



The *Hell* It Don't Curve!

By Joseph F. Drury, Jr.



IN THE early 1870's, two major controversies stormed in the world of sports. One of these arguments ended in a generally accepted decision just five years later. But the other still rages spasmodically today, after more than eighty years of scientific rhubarb.

It was California's Governor Leland Stanford who, in 1878, collected a \$50,000 bet by proving that all four feet of a galloping horse are off the ground at the same time. And it was Igor Sikorsky, internationally famous expert on aerodynamics, who not long ago used a wind tunnel to show that a human being *can* make a baseball curve.

Before Sikorsky approached the thesis, it had been argued and refuted, proved and exploded, sworn to and Bronx-cheered-at by scientists, photographers, and fans in general. Even the philosophers got into the act, one of them observing that "it would be at variance with every principle of philosophy" to contend that the ball does not curve.

Two of the most recent tests of

the curve ball controversy were made by two national picture magazines. Each of them used an elaborate photographic technique, and the conclusions of both were regarded as more or less authoritative. But while one magazine (*Life*) claimed that its studies "raise once more the possibility that this standby of baseball is, after all, only an optical illusion," the other (*Look*) insisted that its own photographs proved "that a curve ball actually does curve." The high-speed cameras merely added fuel to the fires of both camps.

The pictures which purported to indicate that a baseball does *not* curve were themselves branded optical illusions by traditionalists. And when he studied pictures made to show that the ball *does* curve, Ernest Lowry, an outspoken member of the optical illusion school, called them "a most convincing demonstration of the complete *collapse* of the entire curve ball theory."

Incidentally, Mr. Lowry, who says the optical illusion is caused by

“persistence of retinal impressions,” also entertains some rather bitter convictions about what baseball men are doing to the country’s juveniles. “The great injustice of the much publicized ‘curve pitch,’ ” he contends, “is that of the manner in which millions of American boys have been misled on the question. They have been forced to delude themselves into thinking that their pitches do curve, or else be cruelly frustrated when they sense that their heroic efforts failed to achieve that which is now proved an impossibility.”

THUS it was with righteous zeal that Sikorsky took up the scientific gauntlet. If American youth was being outrageously deceived by an unscrupulous combine of club owners and sports writers, if the curve ball religion was nothing but an opiate for the mustard-smearing masses, then he would explode the myth and rock baseballdom with his sock-dolager exposé.

At the time Sikorsky turned to the wind tunnel, major league baseball men openly propagandized the curve ball doctrine. A survey to measure their reactions to the “optical illusion” photographs brought in some interesting comments. Some were subtle. Others carried the impact of a hard-swung fungo bat.

“I am not positive whether a ball curves or not,” said Eddie Sawyer, former manager of the Phillies, “but there is a pitch in baseball

much different from the fast ball that ‘separates the men from the boys.’ If this pitch does not curve, it would be well to notify a lot of baseball players who were forced to quit the game they loved because of this certain pitch, and may be reached now at numerous gas stations, river docks, and mental institutions.”

Ex-Cincinnati pilot Luke Sewell asked a very pertinent question. “Isn’t it strange,” he said, “that the optical illusion only happens when someone tries to throw a curve ball, and never when a fast or straight ball is attempted?” And Earl Mack, of the Athletics, followed up with this: “Is the magazine author crediting pitchers with the power of turning on optical illusions at will?”

AND so the reactions went. Obviously, you would wire-tap a lot of locker rooms and subpoena many a ton of baseball records before you’d find a modern major-leaguer to support Mr. Lowry’s suspicions. But he might have found a useful witness in Colonel J. B. Joyce, who, in 1877, was a ruling spirit in the old Cincinnati Red Stockings. It was to convince Joyce that the first publicized test of the curve ball issue was made. According to A. G. Spalding, who describes the test in his volume, *Baseball, America’s National Game*, Colonel Joyce insisted that it was “absurd to say that any man could throw a ball other than in a straight line.”

The test was made in Cincinnati in the presence of a large crowd. A surveyor set three posts in a row, twenty feet apart. Then two high fences were built, extending beyond each end post and in a direct line with all three posts. Will White, one of the league's best right-hand pitchers, stood to the left of the fence at one end of the course. When he made his throw, the fence prevented his hand from crossing the straight line between the posts.

"White pitched the ball," says Spalding, "so that it passed to the right of the middle post. This it did by three or four inches, but curved so much that it passed the third post a half foot to the left. The test was a success in everything but the conversion. Colonel Joyce would not be convinced."

Shortly after the 1877 experiment, the *Cincinnati Enquirer* printed the views of three college professors on the possibility of a pitched curve ball. Professor Stoddard, of Worcester University, wrote: "It is not only theoretically but practically impossible for any such impetus to be conveyed to a moving body as would be required . . . to control the movement of what is termed a curved ball."

