

7316 - 13th Avenue N.W.
Seattle, Washington 98107
9 Oct 68

Dr. Luis Alvarez
Department of Physics
University of California at Berkeley
Berkeley, California

Dear Sir:

I recently read a book which referred to your appearance on the CBS television show about the Warren Report. I would very much appreciate your indulgence for two questions that occurred to me.

First, I wondered if the show accurately represented your methodology and your conclusions.

Second, I would like to know if there is any minimum time span within which separate shots are not discernible by your method. It would seem that if shots were close enough together, one wince by Mr. Zapruder would suffice for more than one.

Thanking you in advance for your trouble, I remain,

Sincerely yours,

George E. Rennar

UNIVERSITY OF CALIFORNIA

LAWRENCE RADIATION LABORATORY
BERKELEY, CALIFORNIA 94720

October 23, 1968

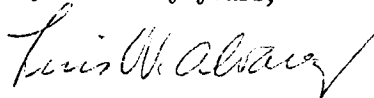
Mr. George E. Rennar
7316 - 13th Avenue, N.W.
Seattle, Washington, 98107

Dear Mr. Rennar:

As you will see from the enclosed correspondence, I have been spending too much time answering questions of the sort you pose, so I will simply send along copies of my correspondence with Dr. Menaker, and you will learn more from them than you will if I had simply answered your two questions directly.

For a long time, I did not answer any letters of the type Dr. Menaker sent me, but he spoke of a number of mutual friends we had, so I put his correspondence in a special category, and answered it "for old times sake".

Very sincerely yours,



Luis W. Alvarez

LWA:am

encls. - copies of correspondence between
Dr. Menaker and Dr. Alvarez

WALTER MENAKER, M. D.
69-09 108th Street
Forest Hills, N.Y.
11375

August 8, 1968

Professor Luis Alvarez
Department of Physics
University of California
Berkeley, California 94704

Dear Dr. Alvarez:

You participated in the CBS NEWS INQUIRY, "The Warren Report", which was broadcast over that television network on June 25, 1967. You and Mr. Wyckoff indicated that three frames of the Zapruder film, numbers 190, 227, and 318, were blurred, thus pinpointing Zapruder's response to three shots he had heard.

Dr. Josiah Thompson of Haverford College, in his book, "Six Seconds in Dallas", devotes several pages (292-295) to "A Critique of the CBS News Documentary 'The Warren Report'", wherein he points out that frames 197, 210, and 331 were also blurred, but neither you nor Mr. Wyckoff nor the CBS commentators mentioned these frame numbers, which would, using the reasoning applied to frames 190, 227, and 318, indicate shots having been fired. I am interested in your reply to the criticism made by Dr. Thompson.

I also wonder whether there might not be a refractory period, during which a "startle-reaction" might not be elicited, if a stimulus, such as the sound of a rifle-shot, is repeated about a half second after the first stimulus. Thus, if Zapruder heard a second sound about half a second after the first sound (rifle-shot), he might not have registered with a slight tremble of his arm. It might be interesting to investigate the length of this refractory period in human subjects.

Welcoming your comments, I am

Very sincerely yours,

Walter Menaker

Walter Menaker, M.S., M.D., M.P.H.

P.S. When I was a student at the U. of Minnesota, I heard your Dad speak. I also used to dine at the men's dorm with several of the sons of your Dad's colleagues (Mann, Sanford, and Lemmon). I am personally on speaking and note-writing terms with Robert F. Loeb, brother of your older colleague at Berkeley, Leonard Loeb.

W.M.

Note: As I was typing your address on the envelope, it first came home to me that I had addressed you as "Professor Walter Menaker" above. I had crossed the name out and typed in "Luis Alvarez".

UNIVERSITY OF CALIFORNIA

LAWRENCE RADIATION LABORATORY
BERKELEY, CALIFORNIA 94720

August 12, 1963

Dr. Walter Menaker
62-31 108th Street
Forest Hills, New York 11375

Dear Dr. Menaker:

Thank you for your recent letter concerning my contribution to the CBS program on the Warren Report. I once leafed through a copy of Thompson's book, when I was in the San Francisco Airport bookshop, and I noted that Dr. Thompson did not have a very clear idea of what I had done. But that is not surprising, since Dr. Wyckoff gave a very abbreviated and highly simplified version of my observations, which he repeated independently.

I documented my observations and measurements in two rather long letters to CBS, totalling about 15,000 words. I believe it is typical of the intelligence of the people who write books of the sort Dr. Thompson produced, that they think someone who is experienced enough in the making of physical observations, that he could be a professor of physics at one of the leading institutions in the world, could overlook some blurs in some photographs, particularly when he appears to be the first one who had ever called attention to these blurs, in a substantive way. Of course, I, and Mr. Wyckoff as well, looked at every single photograph that was reproduced in the Warren Report, and not only made detailed measurements of the blurs, but in addition determined in what direction the camera was being traversed during that particular frame. What I did was to measure the length of each blur, which is of course proportional to the angular velocity of the optical axis of the camera system. By looking at the background in the photographs preceding and following that particular blurred photograph, I could tell which way the camera had moved during the blur. As a result of this, I could assign the length of a blur as, for example, plus 3 millimeters, or minus 1.5 millimeters, where the plus or minus signs indicate clockwise or counterclockwise rotation of the camera, as seen from a point above the operator. Naturally, from the point of view of the physicist, I was not interested in the angular velocity of the camera, but rather in the angular acceleration, since Newton's Second Law tells us that the angular acceleration of an object is proportional to the torques acting on it. (The most common version of Newton's Second Law is that the acceleration is proportional to the force, but this is for systems that move in a linear fashion, whereas we are dealing with a camera which is being moved in an angular sense). An angular acceleration is simply the difference in the angular velocities, divided by the time interval between the two measurements of angular velocity. Since the time interval between all successive frames is the same -- about 18.3

