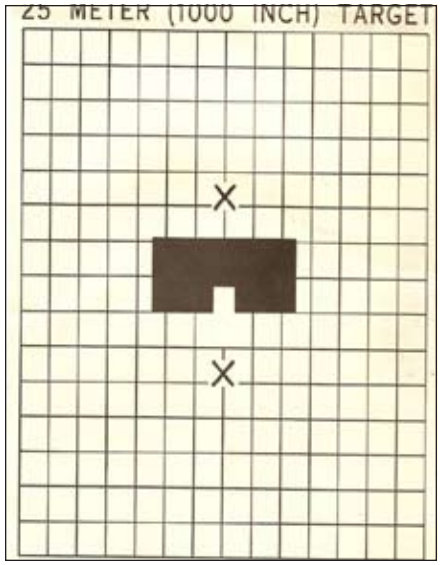
New Zeroing Procedures

The Army's previous training doctrine attempted a simplified approach to zeroing that tried to be successful without having to explain concepts that are important to marksmanship, gunnery, and a basic understanding of ballistics. As explained in FC 23-11 Unit Rifle Marksmanship Training Guide doctrine developed through World War 2 and used through the Viet Nam era started with a 1,000-inch range. Up through the end of the 1970s, the Army used bullseye-type targets intended to maximize consistent sight picture. The last of those was the so-called Canadian bull.

This target was in use when the M14 and M16 were both in service. Set at 25 meters (1,000 inches) the grid has squares at two minutes in size. The aim point is fairly obvious at 6 o'clock and centered at the white square, making for a consistent mark, especially with iron sights. Doctrine then was to establish a 250 meter zero, which requires two different points of impact for the M14 compared to the M16. Note the two Xs. The top X above the mark is the intended impact for the M14 and the bottom X below is for the M16.



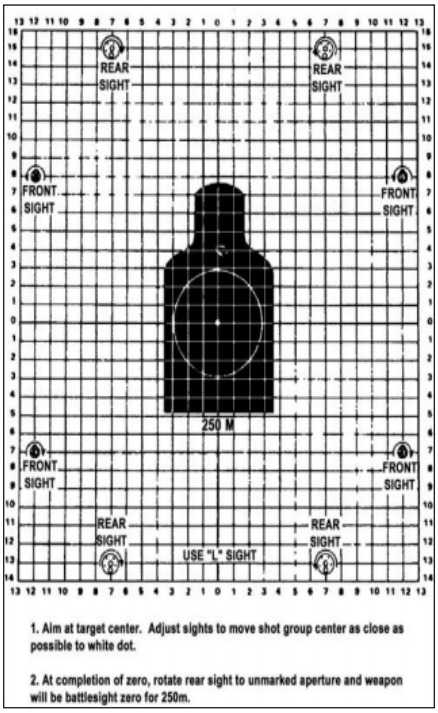
Left: The Canadian Bull

The target doesn't explain any of this. While it's a great mark and grid for knowledgeable shooters, this does not describe most Soldiers and the Army found most personnel didn't understand how to use this.

There are two ways to fix such a deficiency: The first is to teach everyone in the Army units of angular measurement and basic ballistics to insure understanding among personnel down to the unit level. The second approach is to develop a method that eliminates the need to know or understand any of this. The Army chose the second option.

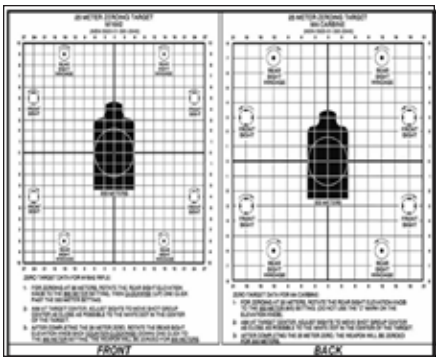
A silhouette was chosen over a more refined aiming mark because it mimics the targets used in qualification and the field, not because it's ideal for zeroing. The M16A1 rear sight had two apertures: The normal height one intended for a 250 meter zero and a second, taller aperture marked with an "L" setting for longer range shots past 300 meters. With an M16A1, a 250 meter zero intersects initially at 42 meters. The taller "L" aperture is about three minutes higher and an initial intersection of 25 meters yields a 375 meter zero. This allowed personnel to shoot point of aim for point of impact at 25 meters on a scaled silhouette that appears like a full-size silhouette at 250 meters. Using the "L" aperture at 25 meters and then flipping back yields a 250 meter zero. While the M16A1 sights were in one-minute increments, no attempt was made to teach that. In fact, the zero target has drawings and arrows directing what and how to spin the sights as needed. No understanding of the why or how was deemed necessary.

This worked fine, until the M16A2 was released. While useful for marksmanship, the A2 sight



design is lost on novice shooters. Worse, it ruins that one square=one click simplicity with the A1. Rather than explain these facts, the target was redesigned to take this into account and the provision to go up one click on the rear sight for 25-meter zeroing was made. While not a perfect solution, it was deemed close enough given the novice skill levels of most Soldiers to manage to pass routine, basic qualification.

