the beginning of a repeat, which included part of Lumpkin's previous message ending with, "with me?" and continuing to repeat Curry's, "Just go on to Parkland Hospital." This repeat was also approximately 3.4 seconds in duration. So that's a total error of 6.8 seconds or so in a very crucial area of timing, which was caused by inaccurate transcripts.

However, the most important error to me was that Bowles left out and Ramsey did not correctly include a message which I feel is the most important on the tape. In my letter of Dec.1, 1980, I pointed out that there was a transmission on the ch. 1 tape which proves that it was McLain's cycle with the open mike. About two minutes after the shots, a fellow officer yells to the cyclist with the open mike, "Take off, Buddy.", whereupon the cyclist turns on his siren and speeds off to catch up with the motorcade. I did not expect Bowles to include that, given the fact that the DPD has been a leader in anti-conspiracy propaganda and many of its officers have destroyed or manufactured evidence over the years. Yet, Bowles does include a highly doubtful identification of the message, " hold everything", which confirms the NAS thesis of a cross-talk, when that message is not at all clear. In his report, Ramsey ignored the message completely. A simple examination of the tape at that point would have shown that the voice was speaking directly into the open mike, confirmed by the lack of a heterodyne, which results from interference, and that the siren was on the open mike, confirmed by the presence of an interference arc. H.B. McLain was the only DPD cyclist named Buddy in the motorcade. There was a Buddy Walthers in Dealey Plaza, but he was on foot directing traffic and stayed in Dealey Plaza. Ramsey made no attempt to find the officer who yelled to McLain, because then he could have testified that it was indeed he who yelled to McLain, and then that proof that it was McLain's open mike might have required the NAS to actually look for the shots which would then have to be recorded somewhere on the tape. This was unacceptable for scientists who were impanelled only to discredit the conspiracy finding. Although there is no direct evidence of who is the unidentified voice, study of the movements of all the cyclists seen in films taken after the shots suggest fellow cyclists J.B.Courson, James Hargis, or Clyde Haygood as possibilities. I tend to think it was Courson as he passed him halfway down Elm Street. Haygood and Hargis parked their bikes on Elm St. and went up the grassy knoll in hot pursuit of the assassin. However, McLain could have slowed down to offer either one help and was yelled off. I do not have the resources to investigate this aspect more thoroughly, but the DOJ does and will not. It is hoped that someone will before more witnesses die. Ramsey's omission of this vital issue is a clear example of the cover-up of evidence.

A related problem is the fact that there are so many versions of the tapes themselves. The Bowles tapes, the Curry tapes, the FBI tapes, the Secret Service tapes, the Warren Commission tapes, the HSCA tapes, etc. I have tried to get a copy from BB&N and from Ramsey. They both declined to share it. When I requested a copy under the Freedom of Information Act from the DOJ, FBI, Secret Service, and National Science Foundation, they all denied ever having or hearing of the tape. The HSCA records are locked up in the National Archives, safe from public access. Therefore, my studies are based on the version I bought from the Collector's Archives, whch I describe as the Canadian copies. I have no idea which other version they are identical to. If you wish to duplicate my research you can get copies from that source.

III. Timing

Ramsey's major thesis rests on the conclusion that Curry's message, "Go to the hospital." occurred before the purported shots. On this basis he concluded that there was no reason to look for shots. It's ironic that the NAS panel was called a "Committee on Ballistic Acoustics" when they didn't perform one such test or deal with the topic. They went to great lengths of propaganda to just avoid having to do any ballistic acoustics. Even if Curry's message came before the time that W&A found a shot, and Ramsey thought their and BB&N's methods flawed, there could still be shots on ch. 1 before Curry's message that went undetected. After all, if BB&N's method could not find shots, then it might have missed them. Ramsey did not look, for his mandate was only to destroy, not seek.

As I pointed out previously, Ramsey failed to deduct time for 2 repeats on ch. 2, amounting to app. 6.8 seconds. Further he based the timing on tapes which he and the government have kept secret. My Canadian tapes show marked differences. The timing between ch. 1 and ch. 2 can be compared by identifying any messages broadcast simultaneously over both channels. Ramsey spent a great deal of effort and money trying to do this for uncertain messages, but ignored an obvious one, Henslee's simultaneous broadcast to all emergency equipment. This one is unmistakable, well documented in transcripts, and needs no elaborate tests to confirm. Comparing ch. 1 to ch. 2 based on that message as the benchmark and making the necessary adjustments for known factors produces the following results: Henslee's ch. 2 message at 324.5 minus Curry's at 32.7 = 291.8 secs. between messages. Deducting 31.1 secs. for the 8 repeats = 260.7 secs. corrected. Two corrections must be made for ch. 1. First, 6 secs. representing a break in recording must be deducted from the 432.5 yielding 426.5. Then the time must be corrected by .99 for the difference in recording speeds (confirmed by a comparison of the frequencies of Henslee's voice during the simulcast), yielding 422.2. The grassy knoll shot at 143.2 corrected by .99 yields 141.8. Then 422.2-141.8=280.4. Then comparing the corrected times, 260.7-280.4= -19.7. This would tend to confirm that Curry's message came almost 20 seconds after the shots, rather than a minute before as Ramsey has concluded. These rough calculations were done easily with little expense and no need to rely on controversial tests. But, can more accuracy be obtained by using as a common reference point a message earlier than Henslee's simulcast? I believe that there is compelling evidence as presented by Ramsey to justify the opinion that the earlier message,"You want me to still hold this traffic..." transmitted over ch. 2 was retransmitted via cross-talk on ch. 1 at the same time. Using this message as the common reference point, the comparison produces the results I have listed in my timing chart.

In order to fit both channels in the same chart for easier comparison, I have omitted some of the calculations used for correcting the times listed as correct. Arguments for those corrections and calculations used for them are found here and in other sections of this paper. In the interest of simplicity, no speed of tape correction was made to ch. 2, but rather to ch. 1. I have estimated that there is approximately a 1% difference in true speed between the two channels. That estimate is based on a comparison of the frequencies of dispatcher Henslee's voice during his simultaneous transmission, "Attention all emergency equipment...". After deducting 6 seconds for the break in recording to cassette,ch. 1 times were multiplied by .99. However, the difference in corrected times for "Attention..." at 426.5 and "You want..." at 318.6 is only 107.9. Ramsey's analysis of "You want..." proves that it is cross-talk, so the time for ch.2 of 109 secs. should be the same for ch. 1, amounting to a discrepancy of 1.1 secs. I have arbitrarily decided to add the 1.1 secs. to ch.1 to correct for that. For one reason, it is possible that the 6 second break in recording chopped off some of the original tape. Second, the corrected times fit the times given by BB&N. Third, the corrections to ch. 2 are already complicated enough. Fourth, deducting more time from ch. 2 would tend to take the corrected timing out of fit with the dispatchers' time notations more than adding the 1.1 secs. to ch. 1.

The major correction to ch. 2 consists of deducting time for repeats, which have added time to the apparent length. Arguments are presented for each repeat:

Repeat 1 is the same as Ramsey identified. Since it is a double repeat, it is two times the period of rotation, 3.3 secs., for a total duration of 6.6 secs. My stopwatch timing timed on the word, "secure" agrees with Ramsey's corrected time.

Repeat 2 is the one that Ramsey missed entirely, as I pointed out previously. Now, because the stylus on a Gray Audograph moves from inside outwards(opposite of the normal phonograph), the period of rotation increases with time. Therefore, this repeat measures 3.4 secs., which is confirmed by noting the difference in time between both "notified"s. An FBI technician probably lifted the stylus to get past the known repeat.

Repeat 3 is the same as Ramsey identified. Because some of the message is unintelligible, it was impossible to tell if it was only one complete repeat or if someone had manipulated this repeat. The closest approximation by timing from different words was 3.8 secs. Although this is not a typical period of rotation, it agrees with Ramsey's uncorrected time.

Repeat 4 is another that Ramsey misinterpreted, as I pointed out previously. Starting the stopwatch at the break after "hospital" produces a time of 3.4 secs., which is a period of rotation.

Repeat 5 is the same as Ramsey identified. Regardless of the fact that the words in the repeat are unintelligible, the total duration is 3.4 secs., again a period of rotation.

This brings up an interesting observation. Ramsey clearly labels this repeat on the strip chart, Figure C-2, but if you look closely, the decibel level is very low. First, what could account for that, and second, what implications does that have. It appears to me that the most likely cause is skating or "soft mistracking", where the stylus rides up one wall of the groove, but does not break away and jump out of the groove. What are the implications? Profound! First, such mistracking can occur not only during a repeat, but also during sections without repeats. Thus, the fact that this is a mistracking can not,not,also prove that it is also a repeat.

Second, Ramsey tried to pad the earlier part of ch. 2 with supposed silences. One of the criteria he used in establishing the existence of the silences was that the strip charts showed periods where the signal stayed below his arbitrarily imposed threshold of 10 decibels below peak voltage for more than 4 seconds. He based that on the word of DPD Capt. Bowles, with no hard evidence. But even granting the possibility that there were hold relays of approximately 4 seconds, there is no firm evidence about the threshold at which they operated or that in fact that they were operating properly on Nov. 22, 1963. Moreover, the fact that repeat 5 has a period of duration less that the estimated hold duration and the fact that its decibel level was much lower than the estimated hold threshold would suggest that such mistracking could be mistaken for a silence. Thus it is possible that none of the silences identified by Ramsey were in fact silences. Further, it seems that the signal in every supposed silence remains higher than at repeat 5. Ramsey then goes on to arbitrarily add 46 seconds to ch. 2 to account for his silences, justified by the specious argument that perhaps ch. 2 wasn't used much at that time. This can easily be refuted by pointing to the fact that many officers were trying and unable to use ch. 1 and switched to ch. 2 to report that fact, get orders, or try to find out what was happening. Also, BB&N's study showed that ch. 2 was running "nearly continuously" during that time.