The handwritten portion of Alvarez's letter of 15 Aug 68 reads:

so when ~~frame~~ /sic/ blur lengths in neighboring frames were sub~~x~~tracted, the differences were essentially zero, (no appreciable sudden torque acted on the camera.

Dr. Walter Menaker
August 15, 1968
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seconds, one can get numbers that are proportional to the angular accelerations, simply by subtracting the algebraic numbers that are proportional to the angular velocities. By making this subtraction of angular velocities, including the algebraic sign, I then came up with a table of numbers that was proportional to the angular acceleration of the camera, corresponding to a time midway between each pair of successive frames. I then plotted these angular acceleration values, which could be either plus or minus, as a function of the frame number. The startling thing was that there were three "trains of pulses", each lasting almost exactly one second, with a definite starting pulse, and a definite final pulse. One of these sets of pulses started at Frame 313, confirming the method, and the other two started at Frames whose numbers I can't remember, and since my original letters are at home, I won't bother with them. (Probably they are the frames mentioned by Mr. Wyckoff in his report on CBS television.) The conclusion I drew then, and the one with which Mr. Wyckoff agreed, was that each shot set the neuromuscular system of Mr. Zapruder into oscillation, and it took approximately one second for him to damp out the oscillations. As far as I could tell from the photographs that were shown in the CBS report, Mr. Wyckoff duplicated these trains of oscillatory pulses in his reenactment of the photography sequences. You will remember that there were photographs showing two or three photographers holding Bell and Howell movie cameras, showing that they reacted to the shock wave of a passing bullet, by going into a neuromuscular oscillation, with a recovery time of approximately one second.

I was not able to examine pictures earlier than the first one shown in the Warren Report, but Mr. Wyckoff did go back to the Archives in Washington, and made similar measurements for the Zapruder frames from 1 up to the one first shown in the Warren Report. He showed that although some of the frames did have appreciable blurs, the length of the blurs varied smoothly with frame number, and simply were a result of the fact that Mr. Zapruder was spraying his camera back and forth like a rank amateur photographer, rather than like the real pro he appeared to be when he settled down to take pictures, when Mr. Kennedy came into view. Incidentally, this observation shows clearly why one should not pay any attention to blurs, but only in the curve showing the difference in blur lengths from print to print. Mr. Wyckoff then, and correctly I believe, concluded that the oscillatory trains which are visible in the photographs reproduced in the Warren Report were really due to some rather distinctive phenomenon, and not due to the fact that Mr. Zapruder had the hiccup, as District Attorney Garrison commented in his appraisal of the work that Mr. Wyckoff and I did on the films! (In the whole sequence of photographs, the oscillatory pulse trains are concentrated into a narrow time region, including the known time range in which everyone agrees that at least two shots were fired. A physicist would say "the background was

As a later frame later, the difference in blur lengths were not actually apparent. It is clear from the camera.

handwriting =

"so when ~~frame~~ (sic) blur lengths
in neighboring frames were sub-
tracted, the differences were
essentially zero, (no appreciable
sudden torque acted on the
camera.

Dr. Walter Menaker
August 15, 1963
Page 5

essentially zero".)

I concluded then that three shots, and only three shots were fired, and I pinpointed the times, within a very small fraction of a second, for each shot. In addition to these three very obvious places at which shots were no doubt fired, there was another rather weak set of pulses, about half way between what I labeled as the second shot, and the very obvious third shot that killed the President. This set bothered me for a long time, but I finally came to what I believe is a proper explanation for this weak train. Although the FBI photo interpreters who testified before the Warren Commission, said that there was no way one could tell the accurate position or velocity of the car, when the background was blank (grass), I found two quite separate ways to do this, both of which gave the same value of the car's velocity, and both showed a very sharp change in velocity at just the time that the fourth weak train of oscillatory pulses took place. I puzzled over this for several days, and then I read that at about the time of the last shot, the Secret Service car just behind the President's car turned on its siren. Since no one was very clear about exact times in this extraordinary few seconds, it occurred to me that the siren probably came on just before Mr. Zapruder's weak oscillations started, and just before the driver suddenly slowed down. After all, the men in the Secret Service car had seen the President hit, and it was only natural that they would have pressed the panic button, by starting up the siren. Everyone who has ever driven a car is taught to slow down as soon as he hears a police or fire engine siren, so it is not difficult to imagine that the driver of the President's car immediately let his foot up on the accelerator pedal, when he heard a siren go off twenty-five feet from his car. Actually the hard thing to understand is why the driver of the President's car kept going at exactly a constant rate during at least one, and I believe two shots to the car which he was driving. The only thing that I can think of in this connection is that he was reacting like a circus horse, who goes trotting around a ring, at constant speed, as the acrobats jump up on his back and turn somersaults. I believe that anyone driving the President's car would have let his foot up from the accelerator when he heard a siren like this. So we note that the driver of the President's car actually slowed down abruptly, and did not speed up as he certainly should have done. (Many people have pointed out that if the driver had speeded up and turned rapidly from left to right, the President might have survived the first bullet to hit him, ~~and the last one~~ probably would have missed him.) We must have an explanation of this really extraordinary behavior on the part of the President's driver, which, so far as I can tell, I am the only person to have noticed. I believe that the siren clearly explains it, and of course it would have triggered Mr. Zapruder into oscillation, although probably not as strongly as he was triggered into oscillation by the obvious gun shots. All of these things tie together, and I believe that I did come up with a consistent picture of the whole sequence of events that led to the angular accelerations of Mr. Zapruder's camera, that I measured in a very straightforward way.

