THE TAPE MEASURE SHOT

The real story of Mantle's Griffith Stadium homer

by Alan M. Nathan

On April 17, 1953, a young Mickey Mantle stepped up to the plate in Griffith Stadium in Washington, DC. It was the fifth inning, there were two outs, and Yogi Berra was standing on first. Hitting right-handed off lefty Chuck Stobbs, Mantle stroked a gargantuan shot that hit a beer sign in the far reaches of left-center, some 460 horizontal feet from home plate and about 60 feet off the ground. The ball glanced off the sign, exited the stadium, crossed 5th Street NW, and ended up in a residential neighborhood. There seems to be no controversy about that much of the story.

What happened next is both unknown and quite likely unknowable with any certainty, given the long passage of time and the lack of eyewitnesses. The generally accepted story is that of Yankees publicist Red Patterson, who was sitting in the press box that day. As Dan Valenti recounts in his book *Clout*, Patterson thought a homer of such prodigious length had publicity value, so he left the stadium to seek out where the ball came down. According to Patterson, he encountered 10-year-old Donald Dunaway holding the ball; young Donald showed him where he found it in the backyard of 434 Oakdale Place. Patterson then paced off 105 feet from that location to the edge of the stadium, added to it the 460 feet to home plate, and concluded that the ball traveled 565 feet. Thus the Mantle legend was born and the phrase "tape-measure home run" was coined, despite the fact the Patterson never actually used a tape measure. Both the ball and Mantle's bat are in the Baseball Hall of Fame in Cooperstown.

The veracity of the Patterson account was investigated extensively by baseball historian Bill Jenkinson in researching his book *Baseball's Ultimate Power*, a history of tape-measure home runs. In his research of the contemporary newspaper accounts, he found no mention of Patterson claiming that

Dunaway showed him where the ball actually landed, as opposed to where it was found. In Jenkinson's interview with Patterson in 1984, Red admitted that he never asked Dunaway if he saw where the ball landed. Nevertheless he stuck with his story that the ball actually traveled 565 feet on the fly. Unfortunately Patterson died some years ago so it is no longer possible to question him about what actually occurred.

In his book, Jenkinson says, "…several physicists with whom I have consulted agree that [the ball] could not have [traveled] more than 510 feet."

Jenkinson's result is similar to that given by Professor Robert K. Adair in his classic book *The Physics of Baseball:* "[A] more precise calculation gives an answer of 506 feet, with an uncertainty I put at no more than 5 feet." Adair also remarks that the distance was aided considerably by a stiff wind, without which the ball would have traveled around 430 feet—still a very long home run, but not one we would still be investigating more than half a century later.

So, we have two competing claims about how far the ball would have traveled unimpeded: the largely unverifiable claim of 565 feet by Red Patterson and the 506–510 feet claims of various physicists. This was the state of affairs several years ago when I was contacted by author Jane Leavy who was researching her since-published biography of Mickey Mantle, *The Last Boy*. Jane's approach to such a mythic figure as Mantle was to question the myths while seeking as much verifiable information as possible. The tape measure homer rates a full chapter in her book ("One Big Day"), and includes an extensive interview with Donald Dunaway, who Jane tracked down 55 years after the event. Dunaway confirmed that he did not actually see where the ball initially landed, but he provided important new information about where he retrieved the baseball.

Dunaway's information allowed me to come to new conclusions about the home run's distance.

Let us start by enumerating those things that we know with some degree of surety, aided by the scale drawing in Figure 1. First, we know that the ball glanced off the beer sign 460 horizontal feet from home plate and approximately 60 feet above plate level. We further know from weather reports that there was a steady, 20-mph wind blowing out, with gusts up to 40. Finally, we have the claims of both Donald Dunaway and Red Patterson that the ball was retrieved by Dunaway *behind* the row houses across from the Griffith Stadium wall on 5th Street NW.

It is also useful to enumerate the things that we don't know, but would aid considerably in determining the ultimate fate of the ball. We don't know anything about the batted-ball parameters, such as speed, vertical launch angle, or spin. We don't know how long it took for the ball to reach the beer sign. We don't know the precise speed and direction of the wind, nor do we know the precise height where the ball hit the sign. Given what we know and what we don't know, let us then pose the following questions:

1. Is there a scenario for the trajectory of the home run that is consistent with all the available information and with the laws of physics?