As pointed out before, ch. 1 and ch. 2 real times must be the same for "You want..." and "Attention...". As you will remember, I arbitrarily chose to use 109 secs. for ch. 1. It could be slightly less, but not by much. The smallest corrected time was 107.9. Ch. 1 was recorded on a Dictabelt running continuously, in contrast to ch. 2's voice-actuated record. So there is simply no way that the time for ch. 1 can be reduced further. If anyone wants to quibble over the 1.1 secs., he can do the calculations the other way. But if the corrected time for ch. 1 is 109 secs., what impact does that have on the corrections for ch. 2? The uncorrected time of 324.5 minus 230.5 yields only 94 secs., not 109. To make matters worse, 7 secs. must be deducted for repeats 7 and 8 yielding only 87 secs. The only way to account for such a large discrepancy is by the fact that there are 22 secs. of silence somewhere during that period on ch. 2. This is the reason for the NA instead of a corrected time and the reason for the 315.4 instead of 293.4. Without access to the strip charts which Ramsey has declined to release, there is no way to tell exactly how many, where, of what duration there are silences. If Ramsey had done this analysis, he'd have found the silences, analyzed their characteristics, and gone back to his previously suspected silences to do a more careful study. Just listening to the tape, it seems to me that there are much fewer messages during this period than the earlier one.

Repeat 6 is the same as Ramsey identified. The duration, of 3.5 secs., the same as Ramsey's, is a period of rotation.

Repeat 7 was overlooked, because Ramsey was only interested in the period before "You want...". Like repeat 2, only one word was repeated and the time between each was a period of rotation. In addition, an analysis of the background frequencies between each word would show a complete match.

Repeat 8 is a very clear example of a repeated phrase. The period of rotation is 3.5 secs. It is so obvious that the only explanation for Ramsey's missing it is the bias he had for padding the earlier part of ch. 2.

IV. Voiceprints

Although I have no expertise in this field, several errors appear obvious even to a layperson. The most controversial finding by Ramsey was his validation of Barber's subjectiveidentification of a simultaneous transmission of the words, "hold everything." I have never been able to hear any distinct words on ch. 1 at that time. Perhaps this is another example of the differences between various versions of the tape.

The correlation shown in NAS Figure 6 is misleading. Here Ramsey uses a favorite old trick of changing the scale in order to create what Huff calls a "gee-whiz" graph. Notice that although the horizontal scale is the same for both the "You want..." correlation and "hold everything", the vertical scale for "You want..." is about 19mm/.1, whereas the "hold everything" is about 28mm/.1. This exhaggerates the goodness of the correlation and distorts the spike in order to make it resemble the "You want..." spike. The actual numbers are more revealing.

The peak of the spike is about .518, whereas even background static reached .3, a difference of .218. BB&N's correlation coefficient = $10 \div \sqrt{12 \cdot 14} = .77$. Yet Ramsey implies such a figure is unimpressive. Then how could he accept .518 as significant? If there is a choice, logic demands that the source with the higher correlation be chosen as the true source. Incidentally, Ramsey criticized W&A for choosing the correction factor which gave the best match and went ahead to do the same thing himself for this correlation. Also, Ramsey criticized W&A for not considering alternative sources, but it would seem that the screening process and Ramsey's voiceprints rule out most other sources. Comparing the grassy knoll shot pattern to other portions of the tape which included static, voice transmissions, etc., BB&N found that the correlation exceeded .6 only during the 9 seconds where other shots were identified. Now Ramsey has found a correlation of only .518, which would not have passed BB&N's screening process.

One weakness of his study, for which he had the gall to criticize W&A, was the failure to do a control. Perhaps <u>any</u> voice-transmission could achieve a correlation of .5, but not even a known simultaneous transmission could achieave a 1.0 correlation, due to the static or background noise. There are some examples on the tape where cross-overs from ch. 2 were recorded along with live sounds on ch. 1 from the open mike. Moreover, Ramsey does not offer any evidence that the message,"hold everything" is unique and identical to Decker's known transmission. If the message had been a very common one, like"10-4." or a persistent one like"75.Signal 5?", there could be several such occurances and it would be difficult to prove which was the match. Ramsey failed to look for other occurances of "hold everything" and do a control correlation for each. If he had done the same comparison to Curry's "hold everything" message, the correlation would have been approximately .55.

The correlation for "You want..." was much better,.766 at the peak of the spike. Looking at the actual voiceprints , the two channels look very much alike, unlike the "hold everything"which look nothing alike. On hearing the two, it seems clear to me that they are the same message, though the ch. 1 cross-talk sounds as if it has more background interference and that the last few words fade out or get chopped off. Ramsey also suggested the use of Bayes theorem, but gave no concrete examples, even though he had a perfect opportunity here. Using Bayesian logic, he should have noted that although the "You want..." is clearly and audibly a known match, the highest correlation he could achieve was .766, which represents a probability of 1.0, amounting to a difference of .234 due to inaccurate methodology, technique, and/or noise. Therefore, the highest correlation one could hope to achieve might be approximately .8. Adding this loss factor to BB&N's .77 results in an estimated .97, which is quite significant.

Further, there is another simultaneous transmission that should have been analyzed. At the time of Henslee's simulcast"Attention..." there was very little noise. Why didn't Ramsey do a control on this message?Because it might achieve a correlation of only .8 or less, which would show how imprecise and subjective his correlation method and technique was, casting doubt on the identification of "hold everything". Second, it would have increased the probability of the grassy knoll shot.

In general the whole study was biased and subjective, relying on the FBI, Bowles, and the one member of the committee whose bias is well documented. Calling in outside consultants would not necessarily have guaranteed elimination of bias, but perhaps might have made the study more objective. As a recent article in "Technology Illustrated"

pointed out, there are several researchers at MIT, Carnie-Mellon University, and IBM doing advanced work on speech recognition by computers. Although they may have ties to the intelligence community, it is assumed that they wouldn't tinker with the basic computer program, so that the computer could do the same study completely objectively. Ramsey failed to use the best resources available.

V. Unanalyzed sounds

Another area left uninvestigated was the analyzing of additional sounds on the tape, not just the ones Ramsey tried to use to prove Barber's thesis. One such sound is the message which I point out to the NAS. The fact that Ramsey did no study of the message proves how important it is. A thorough study might prove that the arcing is a result of McLain turning on his siren. This would put an unbearable burden on those who argue both that McLain turned on his siren immediately and that the open mike was stationary at the Dallas Trade Mart.

Also of interest is the nature of static and interference from the Dallas Electric radios. Could such interference resemble gunshots? Ramsey criticized W&A for not considering alternative sources, but failed to do any study himself. Ramsey also criticized W&A for not using the same method as they did on the grassy knoll shot on the other shots as a control, but fails to point out that the HSCA's contract was only for the detailed analysis of the grassy knoll shot. W&A were not asked to do the same work on the others and were so hard pressed for time that they could not have physically done it. Since the HSCA expired, none of their acoustical experts has shown any interest in doing follow-up work on their own, offer help to other reesearchers, or vigorously defended their reputations. I have attempted to do so in my limited way. I have applied the method W&A used for the grassy knoll shot to the other 4 and offered to share my latest calculations with Ramsey, but received no reply. If Ramsey thought that the method W&A used was flawed, he should have shown that by applying it to the other shots.

VI. Statistics

This is the most crucial and yet perplexing aspect. No scientist involved in any study to date can state with absolute certainty if there were or weren't shots recorded on the DPD tape. Everyone talks in terms of probability and likelihood. This is typical of scientists, but not comforting to the layperson who wants absolute truth. But most people are perfectly capable of understanding simple odds and probabilities associated with everyday life such as games or the weather. If there is a 99% chance of rain, you'd take your umbrella or postpone the picnic, whereas if there is only a 1% chance of rain, you wouldn't. That's no guarantee, but at least it's a good guideline on which to base decisions.

15 matches between test shot patterns and DPD impulses had correlations exceeding .6. BB&N noticed that the pattern of matches seemed to fit the path of the motorcade. Viewing the dots representing the time from the first match to the last on one axis and the distance along the microphone layout on the other as a scattergram, there appears to be a definite non-random sequence. This chart is based on the raw data, which included obvious false alarms. At this point, there was no attempt to deduct them. Mikes had been placed about 18 feet apart along the motorcade route as a compromise between the estimated acceptance windows and the need to cover as much of Dealey Plaza as possible with the fewest necessary mike locations. The design of the test was adequate, given the constraints imposed. The pattern of matches can be as important as the total number. A cluster of several matches from neighboring mikes matching the same DPD impulse not only tends to confirm the impression that the pattern of the DPD impulse is a shot, but also gives clues to the real location of the policeman's mike. If an early DPD impulse pattern matches with mikes 2(5) and 2(6), the true location might be somewhere between them, but if it matches mikes 2(5) and 2(2), the true location is more likely between them. If a DPD impulse pattern matches widely separated mikes, say 1(4), 2(10), and 3(12), that would suggest that 2 or maybe all 3 matches are false alarms.

To test whether there was any relationship between the time and distance coordinates, BB&N partitioned the matches into a 2 X 2 contingency table and used a generalized χ^2 test with the null hypothesis that matches were independent so that the distribution in the

cells should be random. Using the data 1,6,8,0 produced a χ^2 = 11.4. For 1 degree of freedom, BB&N stated that the probability that this large a value could occur at random is less than 1%. Ramsey failed to criticize 2 important aspects of this calculation. First, the 1% level may be too high, because BB&N did not use a table extensive enough to give an accurate percentage level for such a large value. The χ^2 value for the 1% level is 6.635. More extensive tables, such as the Biometrika, show the value for the 0.5% level is 7.879. A Fisher and Yates' table shows the value for the 0.1% level is 10.827. Thus BB&N's stated significance would seem, to the casual reader or layperson, to be not as significant as the value really is. Second, the χ^2 distribution for such a low total (N=15) tends to be skewed. It might have been better to use an exact test. As Langley points out, the recommended test for N<50 is Fisher's Test(1934), which makes use of the hypergeometric formula: $(n_1!\cdot n_2!\cdot n_3!\cdot n_4!)\div(N!\cdot a!\cdot b!\cdot c!\cdot d!)$, to derive the exact probability. Although the computations can be more complex, because of the factorials, the fact that N is moderate and the importance of accuracy necessitates using Fisher's Test. For the data 1,6,8,0 the exact probability computed by this test is .0013986.

