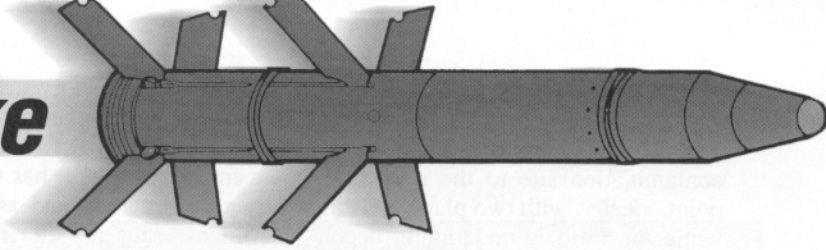
Copperhead Strike



by Captain Samuel C. Cook, USMC

"Copperhead is frequently ineffective out [at the NTC]." These are the words spoken by then National Training Center Commander, Brigadier General William S. Wallace, in his interview "The Challenge: Synchronizing Fires, Maneuver and Intel" in the July-August edition. These are not exactly the words Field Artillerymen like to hear.

Yet, those words are hardly surprising. No other projectile in the cannon artillery inventory demands as much coordination, practice and preparation from the eyes, brain and muscle of the Field Artillery team than Copperhead. But if used correctly, Copperhead allows the commander to shape the battlefield by removing high-payoff targets early without revealing direct fire weapon locations.

Although the projectile has been around for many years, it will be with us until it's phased out in 2007. So, the problem, then, and the focus of this article, is to determine what the difficulties are in firing Copperhead missions and how units can overcome them.

The major errors in employing Copperhead tend to occur at the tactical level of planning–for example, in the S3 shops of both the maneuver and artillery units. Although there are also difficulties in the technical aspects of firing Copperhead, those difficulties would be reduced considerably with proper tactical planning.

Copperhead Projectile. Copperhead is a 155-mm fin-stabilized, laser-guided projectile that has a 14.75 LB-shaped charge with an explosive filler of Composition B. At about the midpoint of its trajectory and based on the time set, the projectile deploys four wings to guide it onto the laser energy being reflected from the target.

The observer must designate the target for 13 seconds for Copperhead to acquire the target, arm and guide onto the target. The pulse repetition frequency (PRF) code set for the projectile must match the PRF code set on the laser designator exactly. The laser energy is provided by the ground/vehicular laser locator designator (G/VLLD) or the Marine Corps' modular universal lasing equipment (MULE).

The fire direction center (FDC) transmits the command, "Designate," digitally or "Laser On" by voice 20 seconds prior to impact. This allows for a seven-second reaction time between the FDC and observer.

Gunnery Solution. The technical gunnery solution will result in Copperhead's being fired with either a ballistic or shaped trajectory. The battery computer system (BCS) determines the trajectory based on observer visibility, cloud height and gun-to-target range. The preferred solution is a ballistic trajectory that produces a higher angle of fall and, thus, a higher probability of a catastrophic kill.

A shaped trajectory is used when cloud cover, range-to-target and observer visibility require a lower maximum ordinate to acquire the reflected laser energy. The shaped trajectory has a more shallow angle of fall that reduces the effectiveness of the Copperhead's shaped charge.

BCS determines its firing solution based on FT 155 AS-1. This solution yields a ballistic trajectory for targets from a range of 3,000 to 8,800 meters under standard conditions. At ranges from beyond 8,800 to 16,300 meters, a shaped trajectory is computed unless high angle is the method of engagement.

Because Copperhead costs $40,000 per round, it's seldom fired in training areas, so the fire direction officer (FDO) rarely has muzzle velocity variation (MVV) data for Copperhead. At the NTC, most FDOs use standard firing table (FT) muzzle velocity (MV) when computing data. Firing standard MV potentially introduces large errors into data calculations.

The FDO must know how to predict the MVV of the projectile using equivalent full charge (EFC) values and pull-over gauge readings in propellant efficiency. Although only an estimate, this technique is better than firing standard MV. In addition, each round fired should be used to calibrate the MV with the data stored in the MVV logbook for future use.

The FDO also must determine if the trajectory will cause the round to impact with any intervening crests. This is especially important in mountainous areas, such as Korea.

The difficulty is that the addendum for Copperhead doesn't have trajectory charts like the ones in the FTs. The FDO has to refer to the maximum ordinate provided by the BCS and the gun target line on his situation map (SITMAP) to see if the projectile can make it to the target area.

Copperhead Planning. Considerations for employing Copperhead include the placement of forward observers (FOs), limitations of their equipment and determination of trigger points.

Observer Location. One element of observer location affecting accuracy is angle-T. When the S3 determines an observer location, the observer must have an angle-T of less than 800 mils with the unit or gun firing the round.

The larger the angle-T, the less laser light is reflected toward the trajectory of the projectile and might be insufficient for acquisition. For Copperhead, 800 mils is the maximum angle-T that will produce a high probability of target acquisition.

In older versions of the BCS (Versions 7 and 9), the computer would yield "No Solution" in "Priority Mission Buffers 4 and 5," if the angle-T was greater than 800 mils. In the current Version 10, the computer computes the data but provides a warning message if angle-T exceeds 800 mils.