Dr. Weller Minkler
August 18, 1968
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I have usually refrained from describing in such detail, the measurements I made, although I have been asked by many people for material of this sort. The main reason that I asked CAC to contract with a research organization of the A1 and A2 type, for which Mr. Wyckoff works, was so that I would not have to spend most of my life writing letters of this sort -- the monkey would be on their back. You can of course send a copy of this letter to Dr. Thompson, but I fear it will do no good -- in his mind I am simply an idiot who could not see some blurs on some photographs that he noticed after I had called attention to the phenomenon, or if I did see them, I did not think they were worth noting.

I hope you will not ask me for copies of my two very long letters, which I consider to be personal correspondence with two friends.

I am pleased to see that we have some friends in common, including some high school classmates, whose names I had not thought of in years.

Very sincerely,

Luis W. Alvarez

LWA:am

WALTER MENAKER, M. D.
69-03 108th Street
Forest Hills, N.Y.
11375

September 18, 1968

Professor Luis W. Alvarez
Lawrence Radiation Laboratory
University of California
Berkeley, California 94720

Dear Dr. Alvarez:

Thank you very much for your long and detailed letter of August 15, which I have read several times.

Before I send a copy of your letter on to Dr. Josiah Thompson, you may wish to make a slight correction. On page 2, line 11, you speak of Frame 313 (which is the famous one showing Kennedy receiving the final and fatal shot) when you mean Frame 318, which I have verified from the mimeographed copy of Mr. Wyckoff's statements on the CBS program. The others he cites are 190 and 227. So I enclose your letter for you or your secretary to correct on line 11 of page 2.

I wish I knew the exact distance of Mr. Zapruder from the 6th floor window of the Book Depository and his distance from the assassin postulated behind the grassy knoll. Better yet, a re-enactment of the crime with guns fired from these positions at a target in the position of the President's car, while someone (preferably Zapruder himself, as his reaction-time is being measured) stood where Zapruder was at the time of the assassination. I suspect that a shot fired from the grassy knoll area might result in a blurring of the frames of film earlier than the shot from the Depository (even though the shot from the Depository occurred earlier). Precise timing would be imperative. And that is what makes me doubt that two assassins, separated by about 100 yards and not visible to each other (nor in radio communication), could fire within 0.1 second of each other, which is what Thompson is postulating.

Looking forward to the receipt of your corrected letter and again thanking you for the pains you have taken, I am

Gratefully yours,

Walter Menaker, M.D.

Dear Dr. Menaker:
This is my message to
you - I am not in
any way responsible for
Mr. Wyckoff's statements.
Sincerely,
Luis W. Alvarez

UNIVERSITY OF CALIFORNIA

LAWRENCE RADIATION LABORATORY
BERKELEY, CALIFORNIA 94720

September 20, 1963

Dr. Arthur Benaker
60-25 185th Street
Forest Hills, New York 11375

Dear Dr. Benaker:

When I took your letter home to file with my material concerning the assassination of President Kennedy, I pulled out a couple of the graphs, and brought them in to the laboratory so that I could duplicate them and send them to you for your own use and so that you could send one of them to Dr. Jorjiah Thompson.

The first chart shows the angular acceleration of the optical axis of Mr. Zapruder's camera, as a function of frame number, reading down in five separate graphs. I'll make a few comments on notations and marks on the chart. First of all you will see that the three main trains of acceleration impulses last for almost exactly one second each. In addition to the three one-second long trains on the first, second and fifth lines, there is the shorter and less intense train starting about 290 that I explained to my own satisfaction, and told you about in my last letter. On the middle line, there are two pulses that are just "out of the noise". By this I mean that there were two photographs where I thought that points were slightly spread out, and I listed these as minimum signals. These are responsible for the two little indications of a back and forth acceleration of the line of sight. (I would like to stress that the data that I show is all original raw data, and I never did anything to smooth out any data, or go back and remove points that I thought had significance on the first survey. Therefore the two noise pulses on the middle line are just at the minimum detectable limit, and since there is always noise in any measurement, I don't think they have to be treated seriously.) I am sorry that I do not have the first 170 frames available, but as I said in my letter, Dr. Wyckoff did measure these, and found that there were no appreciable acceleration pulses, although there were of course streaks due to a high angular velocity of the camera during Mr. Zapruder's enthusiastic panning. (Subtraction of the streak length in neighboring frames gives differences too small to measure.)

