Sniper Tools Design Company's Angle Cosine Indicator—used by most military snipers under the NATO umbrella.

The Steep-Angle, High-Altitude Mountain Sniper

"One Round, One Down"

By Ward W. Brien

A *sniper* is a military/paramilitary marksman who engages targets from positions of concealment or at distances exceeding the target's detection capabilities. Snipers have specialized training and varying special operative battlefield roles. Fieldcraft, tactics, techniques and procedures (TTPs) catalyze their skillset that produces desired mission success.

All snipers begin with the "Basic Sniper" course, with the precision shooting course of instruction accomplished on a flat square range. The "flat square" is where the sniper learns about trajectory, wind boundaries, how the climatic conditions affect trajectory and accuracy, ranging techniques, the trending of the weapon, and so on. "Basic Sniper" is just that, "basic," and it's the beginning of the sniper's journey to maturity.

In the "urban" environment, it is very rare to engage a target beyond a distance of 400 meters. Theoretically, this is a very short distance; however, the top three concerns are as follows: 1) 6 o'clock security; 2) man-made winds; and 3) target acquisition time. The 6 o'clock security is self-explanatory; however, man-made winds and target acquisition time are not. When I say man-made winds, it is the difference of the wind speed at the base of a structure compared to the top of the structure, or the Venturi effect, that can be created when the wind is forced to go in-between two structures and will increase wind speed significantly. Soft

The Sniper Tools Design Company's Angle Cosine Indicator.

Students shooting upward at 15-inch dog targets. "One round, one down."

target acquisition time is a maximum of maybe 5 seconds. There is much more that goes into target engagements in an urban environment than one would think, though that is part of the TTPs.

Ranging is an interesting topic as there are different methods. Without using a laser rangefinder, the precision method is to calculate the distance to target with the standard equation of: (1m x 1,000) / target size in MILs = distance to target. During WWII, a designated marksmen or sniper utilized a technique using the front "dog ears and post" on their M1 Garand, which determined the distance to target out to 500 yards; today, there is another method that delivers extremely fast if not immediate distance-to-target readings and engagements out to 600m. There is nothing faster in reducing targets out to 600m than the use of a MIL-dot reticle—nothing.

Shooting at sea level in a flat AO does have its challenges; however, there is a unique and distinct difference when compared to the high-altitude, steep-angle, mountainous environment. One must experience this environment for himself to begin to understand it.

The challenges here are eye opening as the main components are: 1) climatic environment; 2) density altitude; 3) complex multi-layered and multi-vector winds; 4) steep-angle fire; 5) optical anomalies; 6) engagements beyond 1,000m; and 7) how these elements work in concert creating a puzzle that only the mature shooter can negotiate.

The climatic environment goes beyond temperature, barometric pressure and humidity; although these three components are what manufacture density altitude. Density altitude (DA) is a non-linear component to begin with, which affects the performance and trajectory of the projectile. When shooting at high altitudes at or above 8,000 ASL (above sea level), the density altitude changes dramatically, along with the performance of the projectile/cartridge. As an example, a .308 Winchester utilizing a 175-grain Sierra Match King at sea level will have a velocity at 1,000m of approximately 1,050 fps. However, at or above 8,000 feet ASL, one can expect an increased velocity of approximately 1,300+ fps at 1,000m. This increases the terminal velocity and delivers solid accuracy out to 1,200m, and that is shooting flat. 1,200m on 30 degrees of slope (.87 cosine) equal a corrected-for-gravity, distance to target of 1,044m; 1,450m

MSC's range #16.

on 30 degrees of slope equal a corrected-for-gravity, distance to target of 1,261.5m. Regarding angle fire / sloped distance to target, it is imperative that a method to correct the sloped distance to target to the corrected-for-gravity, distance to target be utilized. Whether in an urban or rural area, correcting for gravity is mandatory for precision fire. One tool that is utilized throughout the world is the Angle Cosine Indicator® (ACI) by Sniper Tools Design Company (**snipertools.com**).

The ACI is a vault-solid tool that is rugged, waterproof and mechanical; it does not rely on batteries or electronics, is extremely reliable and mounts onto the weapon via a Picatinny rail mount, ring or Spuhr® mount. Readings are instant, and failure is unheard of. The ACI is utilized by ranging your distance to target and then multiplying that distance to the indicated cosine numeral; i.e., .87. As an example, if your distance to target is at 1,000m, and you were aiming on a 30-degree angle, the indicated cosine numeral is .87. You would then multiply 1,000 x .87 = 870 meters. The Angle Cosine Indicator is a redundant device as the cosine numerals are laser-engraved onto the body, zig-zagging up and down in 5-degree increments.