Ramsey attempts to criticize BB&N's highly significant result by arbitrarily and informally deducting 7 matches, saying that some of the alarms are dependent,because some of the microphone and rifle locations were similar. Why should independence be a criterion for inclusion when that is what is being tested? Ramsey cites no standard reference or test that advocates such a reduction in the individual cells. Even if that were a valid approach, he'd have to go through the table match by match and justify each deduction. Then we could challenge or debate each one. Due to the design of the test, we would expect patterns from neighboring mikes to be similar, but that does not mean they are dependent on each other. How close or how far away from each other do the mikes have to be for Ramsey to consider them "independent"? He cites no estimates for that. Ramsey's criticism that rifle locations were similar seems to have more validity and should be studied more carefully. BB&N designed the test so that rifles would fire at different targets, with the muzzle first in the plane of the window of the TSBD and then pulled back 2 feet inside to see if there was any significant difference in the patterns, and therefore the correlations. Perhaps the pattern would be different if the shockwave trajectory were different. Or perhaps the inside wall and window significantly reduced the decibel levels of the echoes if the gun were fired from well within the TSBD. If a DPD impulse matched one set of conditions rather than the other, that might provide vital clues to the real conditions of the assassination.

Evidence from other fields contradicts the assumptions that Ramsey used to calculate the probabilities of the other shots. Even Ramsey himself conceeds that his calculations may be too conservative, but fails to fully explain what assumptions he made. He deducted 6 false alarms as BB&N had from the 15 matches to get the 9 remaining. But one of those matches was incorrectly identified as a false match. BB&N stated that the one at 140.32 came too close after another more likely match to have been fired from the same rifle. Although that is a proper attempt to eliminate a false match based on corroborating evidence, the logic is flawed and the acceptance of the veracity of that evidence is biased. Perhaps an automatic weapon was used for those two shots, or one man was firing two weapons, or one shot came from the TSBD and the other came from the grassy knoll. The case that I believe most likely is that another man fired the second shot from a few windows down. There is some evidence and eyewitness testimony that there was a second man on the same floor of the TSBD and a different weapon from Oswald's Mamlicher-Carcano. Ramsey's value of 7 is based on the assumption that only 2 shots were fired in Dealey Plaza, accounting for 9 wounds, 3 points of damage to the limo, and 4 scars in the street. That's how he came up with $1-(7\div9)^3$. If he had stuck to the old Warren Commission 3 shots, then $1-(6\div9)^3=.7037037$. The trajectories of the wounds compared to the timing suggested by the tape make 4 shots the minimum, even without a miss, so $1-(5\div9)^3=.8285323$. I have found corroboration in all the other evidence for 5 shots, which includes BB&N false alarm 140.32, so the equation should be $1-(5\div10)^3=.875$. Notice that for these calculations, Ramsey doesn't complain that the mikes were too close as he did for the chi-square. He wants to have it both ways. If he did, he'd have to deduct 5 of the matches as duplicates, then 5 more false alarms, leaving only 5 matches for 5 possible shots, so the equation would be $1-(0\div5)^1= 1.0$.

The critical issue is BB&N's computation of the probability that W&A could obtain such a good match between the DPD tape pattern and the echo pattern they calculated for their estimated cycle-shooter locations. BB&N calculated that the probablity that such a match could occur at random was about 0.053, giving them a 95+% confidence that the pattern on the tape was a grassy knoll shot. Some of Ramsey's criticisms of BB&N's computation are correct and quite important, but his only purpose seemed to be to increase the p above 0.05, not to seek the true conditions, nor try for maximum accuracy. As W&A pointed out quite clearly, there is always a chance that the pattern is not a shot, but a random pattern due solely to chance.The thing which gives inversely proportional confidence is the chance that it could occur at random.

If Ramsey thinks the randomness of the DPD impulse pattern is an important criterion, then the first thing that should have been done that none of the scientists did, would have been to test the pattern for randomness. Using W&A's Table 4, I counted the runs of signals and the runs of non-signals, using 2 ms. time windows starting at .1 ms. With the values: n_1=22, n_2=163, N=185, and r=40, I used Wald and Wolfowitz's formula with Yates' correction as shown on Langley p.326. The resulting z=-.0200981 doesn't even approach the 10% value of 1.64. Thus this test does not show that the pattern is not random. I then deducted the 190 ms. of silence between the two groups of impulses and tested the randomness with the values: n_1=22, n_2=68, N=90, r=40. The resulting z=.6626179 was slightly more significant, but was still much greater than 10%. Thus even with the deduction for the silence duration, non-randomness could not be shown. Because this test is a modification designed to make calculations easier , I decided to look for a more complex formula. In Freund's Modern Elementary Statistics, p. 326 the test of runs is based on the formula $z=\frac{r-\mu}{\sigma}$. Calculation with the original values yields z=.2858912. Again deducting the 95 time windows of silence this time yielded z=-3.0090982, which is significant almost to the .2% level. This shows a definite non-randomness.

Ramsey tries to criticize the 0.053 figure with a ridiculous analogy to a bridge hand having 3 Aces. That is like comparing apples and oranges. As Russell Langley points out in Practical Statistics, pp. 374-375, a person might throw a handful of coins into the air and notice the pattern they land in. The probability of their landing in those positions may be a billion to one, but that doesn't imply that it is due to anything other than chance. The probability would be significant only if the pattern had been predicted before the experiment. Then we could say that it's extremely unlikely that the pattern is due to chance. The specific bridge hand was not predicted before the deal. W&A did predict an echo pattern that matched with the DPD impulse pattern very closely, as noted elsewhere.

Also, why would anyone suspect the dealer of dishonesty? I dealt that hand a few weeks ago and everyone had to pass. Why not suspect the opponents who shuffled and cut the cards? If a player were dishonest, he'd want to arrange the cards for maximum profit with the least suspicion. An excellent card manipulator can stack the deck or misdeal after the opponents have shuffled and cut to give himself a 7NT hand. But no one would double that 37 point hand and everyone would suspect him of card sharking. Most cheating at bridge consists of secret conventions, hand signals, or other relayingtechniques,Professionals make use of ceiling peepholes and leg transmitters. Most average players' suspicions are not aroused by a few lucky finesses and psych bids, but are when the opponents get a 7 NT hand every time. If a card manipulator were really skillful, he might give himself a 10 card spade suit and two voids, his partner the 3 missing spades and a void in the fourth suit, plus giving the dealer those famous 3 aces and his side most of the remaining high cards, thus fooling him into taking some kind of action over his spade bid, so that when he jumps to 7 Spades, he makes the dealer guess whether to double or bid 7 NT. Either way would be diastrous , giving the manipulator maximum profit.

But Ramsey also makes simple errors in his analogy. He states that p=.044(actually .043841538), but that is cumulative including getting 4 aces. For only 3 aces the p= .0412004786. He then goes on to compare the 0.053 which he considers a Poisson probability with 0.044 which should be considered only a hypergeometric probability. To make a valid comparison, he'd have to take the hypergeometric,and then calculate the chance of getting only 1 in 180 trials as BB&N did. The expected number in 180 would be 7.41608615. Using λ=7, x=1, the Poisson Test shows that p= 0.006832038. So if you never get a hand which contains 3 aces out of 180 deals, you might get some sympathy.

Ramsey correctly pointed out BB&N errors of logic and simple oversight. As Ramsey

pointed out, BB&N did make a simple oversight in stating that N=45 windows as used in the hypergeometric calculation. Each of the two groups containing impulses was 90, for a total duration of 180 ms., thus 90 windows not 45. However, Ramsey doesn't tell you what the hypergeometric distribution would then be,given N=90. In fact, $h(9;12,14,90)= 5.13843913 \times 10^{-7}$, which is much less than $h(9;12,14,45)$, which is $3.12899277 \times 10^{-4}$. Note here that Ramsey fails to point out that BB&N had already made 2 conservative adjustments to the data. First, they deducted the 320 ms.(should have been 190 ms.) of silence between the two groups of impulses. If that duration had been included, then they would have started with a much smaller value for the hypergeometric. Second, they deducted 1 match, because any match could be made simply by moving the time scale of either. Ramsey ignored this adjustment, but I feel that it must be questioned. Moving either time scale would inrease the sampling space. But given the fact that N is now so large, the difference may be minor. On the other hand,Ramsey makes the very important observation that 2 pairs of impulses, 19+20, 23+24 coincide in the same 2 ms. window and one pair of the predicted echoes coincide in the same window. That all depends on where you draw the boundary between time windows. In this case, it is natural to start at 0.0 and make each 2 ms. Thus 312.4 and 313.1 fall in the same window. Further, #19 and #20 are both 283.7; they obviously fall in the same window no matter what boundary is set. So Ramsey deducts those coincident impulses to reduce the data to x=8, n=11, M=12, N=90. That's o.k., but then he goes on to reduce those by 7 to account for the so-called "free" parameters. Later he does note that the data tend to suggest non-randomness, except for his admittedly conservative adjustment. However, he states plainly in the text that such an adjustment of deducting one match for each "free" parameter is a traditional method. To me it seems outrageous, and nowhere does he cite any reference or test which advocates that approach. There may be similar methods applied to other tests, but it is a complete misuse to apply them to the hypergeometric arbitrarily, with no experimental results or logical proof.

Yet even given his adjustments, Ramsey fails to perform the same calculations that BB&N did with that data. Specifically, the hypergeometric $h(1;4,5,83)=.206996006$, not .223. Then the next problem arises when trying to compute the probability of getting such a match only once in the many trials possible just by moving the cyclist's position. Ramsey should have noticed W&A's error in estimating the width of the corridor travelled by the cycle. They derived the 18 feet length correctly by noting that the test pattern from only mike 3(4) matched, not the one before or after, so the cycle was probably in the range of mike 3(4). But when estimating the width, they erroneously concluded that, because the mike was supposed to be in the middle of the street with no mike on either side, the cycle could have been anywhere along the width of the street. In making that estimate, they presupposed certain real-life conditions. They assumed that the cycle remained in the street, otherwise the width could have been 100 feet or more. That is not necessarily a safe assumption, given testimony of witnesses that saw a cyclist try to jump the curb and drive up the grassy knoll. In this case they should have examined the evidence more carefully. The estimate of 180 Bernoulli trials is very important. W&A never actually performed 180 trials, but BB&N estimated that they could have and used that figure in the binomial calculation. There are several clues which they overlooked.