On the right-hand column, it says "camera turns cwld", which is physics shorthand for clockwise looking down. Which means that the initial motion of Mr. Zapruder's camera was such as to move the optical axis of his camera suddenly towards the right, and then back to the left. This motion occurred in frame 313, and is of the proper sign to be caused by the shock wave from the bullet, which passed very close to the camera on

Dr. Walter Venker
September 20, 1963
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the way to the automobile. I believe that this "first motion" was a direct interaction of the shock wave on the camera, and did not involve Mr. Zapruder's neuromuscular reaction. Of course that reaction can be seen very strongly in the next few frames, but it is my belief that the first reaction was occasioned by the shock pressure acting on the camera itself. This same pressure is of course what breaks windows when a supersonic airplane flies overhead. (In the earlier shots, the bullet didn't pass so close to the camera and was therefore not strong enough to cause this direct interaction.)

The two circles on the first and second lines are my best guess as to when the shot was fired -- about $1/3$ of a second before Mr. Zapruder's neuromuscular system went into oscillations. There is much in the literature that says that the response time of the human neuromuscular system is a third of a second, and therefore it seems reasonable that the first reaction would come about a third of a second after the system had been stimulated. (You will note that the pulses are about one third of a second apart.) For this reason, my best guess as to the times of the three shots are approximately 177, 217, and of course 313.

I have never checked to see what Mr. Wyckoff said, until this very moment, when I looked at your letter again. I see you say that he quotes 190 and 227, which of course are different than my best guesses. (Let me remind you again that the reason I asked CBS to get someone like Mr. Wyckoff to do the job, was so that I wouldn't be spending the rest of my life writing letters explaining why I thought it was one frame number while somebody else thought it was another. I still like the numbers I selected better than the ones Dr. Wyckoff did, but please let's not get into an argument about this.)

The Warren Commission, according to the notation I made on the chart, said that the shot that they could identify came somewhere in the range of frames 206 to 225. As far as I can tell this came largely from an examination of Mr. Kennedy's reaction in putting his hand to his throat. I think it is interesting that my suggestion that it happened at frame 217 comes almost halfway between the two limits set by the Warren Commission report.

Before I leave this figure, I should say that I believe it could be reproduced by anyone who took the trouble to examine and measure the photographs reproduced in volumes that were appended to the Warren Report. I should say that I started out measuring each streak with a fine scale and a pair of dividers, but after I had gone about halfway through the frames, I concluded that I could do just about as well by looking at the streaks and assigning them an estimated value between 1 and 5, together of course with the algebraic sign saying which way the acceleration moved the camera axis. I mention this only to say that a remeasurement might

Dr. Walter Menaker
September 20, 1966
Page 2

change the magnitudes of the accelerations, but it would certainly not change their signs, nor change the frame numbers at which they occurred. I did the measurements as well as I could, and as I said earlier I never changed any numbers, and I certainly did not go back and repeat the measurements. For this reason, I may have made a mistake or two, but I do not think that the general pattern of the trains of acceleration pulses can be changed by further measurements. Certainly it does absolutely no good to use a microscope or a magnifying glass, since the pictures available are all half tones, and one can actually see better without a magnifying glass under these conditions.

The second figure shows the position of the car relative to the background, from frames 260 to 340. I was most interested to read the details of the testimony by the FBI photo interpretation expert, who said that it was absolutely impossible to tell where the car was in this period, since there were no marks on the background against which to make the measurements. If you look at these pictures, you will see that there was a shiny piece of metal or glass on the grass, and this reflected light directly from the sun into Mr. Zapruder's camera. As a result of this, there is a streak in the background which one can use as a perfect reference mark, and measure the position of the car certainly better than ± 4 inches, in real space. The curve shows that the car was going at a very uniform speed very near to 12 miles an hour, from frame 260 to about frame 300, and after that it again went at a very constant speed, but closer to 8 miles per hour. All of the points on this graph are again original data, with no smoothing of any sort. The fact that the line goes through practically the center of each point indicates the extreme accuracy of the measurements. At an average of about 10 miles an hour, the car moved about 15 feet per second, or close to 1 foot per frame. The very small scatter of the points will convince you that I knew exactly where the car was during this whole period, and that the sudden change in the velocity was a real thing, and that it should be explained in some way.

even low

In addition to the two curves that I show here, I made a number of others, one of which showed quite conclusively that the camera was not running at 24 frames per second, as Mr. Zapruder was at one time quoted as saying. It took me several weeks to find a "clock", that would let me make such a statement unequivocally. From the point of view of the physics of the investigation I made, I got more personal satisfaction out of that discovery than out of anything else, since it took a good deal of observation and analytical experience, to make the deduction. I don't believe that anyone seriously questions the camera speed any more, so it can simply remain a bit of personally satisfying detective work that I did on that matter.

