**Ballistics For Dummies**

*The basics that every shooter should know about the bullet's flight from muzzle to target.*

By Jon R. Sundra

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| http://www.rifleshootermag.com/shooting_tips/RSballistics_0303A.jpg  It doesn't take a master's degree in math or physics to understand a rifle bullet's trajectory. The illustration above is exaggerated to show how the bullet, which is always falling away from the Line of Departure, intersects the Line of Sight at two distances, the second of which is the range at which the rifle is zeroed. |

To understand what happens from muzzle to target and why--or at least to the extent we hunters need to know--there are some definitions and fundamental concepts one must be familiar with before all the pieces can fall into place.

**DEFINITIONS**  
**Line of Sight (LOS)**: A straight line out to infinity as represented by the scope's reticle, or the sighting plane formed when the front and rear sights are aligned.

**Line of Departure (LOD)**: Another perfectly straight line, this one running down the center of the bore to infinity.

**Bullet Path**: The arc or trajectory of the bullet relative to LOS.

**Drop**: The actual drop of the bullet relative to LOD. I'm sure we've all heard someone describe a rifle as being so flat-shooting "the bullet doesn't even drop for the first 100 yards!" Nonsense. Even with the flattest-shooting super magnum, the bullet starts dropping away from the LOD the moment it leaves the muzzle. A popular misconception is one that results from the use of the word "rises" in various ballistics charts. A bullet is always dropping, but it does indeed "rise" relative to the LOS. This seeming anomaly exists because with the scope being positioned above the bore, the only way the LOS could converge with the bullet path is to angle the sights downward. In other words, if the LOD and LOS were parallel, the bullet would exit the muzzle 11⁄2 inches low and start falling farther away from there.

Adding to the confusion is the fact that, once those sights are angled downward to converge with the bullet path at some practical distance downrange--whether it be 100, 200 or 300 yards--the bullet and LOS will have already converged once before. Whether we're shooting a .45-70 that we want zeroed at 100 yards or a 7mm Ultra Mag at 300, this first convergence of LOS and bullet path occurs between 20 to 40 yards from the muzzle.

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In the case of the .45-70, to get it to print dead-on at 100 yards, we'd find that our bullet first converged with our LOS about 20 yards from the muzzle. From that point on, the bullet would be "rising" to where at 55 yards it would be at its highest point above our LOS--about 21⁄2 inches. At that point the bullet begins to fall relative to LOS to where the two again converge at our desired zero range of 100 yards.

With the 7mm Ultra Mag zeroed at 300 yards, first convergence is at about 40 yards. Between that point and 300 yards, our bullet path will attain a maximum height of about 31⁄2 inches above our LOS. Bottom line: Bullet path and LOS converge at two distances, the second of which is actually the zero range.