The S3 can plan the location and coverage area of an observer and battery firing Copperhead using the Copperhead Coverage Template. It tells the FSO if Copperhead can be used in an engagement area from a potential observation post (OP) with a greater than 50 percent probability of hitting the target. Instructions for using the Copperhead Coverage Template are found in *FM 6-20-40 Tactics, Techniques and Procedures for Fire Support for Brigade Operations (Heavy)*, Appendix H.

The template tells where the observer has a greater than 50 percent probability

of hitting the target based solely on observer location, battery location and range to the target area The coverage area designated does not take into account terrain, visibility or survivability. Too often, OPs are planned based on a map spot and coverage template when they are inaccessible or unsuitable for the observer on the ground. Reconnaissance is still necessary to ensure the planned OP is useable.

Copperhead Footprint. Once the OP has been selected, the FO determines how much of his area Copperhead can engage. Although Copperhead can be maneuvered, there's a limit to how much. The FO uses the Copperhead footprint templates to determine the limit. These templates are in FT-155-AS-1 or units can order them. (Instructions for using the footprints are in *FM 6-30 Observed Fire Procedures.*)

The edge of the footprint is how far from a grid aim point the projectile can be maneuvered and maintain a 50 percent probability of hitting the target. The closer the round hits to the center of the footprint, the higher the probability of impacting on the target. Outside the footprint, the FO may be able to maneuver the round, but its chance of impacting on the target is severely degraded.

Selecting the footprint is a function of cloud height, weapon system and observer visibility. The FO selects, orients and traces the footprint on his map. He then visualizes the footprint on the terrain via terrain association or by lasing the direction and distances to landmarks.

Trigger Point. The FO selects a trigger point to initiate the Copperhead mission. The observer first must estimate the speed and direction the target will be moving (see FM 6-30, Pages 5-23 to 5-26). He adds the call-for-fire transmission time, mission processing time and Copperhead time-of-flight and multiplies the result by the predicted target speed. (If the FO doesn't know how much lead time to factor in, a good estimate is 200 seconds for a target of opportunity.)

When determining the location of the trigger point and the predicted impact point, the FO must keep in mind the distance his laser can designate the target. A G/VLLD can designate a stationary target to a range of 5,000 meters and a moving target up to 3,000 meters. The MULE can designate stationary targets at 3,500 meters and moving targets out to 2,000 meters. Beyond these ranges, the amount of reflected energy is insufficient to guarantee the projectile will lock onto the target.

The S3 must consider these ranges when planning observer locations and engagement areas. The coverage template can represent both 5,000- and 3,000-meter ranges when drawn on a map, allowing the S3 to visualize the area that can be lased from a potential OP.

PRF Code. Copperhead seeks a particular PRF when trying to acquire the target. This allows a specific projectile to be guided by a specific designator using a three-digit decimal code. This code allows inter-service use of designators and weapons systems.

The code is broken down into two bands of either 10 and 20 pulses per second, respectively, as shown in *ST 6-30-30 Copperhead Firing Procedures,* Page 45. Although either band code can be used for Copperhead missions, Band 2 with its higher pulse rate and 256 possible settings is preferred. (Band 1 codes are usually reserved for use by the Air Force.)

One major error occurring frequently is the wrong PRF code is being applied to the G/VLLD, which results in the round's missing the target. There is no excuse for this error. The PRF code for the projectile is included in the message to observer (MTO).

Because the codes must match exactly, the fire support element (FSE) manages and assigns the PRF codes. The lowest level for managing the switch settings for both the designator and FDC is the brigade FSE. Most units have standing operating procedures (SOP) that assign PRF codes in blocks similar to target blocks. ST 6-30-30, Pages 45 to 48, gives an example of corp-, division- and battalion-level assignments for PRF codes.

Command and Control. When setting Copperhead guidance, several factors must be considered. The first is ammunition availability and distribution. The basic load of Copperhead is usually no more than three rounds per tube. A 3x6 battalion has 54 rounds available. Therefore, the commander can't make every tank or armored personnel carrier (APC) a Copperhead target. Copperhead only should engage targets that can affect the battle tactically, such as command, control and communications vehicles.

Also, each Copperhead mission is a two-round mission–even with only one predicted target. This ensures the target is engaged, but it also means at least two howitzers in the battery must be loaded with Copperhead.

The second consideration is the response time for Copperhead missions and the number of priority missions that can be assigned. Only priority and on-call missions have response times of 60 seconds or less. Using Copperhead for targets of opportunity can result in processing times of more than five minutes because the observer must determine and orient the footprint and determine the trigger point and angle-T.

The commander should plan priority Copperhead targets to allow the observer to orient the footprint and the FDC to predetermine data for the gun line. Priority missions are stored in BCS in "Mission Buffers 4 and 5." The BCS can store one final-protective-fire (FPF) mission and one Copperhead priority mission or two Copperhead priority missions. In a 3x6 battalion, a total of six Copperhead priority missions can be stored. When the howitzer isn't engaged in other missions, the Copperhead data is set on the howitzer.

Finally, a primary and secondary FO and firing unit must be assigned to each Copperhead target area planned. Also, the artillery battalion S3 must incorporate firing Copperhead targets into his movement order so the battery with the mission isn't displacing or in the wrong position when the target needs to be fired.

Although firing Copperhead is a complex mission, it offers the commander the opportunity to shape the battle with a single round. The key to success with Copperhead is simple: practice, practice and more practice.

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