First, the cycle has been identified as McLain's which was on the left side of the motorcade at the side of the press cars. Also, the previous matches were with mikes on the left side of the motorcade route. For the cyclist to have been on the right side of the motorcade at the time of the grassy knoll shot, he would have had to cross the center lane through the press cars. There is absolutely no testimony that McLain did that. Further, there is photographic evidence that only one cycle, Courson, crossed through the press cars from the left to the right side of the street. These films, including Dorman and Couch, show that McLain stayed on the left. Also, the Altgens 5 photograph, taken at about the same time as Zapruder frame 255, just a few seconds before the grassy knoll shot shows several cars rounding the corner in the middle of the street. Calculating a smooth trajectory from his known positions in these films, the farthest to the right McLain could have been would be about 5 feet into the middle lane, and that is even doubtful, given the closeness of the press cars. We must assume that W&A would remember that no two objects can occupy the same space at the same time. If that space was occupied by a car, it is unavailable to the cycle as a possible trial. So these limits produce a corridor of 18 by 18 feet square, equal to 81 trials.

Ramsey's deduction of 7 parameters must be studied more in depth. For example, he states that there are 2 parameters associated with the location of the shooter. If one is for the test shooter and the other for the second assassin, then a more careful examination of the evidence would allow one to determine their positions within a very small margin of error. If both are for just one, representing the x and y axes, then why not a third for the z axis? Even then, the variation in recoil would leave an uncertainty of about 1 inch. Would Ramsey still cite that as a "free" parameter when it has an impact of less than .001% on the calculations? If the 2 parameters are for one shooter, then maybe there should be 6 total, 3 for each shooter. Or what about the cycle position? Ramsey seems to imply that the cycle can be anywhere, whereas I have shown that the travel corridor was actually much narrower. Even such minor factors as the wind velocity, building shading, bullet airodynamics, etc. could be considered "free" parameters. The main problem is that Ramsey never cites any criteria for deciding what a parameter is and how "free" it is, nor any standard method of accounting for them. Some of the parameters he lists are dependent or off-setting. Others fall far below the built-in uncertainty. In addition, there are other factors which Ramsey did not consider. The maps used were only accurate to ±3 feet, so that's almost a 1% difference for most echoes right there. Or perhaps one temperature was measured with a dry bulb and the other with a wet bulb. What difference would that make? Perhaps the shockwave of one bullet or the explosion of the explosive bullet temporarily rarified the air through which the sound of the next echo travelled. What difference would that make? No logic seems clear. Any fool could make up a list of all the variable conditions that could have existed and then deduct one match for each.

Perhaps the worst mistake Ramsey makes is found in the next to last sentence of his criticism of BB&N's computation. I tend to give him the benefit of doubt and assume it was a simple oversight or writing fatigue. If not, it is one of the most blatant misrepresentations of fact ever. Ramsey states that the level of p=0.223 is not impressive in contrast to the claim of p=0.053. Again Ramsey is comparing apples and oranges by contrasting the p of his incorrect hypergeometric with BB&N's binomial. In his attempt to raise the p level, he incorrectly plants the impression that the p level of the hypergeometric is what determines the significance. Here Ramsey went overboard the other way. If the h(x) is .206996006, then the expected occurances by chance in 180 trials would be 37.2592811. Contrary to Ramsey's summary of BB&N's analysis, one does not obtain the binomial probability simply by multiplying the h(x) by the number of trials. That may be an approximation if the E(x)<x. But by using a standard binomial test for that data, the actual probability of only one match is $3.47957775 \times 10^{-17}$. Ramsey suggests using the Poisson Test, but that may be less accurate than a simple binomial test when the p is so large. For the other calculations where the p is small and n is large, the Poisson may be a good approximation. It is often used as an approximation, because calculations are done more easily than by the binomial. As an analogy, suppose you have 180 coins whose bias is known that approximately 37 heads will come up when they are all tossed. Then suppose that on the next trial only 1 head comes up. Given the expected value, $\lambda=37$, the probability of getting only 1 head is $3.15730616 \times 10^{-15}$. As it turns out, calculation is relatively easy using the binomial, because x=1 in all these cases so that nCr=n. This means that the calculation of the combinations does not involve any factorials or logs of them. Usually, the variance should equal the mean to use the Poisson.

I believe that the actual situation is $h(8;11,12,90)= 9.0512911 \times 10^{-7}$. Then the chance of 1 success in 81 trials= 7.3310083×10^{-5}. That value of p makes me 99.99% confident that the DPD pattern matches the predicted grassy knoll shot pattern, and given the fact that other shots were identified by the same method before and after this impulse convinces me that the DPD pattern is a shot from the grassy knoll.

As Ramsey pointed out, there are some places in BB&N's report where the wording is misleading. He missed some however and should have been more specific. For example, on p. 75, the following corrections should have been made: in the first paragraph, the first sentence should read, " 12 of the 22 predicted echoes would be..."; in the next sentence, "...that were judged loud enough..."; in the last paragraph, starting at the second sentence, "We observed that they obtained 10 matches, within ±1ms., out of 12 predicted echoes, with 14 DPD tape impulses in a 370 ms. time span. We note, however, that the 12 predicted echoes were contained in two time intervals of approximately 90 ms. each, for a total duration of 180 ms.These two time intervals were separated by a span of about 190

ms. in which no echoes louder than background noise appeared. Because an echo was counted if it occurred within a 2 ms. time window, there were 90 possible windows in which echoes might have occurred, ignoring the 95 windows between the two time intervals."; and on p. 76 BB&N should not say 9, or more out of 12. Instead of pointing out this error, Ramsey copied it. The calculation of the hypergeometric is a simple one, not cumulative. Only 10 matches were made, not 11 or 12. And the number of trials should be 81 as I pointed out previously.

Even though W&A's match between a DPD impulse pattern and their predicted grassy knoll shot was significant, Ramsey still criticized the conclusion that there was evidence that it was actually a shot. He claims that W&A and BB&N failed to consider alternative sources, but gave no examples. I have always thought that one of the basic tenets of science is that one cannot attempt to disprove a contention without offering an alternative explanation. That would be like saying that you think Einstein's Special Theory of Relativity is wrong, because other things could account for the observed phenomena which it accurately predicted, but offer no alternative theory or examples. That's not a scientific argument; it is demagoguery. In the case of possible shots on ch. 1, there are several obvious alternative sources. Ramsey dare not specify or consider them, because all of them can be easily disproven. I offer some now merely as strawmen to show why Ramsey couldn't risk specifying. If static was the source, matches should be found at other portions of the tape, yet none were found elsewhere and 15 were found within a 9 sec. portion of the tape. No attempt was made by Ramsey to show that any portion of the tape contained static that was not random and then no explanation for the non-randomness, such as sunspots, RF interference from the Dallas Electric radios, natural electrical discharge like lightning or static electricity, periodic discharge such as the motorcycle's ignition, or nearby cars without suppression spark plug wires, is offered, because there is no evidence that such sources occurred and were recorded on the tape, especially during the critical 9secs.However, there are examples of mechanical sources, such as the fact that the mike had stuck open before the well-known 5½ min. portion and occassionally after, but never has Ramsey tried to prove that the action of turning on or off the switch, or even the headlight or turn signal or emergency lights, or the siren could mimic a gun shot pattern. The mike turning on or off while other radios were trying to use the same channel should display a heterodyne(interference tone) of a specific pitch and the actual noise of the switch keying in takes less than .1 sec., whereas the detected shots had no heterodyne, were recorded while the mike was continuously open, and lasted for almost a half second. Nor did Ramsey attempt to compare the decibel levels of the keying in to the shots. Another mechanical event which Ramsey overlooked was the jarring of the mike, which should not be considered unusual given the fact that the mike was on a moving motorcycle, a fact that can be confirmed by the presence of exhaust noise and squealling tires while rounding corners. These may be what Bowles calls the "bonk-bonk" sounds heard near the time of the shots. For years I had thought these might be the shots, but at the closest time to the BB&N detected shots, there are only two of these bonks, spaced about a second apart, so that if these were typical shot sounds, and may be loud enough, there would only be 2 shots to the assassination, separated by about 1 second. This definitely does not fit the known ballistics, medical, photographic, or earwitness testimony. JFK is clearly wounded by Zapruder frame 225 and struck in the head at frame 313, a difference of about 4.8 secs. Any detected shots must have at least that separation. Some examples of jarring which Ramsey should have tested are: hitting the mike, running the bike over a bump, into a curb, etc., and kicking the side while shifting gears or putting up the kick stand. These are mechanical sources that also should be detected as impulsive sources, but could they mimic a shot? And how likely would it be that 5 such events occurred only within the 9 sec. section and nowhere else.

Ramsey dare not even consider alternative acoustical sources, lest he fall into the same trap that the FBI did. Once you start with the premise that the sounds are impulsive, it doesn't matter what you chose as the initiator, the matching test will still identify the location of the source and the open mike. Then you can just argue what type of source could have made such a loud sound with echoes coming in after .5 sec. at 100 decibels. The FBI tried to suggest a stick hitting concrete, but when have you ever heard a stick hitting concrete inside a building as loud as 130 decibels? And if you try to use that alternative source for all 5 shots, you are left with the improbable conclusion that professional assassins tried to kill the President of the United States by slapping sticks

against concrete walls. The only sources capable of producing the high volume levels are explosive, so it really doesn't matter what you call the source, but that it's very loud and it's location is identifiable. It could be any type of firearm, even firing blanks, or even a loud firecracker. But again, the BB&N method would work and you'd identify the source as a loud explosive impulse. In the case of the TSBD, there is no physical evidence of anything other than a gun, and loads of physical and eyewitness evidence of the gun. On the grassy knoll, there is no evidence of anything other than a gun, and some circumstantial evidence that if there was a loud explosive sound from there, that it was due to a gun. There is no photographic evidence of any other source such as a firecracker or car exhaust backfire, but there is photographic evidence of a gun at that location. There is also the speculative identification of a shockwave which would have to preceed the blast of a loud explosive sound. As far as I know, there are no supersonic blanks, and there is no evidence that a high explosive like TNT or RDX was set off above the fence. Other loud impulses such as jet plane sonic booms or thunderclap are absurd explanations. These few examples show why Ramsey dare not offer alternative explanations.

