Weapon and Navigation HUD Modes

When the IFFCC switch on the AHCP is placed in the ON position, there are five master HUD modes that you can cycle through using the Master Mode Control Button on the control stick.

· **NAV**. Navigation data only with no weapon delivery symbology.
· **GUNS**. Select and display multiple gun sight options.
· **CCIP**. Bombing symbology for Continuously Computed Impact Point delivery including Consent to Release(CR) modes. Maverick delivery also uses the CCIP mode.
· **CCRP**. Bombing symbology for Continuously Computed Release Point delivery for illumination flares, unguided bombs, laser-guided bombs, and Inertially Aided Munitions (IAM).
· **AIR-TO-AIR**. Display symbology for Air-to-Air gun and AIM-9 missile.

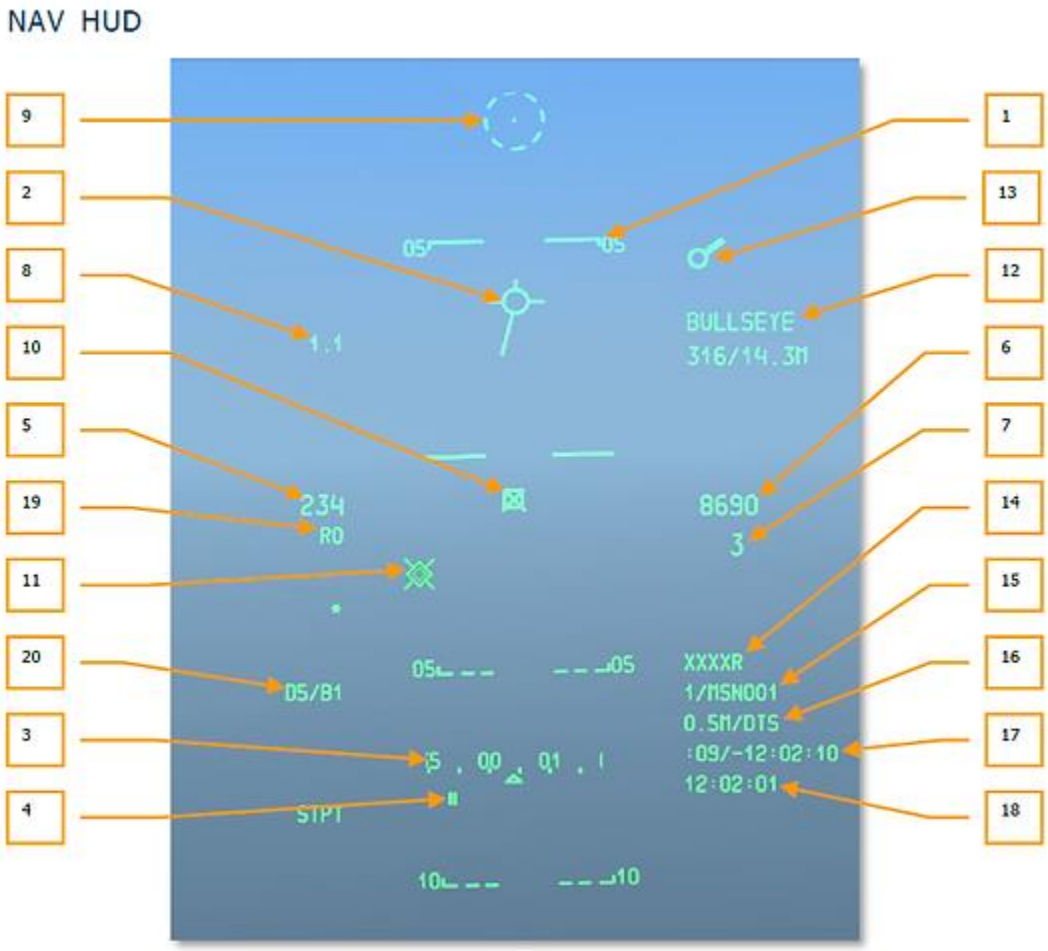


Figure 268. Basic Navigation HUD Symbology

1. **Flight Path Ladder**. The flight path ladder consists of three or four ladder lines that indicate the aircraft flight path angle over a range of ±90º. The ladder is a tape scale without minor increment marks that moves past the TVV and uses the entire FOV of the HUD for display. The ladder lines are labeled in 5º increments of flight path angle and have tabs at each end pointing toward the horizon line. Dashed lines indicate negative flight path angles, and solid lines indicate positive flight path angles. The flight path ladder also indicates aircraft roll anglesof 0º - 360º by rotating around the TVV.