2. How far would the ball have traveled unimpeded?

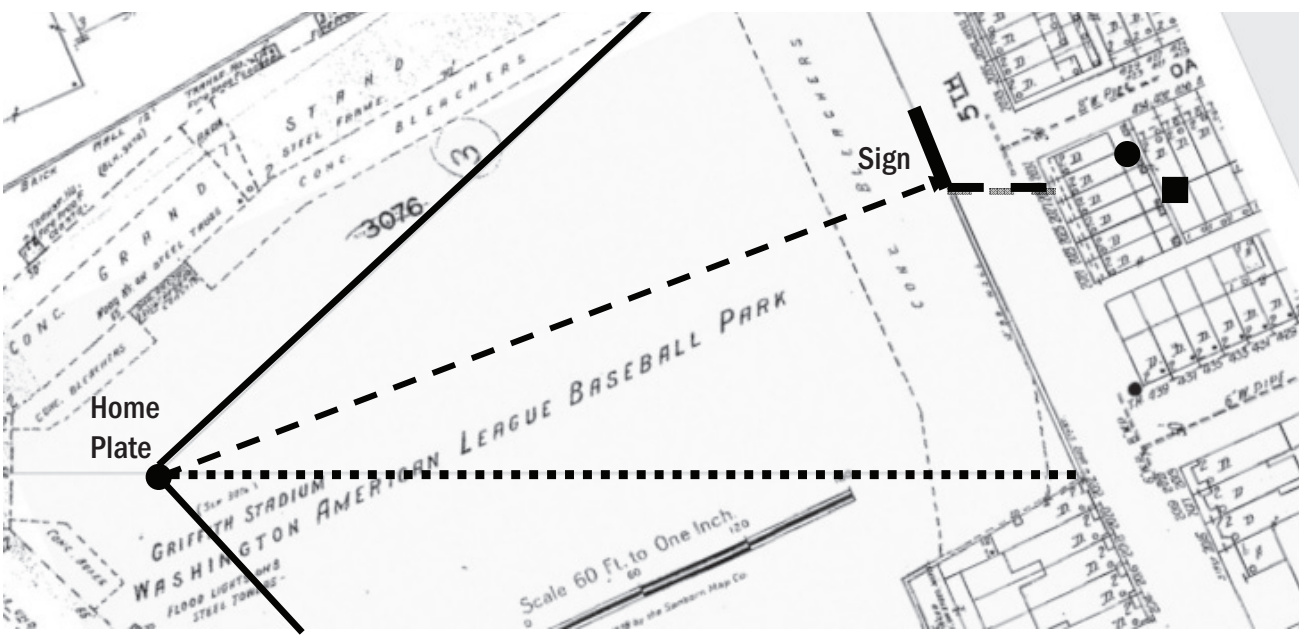

Figure 1: The dashed line is the likely path of the ball to the edge of the beer sign (460 feet). The black square is where Patterson claims the ball was found; the black dot is where Dunaway told Leavy he found the ball, behind 2029 5th Street.

Photo on previous page: Louis Requena/MLB Photos via Getty Images

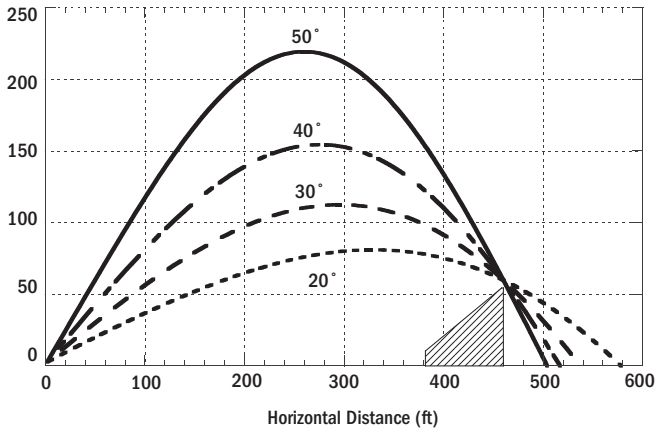

Figure 2: Possible trajectories of the Mantle home run, all of which pass through a point located 460 feet from home plate and 60 feet off the ground. The numbers label the vertical launch angle.

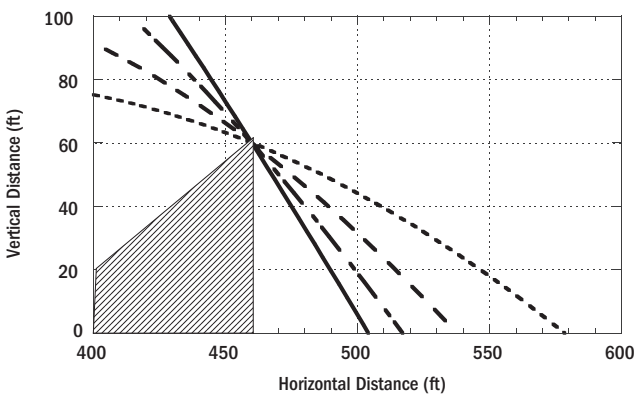

Figure 3: Expanded view of the trajectories in Figure 2.

As we shall see, the answer to the first question is a definite "yes." As for the second...

Let's first start with the information that the ball hit the sign 460 feet from home plate. For the sake of definiteness, assume that the ball hit 60 feet above ground level and that a steady wind of 20 mph was blowing horizontally, straight out in the direction of the fly ball. Given these assumptions, what can we say about the trajectory of the fly ball? The answer is, "not very much," as one can appreciate from an inspection of Figures 2 and 3. These figures are calculations of four possible trajectories, each labeled by the vertical launch angle and constrained to hit the sign at the indicated location. Between some minimum and maximum launch angle it is always possible to find a batted-ball speed such that the resultant trajectory hits the sign. The figures show that the landing point of the ball depends on that vertical launch angle, traveling farther for a line drive and less far for a pop fly. For the trajectories shown in the figure, the landing point is 504, 517, 538, and 578 feet for launch angles of 20, 30, 40, and 50 degrees, respectively. With no knowledge of the actual launch angle, the ball could have even traveled outside of those ranges. The location of where the ball hit the sign is simply not enough information to determine its landing point. By the way, this conclusion has nothing to do with aerodynamic effects such as air drag. It would exist even for a "Physics 101" trajectory acting only under the influence of gravity.