Ramsey's improper methods not only impede a proper investigation of the assassination, but they also pose a danger to traditional science. Take, for example, his assertion that just because BB&N were able to reject the null hypothesis, that doesn't mean that their alternative hypothesis was correct. Ramsey introduces unnamed alternatives as equally likely causes. By that same reasoning, all statistical tests and analyses of experiments are invalid, because the results may be due to some "magical" alternative sources. Thus no medical firm or researcher could claim success with a new drug or treatment simply because the null hypothesis was rejected at a highly significant level. The basic definition of success of an experiment would be invalid. Progress would come to a complete standstill. I can understand why experts on statistics and acoustics are not interested in the assassination of a political figure, but they should rise up in anger when their science is degraded by misuse.

Addendum, Sept.1983: The national security establishment should also be alarmed that the work of this country's top acoustical experts was dismissed so cavalierly. In addition to having analyzed the Watergate tapes and proven who fired which shots in the Kent State Massacre, Bolt,Beranek and Newman is an important defense contractor, especially to the Navy. If their basic understanding of science is as flawed as Ramsey suggests, the implications are frightening. In that case, they couldn't tell a Russian sub from a whale by sonar. No intercepted code could be decrypted, because the noise reducing or filtering algorithms would be suspect. As for the validity of Ramsey's work, it would be a travesty if someone were convicted on the basis of the same type of voiceprint analysis he did. If that work is accepted as a precedent for the growing field of speech recognition,there will be a lot of dangerous and costly misidentifications leading to cold leads and needless brinksmanship.

Addendum, Dec.1983:Another piece of unanalyzed evidence which I have recently come across is the live broadcast by KBOX at the Dallas Trade Mart. As reporter Ron Jenkins breaks in, he states quite clearly that he had just heard the broadcast about Industrial Boulevard over the radio. Then the motorcade goes past; then he and the DPD motorcycles stationed at the Trade Mart join the race to Parkland Hospital. It is obvious from listening to the KBOX tape that none of the DPD cyclists at the Trade Mart had turned on their sirens until several seconds after the motorcade passed them. Thus it is impossible that the open microphone was at the Trade Mart, as suggested by some critics of the HSCA acoustical studies. Sirens are clearly heard on Ch.1 at 12:32:56.1(262.6 seconds after the mike stuck open) and on on Ch.2 at 12:32:37.3(132.7 seconds after Curry's "triple underpass" message), but the first mention of Industrial Boulevard on Ch.2 was almost two minutes later, from Unit#15-car 2, Capt. J.N.(Red) Souter's order to the dispatcher to have Unit#283 cut the traffic at Hines and Industrial, followed immediately by the dispatcher's order to 283 to cut traffic, Hines and Industrial. Furthermore, the patterns, types, and sheer numbers of sirens you can hear at the Trade Mart joining the motorcade sound much different from the patterns, types, and much fewer numbers on Ch.1. This is proof that the sirens heard on Ch.1 were not at the Trade Mart. Therefore, they were part of the motorcade.

Corrections to "Rebuttal to Ramsey"

Page 8: All calculations of the Runs Test were incorrect. In each case, the value for r was keyed into the calculator instead of the value for N. I have since expanded my computer's statistics program to include the Runs Test. Using the same data and tests, the results calculated by the computer are as follows:
For n_1=22,n_2=163,N=185,r=40,z=.25964663
using Langley's version of the Wald-wolfowitz Test with Yates correction, whereas z=.0823970838 using the simpler version found in Freund.

For n_1=22,n_2=68,N=90,r=40,z=1.8024943
using Langley's version of the Wald-Wolfowitz Test with Yates correction, whereas z=1.65842282 using the simpler version found in Freund.

In order to reject the null hypothesis, that the pattern is random, at the 5% level, the z score must be=> 1.96. In none of these calculations did the z ever exceed 1.96, therefore there is no statistical evidence that the DPD impulse pattern is anything but random.

Although this result is merely peripheral to the issue of the match between the W&A predicted pattern and the DPD pattern, it does confirm my suspicion that prediction is much more important than randomness.

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†Ch. 1 brief transcript of DPD tape (Canadian copies) & †Ch. 2 brief transcript compared to establish real time on 11/22/63

Elapsed time in seconds	Unit Number Calling or person	Message(""),event,repeat({}), unintelligible(~~~~~~) timed at underlined word	Correct time in seconds	Elapsed time in seconds	Unit Number Calling	Channel 2 message(""),event,repeat({}), unintelligible(~~~~~~) timed at underlined word	Correct time in seconds	Estimated realtime P.M.
0.0	38	"Mind telling some of those people involved having this deal out here at Market Hall that there's people walking across Southbound Stemmons here in front of the Marriott Hotel all the way down |South?"	3.2					28:36.7
61.3		tires squealling	63.9					29:37.4
				0.0	1	"Triple underpass."	0.0	30:24.6
114.1		tires squealling	116.1					30:29.6
				8.0	dispatcher	"12:30, KKB-364."	8.0	30:32.6
136.0		Shot #1 from TSBD	137.8					30:51.3
				32.7	1	"Go to the hospital..."	32.7	30:57.3
143.2		Grassy Knoll shot	144.9					30:58.4
				40.6	Dallas 1	"Get a man on top of that..."	40.6	31:05.2
150.8		Bell tone(low A @220 cps)	152.4					31:05.9
				55.1	1	"Have Parkland stand by."	55.1	31:19.7
				90.5	Dallas 1	"..and hold everything secure until Homicide & other investigators can get {secure..} {secure..} there."	90.5 -6.6	31:55.1 Repeat 1
				125.3	dispatcher	"Parkland has been notified, 12:32 ... {notified...} " Repeat 2	118.7 -3.4	32:23.3 32:32.8
238.5	dispatcher	"531, testing-1,2,3,4..",whistles	239.3	142.7		sirens	132.7	32:37.3
				153.7	5	"You want, what's the~~that I have with me? {what's the~~.. with me?}"	143.7 -3.8	32:48.3 Repeat 3
				160.0	1	"Just go on to Parkland Hospital{	146.2	32:50.8
262.1		sirens	262.6		5 & 1	with me? Just go on to Parkland	-3.4	32:56.1
268.5	Courson?	"Take off, Buddy."	269.0			Hospital!} " Repeat 4		33:02.5
				183.0	1	"Get these trucks out of the way...	165.8	33:10.4
297.0		car horn beeps	297.2			{~~~~~~~~~~~~~~}" Repeat 5	-3.4	33:30.7
				209.3	dispatcher	"...Could you send someone up there to tell him to shut it of$tuck open on channel 1.Could you send..off?}"	188.7 -3.5	33:33.3 Repeat 6
317.5	190	"You want me to still hold this traffic on Stemmons 'til we find out something or ~~~~~~~~~."	317.5	230.5	190	"You want me to still hold this traffic on Stemmons 'til we find out something or let it go?"	206.4	33:51
344.5		break in recording for 6 seconds	345.3					34:18.8
				271.9	dispatcher	"12:35 {12:35}" Repeat 7(-3.5)	247.8	34:32.4
				318.8	dispatcher	"10-4.283, cut traffic Hines and Industrial.{10-4.283, cut traffic}"	NA -3.5	NA Repeat 8
432.5	dispatcher Gerald Henslee simulcast	"Attention all emergency equipment, attention all emergency equipment. Do not use Industrial Boulevard,do not use Industrial Boulevard.12:36."	426.5	324.5	dispatcher Gerald Henslee simulcast	"Attention all emergency equipment, Do not use Industrial Boulevard, 12:36." Skips 1 & 2	315.4	35:40

Coordinates of reflective points in Dealey Plaza to be considered in an echo study of the DPD Ch.1 recording of Nov. 22, 1963 (for bullets fired from the Northeast corner of Dealey Plaza and a motorcycle travelling North on Houston Street).

Point of origin (Ø,Ø) is the intersection of the middle of Houston St. and the middle of Main St.

Object	X coord.	Y coord.
Traffic light #1	276.ØØØ	72.5
Traffic Box	2Ø2.5	32.5
Pool,tip	211.ØØØ	56.25
Pool, NE corner	199.5	44.75
Tree A	272.5	97.ØØØ
Column B, North tip	2Ø1.5	79.25
DCRB, NW corner	239.833	-4Ø.333
Column A, East tip	265.75	113.1666
DAL-TEX, SW corner	319.5	-39.ØØØ
Tree N	174.ØØØ	82.ØØØ
Wall A,NE corner	248.5	142.ØØØ
Tree D	296.5	149.ØØØ
Tree B	179.ØØØ	12Ø.25
DCRB, SW corner	158.5	-4Ø.333
Neon light #1	132.5	31.ØØØ
DCCB, NW corner	129.8333	-39.ØØØ
Tree C	227.5	182.ØØØ
Column D, NE corner	1ØØ.5	96.ØØØ
Monument, NE corner	71.ØØØ	65.5
N.Shelter,SE corner	262.ØØØ	235.ØØØ
Column C, NE corner	39.25	76.5
DCCB, SW corner	38.5	-39.ØØØ
S.Shelter,SE corner	2Ø5.ØØØ	291.ØØØ
Retaining wall, tip	161.ØØØ	287.ØØØ
City bus	-11.ØØØ	8Ø.ØØØ
Old Courthouse	-4Ø.ØØØ	-4Ø.ØØØ
T.O., NE corner	-315.ØØØ	5Ø.ØØØ

the echo prediction procedure was tested. Given the estimated accuracy of the map, we expected to be able to predict echo-delay times to within ±1 millisecond for specified locations of a gun and a microphone. However, it was essential to verify that this accuracy would be achieved in practice and that the identified echo-producing objects would generate significant echoes in the region of interest on Elm Street.

To test the procedure, we predicted the delay times of the echoes that would be received by a microphone at the location of microphone 4 of array 3, as shown in figure 5, for a shot fired from the grassy knoll by the DPD shooter during the acoustic reconstruction experiment. We then compared the predicted echo-delay times to echo-delay times actually recorded on the BBN tape recording of the shot that was fired by the DPD shooter. At the time that the test shot was fired, the temperature in Dealey Plaza was approximately 90° Fahrenheit. Accordingly, the value used for the speed of sound was 1,150 feet per second. As discussed in section 4.1.5, the echo-delay time is computed by subtracting the muzzle blast travel time (185.2 msec.) from the echo travel time. The muzzle blast travel time is obtained by dividing the distance between the gun and the microphone in Dealey Plaza (213 feet) by the speed of sound.