2. **Total Velocity Vector (TVV).** The TVV consists of a circle with three lines extending outward from the circumference at the 12, 3, and 9 o'clock positions. The TVV indicates the aircraft inertial velocity vector. At the horizontal limit in the HUD, an arrowhead is displayed at the end of the horizontal line that points toward the computed TVV position. You would most often see this in windy conditions. In CCIP mode, the gun cross will occult the Total Velocity Vector if Y is selected for CCIP GUN OCCULT in the DISPLAY MODES sub menu.
3. **Heading Tape / Scratchpad**. The heading tape scale is a tape of increment marks and numeric s indicating magnetic heading. A fixed index pointer indicates the magnetic heading.Each mark on the tape represents 5º of magnetic heading, and a 2-digit label is provided at each 10º interval. When text or numeric data is entered on the UFC or CDU, the scratchpad appears in this area and replaces the heading tape and desired magnetic heading.
4. **Desired Magnetic Heading**. The desired magnetic heading is displayed as 2 vertical lines under the tape at the magnetic heading. It indicates the desired magnetic heading to the selected steer point. If the desired heading is off the scale, the desired heading numeric and an arrow are displayed on the side of the shortest turn to the desired magnetic heading.
5. **Airspeed**. Airspeed is displayed as a 3-digit numeric. The airspeed range is 50 to 500 knots. A "T" is displayed to the right of the displayed value for true airspeed, a "G" for ground speed, or no letter for indicated airspeed.The power-on default is indicated airspeed. The airspeed numeric will flash when the master caution light is activated. Display options are changed from indicated to true to ground via the IFFCC Test menu.
6. **Barometric Altitude**. The altitude display is in feet and is displayed up to 5 digits. The barometric altitude range is -2,000to 38,000 feet and is displayed to the nearest10 feet. In NAV and Air-to-Air modes, the display is the uncorrected CADC barometric altitude. The displayed altitude in these modes should be the same as the cockpit altimeter. In GUNS, CCIP, and CCRP Modes, the displayed altitude is corrected by LASTE for installation errors, non-standard temperatures, and non-standard pressures.
7. **Flight Path Angle**. The flight path angle is displayed below the altitude numeric. A minus sign is displayed for negative values, and positive values are unsigned. The flight path angle has a range of -90º to +90º.
8. **G-Meter**. The Digital G Meter provides a HUD indication of aircraft load factor and is displayed at a fixed point in the top left corner of the HUD. The G value is displayed to the nearest tenth of a G, and ranges from +9.9 to -9.9 G's. If the aircraft load factor exceeds this limit, the displayed value is clamped at the limit.
9. **Depressible Pipper**. The Depressible Pipper/Reticle is a dot at the center of a dashed circle. The circle consists of eight equally spaced dashes and gaps. Using the manual depression control on the UFC, the pipper can be positioned vertically from +10 to -300 mils with respect to the zero-sight line, and it is fixed horizontally on the HUD center line and not wind- corrected. The DEPR rocker switch on the UFC enables the depressible pipper/reticle to be manually depressed over a range of +10 to -300mils referenced to Zero Sight Line (ZSL). Individual, momentary depressions of the rocker switch move the applicable pipper up or down one milliradian. The mil depression of the depressible pipper is displayed over the HUD displayed FOM values while adjusting the pipper and for 3 seconds afterward.
10. **Target Designation Cue (TDC)**. The TDC is always displayed when the HUD is the Sensor of Interest (SOI). Initially, the TDC will appear caged within the TVV. The TDC can then be slewed to any location within the HUD Field of View (FOV). When slew is released, the TDC will attempt to compute a position on the ground (latitude, longitude, and elevation). If

