

NAA & JFK – yet again!

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INTRODUCTION

At the 2003 Pittsburg conference, organized by Cyrill Wecht, Stuart Wexler raised the very interesting point of “sampling bias” in the selection of the 14 bullet control samples and among the bullets in “Oswald’s box.” Stu shows that sampling bias, in fact, destroys the entire basis of Guinn’s analysis and makes Larry Sturdivan’s attempt to estimate the probability of an accidental match between the “magic” bullet (CE399) and the Connally wrist fragments irrelevant. In my previous critique of Larry’s analysis, I have explicitly accepted his assumption of unbiased sampling and argued about other suspect assumptions underlying his analysis. This was a mistake; the entire analysis is ill conceived.

LARRY’S ANALYSIS

Let me beginning by repeating my previous criticism of Larry’s approach. Larry is attempting to estimate the probability of an accidental match (“false positive”) between the Connally wrist fragment(s) and CE399 under the assumption (hypothesis) that CE399 was a randomly selected WCC Carcano bullet and that the 14 control samples measured by Guinn are representative of the entire the production of WCC bullets. His estimate of the probability of such an accidental match is 2 – 3%. However, Larry’s analysis contains the unjustified assumption that the probability distribution (PDF) for antimony content is smooth rather than spiky; indeed the bullet manufacturing process would lead one to expect a spiky rather than a smooth distribution, since bullets from the same “melt” would tend to match pretty closely in antimony content.

Once the possibility that the distribution is spiky rather than smooth is admitted, the 14 bullet control sample (even if it was unbiased) is not big enough to place much constraint on how big the probability of accidental matches might be. This is illustrated in table I which shows the probability P_{miss} that no wrist fragment matches would be found in a 14 bullet sample versus the fraction F_{match} of such bullets produced. The formula is just $P_{miss} = (1 - F_{match})^{14}$.

Table I: Probability P_{miss} of missing wrist fragment matches ($\approx 800ppm$) in 14 test sample as function of the fraction F_{match} of such bullets manufactured.

F_{match}	P_{miss}
0.01	0.87
0.02	0.75
0.05	0.49
0.10	0.23
0.20	0.044
0.30	0.0068
0.40	0.00078

In a random draw, the probability of getting a accidental match will just be F_{match} .

So you can see that with 14 samples, there is $\approx 1/4$ chance of missing 10% accidental match probability and even $\approx 1/23$ of missing a 20% spike. Without the constraint provided by **assuming** a smooth distribution it's not possible to restrict the accidental match probability to be much lower than 20%. This was the basis of my claim that the NAA evidence favored the single bullet theory (SBT) – but not by much.

Sampling bias

Sampling bias introduces two problems into the NAA analysis of the JFK case: the 14 bullet control sample used as a representative sample of all WCC bullets may be biased and the antimony content of bullets drawn from the same box may be correlated. This knocks the very foundation out from under Prof. Guinn's NAA analysis.

The 14 bullets are drawn from 4 boxes taken from each of the 4 WCC lots. There are 4 bullets coming from three of the boxes and only 2 from the remaining one. Since lots are only an administrative boundary, and do not correspond to physical difference in the processing (e.g, there are many different “melts” in each lot), using samples from all 4 lots does not guarantee a representative sampling as we still have samples drawn from only 4 points during the manufacturing/packaging process. With only 4 sampling points it is possible, indeed quite

likely, that the combination of the points is not representative of all the WCC bullets produced. Even if we had many more bullets taken at each point, if they were drawn from only 4 points in the process they would not be representative of the whole and the higher statistics would be of limited value. Test bullets need to have been drawn randomly from the whole WCC production run to obtain a representative sample.

The antimony content of the 14 test bullets tends to be low with more bullets below 600ppm (10/14) than above. It is this relative lack of higher antimony content samples when combined with the assumption of a smooth log-normal distribution that leads to Larry's estimated accidental match probability being only 2 – 3%. If high antimony bullets just happen to be underrepresented among the 4 sampling points selected, Larry's estimate could be much too small.

An even more important bias is that CE399 even if it was "planted" could be from the same box as the other WCC bullets involved. If one does not presume Oswald is the lone assassin others may have had access to the box. The "frame the guilty man" scenario is another possibility. We have no basis for assuming that a randomly selected CE399 is the only alternative to the hypothesis that the wrist fragments are from CE399.

In this context the following quote from the Iowa State¹ study on the difficulties in matching bullets is worth considering:

A key point is that the bullet manufacturing process itself makes the analysis of forensic evidence difficult. Bullets manufactured from different batches of raw material may end up in the same box; similarly bullets manufactured from the same batch can end up in different boxes. It has been difficult from the limited data available to estimate the relative frequency of these events. This appears to be crucial information for developing quantitative methods for the assessment of bullet evidence.

Thus, while it is likely that bullets from the same "melt" with similar antimony content have some tendency to end up in the same box, bullets from different batches do end up in the same box too. The degree to which bullets from different batches get mixed isn't known, but while not small, it's unlikely to be complete. The bottom line is that if you find one 800ppm bullet in a box, the probability of finding another in that same box is going to be higher than the probability of drawing another one randomly from all the bullets. This makes Larry's estimate of the probability of an accidental match irrelevant, unless it can be demonstrated

¹ "Statistical Treatment of Class Evidence: Trace Element Concentrations in Bullet Lead", Alicia L. Carriquiry, Michael Daniels, Hal S. Stern Department of Statistics, Iowa State University and Ames Laboratory May 4, 2000

with more than some loose hand-waving argument that any possible “ringers” or “plants” could not come from the same box² .

Let me illustrate the principle of this within-a-box correlation with an extreme **EXAMPLE**³ :

Suppose there was a bullet manufacturer that produced bullets in 100 distinguishable equal sized batches. In the packaging process the batches get somewhat mixed up, such that a typical box contains bullets from three different batches in about equal numbers. If two bullets are selected at random from the entire production, the odds of an accidental match is about 1%. However, if two bullets are selected from the same box , the odds of an apparent match are about 33%.

I think it unlikely the degree of mixing was this small in the case of WCC, but the mixing could be considerably larger and still yield much bigger probabilities for a fake match than would the case if CE399 was drawn randomly from all the WCC bullets ever made. Thus, Larry may be answering the wrong question. His result is pretty useless, since we don't know what the right question is.

CONCLUSION

The above does not really add anything to what Stu has said and written; it is just restated in my own way. He is to be congratulated for making this important clarification of the very minimal probative value of the NAA evidence. Stu has changed my mind on the value of NAA evidence: Instead of saying “it mildly supports the SBT,” I would now only say “it is not inconsistent with the SBT.”

² Or even from boxes packaged at about the same time which would tend to have been assembled from the same configuration of “melts” and which also would tend to be shipped together.

³ I emphasize “example” because examples from previous notes have been plucked out of context and criticized as if they were specific claims about the case.