Feature

Mavericks, Rockets, and the Gun

Air To Mud Shooting In The Hog

by **Andy Bush**

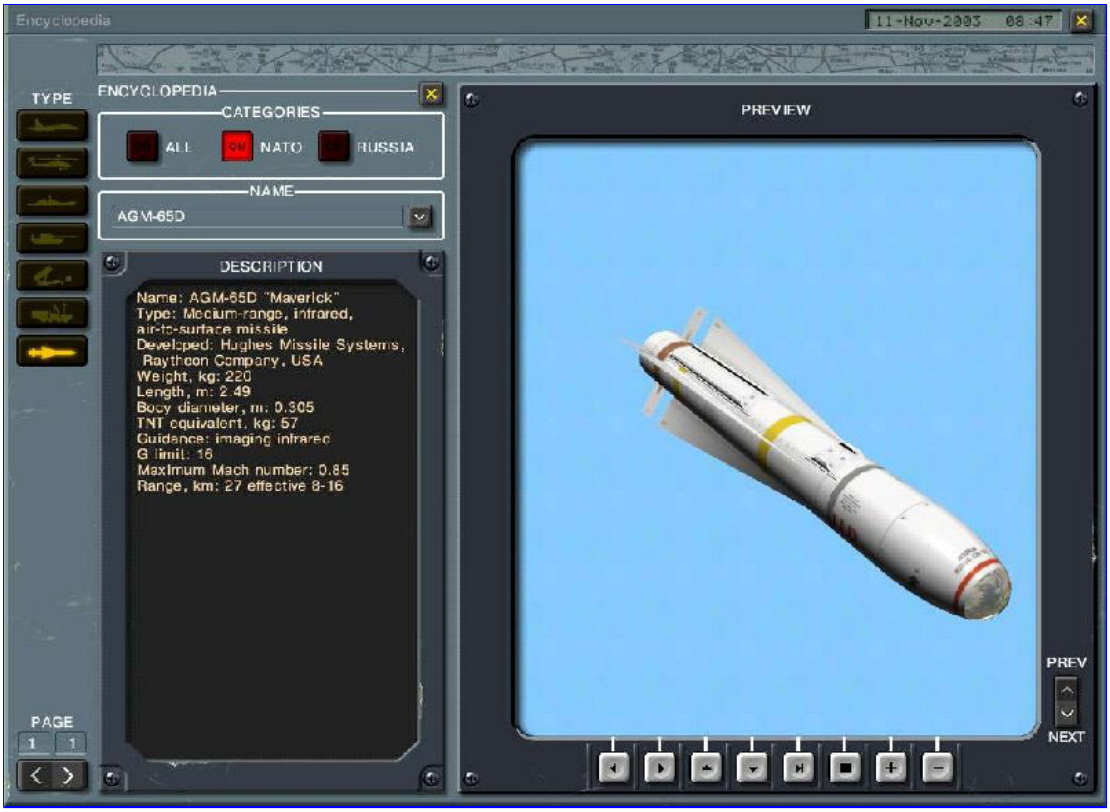
Let's talk a little about how to employ the forward firing ordnance in the **LOMAC A-10**. While "point and shoot" has a certain simplistic ring to it, sometimes it just isn't that easy. In this article, we'll take a look at HUD presentations, weapon switchology and capabilities, and employment techniques.

AGM-65D/K Maverick Missile

When you build your A-10 missions in LOMAC, you'll have a choice of two types of Maverick missiles, the K and D models. You may choose from a variety of weapons combinations, and typically you may carry missiles of both types. Mavericks are carried on stations 3 and 9 only.

AGM-65K Model Maverick

The K model is an upgraded B and is the electro-optical (EO) version of the missile. It is commonly known as the “TV” Maverick and functions by locking on to the light and dark contrast of a target... for example, a dark tank against a lighter background. If the level of contrast is insufficient for the missile seeker head to “see” enough contrast, then the missile will not lock. Please note that the seeker functions on visible light contrast, so the K model is ineffective at night.



AGM-65D Model Maverick

The D model is the IR (infra-red) version of the missile. Unlike the TV model that functions by light contrast, the D model functions by the contrast in IR signature of a target.