successful, the TDC will ground stabilize on that point. If unsuccessful (location > 13nm away), an “X” will be drawn over the TDC and the TDC will be HUD stabilized with an “X”indicating an invalid designation. In this condition, the TDC cannot become the Sensor Point of Interest (SPI). Even if the HUD is not SOI, commanding slave to SPI will slave the TDC to the position of the current SPI. The TDC remains slaved until the SPI changes or until the HUD becomes SOI and the Slew Control switch is used to move the TDC. When the position designated by a ground stabilized TDC is outside the HUD FOV, but within 60 degrees of the aircraft nose, the TDC symbol is clamped to the HUD FOV on the appropriate side of the HUD. If the position is outside the HUD FOV and outside of 60 degrees of the aircraft nose, the TDC is clamped to the HUD FOV and horizontally stabilized to the TVV. The following HOTAS functions apply when HUD is SOI:

· **Ground Stabilize** (TMS Forward Short). Ground stabilize happens automatically after slewing as long as a position on the ground can be calculated; additionally, while the TDC is still caged within the TVV, this command will attempt to ground stabilize the TDC. If successful, the TDC will ground stabilize on that point. If unsuccessful (location > 13nm away), an “X” will be drawn over the TDC and the TDC will be HUD stabilized with an “X” indicating an invalid designation. If TMS Forward Short is selected while the TDC is HUD stabilized with an “X” drawn over it, the TDC will again attempt to establish a position on the ground. If successful, the TDC will ground stabilize; if unsuccessful, the TDC will remain HUD stabilized, with an “X” drawn over the TDC.

· **Make SPI** (TMS Forward Long). This will make the current TDC location the SPI. If TMS Forward Long is selected while the TDC is HUD stabilized with an “X” drawn over it, the TDC will attempt to establish a position on the ground.If successful, the TDC will ground stabilize and become the SPI. If unsuccessful (location > 13nm away), the TDC will remain HUD stabilized, with an “X” drawn over the TDC and the TDC will not be made SPI.

· **Mark point**(TMS Right Short). Create mark point at TDC line of sight intersection point with ground.This only functions with a valid TDC (no “X” indication).

· **Reset SPI** (TMS Aft Long). When the SPI is reset (HUD Mode or Steer point), the TDC remains ground stabilized at its current location.

· **Recage** (China Hat Aft Short). Re-cages the TDC to TVV. If the TDC was the SPI, the SPI will change to default for the current HUD Mode.

11. **Pave-Penny Cue Index**. The PAVE-PENNY Cue Index is displayed as a dotted line extending from the TVV to the TISL Spider when the Spider is outside the HUD FOV. The dotted line is removed once the target enters the HUD FOV. If the TISL Spider is within the HUD FOV when lock on occurs, the PAVE-PENNY Cue Index appears for 2 seconds and is then removed. The purpose of the index is to provide a method for acquiring the TISL Spider and distinguishing it from the TD Box during maneuvering. With the removal of the Pave Penney and TISL panel,this symbol is no longer present in the A-10C.

12. **Anchor Point Display**. The HUD Anchor Point display indicates the position of the aircraft relative to the preselected Anchor Point (selected via the CDU Anchor Page). Anchor Point data is displayed in the upper right corner of the HUD anytime an Anchor Point is selected from the Navigation Mode Select Panel. If no Anchor Point is selected, no HUD Anchor Point is displayed. The HUD Anchor Point display has two lines. The first line displays the way point ID of the selected Anchor Point. The second line displays two items separated by a slash (/): · Magnetic bearing from the Anchor Point to the aircraft (3 characters from 001 to 360). · Ground range from the aircraft to the Anchor Point.