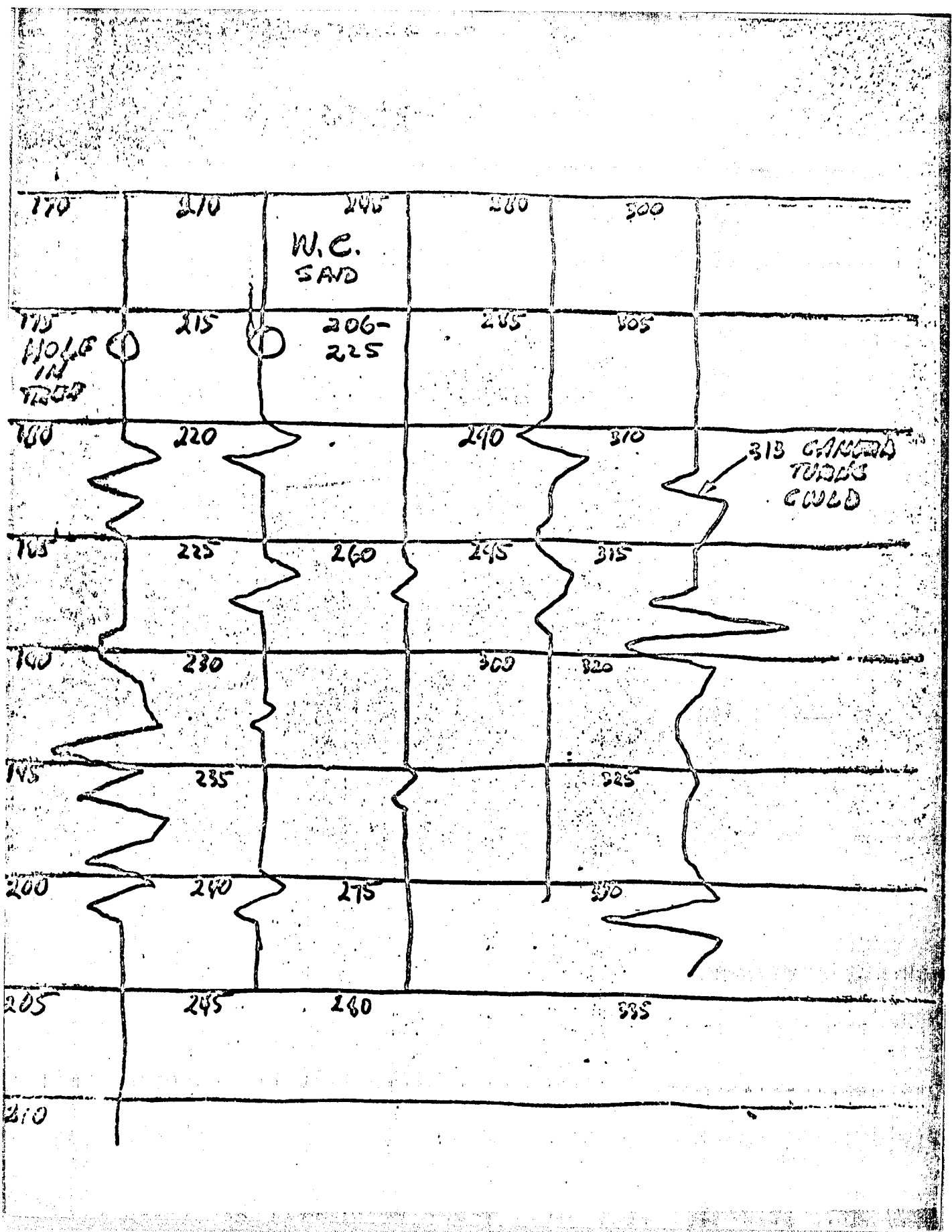
Dr. Walter Diederich
September 20, 1963
Page 4

I have just reread your letter, and am really quite astounded that you would think I would change my letter to agree with something that Mr. Wyckoff said. Once a scientist comes to believe that he should only publish things that are the consensus of the measurements of all of his scientific associates or competitors, he stops being a scientist. Unfortunately I am finding that many of my young associates feel that they should never publish anything until they have telephoned to all of the people they know who are doing similar experiments in this country and abroad, to see if they are "getting the right answer". I am intensely opposed to this way of doing science, and that is why I reacted so strongly to your suggestion that I change something that I stated with some conviction in my letter. (Of course anyone can make typographical errors, and had you pointed out such an error, I would have been happy to change it. But the thought that I should change my personal conclusion because it disagrees with something Mr. Wyckoff said, is absolutely shocking to me.)