All objects emit a level of IR energy... this energy is in the form of “waves”, similar to light or radio waves... but is in a different part of the electro-magnetic energy spectrum. The D model seeker head senses this IR energy and displays it to you on the TVM as differences of color. We refer to this as differences of “heat”... ”warmer” objects appear whitish, while “cooler” objects appear dark. The seeker head must see this “heat” contrast otherwise it will not lock.

The D model has one significant improvement over the K model. Whereas the K model must actually “see” light, the D model is unaffected by the level of illumination. The D model will work at night just as well as it does in the day.

Maverick Switchology and Cockpit Displays

For this discussion, I'll refer only to the default keyboard settings. I realize that many of you will modify these settings based on your particular HOTAS system. You have two cockpit Maverick displays... HUD info and a television monitor (TVM) picture. These are separate displays and are independent of each other as far as missile weapon system operation is concerned. In practice, however, you should use them both together to acquire, identify, and complete the lock on/firing process.

Normally, you begin a mission with the HUD in the navigation display. Press the number 7 key to switch to the A2G HUD. You may cycle between A2G munitions by pressing the D key. The HUD display will not tell you which station you have selected... and therefore what type missile is selected. The TVM display is the most obvious indicator since the TV display looks quite a bit different from the IR display. The LOMAC cockpit station select panel will also correctly display what stores are loaded and selected.

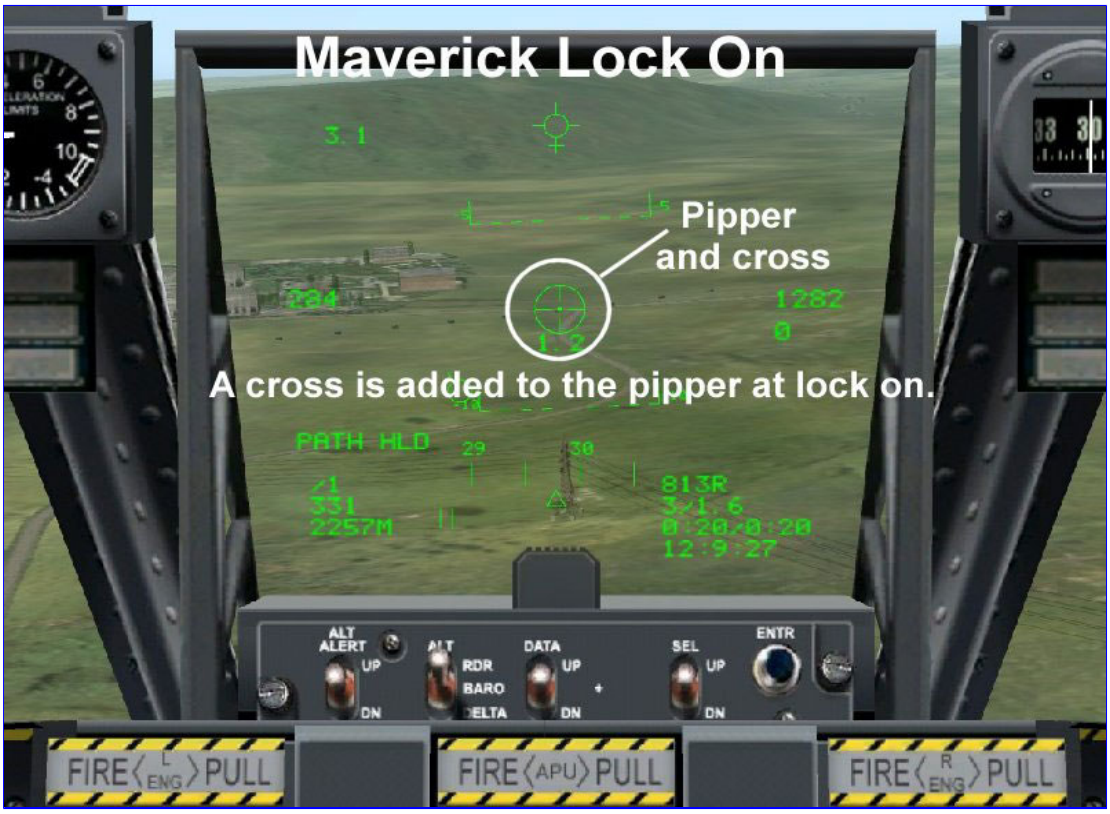
HUD Display

The HUD display is the same for both missile types and consists of an aiming device for the missile seeker head and slant range information from you to the target.