For echoes produced at the corners of structures, the measurement procedure was simple and direct. For example, the path of echo 2 in figure 5 consisted of two segments. As measured on the map, the segment from the shooter to the diffraction point was 499 millimeters and from that point to the microphone was 92 millimeters. The total path length, 591 millimeters, when divided by the sound-speed constant (2921 mm/sec) yielded an echo travel time of 0.2024 second (202.4 msec). Subtracting the muzzle blast travel time from the echo travel time yielded an echo-delay time of 17.2 milliseconds.

For an echo produced by a specular reflection, it was necessary first to locate the point at which the reflection would occur. Such reflections occur at that point on an echo-producing surface at which the total length of the echo path to that surface is a minimum. At that point, the reflecting surface will be tangent to an ellipse for which the locations of the gun and the microphone are the locii and the total length of the echo path is equal to the sum of the radii. The required ellipse was easily generated by the following procedure. First, a nonextensible string was cut to a length greater than the probable length of the echo path on the topographical map. One end of the string was tied to a pin at the location of the gun and a portion of the string near its other end was wrapped tightly around a pin at the location of the microphone. The string was then pulled toward the reflecting surface by the point of a pencil. With the string drawn taut, the pencil was moved so that its point drew an arc on the map in the region of the line that represented the reflecting surface. The length of the string was then adjusted until the arc was just tangent to the line. The point at which the arc touched the line was the desired point of reflection. The path from the gun to the point of reflection and then to the microphone (the echo path) was then measured. The total distance of the echo path divided by the speed of sound was the echo travel time. Subtracting from it the muzzle blast travel time yielded the echo-delay time.

only 2 dimensional

TABLE 1.— *List of structures in Dealey Plaza that would have produced echoes of sufficient strength to have been recorded on the DPD tape*

Object No.:	*Identification*
1	South shelter : South door, east post.
2	South shelter : East door, south post.
3	South shelter : East door, north post.
4	North shelter : South door, west post.
5	North shelter : South door, east post.
6	North shelter : East door, south post.
7	North shelter : East door, north post.
8	Wall "A."[1]
9	Wall "A" : Corner 1.
10	Wall "A" : Corner 2.
11	Column "A"[2] : Southwest corner.
12	Wall "B"[3] : Corner 1.
13	Wall "B" : Corner 2.
14	Column "B"[4] : West corner.
15	Wall at the north end of the reflecting pool.
16	~~DCRB~~ : Southwest corner. Dal - Tex
17	DCRB : Northwest corner.
18	DCRB : West wall (front of building).
19	DCRB : Roof edge on west wall.
20	DCRB : Southwest corner.
21	New DCCCB : Northwest corner.
22	DCRB—New DCCCB : Alley wall between buildings.

[1] Wall "A" is a concrete wall on the north side of Elm St. that runs in an east-west direction. Corners 1 and 2 are at the east end of the wall. The direction of the wall changes from east to northeast at corner 1, and from northeast to north at corner 2.

[2] Column "A" is a concrete column on the north side of Elm St. near the intersection with Houston St.

[3] Wall "B" is a concrete wall on the south side of Elm St. near the reflecting pool. It runs in a generally north-south direction. Corners 1 and 2 are at the northern end of the wall. The direction of the wall changes from north to northeast at corner 1 and from northeast to east at corner 2.

[4] Column "B" is a concrete column on the south side of Elm St., at the northern end of Wall "B."

TABLE 2.—*List of echo paths used in the predictions of echo-delay times*

Path No.:	*Echo producing objects (Identification numbers)*
1	1
2	2
3	9
4	2, 8
5	10
6	5
7	4
8	6
9	7
10	12
11	13
12	14
13	3, 13
14	3, 14
15	3, 15
16	16
17	8, 13
18	19
19	18
20	21
21	22
22	4, 19
23	6, 19
24	20
25	17
26	23

BB&N Echo Study
Microphone # 4 in array 2.
Rifle in Window #1 on the sixth floor of the Texas School Book Depository
Rifle Coordinates: 322.416667 x 46.3333334
Microphone Coordinates at Blast: 194 x 14
Speed of sound: 1139.5 fps.

Millisec.	Corrected	Elapsed sec	Elapsed ft	Calc. feet	Deviation	Matches
25.000	0.0250000	0.1264751	144.1184	144.1184	11.6135	**BLAST**
30.000	0.0300000	0.1314751	149.8159	152.1016	2.2857	TrafficBox
31.875	0.0318750	0.1333501	151.9524	152.1016	0.1492	TrafficBox
41.875	0.0418750	0.1433501	163.3474	164.1760	0.8285	Trf. light
54.375	0.0543750	0.1558501	177.5912	0.0000	OVER 5.0	No Match
60.000	0.0600000	0.1614751	184.0009	0.0000	OVER 5.0	No Match
68.750	0.0687500	0.1702251	193.9715	193.8938	0.0777	Tree A
74.375	0.0743750	0.1758501	200.3812	199.2825	1.0987	Column B
83.750	0.0837500	0.1852251	211.0640	207.0804	3.9836	DCRB face
103.750	0.1037500	0.2052251	233.8540	236.9121	3.0581	North post
113.125	0.1131250	0.2146001	244.5368	0.0000	OVER 5.0	No Match
131.250	0.1312500	0.2327251	265.1902	266.1612	0.9710	Wall A,NE
150.000	0.1500000	0.2514751	286.5559	291.3903	4.8344	St.light 2
178.125	0.1781250	0.2796001	318.6043	0.0000	OVER 5.0	No Match
258.750	0.2587500	0.3602251	410.4765	408.6928	1.7837	Tree F
448.750	0.4487500	0.5502251	626.9815	0.0000	OVER 5.0	No Match
907.813	0.9078125	1.0092876	1150.0832	1149.1067	0.9765	P.O., NE

BB&N Echo Study
Microphone # 5 in array 2.
Rifle in Window #1 on the sixth floor of the Texas School Book Depository
Rifle Coordinates: 322.416667 x 46.3333334
Microphone Coordinates at Blast: 212 x 12.5
Speed of sound: 1140 fps.

Millisec.	Corrected	Elapsed sec	Elapsed ft	Calc. feet	Deviation	Matches
11.375	0.0113750	0.1126859	128.4620	128.4620	8.1191	**BLAST**
14.375	0.0143750	0.1156859	131.8820	0.0000	OVER 5.0	No Match
22.500	0.0225000	0.1238109	141.1445	0.0000	OVER 5.0	No Match
30.000	0.0300000	0.1313109	149.6945	151.8224	2.1280	Trf. light
30.000	0.0300000	0.1313109	149.6945	151.8224	2.1280	Trf. light
42.500	0.0425000	0.1438109	163.9445	165.4783	1.5339	Pool tip
64.375	0.0643750	0.1656859	188.8820	188.0445	0.8374	DCRB, NW
78.125	0.0781250	0.1794359	204.5570	203.9031	0.6538	DCRB face
91.250	0.0912500	0.1925609	219.5195	216.4673	3.0522	South post
106.875	0.1068750	0.2081859	237.3320	238.5821	1.2502	Tree N
131.250	0.1312500	0.2325609	265.1195	266.6133	1.4939	DCRB, SW
156.250	0.1562500	0.2575609	293.6195	290.1082	3.5112	Tree O
173.250	0.1732500	0.2745609	312.9995	312.7180	0.2815	DCCB, NW
203.750	0.2037500	0.3050609	347.7695	348.6498	0.8804	Tree P
265.750	0.2657500	0.3670609	418.4495	415.6577	2.7917	Fence face
461.250	0.4612500	0.5625609	641.3195	0.0000	OVER 5.0	No Match
925.000	0.9250000	1.0263109	1169.9945	1167.1168	2.8776	P.O., NE

BB&N Echo Study
Microphone # 4 in array 2.
Rifle in Window #1 on the sixth floor of the Texas School Book Depository
Rifle Coordinates: 322.416667 x 46.3333334
Microphone Coordinates at Blast: 194 x 14
Speed of sound: 1139.5 fps.

Millisec.	Corrected	Elapsed sec	Elapsed ft	Calc. feet	Deviation	Matches
25.000	0.0250000	0.1264751	144.1184	144.1184	13.7097	**BLAST**
30.000	0.0300000	0.1314751	149.8159	152.1016	2.2857	TrafficBox
31.875	0.0318750	0.1333501	151.9524	152.1016	0.1492	TrafficBox
41.875	0.0418750	0.1433501	163.3474	164.1760	0.8285	Trf. light
54.375	0.0543750	0.1558501	177.5912	0.0000	OVER 5.0	No Match
60.000	0.0600000	0.1614751	184.0009	0.0000	OVER 5.0	No Match
68.750	0.0687500	0.1702251	193.9715	193.8938	0.0777	Tree A
74.375	0.0743750	0.1758501	200.3812	199.2825	1.0987	Column B
83.750	0.0837500	0.1852251	211.0640	0.0000	OVER 5.0	No Match
103.750	0.1037500	0.2052251	233.8540	230.6427	3.2113	Tree N
113.125	0.1131250	0.2146001	244.5368	0.0000	OVER 5.0	No Match
131.250	0.1312500	0.2327251	265.1902	266.1612	0.9710	Wall A,NE
150.000	0.1500000	0.2514751	286.5559	0.0000	OVER 5.0	No Match
178.125	0.1781250	0.2796001	318.6043	0.0000	OVER 5.0	No Match
258.750	0.2587500	0.3602251	410.4765	0.0000	OVER 5.0	No Match
448.750	0.4487500	0.5502251	626.9815	0.0000	OVER 5.0	No Match
907.813	0.9078125	1.0092876	1150.0832	1149.1067	0.9765	P.O., NE

DCRB face

~~Dal-Tex~~ no Mth post tree N

627 Fence (321, 199)
410 Tree F (269, 222)
319 Sign (229.5, 173)
286 ~~DCCB Alley~~ (135.5, -40)
Light 2 (225.5, 152.5)

BB&N Echo Study
Microphone # 5 in array 2.
Rifle in Window #1 on the sixth floor of the Texas School Book Depository
Rifle Coordinates: 322.416667 x 46.3333334
Microphone Coordinates at Blast: 212 x 12.5
Speed of sound: 1140 fps.