13. **Destination Index (Tadpole)**. The destination index is a circle with a double radial line (strobe) extending out from the circumference. It is displayed when the selected steerpoint is outside the HUD FOV and the steerpoint is not the current SPI. The strobe indicates relative bearing to the selected steerpoint over a range of 0-360 relative to the 12 o'clock position. If the tadpole is not clamped to the HUD FOV limit, the position of the tadpole represents the relative bearing to the selected steerpoint.
14. **Radar Altitude**. The radar altitude numerics consist of 4 digits followed by an "R" and are located on the lower right of the HUD below the altitude. The numerics display altitude to the nearest 10 feet. If the Radar Altitude is invalid or above 5000' AGL, the display is"XXXXR."
15. **Steerpoint Number and ID**. The steerpoint database number and ID are displayed at a fixed position on the lower right side of the HUD FOV. The steerpoint number consists of up to four characters, as provided by the CDU. All mission waypoints are designated 0–50; all navigation waypoints are designated 51–2050; and all mark points are designated A–Z. The selected steerpoint ID consists of up to 12 alphanumeric characters.
16. **Steerpoint Distance to Go and Target Elevation**. The Steerpoint Distance-to-Go Numeric shows the ground distance to the current steerpoint. The display consists of up to a 4-digit number followed by "M"; when the distance-to-go is less than 10, a decimal point and a tenths digit are displayed. The second half of the line indicates the target elevation at the location of the CCRP reticle.
17. **Time to Go (TTG) and Time on Target Delta (TOT)**. These values are used when a set Time On Target (TOT) is created in the CDU and it allows you to better reach your target steerpoint on time. The TTG indicates the estimated time it will take to reach the steerpoint and the TOT estimates the time difference between when you will reach the steerpoint and the TTG. The delta value can be negative or positive.
18. **Current Time / HACK**. This indicates the time in hours:minutes:seconds in regards to GMT. In addition to the TTG/TOT functionality, this field also serves to display the Hack time.Hack time is a handy way for you to input a time duration on the UFC and then have that time countdown in this field. To do so, select HACK from the UFC and use the keypad to enter a time duration in minutes:seconds (XX:XX). When complete,press the UFC ENTER button and the inputted time will appear in this field and begin counting down. To return to current GMT time, press the HACK button again.
19. **Required Airspeed**. When a Time on Target has been set, this numeric below the airspeed will indicate the airspeed you need to be flying at to reach your steerpoint at the defined time. This field can also display the airspeed Mach value when the IAS/MACH airspeed option is selected from the IFFCC Test Menu.
20. **DTSAS Mode and FOM Message**. This field displays the DTSAS mode and FOM message as set on the EGI CDU. GUNS HUD When selecting GUNS mode, you enable the HUD for exclusive use of the gun with multiple gun aiming sights.Symbology and functionality of this HUD includes:

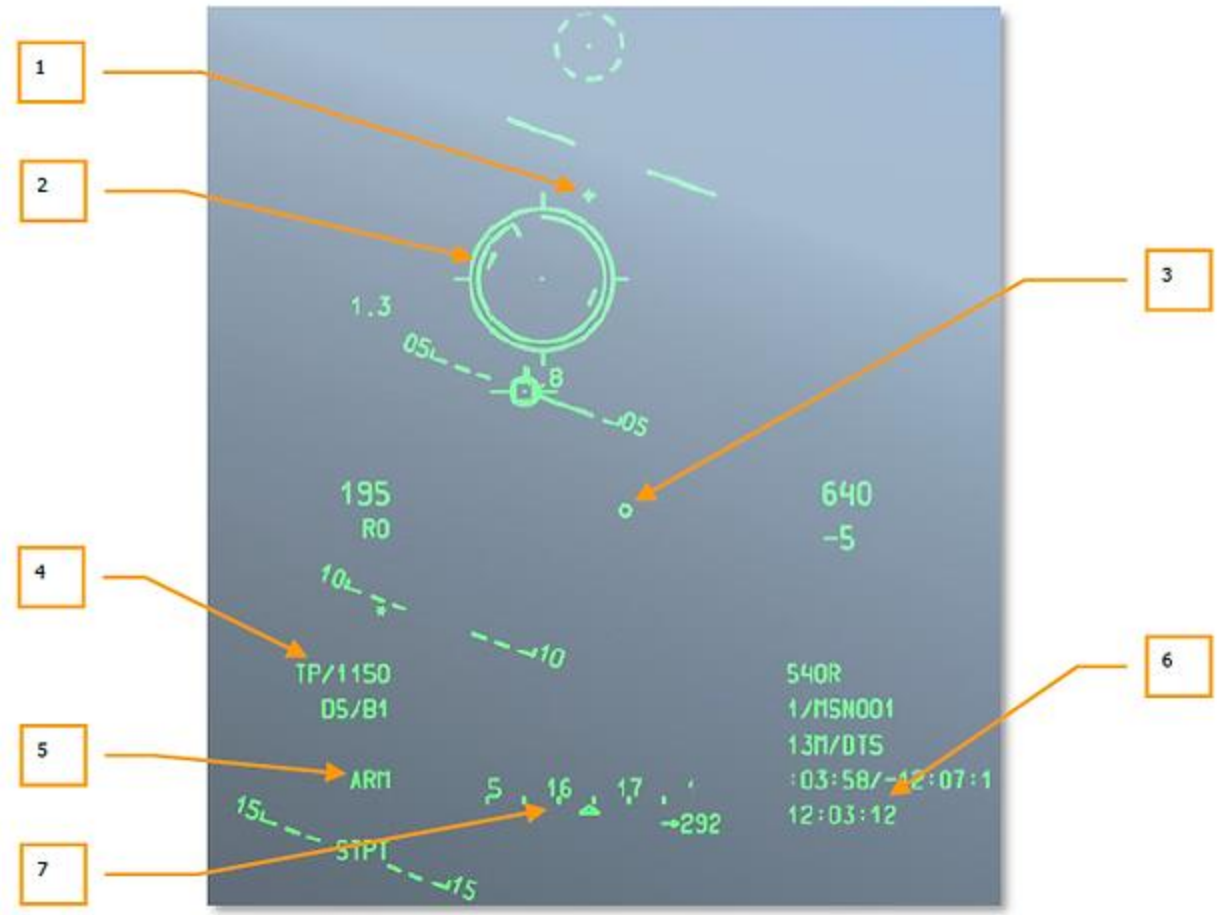


Figure 269. Gun HUD Symbology

1. **Gun Bore Line (GBL) Cross**. This cross represents the longitudinal axis of the 30 mm gun. When in GUNS mode, you may cycle between four different gun-sights. These can be cycled using DMS Left or Right Short when the HUD is SOI.

2. **CCIP Gun Reticle.** The CCIP gun reticle consists of a pipper centered in a reticle. Radial hash marks extend outward from the reticle at the 3, 6, 9, and 12 o'clock positions.