The aiming device is the Maverick pipper, a 25mil segmented circle consisting of four arcs and a center dot. Technically, the dot in the center is the pipper (the circle being the reticle) ...but we'll defer to common practice and call the whole thing a "pipper"!

The pipper is displaced below the gun line about 2 ½ gun reticles or about 4 degrees. Since the gun line represents the approximate aircraft flight path at one g, then you can see that the pipper is located well below the flight path. The flight path symbol on the HUD is the Total Velocity Vector (TVV) as shown in the previous figure.

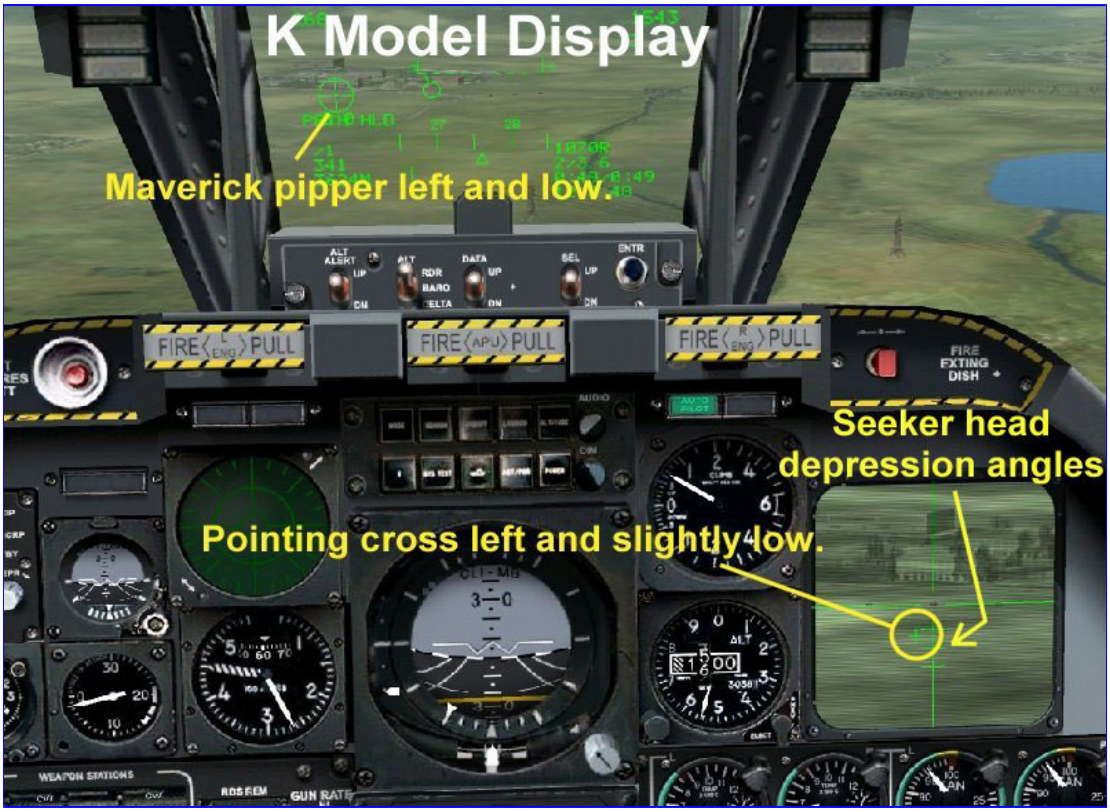
Immediately below the pipper is the slant range in nautical miles to the target. Notice that if you move the pipper up or down that this distance will change. This is because the weapons computer is using your nose position to estimate slant range to where the pipper is pointing. The weapon data box on the lower left of the HUD includes weapon type, number remaining, and slant range to the target in meters.