But Professor Lewis Swift, of Rochester University, disagreed. "It is true that some time ago, when the subject was first broached to me," he said, "I denied that it was possible to do it. But I began to investigate the matter and soon saw that, in-

stead of being impossible, it was in accordance with the *plainest principles of philosophy.*"

IT is doubtful that principles of philosophy were in the mind of Ralph Lightfoot while he was test-flying in a helicopter over Bridgeport, Conn., some time ago. Lightfoot is chief of flight research at United Aircraft Corporation's Sikorsky plant. When he landed, he was given a message to report immediately to Mr. Sikorsky for discussion of an "important project."

Sikorsky had just received a telephone call from New York, where United Aircraft's Lauren "Deac" Lyman had been lunching with Walter H. Neff of United Air Lines. During their luncheon conversation, the topic had turned to the opening of the baseball season and the curve ball talents of leading pitchers.

"Doesn't it strike you as strange," asked Neff, "that science counts the wing-beats of insects and controls planes at supersonic speeds — but it can't seem to prove what happens when a man throws a baseball sixty feet?"

"The problem should be simple enough," said Lyman. "Just a combination of human factors and pure aerodynamics."

"Then why couldn't one of your company's engineers do it, Deac?"

Lyman smiled thoughtfully. "I wonder . . ." he said. "By gosh, why don't we phone Igor?"

When Lightfoot entered his office, Sikorsky greeted him in his soft, continental accent. "Look, Mr. Lightfoot," the helicopter genius began, gesturing with cupped hands. "Here we have a solid sphere, moving rapidly in space and rotating on a vertical axis. You see?"

Lightfoot nodded. His mind raced ahead of Sikorsky's words. It sounded alarmingly like flying saucers. But as his boss continued, the engineer grinned broadly. "The object," said Sikorsky, "is to elude the man with the stick."

Whatever he lacked in baseball lingo Sikorsky made up for in scientific lore. For instance, he knew that a pitched ball, traveling in a curved path, is an example of aerodynamic action in everyday life. He realized, too, that the force which causes a ball to curve in flight is the same force known to engineers as "the Magnus effect," because it was explained by Professor G. Magnus, of Berlin, way back in 1851. Needless to say, Magnus wasn't interested in baseballs. His subject was *cannon* balls, and he was trying to find out why German artillery couldn't throw more "strikes."

BUT 25 years later, a British physicist named Lord John Rayleigh applied the Magnus findings to a report on the flight of a tennis ball. Briefly, what Rayleigh found was this: That when a ball is in flight but not spinning, it is exposed to a uniform air flow in one direction. So

it follows a straight line. But when the ball is made to rotate sideways, friction between the ball and the air around it forms a sort of whirlpool. When this happens, the air flow is no longer in one direction. The whirlpool brings another force into play. And this double force on only one side of the ball produces a *lateral* force which drives it in the direction toward which it is spinning.

The picture magazine which favored the optical illusion explanation of the curve ball theory accepted, of course, the more obvious fact that a tennis or ping-pong ball curves. In fact, the author wrote: "If a baseball could be spun with the same amount of power relative to its weight that a tennis ball is spun, then its path, it is agreed, would also be curved to the same extent. But," he added, "no pitcher, it seems, has a strong enough finger and wrist motion to put the necessary spin onto the ball which would materially affect its sidewise motion."

It was Sikorsky's first problem, then, to determine how much "stuff" or spin a pitcher can put on the ball in the regulation sixty-foot, six-inch distance from the mound to the plate.

To learn this, baseball fans among the plant's engineers were glad to contribute some of their off-duty time. Careful studies were made of rapid-fire flash photographs showing the progress of a single pitch. Aircraft technicians, experienced in ob-

servicing the behavior of whirling propellers, examined the change in the position of the ball's stitches from picture to picture. They figured that the ball was spinning at the rate of one-third of a revolution during each one-thirtieth of a second between exposures. Since the entire pitch took less than a half second, the rate of rotation was seen to be about five revolutions for the pitch, or about 600 per minute.

SO FAR, the engineers knew how much spin a human could put on a pitched baseball. But they still had to find out whether that was enough to make it curve. For the wind tunnel, that job was literally "a breeze."

Using official National and American League balls — identical except for their markings — Sikorsky and Lightfoot impaled them on a slender spike connected to the shaft of a small motor. During the next "stand-by time" between aircraft tests, the baseballs were inserted into the tunnel and rotated by the motor at speeds from zero to 1,200 revolutions per minute. Since official army devices had clocked Bob Feller's fast ball at 98.6 miles per hour, the forward speeds of the air moving through the tunnel were varied between 80 and 110 miles per hour. The motor was mounted on a delicately-balanced scale which measured the direction and force of all pressures brought on the balls.

To observe maximum and mini-

mum effects, the baseballs were spiked and rotated at two different angles. In one position, four seams met the wind during each revolution. This produced the greatest amount of side force on the ball. In the other position, only two seams met the wind, producing less friction and less side force.

When the wind tunnel results were plotted on conventional engineering graph sheets, Sikorsky knew he had "something for the books." The results have so much significance that they could even cause changes in pitching and batting techniques. Here, in the order of their importance, are the findings.