Simplicity was retained for a while, until the M16A4 and M4 was adopted. The removable rear sight is in half minute increments instead of full minute clicks. Unless mounted on an M4, with its shorter sight radius which moves the point of impact further with each click. Again, no attempt was made to explain any of this to rank-and-file Soldiers. This complicated things a bit but a dual-sided zero target with different size grid squares tried to retain the original simplicity without the need to educate Soldiers about why.



Left: M16A2 and M4 zero targets, printed front and back.

This was fine... up until technology ruined everything.

As the Army trudged into the 21st Century, a host of new aiming devices, lasers, optics, and mounting systems became available. Equipment intended to help Soldiers become more effective destroyed the no-explanation approach used for zeroing as each unique combination of weapon, device, and mounting demanded a unique offset.

In response, the Army released the Small Arms Integration Book. Consisting of 448 pages of instructions and charts, the SAIB provided zeroing and offset data for all the then-current options. The problem was the Army had spent the past two decades trying to eliminate the need to understand units of angular measurement and basic ballistics to the point – for simplicity's sake – that it was found necessary to publish the Small Arms Integration Book. When your organization is forced to publish a 448-page book of instructions and charts in order to retain "simplicity" then it is long past time to consider you've lost the plot.

New Zero Procedure

Rather than hide from it, the current approach to zeroing is to start by explaining how and why it works. With better understanding comes better capability and the knowledge to adapt when things change. Think of this as a validation of your GT score.

Zeroing a weapon is not a training exercise, nor is it a combat skills event. Zeroing is a maintenance procedure that is accomplished to place the weapon in operation, based on the Soldier's skill, capabilities, tactical scenario, aiming device, and ammunition. Its purpose is to achieve the desired relationship between the line of sight and the trajectory of the round at a known distance. The zeroing process ensures the Soldier, weapon, aiming device, and ammunition are performing as expected at a specific range to target with the least amount of induced errors.

For Soldiers to achieve a high level of accuracy and precision, it is critical they zero their aiming device to their weapon correctly. The Soldier must first achieve a consistent grouping of a series of shots, at least three but ideally five. This is a Shot Process and Functional Elements exercise. When the groups look good, the shooter aligns the mean point of impact of that grouping to the appropriate point of aim. Depending on the equipment and distance used, the point of impact may be in a different place than the point of aim. Consult the appropriate Technical Manual to learn what this is.

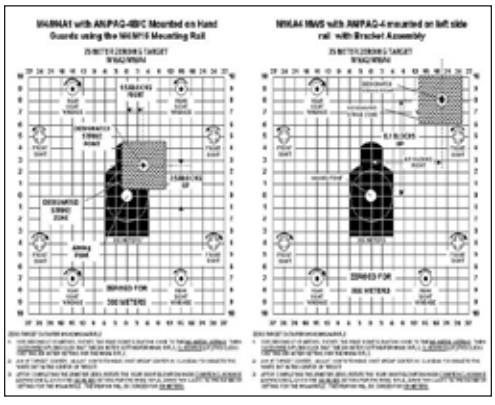
Angular Deviation

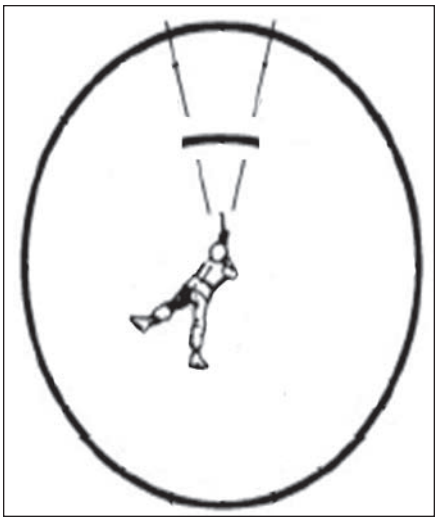
For adjustment, we must understand angular deviation. Imagine the shooter is inside the middle a very large circle with the target on the circle's edge. Any movement or adjustment is an angle from circle center to circle edge where the target is. The range to the target is the circle's radius. Every movement or sight adjustment is a set angle and the size of the circle determines how much that adjustment moves at the target. With the target half as far away, the same size angle or sight adjustment moves half as far.

Anyone that ever used a compass during Land Navigation understands degrees and that there are 360 degrees in a circle. There are always 360 degrees in a circle, no matter how big the circle.

Degrees are far too large for marksmanship and gunnery. A target at 100 yards puts us inside a circle with a 100 yard radius. One degree of angle moves more than five feet at that distance. Just as we can measure length in inches, meters, or miles, we can also measure angles in different increments. Dividing one degree of angle into 60

Below: The Small Arms Integration Book is a huge index of offset data for establishing zeroes at 25 meters. This requires offsets depending on the specific weapon, sight, and mount. The two targets below have correct impact boxes for differing setups. Soldiers that fail to understand this completely fail to zero.