So, we need to find a way to resolve the ambiguity, which will require either additional assumptions or additional information. Fortunately there is one additional piece of information that seems not to have been used in the previous physics analyses, namely—regardless of whether Patterson's or Dunaway's version is correct—that the ball was retrieved behind the row houses on 5th Street NW. The houses are no longer there. However, as part of her research, Leavy determined that the distance of the nearest house to home plate was 512 feet and the height of the roof was 22 feet. How did the ball get behind the houses? A possible scenario, shown schematically in Figure 4, is that the ball hit the roof of the house at 2029 5th Street, then bounced into the back yard where it was retrieved by Dunaway. (A skeptic could argue that the ball could have hit the street between the stadium wall and the nearest house, then bounced over the roof. I have investigate that possibility and find that for that scenario to be viable, the launch angle of the batted ball would have to be unreasonably large, greater than 50 degrees and very far from optimal.)

Such a scenario allows us to set a very precise *lower limit* on how far the ball would have traveled unimpeded. The lower limit occurs when the ball hits the roof at the front of the house. The two fixed points on the trajectory—the beer sign and the front of the roof—leave little freedom

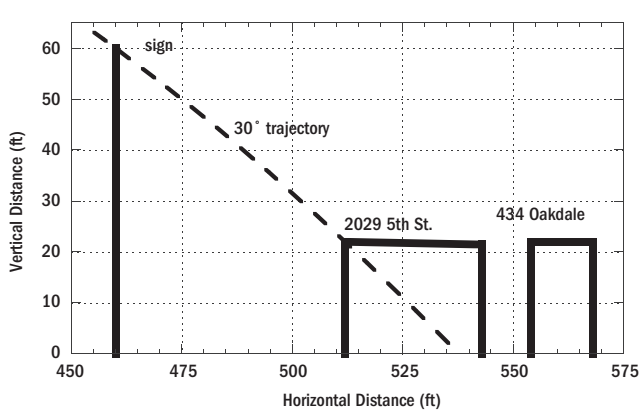

Figure 4: A possible scenario for the home run trajectory, showing the beer sign, the house on 2029 5th Street NW, and the house on 434 Oakdale. This plot indicates that the minimum distance the ball would have traveled unimpeded is 537 feet.

Mickey Mantle's ball reportedly glanced off the sign just above and to the right of the final "r" on this sign which read "oh boy what a beer."

on the extrapolation to ground level. We find the minimum distance to be 538 feet with an uncertainty no greater than two feet, a result which is significantly larger than that found by the Adair or Jenkinson analyses.

This result is very insensitive to details of the aerodynamic effects, the precise wind speed and direction, the spin on the batted ball, and other factors. The inferred parameters of the batted ball are reasonable: 114 mph batted-ball speed and a 30 degree launch angle. The ball was considerably aided by the 20 mph wind; it would have traveled only 464 feet in the absence of wind and only 359 feet had the wind been blowing in at 20 mph. Of course, this scenario only gives a lower limit, since the ball had to at least hit the roof to get into the backyard.

It is interesting to examine the consequences of assuming that the ball was hit optimally, meaning that for the given wind condition, the ball was hit at an angle that results in the longest distance. The rationale for the assumption is that hitting a ball out of Griffith Stadium is an extremely rare event, so it is reasonable to expect that it only occurs under optimal conditions. This argument is that used by Adair in his analysis, although we differ in the effect of spin on the flight of the baseball, leading to numerically very different results. The result of the analysis is shown in Figure 5, from which we find a vertical launch angle of 31.8 degrees, a batted-ball speed of 113 mph, and a corresponding range of 535 feet. The "just hits the roof" scenario is therefore very close to the optimum.

In the discussion thus far, we have ignored any change to the velocity of the ball as a result of hitting the sign. We know it was a glancing collision, changing the direction of the ball by approximately 20 degrees, as estimated from Figure 1. In such a collision, the ball would lose at most about 20% of its velocity, so that to "just hit the roof" the ball would need a slightly larger initial speed and slightly smaller launch angle. Under such conditions, the unimpeded distance would increase, but only by about four feet.

So there you have it, a new analysis of the trajectory of the famous Mantle home run. The principal new piece of information missing from previous analyses is that the ball was retrieved behind the row houses facing 5th Street. For the ball to get to the backyard of those houses, it had to travel far enough to at least hit the roof, which allows a precise determination of a minimum distance that the ball would have traveled unimpeded. As it happens, that minimum distance is very close to the distance one would expect for a ball hit optimally. Thus, a physically plausible scenario has been found for the trajectory that is consistent with all the available information and the laws of physics. The minimum distance is found to be 538 feet, quite a prodigious clout. **MSP**

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