Millisec.	Corrected	Elapsed sec	Elapsed ft	Calc. feet	Deviation	Matches
11.375	0.0113750	0.1126859	128.4620	128.4620	13.2776	**BLAST**
14.375	0.0143750	0.1156859	131.8820	0.0000	OVER 5.0	No Match
22.500	0.0225000	0.1238109	141.1445	0.0000	OVER 5.0	No Match
30.000	0.0300000	0.1313109	149.6945	151.8224	2.1280	Trf. light
30.000	0.0300000	0.1313109	149.6945	151.8224	2.1280	Trf. light
42.500	0.0425000	0.1438109	163.9445	165.4783	1.5339	Pool tip
64.375	0.0643750	0.1656859	188.8820	188.0445	0.8374	DCRB, NW
78.125	0.0781250	0.1794359	204.5570	200.9269	3.6300	Column B
91.250	0.0912500	0.1925609	219.5195	0.0000	OVER 5.0	No Match
106.875	0.1068750	0.2081859	237.3320	238.5821	1.2502	Tree N
131.250	0.1312500	0.2325609	265.1195	266.6133	1.4939	DCRB, SW
156.250	0.1562500	0.2575609	293.6195	0.0000	OVER 5.0	No Match
173.250	0.1732500	0.2745609	312.9995	312.7180	0.2815	DCCB, NW
203.750	0.2037500	0.3050609	347.7695	0.0000	OVER 5.0	No Match
265.750	0.2657500	0.3670609	418.4495	0.0000	OVER 5.0	No Match
461.250	0.4612500	0.5625609	641.3195	0.0000	OVER 5.0	No Match
925.000	0.9250000	1.0263109	1169.9945	1167.1168	2.8776	P.O., NE

BB&N Echo Study
Microphone # 6 in array 2.
Rifle in Window #1 on the sixth floor of the Texas School Book Depository
Rifle Coordinates: 322.416667 x 46.3333334
Microphone Coordinates at Blast: 230 x 12
Speed of sound: 1140.7 fps.

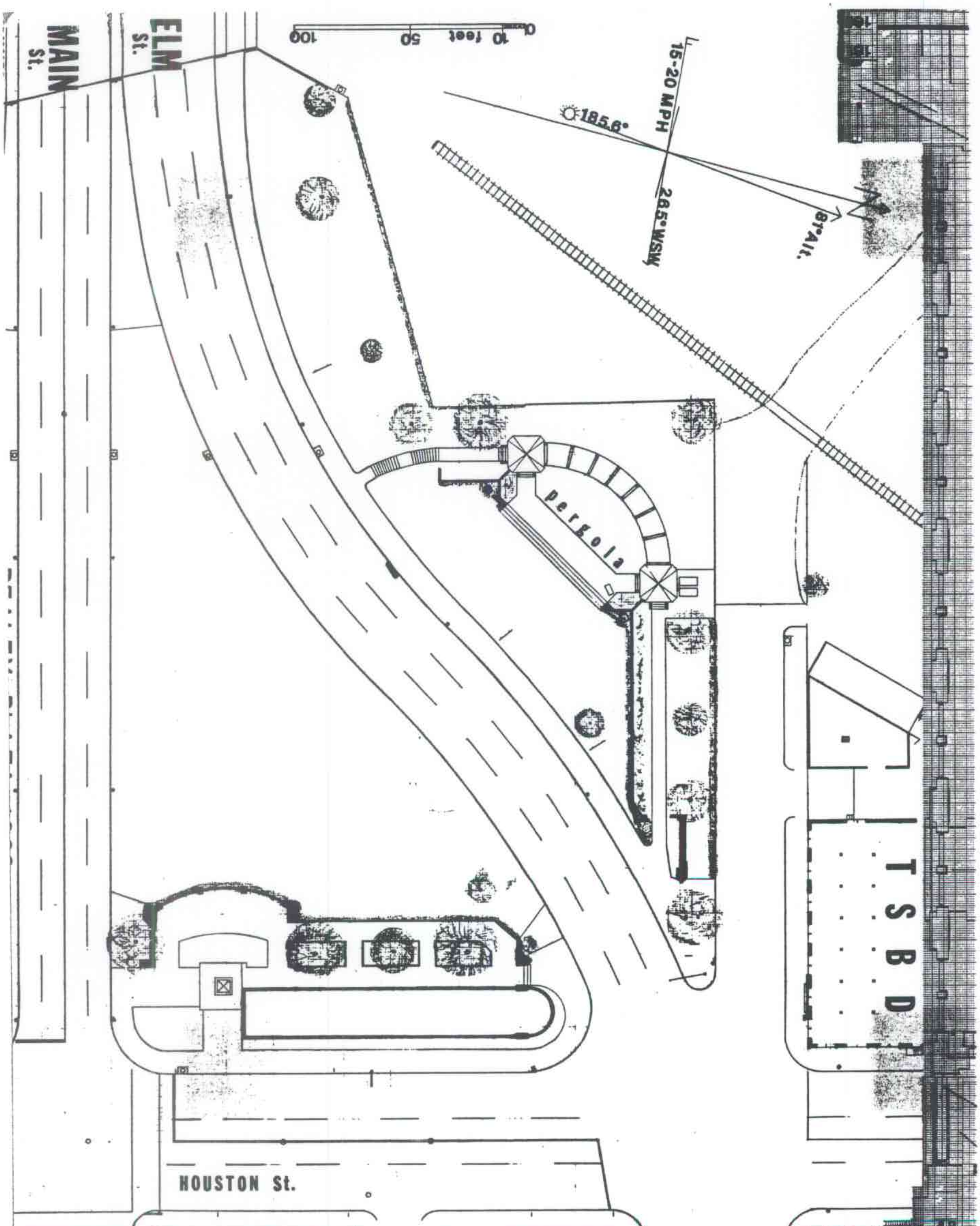
Millisec.	Corrected	Elapsed sec	Elapsed ft	Calc. feet	Deviation	Matches
9.000	0.0090000	0.0994263	113.4156	113.4156	18.4438	**BLAST**
16.875	0.0168750	0.1073013	122.3986	0.0000	OVER 5.0	No Match
38.750	0.0387500	0.1291763	147.3514	0.0000	OVER 5.0	No Match
64.375	0.0643750	0.1548013	176.5818	176.8048	0.2230	Pool, NE
91.875	0.0918750	0.1823013	207.9511	206.1283	1.8227	Column B
111.875	0.1118750	0.2023013	230.7651	0.0000	OVER 5.0	No Match
143.125	0.1431250	0.2335513	266.4119	264.1918	2.2202	Tree D
156.875	0.1568750	0.2473013	282.0966	279.7008	2.3957	DCRE, SW
178.750	0.1787500	0.2691763	307.0494	0.0000	OVER 5.0	No Match
215.625	0.2156250	0.3060513	349.1127	0.0000	OVER 5.0	No Match
227.500	0.2275000	0.3179263	362.6585	0.0000	OVER 5.0	No Match
235.000	0.2350000	0.3254263	371.2138	0.0000	OVER 5.0	No Match
318.750	0.3187500	0.4091763	466.7474	0.0000	OVER 5.0	No Match
350.000	0.3500000	0.4404263	502.3943	497.8054	4.5888	DCCB, SW
440.000	0.4400000	0.5304263	605.0573	0.0000	OVER 5.0	No Match
551.875	0.5518750	0.6423013	732.6731	0.0000	OVER 5.0	No Match
951.250	0.9512500	1.0416763	1188.2401	1185.0774	3.1627	P.O., NE

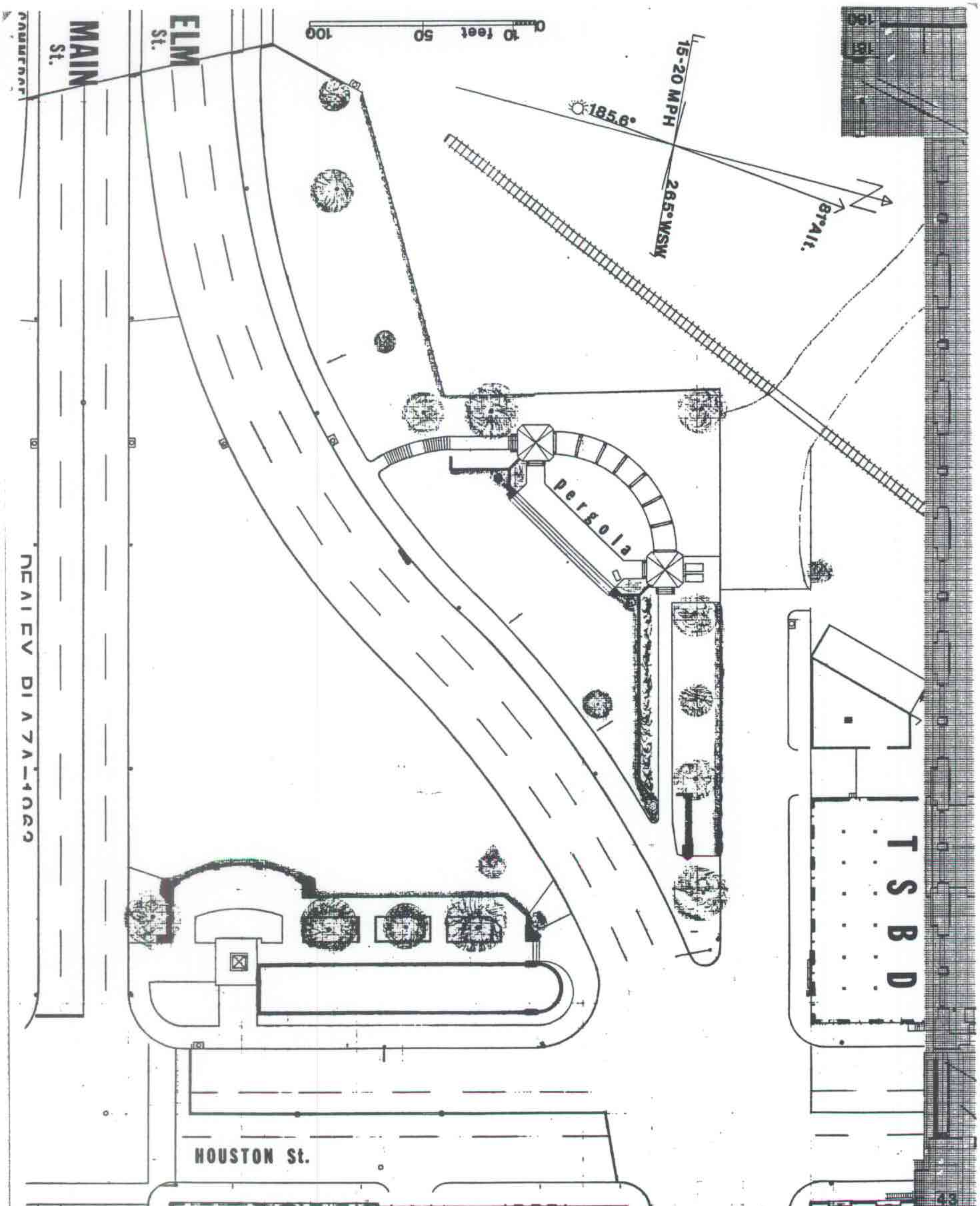
BB&N Echo Study
Microphone # 6 in array 2.
Rifle in Window #1 on the sixth floor of the Texas School Book Depository
Rifle Coordinates: 322.416667 x 46.3333334
Microphone Coordinates at Blast: 230 x 12
Speed of sound: 1140.7 fps.