When you command a lock on (Tab key), the pipper will add a cross inside the reticle. The slant range will continue to be displayed. Once locked on, the pipper will now be free to move in the field of view of the HUD as it tracks the target. Its freedom of movement is approximately +/- 30 degrees, almost to the edge of the HUD frame.

AGM-65K Model TVM Display

Here is the K model TVM picture. This picture is different from any other EO Maverick display that you may have seen in the past. The K model TVM is different looking than the earlier A and B model Maverick TVM displays, but it functions in a similar manner.



The picture at right is a 3X magnified view of where the seeker head is looking. The TVM display is made up of a large “cross-hair” that has a gap where the vertical and horizontal lines meet. This gap is where the target must be in order for the seeker to lock on. Once locked, a target will be centered in this gap. There are three small horizontal lines on the six o’clock leg of the “cross-hairs”. These are seeker head angle indicators and represent seeker head angles of 5, 10, and 15 degrees below the Maverick launcher rail. A small cross is also visible. Called the “pointing cross”, this display shows where the seeker head is pointed relative to the boresight axis of the missile. If the seeker is pointing in the lower left half of the TVM display, then the missile is looking low and left of the boresight axis. The pointing cross will be steady without a lock on and “flashing” (blinking) once the missile is locked on to its target.

AGM-65D Model TVM Display

At right is the TVM display of the D model. The crosshairs, dive angle references, and pointing cross are the same as in the K model. The only difference is that the D model TVM has a magnification capability. The D model has two levels of magnification ..3X and 6X... sort of a close and closer view! The basic view is the 3X picture and is identified by the brackets around the mid point of the TVM. The area inside the brackets represents what you will see when changing to 6X. Use the +/- keys to cycle between magnification levels.

TVM Operating Concepts

The TVM will show what the missile seeker head is looking at. As mentioned before, there are two types of displays, the K model electro-optical (EO) or “TV” display, and the D model infra-red (IR) display. The TVM picture for the EO seeker will appear to be a toned down greenish-gray looking picture. The seeker is tuned for recognizing color contrast (light/dark) and therefore if your targets are similar in color to their surrounding background, then they will be difficult to both see on the monitor and very possibly lock up as well. The EO seeker needs a fair amount of discrimination to be able to lock an object. If you are having a hard time seeing it in the HUD, the chances are very good that the EO TVM picture will be less than optimal.

Background terrain features do not show up well, as the next shot shows (below Left) but close in shots of urban detail often look much more detailed.

It is possible that you may see your target in the HUD and not on the TVM when using the EO missile. Reducing your range is the best way to improve this situation. In real life, we wanted the sun at our backs when using the EO missile... whether this technique applies to the sim is open to debate... but as a

technique, it can't hurt!

When compared to the EO TVM display, the IR TVM picture has a different overall appearance that is characterized by a smaller color range but often sharper detail. You will tend to see a mildly dark background with isolated light and darker images on that background.

In general, the IR display will contain less detail than the EO picture... however, the IR display has a much more powerful ability to discriminate targets. Remember, the IR display is not looking for color contrast... it's looking for a difference in IR radiation levels (we simplify this by referring to this as "heat" levels). Targets are either "hot" against a "cool" background or vice versa.

Any type of pollution in the air can reduce the IR seeker's ability to sense IR radiation... smoke, haze, and humidity play a negative role. But light levels are irrelevant, so the IR missile works great at night!