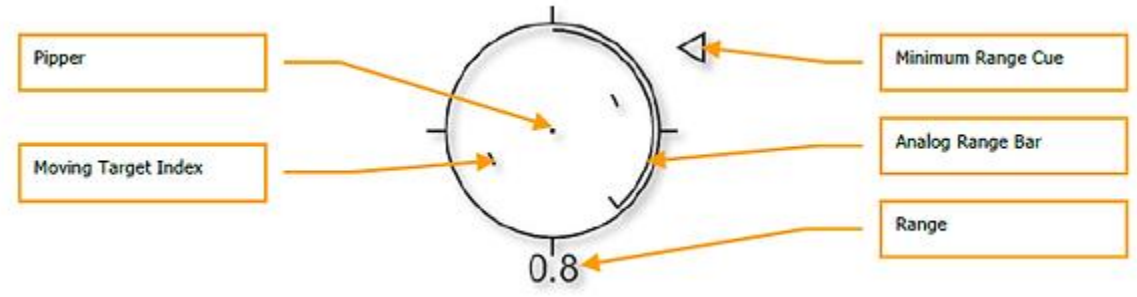
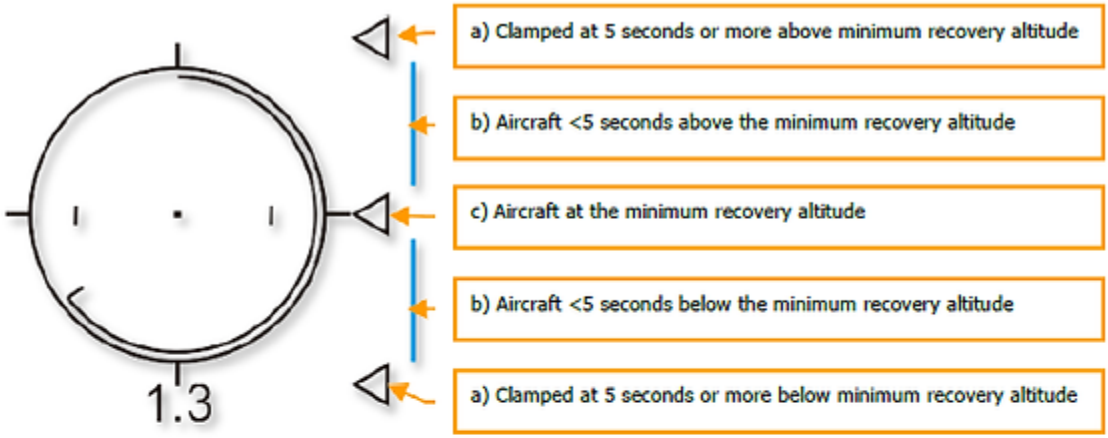


Figure 270. Gun CCIP Reticle

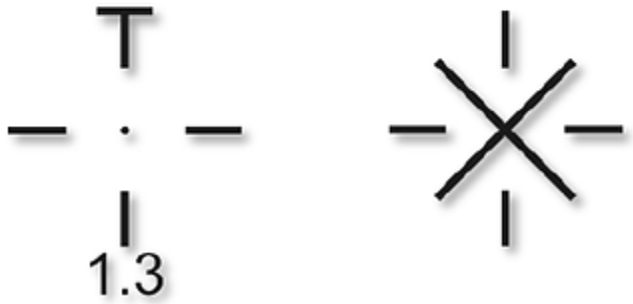
An Analog Range Bar extends around the inside of the reticle clockwise from the 12 o'clock position to a clock position that indicates the range (to the CCIP) in thousands of feet (for

example, 5 o'clock = 5,000 feet). A tick marks the end of the analog range bar. For ranges greater than 12,000feet, the range bar is clamped at 12,000 feet (12 o'clock position).
When CM ammunition load is selected, there will be two pippers in the center of the reticle. The center most one indicates predicted impact point on Armor Piercing (AP) rounds and the one to the lower right is for High Explosive Incendiary (HEI) rounds. The image above shows the reticle with HEI or TP loading. The 2-digit numeric displays the Range in nautical miles beginning at 0.1 and increasing to 9.9. The numeric then changes to an integer beginning at 10 and increasing to 99. The reticle contains Moving Target Indices that consist of vertical lines on either side of the pipper. The position represents the lead required for a target moving at 20 knots perpendicular to the LOS. The Moving Target Indices are roll stabilized such that an imaginary line between the vertical lines passing through the pipper remains parallel to the horizon.
An "X" in the middle of the reticle indicates no solution due to lack of an altitude source or the solution is below HUD FOV. In this case, the analog range bar will not be present, no range numeric will be shown, and the reticle will be clamped at a maximum range solution. It will still be roll stabilized and wind-corrected. A Gun Minimum Range Cue (MRC) is a triangle used to calculate a minimum recovery altitude using the minimum altitude from IFFCC 30 MM IFFCC Test Sub-menu setting.