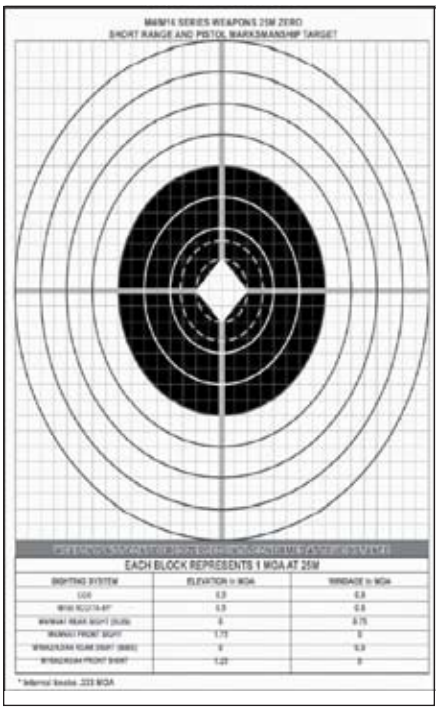


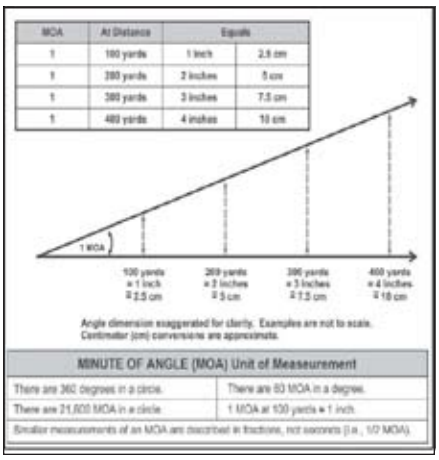


Above: Imagine the shooter in the middle of a very large circle, the radius of which is the distance, with the target on the circle.

equal parts gives us sixty minutes of angle, just like having 60 minutes in one hour. This makes for an angular measure that moves about one inch with a target at 100 yards or so and close enough when measuring in meters.

The same idea works with mils, short for milliradian. A circle has two pi radians, or just over 6.283 radians. With metric measurement, the mil- pre-fix indicates thousandths. That measures about 6,283.18 mils in a circle. For simplicity, the military often rounds this to 6,400 mils – a so-called artillery mil.





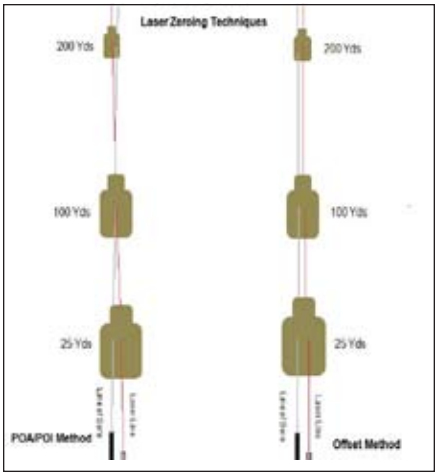
New Zero Target

The new zero target demands understanding of these concepts.

In the center is a 4 MOA diamond and dashed circle, surrounded by a 6 MOA (4cm) dashed circle, same size as old zero target. This is surrounded by 8, 12, MOA rings inside a 16 MOA bull (4-inch black circle, which scales the same as B-6 NRA bull at 50 yards.) Around this are 20, 24, 28, 32 MOA circles (5, 6, 7, 8 inches, respectively.) The entire target has 1 MOA grid squares. Soldiers are expected to learn MOA/mils and use as appropriate.

Notice the grid is in an even adjustment of one minute when placed 25 meters downrange, not for any particular sight's adjustment. No cartoons or pictures show which way to turn the sight for a desired adjustment. The Army's current doctrine for zeroing procedure demands Soldier understanding of their issue equipment. The Technical Manuals list appropriate offsets as needed. Of course, because the laws of physics haven't changed, the data in the Small Arms Integration Book is still a valid resource. That will take research on your part.

For lasers, it's likely ideal to establish a fixed offset instead of a crossing point of aim/point of impact zero. The offset method zeroes the windage setting of the laser to remain constantly parallel to the line of bore at all ranges.



Zero Confirmation

The most important step in the zeroing process is confirmation at full distance. If we're supposed to establish a 300 meter zero then confirmation is needed at 300 meters. The 25-meter exercise is a "nearo" that does not guarantee a center hit at distance. The only way to rely on a 300-m hit is to confirm a 300-m zero.

Confirmation can be done on any range where shooters can see the impacts of their rounds. Groups should be fired and aiming devices should be adjusted. At a minimum, the confirmation should be done at 300 meters or similarly-appropriate zero distance. If rounds are available, groups can be fired at various ranges to show the firers where their impact will be.

When confirming zero at ranges past 100 meters, the effects of the wind needs to be considered and acted upon, if necessary. If a zero is confirmed at 300 meters on a windy day, and then the weapon is fired at a later date in different wind conditions or no wind at all, the impact will change. USARCMP