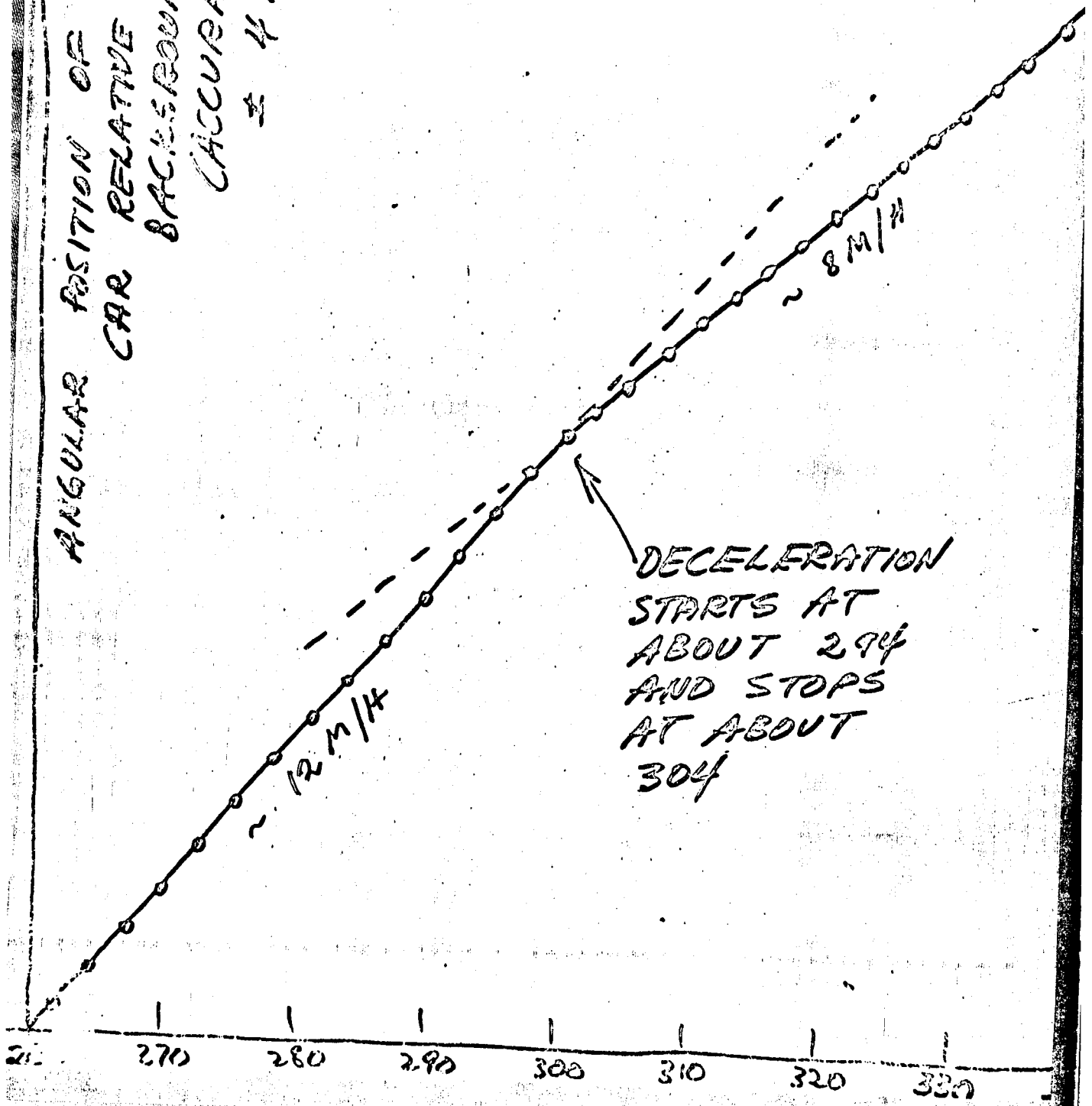
Very sincerely,

Luis W. Alvarez

LWA:am



ANGULAR POSITION OF
CAR RELATIVE TO
BACKGROUND
ACCURATE TO
 ± 4 INCHES)



DECELERATION
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ABOUT 294
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Tel. (212)-793-0496

WALTER MENAKER, M. D.
69-09 108th Street
Forest Hills, N.Y.
11375

October 16, 1968

Professor Luis W. Alvarez
Lawrence Radiation Laboratory
University of California
Berkeley, California 94720

Dear Dr. Alvarez:

I was pleased to get your detailed letter of September 20 after I had been "flogged" by your surprising reply or comment (handwritten) at the bottom of my ^{copy of} reply of September 12. In the very last paragraph of yours of the 20th you state that you have reread mine of the 18th and that you interpret it as an attempt to have you change your letter to agree with Mr. Wyckoff. If you had also reread your repeated references in yours of August 15 to the "oscillations" of Mr. Zapruder's "neuromuscular system" and realized that no one could believe --- as you still do not --- that frame 313 could show any "oscillations of Zapruder's neuromuscular system", you would have realized that I thought you had merely misspoken yourself when you alluded to pulses starting at Frame 313. You now postulate that, unlike Frames 181 or 182 and 220 or 221, Frame 313 is due to a shock wave. So you see my motive was (without seeing the graph you have now sent me) to correct what I thought was an inadvertent misstatement by you or a typographical error of your secretary.

If the graph that Mr. Wyckoff has worked out --- and I hope you can get a copy of his graph --- is the same as yours, I fail to see why he ignored the starting points at 181-182 and 220-221. You say that you assume it takes $1/3$ second for the neuromuscular system to respond to a stimulus. As each Frame is 0.055 second, it takes 6 Frames to cover 0.330 second. (But I think you overestimate the time it takes for the neuromuscular system to react to a startle-stimulus.) You overlook the time that sound takes to traverse about 270 feet from the 6th floor Depository window to Zapruder's ears --- about $1/4$ second or 4 to 5 Frames. Thus the shots would be fired 10 to 11 Frames before the oscillations that begin at 181-182 and 220-221. As I think that the neuromuscular response takes about $1/6$ second, you need subtract a total of only 7 or 8 Frames, thus putting the ^{of the} first two shots at Frames at 174 and 213. But let me remind you that you have no positive proof as yet that the oscillations at 181-182 and 220-221 are not "shock wave" responses, as is Frame 313. That is why I think it is high time that those, who express an interest in getting to the bottom of this thing, ought to behave like scientists by passing from the observational stage to the experimental stage and determine, by firing a gun near a man of Zapruder's make-up (age, etc.), how long it takes for his hand (holding a camera or a pen that is poised) to respond to a loud noise, and also to determine whether a shock wave shows up even if the gun is fired almost 100 yards away and the bullet comes no nearer than 50 yards away. Yesterday I spoke by phone with several authorities or investigators of the nervous system, but not a single one could answer the question of how long it takes for the human hand to respond to an unexpected noise. If you will use the facilities of your own department (and, if need be, of related departments) at Berkeley, you may become the foremost authority on the correct answer to this question.