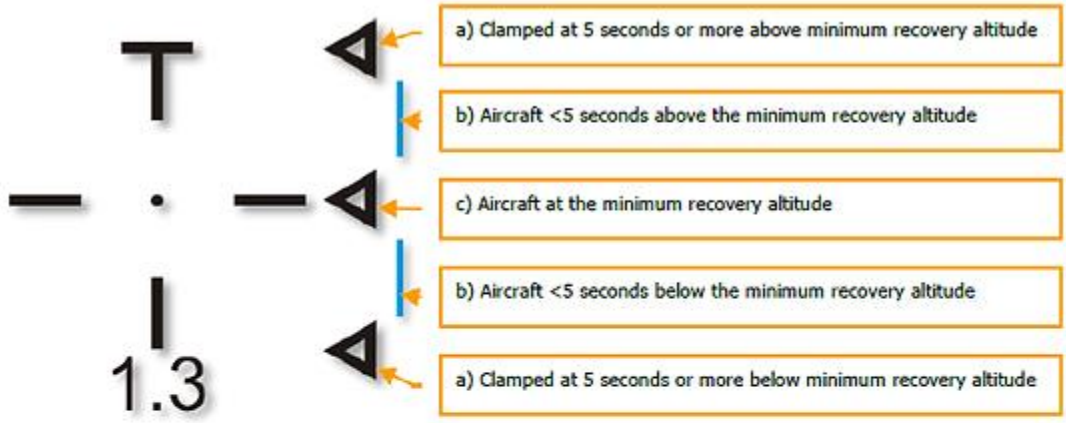
The three other gunsights include:

CCIP Gun Cross

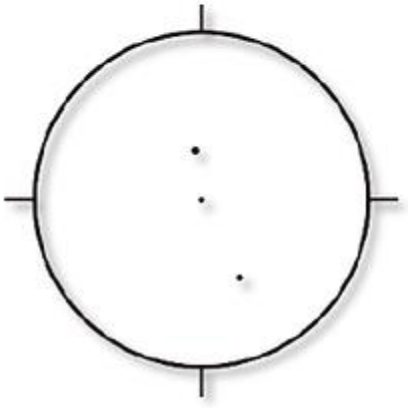


The CCIP gun cross displays the same computed impact point as the CCIP gun reticle,using more compact symbology. A 2-digit numeric displays the range in nautical miles beginning at 0.1 and increasing to 9.9. The numeric then changes to an integer beginning at 10 and increasing to 99. An “X” in the middle of the cross indicates no solution due to lack of an altitude source or the solution is below HUD FOV. In this case, the horizontal bar will not be present,no range numeric will be shown, and the cross will be clamped at a maximum range solution. It will still be roll stabilized and wind-corrected. A Gun Minimum Range Cue (MRC) is a side triangle used to calculate a minimum recovery altitude using the minimum altitude from IFFCC 30 MM Sub-menu. This caret also provides the time-to-go indication before aircraft recovery from the gun pass must begin.

4/8/12 Gun Reticle



4/8/12 Gun Reticle



The 4/8/12 Gun Reticle is a degraded mode of the CCIP Gun/Pipper Reticle which displays a reticle with three wind-corrected fixed range pippers representing 4,000-, 8,000-, and 12,000-foot slant ranges and no Analog Range Bar. It is primarily used when inaccurate target elevation information prevents an accurate CCIP solution.

4000-Foot Wind Corrected Gun Cross

The 4000 ft Gun Cross is similar in appearance to the CCIP gun cross, except it has no horizontal bar at the top and no range numeric. It displays a 4,000 foot wind-corrected slant range solution.It is primarily used when inaccurate target elevation information prevents an accurate CCIP solution.

3. **Bullets at Target Altitude(BATA) Circle**. This small circle on the HUD is calculated using CCIP gun ballistics and represents the estimated impact of gun rounds based on time of flight.
4. **Round Type and Remaining Number**. This field indicates the type of gun round loaded(TP, HEI or CM) and the number of rounds remaining. The remaining rounds decrement in increments of 10.
5. **Weapon Status Indicator**. This field is set according the position of the Master Arm switch on the AHCP. When set to ARM, ARM is indicated in the field. However, if SAFE or TRAIN are selected on the AHCP, these are also indicated on the HUD field.
6. **Current Time / HACK**. This image shows an example of the field in current time mode.
7. **Heading Tape / Scratchpad.** This field displays either the heading tape or the HACK time.