1. *It can be definitely concluded that a pitched baseball does actually curve, in addition to any optical illusion which may exist.*

2. A pitched baseball travels in a *uniformly* curved path from the time it leaves the pitcher's hand until it reaches the catcher's glove. There's no such thing as a "sharp-breaking curve" in the sense that a ball can be thrown so that it flies first in a straight line and then suddenly veers off. That kind of "remote control" is strictly from *fiction*, not friction.

3. To an observer at or behind the plate, it *appears* that the ball travels fairly straight most of the way and then breaks suddenly and sharply near the plate. Actually, the curve ball *arcs* toward or away from the plate *throughout* its flight; but the batter, because he views the flight

at an angle, cannot discern the gradual arc and believes the ball "breaks" at an angle.

4. Here's one for the coaches. The pitcher who learns to release the ball so that *all four* seams meet the wind each time it rotates will have the nearest thing possible to a "jug-handle" curve. If he has Feller's speed of over 80 miles per hour, and Carl Hubbell's spin of 600 revolutions per minute, his curve will "break" as much as 19 inches. With the same speed and rotation, but with only two seams meeting the wind, the amount of curve will drop to about $7\frac{1}{2}$ inches.

IF YOU'RE an average fan, you'll be content to measure a curve by how well it fools the batter. But for those with technical minds, here's a Sikorsky formula that will tell you how much a baseball will curve:

$$d \text{ equals } \frac{CL P V^2 t^2 g C^2}{7230 W} \text{ feet}$$

Where: d equals displacement from a straight line; CL equals circulation of air generated by friction when ball is spinning; P equals the density of the air (normal at .002378); V equals the speed of the ball; t equals the time for delivery; g equals the acceleration of gravity (32.2 feet per second²); C equals the circumference of the ball (9 inches); and W equals the ball's weight (.3125 pounds); while the

number 7230 relates other values of pounds, inches, feet, seconds, etc., to arrive at an answer in feet.

Sikorsky and his co-workers may well have produced the most convincing evidence yet that a pitcher can throw curves. Happily enough, their findings offer both the curve ball *and* the optical illusion squads their inning of vindication. The fact of the matter, stated simply, is that the curve ball *does* curve, but the batter — because of his angular view of the pitch — experiences the *optical illusion* that the ball curves more radically than it does.

Al Schacht, the "Clown Prince of Baseball," now runs one of the world's swankiest "cracker barrel leagues" at his New York restaurant. And to illustrate how seriously the world of baseball takes its curves, Al revives this favorite story:

A farm-belt ball player, locally famous for his hitting powers, won a major league try-out during spring training. Each week, as his batting average and confidence soared, he wired his mother. The first week, he said: "Dear Mom. Leading all batters. These pitchers not so tough." A week later, he boasted: "Looks like I will be regular outfielder. Now hitting .433." Early in the third week of training, the yokel's mother got a wire that led her to dismiss the new farmhand and get out her son's work clothes. "Dear Mom," it said. "They started throwing curves. Will be home Friday."

SIR DAVID OCHTERLONY

By Humphry Bullock ~~~~~

THIS is the story of the boy from Boston, Mass., who became a general in the service of the Honourable East India Company and was the only British commander who ever fought and beat the Gurkhas. He was made a Baronet and a Knight Grand Cross of the Most Honourable Order of the Bath; and, having first set foot in India at the age of 19, he never left that country but took to himself Indian wives and lived in oriental state, the outstanding soldier-diplomat of his age and clime. Yet the name of this celebrated son of New England is almost forgotten today. It was David Ochterlony, and it deserves to be remembered.

His father, a Scot from Forfar, took to the sea and became master of a ship trading out of Boston. There he met his wife, Katherine Tyler, niece of the gallant General Pepperell who was acclaimed as "the Hero of Louisburg" for capturing that place from the French. Their first child, called David after his father, was born at Boston in 1758. Seven years later David the elder died at St. Vincent on a West Indian voyage and his young widow, with four small children and smaller

resources, made her way to London and in 1770 married Isaac Heard, then an officer of the College of Heralds and later its chief as Garter King of Arms. To his stepfather David was to owe a debt of kindness which he never forgot.

At the age of 19 he entered as a cadet the service of the East India Company and on his arrival at Calcutta in 1778 he was commissioned as ensign of infantry. Within two years he found himself with his regiment in the field against Hyder Ali of Mysore, who with his French allies sought to dominate the south of the Indian subcontinent. There Ochterlony spent some five years, and was wounded and taken prisoner but soon released. His work as a battalion quartermaster met with official approval; and, on his return to Bengal, he was rewarded with the important and well-paid post of deputy judge advocate general at Dinapore, where he remained for no less than sixteen years. It was here that, following the practice of many of his contemporaries, he took to himself an Indian consort, and his only son was born in 1784, to whom five daughters were in due course added. Later legend was to