System 88, The Missing Link

If you work with external ballistics programs for years, you learn three things.

1. All reputable programs give the same answer if given the same inputs.
2. All programs ask you for muzzle velocity and a ballistic coefficient.
3. No program tells you where to find the muzzle velocity and ballistic coefficient. **That's the missing link.**

Individual ballisticians have struggled for the last century to make predictions of downrange ballistic behavior. Techniques have changed little over the years. Modern technology just makes things faster and easier; shooters can now use computers instead of having to manually trudge their way through the tables of Siacci.

Their predictions are still based on a drag function that describes the drag behavior of a standard bullet. The most commonly used drag function is called G1. Some argue that G1 should be replaced by G7 using a different standard bullet. In fact, there is no one-size-fits-all drag function, but G7 is probably a closer fit to modern bullets.

Downrange predictions have always been computed in the same fashion. The shooter must first enter his data. There are three essential inputs.

1. Start the computations at a known muzzle velocity.
2. Pick a drag function that fits the bullet.
3. Pick a ballistic coefficient to relate the bullet to the drag function.

The mechanics of the program will take into account the variations of air density and the speed of sound caused by changes in pressure, temperature, and humidity.

Muzzle velocity is easy. You will use a chronograph to measure the velocity of your lot of ammo from your rifle.

Picking the appropriate drag function is also easy. G1 is universally accepted and most manufacturers quote the ballistic coefficients relative to G1. The use of G1 is perfectly acceptable for use at intermediate ranges (say 400 to 800 yards). In recent years it has become apparent that G7 provides a better fit to the behavior of the streamlined bullets intended for use at longer ranges. Either function provides reasonable predictions down to the transonic velocity (typically Mach 1.2 or 1350 feet per second) if used with the correct ballistic coefficient. G7 typically gives a better prediction as the bullet passes through the sonic region.

System 88 Controller Unit

Choosing the initial velocity is easy, but picking the ballistic coefficient relating your bullet to the chosen drag function is more difficult. Shooters are accustomed to seeing ballistic coefficients quoted to a precision of three decimal places and may assume that this implies three-place accuracy. They are surprised to learn that it is very difficult to measure ballistic coefficients to better than a few percent accuracy, that lot-to-lot variations may be a few percent, and that the ballistic coefficients are influenced by barrel twist, barrel crown, and other rifle characteristics.

Most available ballistic coefficients have been measured over ranges extending no more than a few hundred yards from the gun. Downrange performance is predicted by choice of drag function. Just as a running coach cannot predict marathon performance by checking sprint times, it is difficult to predict long range performance based on short range tests. Shooters who would not consider using the catalog or loading manual for velocity input assume that a published three-digit ballistic coefficient is a sacred constant. **The System 88 accurately measures muzzle velocity; it also accurately measures ballistic coefficient over a long distance.**

You provide your program with muzzle velocity and ballistic coefficient. Your program then *predicts* the time-of-flight. The System 88 *measures* the time-of-flight over a long range along with the initial velocity. The program of the System 88 then works backwards to find the exact ballistic coefficient required so that the predicted time-of-flight matches the measured time-of-flight. The System 88 lets you select any commonly used drag function and even allows you to define your own custom drag function.

For any given drag function, the System 88 finds a ballistic coefficient that fits both the measured long range data and the muzzle velocity. If you select a different drag function, the System 88 again forces measurement and theory to agree at the muzzle and at the distant target. Your distance versus time curve starts at zero for time and distance; the initial slope of the curve represents the initial velocity; and the correct time-of-flight is predicted at the target. When you compare many such curves, you will see that the curves given by different drag functions are practically the same. The actual measurement and fit to the one distant data point is much more significant than is the choice of drag function. This means that either G1 or G7 will work equally well down to the transonic velocity, but you must measure the long time-of-flight.

For accurate predictions, you must provide your program with the correct muzzle velocity and ballistic coefficient measured over the long range. The System 88 measures both to provide the missing link.

The System 88 is designed for professional use in the field.

- **Battery operated for use at remote ranges.**
- **Set up is fast and easy.**
- **Wireless, proven over one mile.**
- **One-man operation.**
- **Immediate results within seconds after a shot.**
- **Proven skyscreens for accurate initial velocities.**
- **Rugged microphones.**
- **Square, fly-by, and fly-over acoustic targets available.**
- **Multiple targets and ballistic coefficients on one shot.**
- **Can use impact target to measure subsonic times.**
- **Excel and pdf data outputs.**
- **Technical support from Oehler.**