

## CSEC ELR CALIBRATION TARGET HANDOUT

The purpose of the ELR Calibration target is to refine the ballistic coefficient (BC) to match bullet impact at Extreme Long Range. However, refining BC should be done in the bullet's Transonic Zone, Mach 1.2 - .9.

The ELR Calibration target is 12"H x 48"W (1MOAx4MOA or .3Milx1.2Mil @ ~1150 yards or 1051.5m). Top 6" is White, bottom 6" is Orange which gives either a precise horizontal aim point or a 1/2MOA or .15Mil precision using either the White or Orange as desired.

The ELR Calibration target is positioned down range at a distance where many 6mm, 6.5mm, 260 Rem, .308 Win and .30-06 cartridges approach the Transonic Zone (1.2M - .9M) and where BC becomes an important factor in obtaining consistent accuracy.

In general when the bullet velocity is in the Supersonic Zone, Muzzle Velocity (MV) should be adjusted, not BC. High Velocity, low drag bullets such as found in the PRC, 7mm Mag, 300 Win Mag, and .338 Lapua Mag cartridges will be Supersonic at 1150 yards. A 12" Circular target is provided in addition to the ELR Calibration target for truing MV of these cartridges. Also, 12"x12" Chandler Challenge targets are provided at 1309, 1400, 1500, 1600, 1760, and 1940 yards which can be used for truing BC for these calibers.

Prior to fine tuning BC to match bullet trajectory at extreme long ranges:

- **Establish True Zero:** When entering Zero data into the ballistic application enter the precise ranged yardage. For example, do not enter an automatic 100 yards when actual distance was 105 yards (a 5 yard difference at 1000 yards equals about ½ MOA). One to three shots will only be a rough approximation of group center, a 5 shot group is still a small sample size but better, and a 10 shot group is preferred. Enter the group center's distance from precise center into the ballistic application as Vertical and Horizontal offsets. If the gun does not hold true Zero from time to time on the range, check that the rail, mount, rings, and scope tracking (Tall Target Test) is not holding Zero. Note: consider that 1/4" @ 100 yards is almost 3" at 1150 yards ... small things add up!
- **Establish True Muzzle Velocity (MV):** Use of a chronograph will give a close approximation of MV and will make quick work of truing MV at range. Ideal measured MV Extreme Spread (ES) is less than 1% of average MV value with Standard Deviation (SD) in the single digits. Otherwise, start with MV given by manufacturer or from Load Data. Chose a target at least 700-800 yards and adjust turret elevation to achieve center impact, then adjust MV in the ballistic application to match predicted elevation to true turret elevation..
- **Chose the appropriate Drag Form:** The G7 drag form is the best fit for most low drag and very low drag bullets having a long boattail and long tangent or tangent-secant hybrid ogives. The G1 drag form used with VLD bullets will undergo changes in G1 BC value depending on bullet downrange velocity requiring the ballistic application to handle multiple BC values. Sierra Matchking lists the multiple G1 BC values vs Velocity, otherwise most manufacturers only list a vague, single G1 BC value, good within 600 yards or so but breaks down for longer ranges.

Prior to engaging the ELR Calibration target verify correct atmospheric, Direction of Fire, and ranged distance are entered into the ballistic application and that elevation deflection due to Coriolis Effect and Wind Direction/Speed will be calculated. Note: some applications' default setting is with Coriolis and Wind Deflection turned off.

- **Range and Direction of Fire (DOF)** will vary slightly depending on which bench position is used. DOF is particularly important in order to correct for Vertical deflection due to Coriolis Effect, which can amount to several inches depending on Time of Flight (ToF).
- **Wind Speed and Direction** can also create a vertical deflection of several inches and must be taken into account ... this is unfortunately the most difficult variable to manage, making calm days the preferred conditions for truing BC or MV. Truing MV or BC while there is an atmospheric inversion/turbulence creating variable vertical wind deflection, normally between 9:30 to 11:30 AM, will result in a suspect solution. Also, once ground temperature exceeds 100°F, vertical thermal rise will degrade ballistic truing results.

This information is partially derived from several Applied Ballistics sources which are recommended reading:

<https://appliedballisticsllc.com/wp-content/uploads/2021/06/Practical-Ballistics.pdf>

<https://thescienceofaccuracy.com/podcast/93-ap-ch11-calibrating-ballistic-solutions/>

<https://appliedballisticsllc.com/wp-content/uploads/2021/06/BC-Testing.pdf>

<https://thescienceofaccuracy.com/podcast/76-truing-your-ballistic-solver-part-1/>