If you are utilizing ballistic targeting software such as X-RING or AIM-E®, authored by Lyman Hazelton, Ph.D., the software will *very effectively* comingle the cosine / angle from the ACI with the projectile's ballistics (ballistic coefficient, or radar data, and velocity) with the current meteorological data to produce *extremely accurate results*—both the vertical and horizontal trajectory, out to extremely long distances and without fudging the software. Radar data is very unique as it takes 12 very expensive Doppler radar heads set up in an array to establish the data. Once implemented within the software, it then takes very specialized calculations to utilize the information. Doppler radar drag models are exchanged for a bullet's ballistic coefficient (BC) and have proven to be the most accurate method that can be used, "when utilizing the correct ballistic software." BCs are established at sea level and only in a temperature of 59 degrees. When at firing points that are located at 9,300 feet ASL, the bullet's BCs have changed dramatically. Its BCs along with the density altitude and barometric pressure will also change throughout the trajectory; i.e., shooting from 9,300 feet ASL down to 7,500 feet ASL. If you are an extreme long-range shooter, this is something to know.

The Mountain Shooting Center

There is a training venue within the United States called, The Mountain Shooting Center (MSC) (**mountainshootingcenter.com**). The MSC is a high-altitude (9300 feet above sea level), long-range shooting complex designed for the training of all advanced shooters and also military snipers who expect to engage targets at steep angles (up or down), and at long distances. Ward Brien, owner

The target above and on the right was engaged by "Mr. Trey Sprinkle" from a distance of 2,320m, with four lead sniper instructors from 10th Mountain Division as witnesses. His cold bore hit on the right collar bone with his follow-on hitting approximately 5 inches lower and 1 inch left of center with a 6.5 SAUM using a 142-grain Sierra Match King. "One round, one down."

of the MSC and Chief Instructor, has instructed U.S. Special Forces snipers, U.S. Special Forces lead sniper instructors, foreign snipers, contractors and hunters in the details of steep-angle, high-altitude, mountain shooting. As the proof is in the pudding, the real-world results speak volumes. The course(s) of fire are based on science that is comingled with over 50 years of high-altitude, precision mountain shooting. A quiet professional, Mr. Brien schedules his steep-angle, high-altitude, mountain shooting courses throughout the summer months or winter months in the Southern Hemisphere. His contact information is: **info@snipertools.com** or (818) 359-0512.

Altitudes at or above 8,000 feet ASL, angle of aim and density altitude play a very large role in mountain shooting. Still, there is more. One of those elements is humidity. In reality, humidity only makes up 1/10th of 1% of accuracy, or roughly 1/100th of 1 inch at 1,000 yards. However, if it has been raining for the last several days, and the shooter is perhaps running the meter lines at 0900, and the sun is out, the sun will cause high humidity at the ground level. This in turn will cause light refraction and an inversion layer that will produce negative results.

In addition to angle fire, wind(s) are another attribute that must be recognized and corrected for, just like on the flat square range. However, the winds in the mountains are very different. Not only will the shooters experience wind boundaries, but they will also experience layers of wind. As an example, on a ridgeline firing down, the wind at the muzzle may be an updraft of 8+ mph. However, 50 feet further out, the wind is a headwind, and then 50 feet below that wind, there may be another wind from 270 degrees with a velocity of 6+ mph, and perhaps one more as well. Now the complexity begins to be magnified. Add in the optical anomalies, angle fire and the other climatic conditions, and there is much to consider.

In regards to ballistics, snipers have been utilizing software for many years. However, to cut to the chase, in my opinion, there is only one ballistic targeting software that takes into account the many equations that produce real accuracy, and that is X-RING/AIM-E. It was authored by Doctor Lyman Hazelton, Ph.D., astrophysics/MIT. All other software on the market pales in comparison. Sorry, but I'm not a politician, and this is the cold hard fact. Without X-RING/AIM-E the shooters must rely on their recorded data in their data book, and that in part limits the ELR game changing distances. "One round, one down" is our motto.

The difference between the flat square range and the mountain range is draconian in nature. Yet one round, one down engagements in a mountainous AO are absolutely doable. "I have watched attendees at the Mountain Shooting Center go from having a very difficult time, to first-round hits out to 1,400 meters in a few days." The most common phrase mentioned at the end of the course is, "Mission Accomplished." SADJ