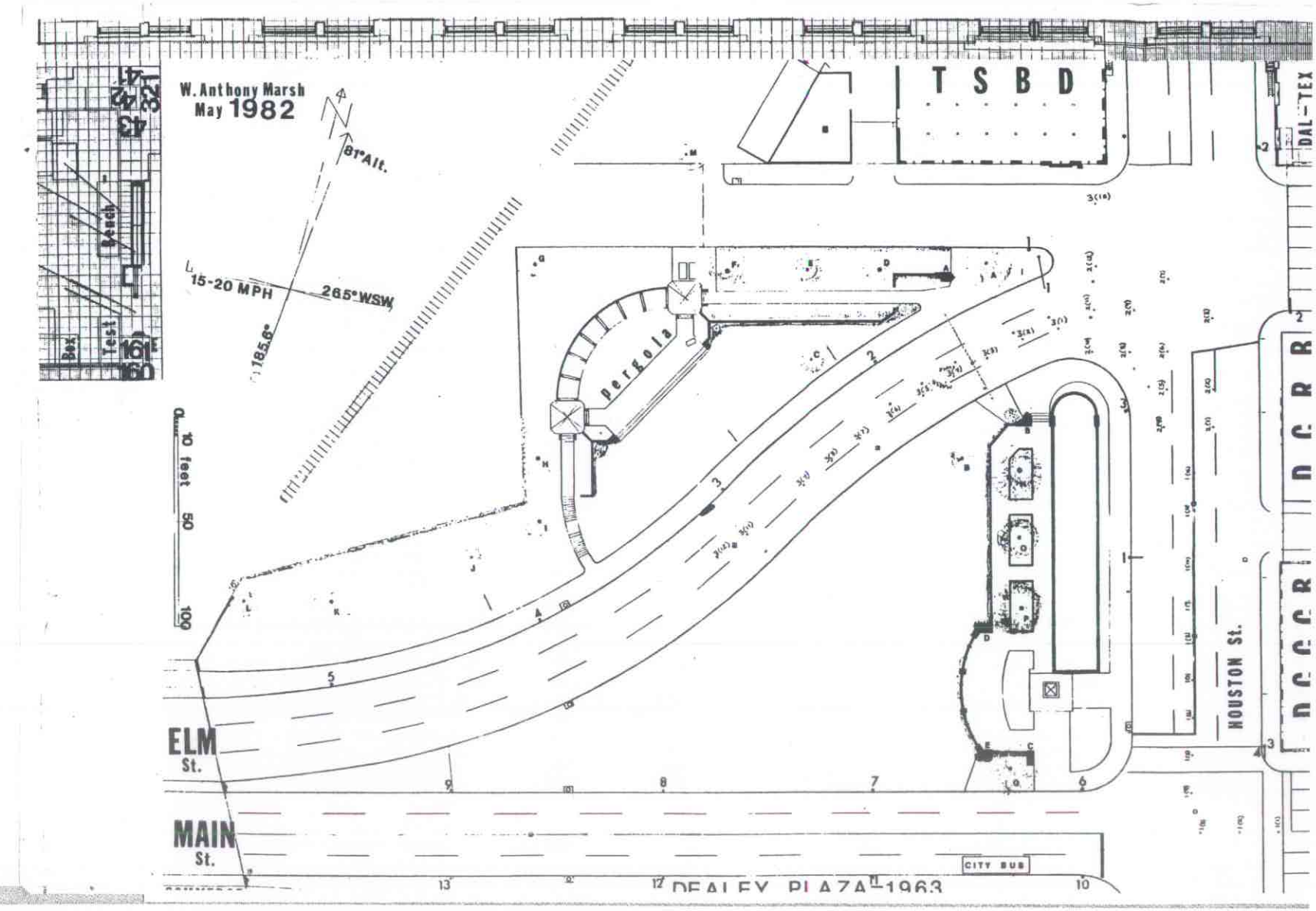
Millisec.	Corrected	Elapsed sec	Elapsed ft	Calc. feet	Deviation	Matches
9.000	0.0090000	0.0994263	113.4156	113.4156	16.5766	**BLAST**
16.875	0.0168750	0.1073013	122.3986	0.0000	OVER 5.0	No Match
38.750	0.0387500	0.1291763	147.3514	0.0000	OVER 5.0	No Match
64.375	0.0643750	0.1548013	176.5818	176.8048	0.2230	Pool, NE
91.875	0.0918750	0.1823013	207.9511	207.5139	0.4371	DCRB face
111.875	0.1118750	0.2023013	230.7651	234.7100	3.9449	North post
143.125	0.1431250	0.2335513	266.4119	0.0000	OVER 5.0	No Match
156.875	0.1568750	0.2473013	282.0966	279.7008	2.3957	DCRB, SW
178.750	0.1787500	0.2691763	307.0494	303.5534	3.4960	Tree O
215.625	0.2156250	0.3060513	349.1127	0.0000	OVER 5.0	No Match
227.500	0.2275000	0.3179263	362.6585	363.9548	1.2963	Tree P
235.000	0.2350000	0.3254263	371.2138	0.0000	OVER 5.0	No Match
318.750	0.3187500	0.4091763	466.7474	0.0000	OVER 5.0	No Match
350.000	0.3500000	0.4404263	502.3943	497.9471	4.4472	Column E
440.000	0.4400000	0.5304263	605.0573	0.0000	OVER 5.0	No Match
551.875	0.5518750	0.6423013	732.6731	0.0000	OVER 5.0	No Match
951.250	0.9512500	1.0416763	1188.2401	1185.0774	3.1627	P.O., NE

DPD Echo Study (in PROMAL).
Shot#5
Rifle located the 6th floor of the Texas School Book Depository, window 1.
Rifle coordinates: (321.250, 46.100).
Cycle coordinates at blast: (208.300, 128.500).
Cycle's initial speed 8.5000 MPH
Cycle's path: 35.0000 degrees south of due west.
Tape correction factor: 1.0430
Speed of sound: 1123.00 fps.

Millisecs.	Corrected ms	Elapsed sec	Elapsed ft	Computed ft	Deviation	Matches
48.7500	.050846250	.137979203	154.950645	154.950645	Sum: 21.6	Blast
62.5000	.065187500	.152320453	171.055869	0.000000	Over 5.0	No Match
67.5000	.070402500	.157535453	176.912314	0.000000	Over 5.0	No Match
74.3750	.077573125	.164706078	184.964926	186.497559	1.532633	Column B
79.3750	.082788125	.169921078	190.821371	195.052959	4.231589	Pool tip
87.5000	.091262500	.178395453	200.338094	0.000000	Over 5.0	No Match
110.0000	.114730000	.201862953	226.692097	226.208371	.483726	TrafficBox
158.7500	.165576250	.252709203	283.792435	0.000000	Over 5.0	No Match
186.8750	.194910625	.282043578	316.734938	0.000000	Over 5.0	No Match
220.0000	.229460000	.316592953	355.533887	0.000000	Over 5.0	No Match
234.3750	.244453125	.331586078	372.371166	0.000000	Over 5.0	No Match
246.8750	.257490625	.344623578	387.012278	0.000000	Over 5.0	No Match
254.3750	.265313125	.352446078	395.796946	400.537372	4.740426	DCCB, NW
286.2500	.298558750	.385691703	433.131783	0.000000	Over 5.0	No Match
322.5000	.336367500	.423500453	475.591009	0.000000	Over 5.0	No Match
336.2500	.350708750	.437841703	491.696233	0.000000	Over 5.0	No Match
368.1250	.383954375	.471087328	529.031070	0.000000	Over 5.0	No Match
403.1250	.420459375	.507592328	570.026185	0.000000	Over 5.0	No Match
428.7500	.447186250	.534319203	600.040465	0.000000	Over 5.0	No Match
462.5000	.482387500	.569520453	639.571469	0.000000	Over 5.0	No Match
473.1250	.493469375	.580602328	652.016415	0.000000	Over 5.0	No Match
493.7500	.514981250	.602114203	676.174250	672.759282	3.414969	Old Court.


MAIN St.
ELM St.
100
50
10 feet
0
15-20 MPH
185.6°
26.5° WSW
81° Alt.
pergola
T S B D
HOUSTON St.
D C C C B
D C R B
DALL-TEX


MAIN St.
ELM St.
0 10 feet 50 100
15-20 MPH
185.6°
26.5° WSW
81° Alt.
pergola
DEALEY PLAZA-1963
T S B D
HOUSTON St.
D C C C B
D C R B
DALL-TEX
43
42
41
180
181


W. Anthony Marsh
May 1982
81° Alt.
15-20 MPH
265° WSW
185.6'
Box
Test
Beach
Pergola
T S B D
DAL-TEX
10 feet
50
100
ELM
St.
MAIN
St.
HOUSTON St.
CITY BUS
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