I shall be glad to learn what you and your colleagues are able to ascertain regarding the actual time it takes for a man (like Zapruder) to respond to a rifle-shot, as evidenced in a tremor of the arm or hand. (I also welcome literature sources you may have on this subject.)

Your graph indicates that, in actual practice, when placing the time of the shots, you subtract only 3 or 4 frames (equivalent to about 0.16 to 0.22 second). When calculating the time or frame when Kennedy was hit, I would subtract 7 or 8 and then add 2 (for the time it took the bullet to travel) where Frames 220-222 are concerned, thus making the time of the hit to be at Frame 215. (He was about 120 feet from the Depository window; the velocity of the bullet is assumed to be about twice that of sound.)

Dr. Thompson mentions that the films used by the Warren Commission are a copy of a copy, and hence are not so clear as what one might be able to get if you were able to persuade LIFE magazine to lend a copy taken directly of the original Zapruder film in their vault. He shows examples of each to illustrate the difference in clarity.

I am sending "zeroxed" copies of your letters (to me) of August 15 and September 20 (with the two charts) to Dr. Josiah Thompson.

With many thanks for the time and energy you have given, and with hopes for reliable information on the actual time for a "startle-reaction," I remain

Gratefully yours,

Walter Menaker
Walter Menaker, M.D.

UNIVERSITY OF CALIFORNIA

LAWRENCE RADIATION LABORATORY
BERKELEY, CALIFORNIA 94720

October 23, 1968

Dr. Walter Menaker
69-09 108th Street
Forest Hills, New York 11375

Dear Dr. Menaker:

Thank you very much for your latest letter. I'm afraid that we are now getting into the little details with which I vowed I would not concern myself. You will remember that I stated that the main reason I asked CBS to hire an independent consulting firm to analyze the films themselves, using the general principles I enunciated in my letters, was to avoid being questioned about a difference of two or three frames here or there.

I find that you have devoted more than a page of single-spaced typed comments concerning what I would class as minor details of timing. I can't for the life of me understand why these should be of any interest to anyone, but that is for you to decide for yourself. For example when you say "you overlooked the time that sound takes to traverse about 270 feet from the sixth floor depository window to Zapruder's ears" I can just as well point out that you forgot to include the time the bullet took to get from the depository window to the automobile. If the bullet were traveling close to the velocity of sound, these two things would very nearly cancel out, since the sound does not come "from the window" but is a shock wave that comes from the bullet in flight.

You say "if you will use the facilities of your department (and, if need be, of related departments) at Berkeley, you may become the foremost authority on the correct answer to this question." That may very well be true, but I haven't the slightest interest in becoming such an authority.

My reference to the one-third of a second reaction time was really not to the time from the stimulus to the reaction, but really to the oscillation period of the neuromuscular system. Since I am not an expert in this field, I mixed up the definitions, but as a physicist I would simply say "the characteristic time of the neuromuscular system is one-third of a second." This is typical "physicist talk", and means that the reaction time is not measured in nanoseconds or microseconds or milliseconds or seconds or hours or centuries or eons. Since physicists deal with times that go from approximately 10^{-25} seconds to 10^{10} years, it is important for them to state what the "characteristic time" is of any system they study. So when I implied that the characteristic

Dr. Walter Menaker
October 23, 1968
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time of the neuromuscular system was one-third of a second, I was not trying to specify it in any more detail than that.

As you can see from my comments, I feel that our letters are degenerating into details about whether something happened in this frame or two frames earlier or two frames later, and I really have absolutely no interest in such a discussion. Perhaps if you could indicate to me why you consider it important, I could get interested. But in the absence of such an explanation, I just will have to say I can't take the time to answer all the detailed questions you ask.

I will comment on only one of the questions you asked. You wondered why if I believed that the reaction in frame 313 could be due to a direct interaction of the shock wave, the earlier frames could not have such an explanation. If you will look at the chart I sent you, you will see that the angular acceleration in frame 313 is clockwise looking down, and the other "first reactions" of the camera are counterclockwise looking down. Had the earlier two been in the same direction, I might not have come to my stated conclusion, and would certainly have entertained the possibility that they were due to direct interaction of the shock wave with the camera. My calibration point is of course the shot at 313, where the camera moved in the direction I would have expected it to move from the interaction of a close-by shock wave with the camera body. (In the two earlier shots, the bullets -- not the gun! -- were farther from the camera, so the shock waves were less intense.)

Very sincerely yours,

Luis W. Alvarez

LWA:am

1249 Hi Point St.
Los Angeles, Calif. 90035
October 30, 1968

Mr. George Rennar
7316 13th Avenue, N.W.
Seattle, Wash, 98107

Dear George,

Many thanks for sending the copies of yours and Menaker's correspondence with Alvarez. Again, he does not choose to deal with the crucial question, ~~the possibility~~ the possibility (to my mind, the certainty) of additional shots fired very close to those he specifies -- which he has admitted to me would be undetectable with his method. Since the two additional hits I posit (the 237-238 Connally shot, and the second JFK ~~hit~~ head-shot at app. 314) both are in this category, his repeated failure to confront the implications renders meaningless his conclusion that "...three shots and only three were fired..." (his letter to Menaker, 8/15/68)

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In his letter to me of 5/10/68, Alvarez said:

"This is what I saw in the Kennedy film--a series of three well-defined trains of oscillations, each lasting approximately one second. I attributed these three trains -- not the individual pulses within a train -- to a shot. I am quite convinced that one cannot use this method to look at shots that come closer than 1 second, since then the trains would overlap, and could not be resolved."

In my letter to him of 5/16/68 I said:

"I believe that CBS should have indicated to the public that your analysis did not preclude more than three shots having been fired if any two were fired within a second of each other. I feel sure I am correct in assuming that you informed them of this, am I not?"

In his distinctly testy reply of 5/23/68 he dealt with irrelevancies and did not answer my question. In my next letter to him (5/31/68) I repeated the question as follows:

"In my last letter, on the assumption that you had informed CBS of this one-second limitation, I pointed out that they should have indicated this fact to the public. You did not respond to my request for clarification as to whether or not my assumption was correct, and I again ask for such clarification."

He started his next (again, testy) letter of 6/8/68 with the following:

"Referring to your latest letter on the Zapruder films, you are certainly right that the conclusion that there were only three shots does depend on the fact that if there had been more shots, some of them must have occurred within one-half second of another one. I fail to see why CBS should have informed the public of this half-second time resolution, because they did not go into any detail at all as to the nature of the trains of oscillations, but merely pointed out the three times when the three shots that showed up were fired. I would take your concern about the notification of the public of the one-second limitation seriously if, when you publish your work, you put in a proviso that you cannot eliminate the possibility that 13 more shots were fired in a frame you designate as coinciding with a shot. You will certainly have to agree your method has a resolution

time of approximately 2 frames, or 1/9 second, as contrasted with
* the half-second resolution of my method. That small difference be-
tween our two resolutions hardly seems significant to me."

In my last letter to him, 6/15/68 (copy enclosed), I decided to play
straight-man to his reductio ad absurdum, and tried once more to get
a meaningful answer to the question. Although he has not replied, I
now believe that CBS was not specifically informed of the limitation --
although I am certain it wouldn't have influenced their snow job even
had he done so.

It isn't clear to me whether his one-second resolution of 5/10/68,
which seems to have become a one-half second resolution by 6/8/68, has
now been reduced to a one-third second resolution (his letter to Menaker,
9/20/68, pg2).

Also, I note he repeatedly uses the same testiness in his letters
to Menaker as he did in mine. I don't know if this is his normal per-
sonality, or whether it's reserved for those questioning his findings
on the assassination. Dr. Alvarez protests too much.

Sincerely,



encl: ~~EM~~ letter to IA, June 15, '68

1249 Hi Point St.
Los Angeles, Calif. 90035
June 15, 1968

Dr. Luis Alvarez
Lawrence Radiation Laboratory
Berkeley, Calif. 94720

Dear Dr. Alvarez:

You say in your letter of June 8 that you would take seriously my concern about CBS' failure to notify the public of the one-second limitation in your method only if, when published, my work contains a proviso noting that I ". . . cannot eliminate the possibility that 13 more shots were fired in a frame (I) designate as coinciding with a shot".

Your suggestion that my finding of five hits cannot by itself establish the maximum number of shots fired is not only well taken, but is a fact which I have recognized from the first, and which I usually call to the attention of interested parties. In fact, I have long believed that in addition to the five hits, at least one additional shot missed--a shot which I cannot pinpoint by studying the Zapruder film.

But despite our agreement that neither of our methods can establish the maximum number of shots fired, the situations are not really analogous as you seem to indicate; for your findings have already been presented, and presented by CBS in such a way as to give the public the false impression that the three shots you specify do in fact represent the maximum (as well as the minimum). This of course is a crucial determination, for it is well understood that no more than three shots, and certainly not as many as five, could have been fired from the Mannlicher-Carcano. Therefore, CBS' presentation of your findings as scientific proof that there were three shots and no more than three constituted an indispensable prop to its defense of the Warren Commission's lone-assassin theory; whereas a disclosure by CBS that your findings did not establish the maximum number of shots fired would have seriously undermined this prop. On the other hand, my acknowledgment that the five shots detectable by my method fix only the minimum number fired in no way invalidates the thesis that the Commission's three-shot lone-assassin case is untenable.

Although I found interesting your opinion that CBS had no reason to inform the public of the limitation imposed by your method, I must point out--with all due respect--that the question in my letter ~~was~~ of May 31, which I had posed earlier on May 16, was addressed not to a matter of opinion, but to one of fact; i.e., was CBS informed of the time-resolution limitation in your study (whether the one-second limitation you specified in your letter of May 10, or the one-half second mentioned by you on June 8)?

Sincerely yours,

Raymond Marcus