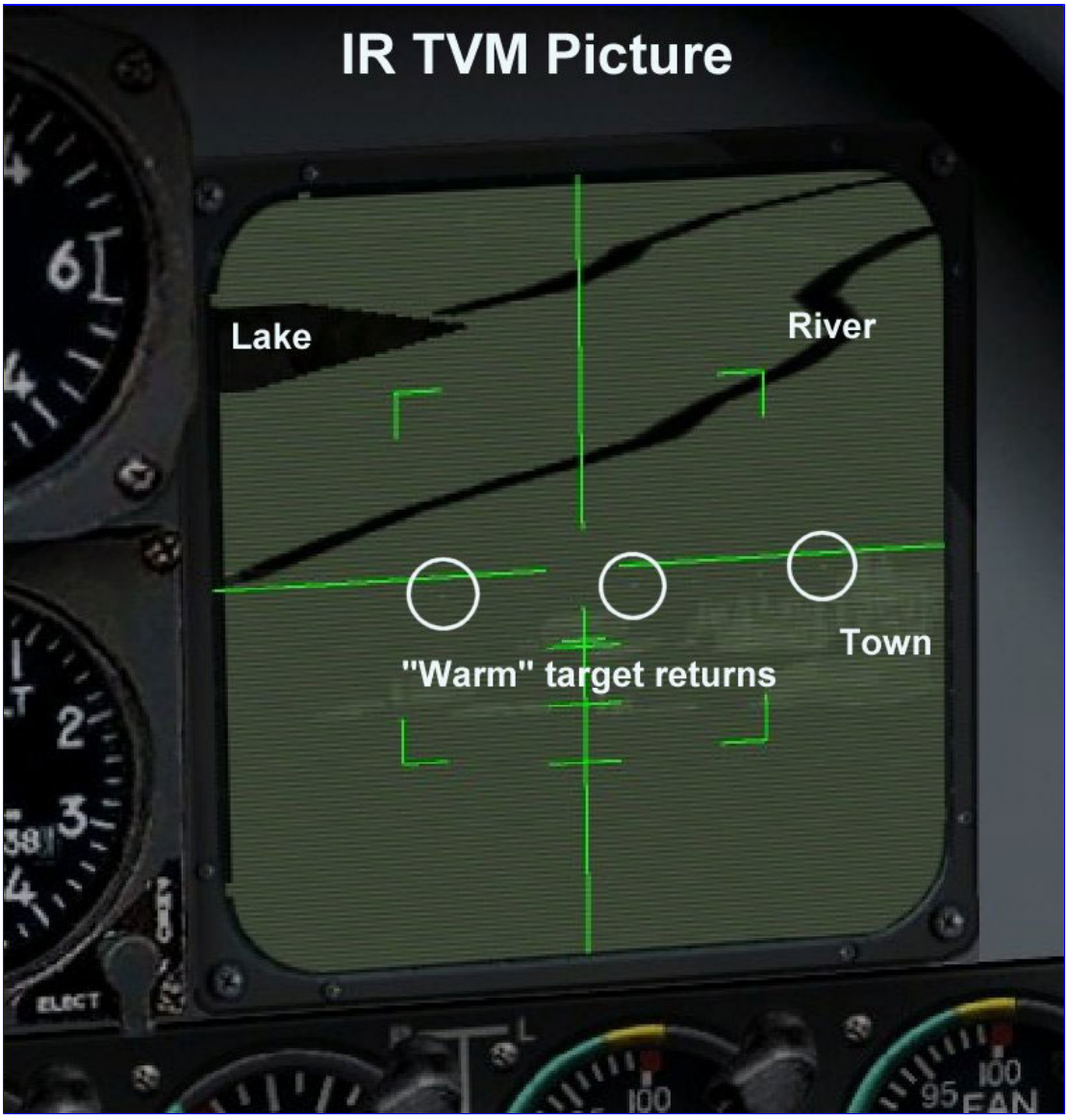
The major advantage in using the IR missile in many cases is its extended target acquisition range capability over the EO seeker. Simply put, you can “see” much further with the IR missile. Here are some screenshots demonstrating this. I’ve pointed the Maverick pipper into a known truck target area while I am a number of miles away... 6nm in fact. This is a long way to be visually acquiring targets the size of trucks and tanks. In this example, I know where the trucks are, so I’m able to get the pipper placed in the general area. Here’s the HUD picture (below left).

Can’t make out any targets with the proverbial naked eye... so I switch to Maverick mode. First, I select the EO missile. Looking into the TVM, I try to find those trucks. I slew the pipper around a little but no joy! There just isn’t enough discrimination at this range to see those targets.

HUD View Of Target Area

EO TVM View Of Target Area

Then I select the IR missile and place the pipper into the same general area. Checking the TVM, this is what I see.



OK... that's better! At this range I can now make out the "warm" returns from the targets (trucks). Also, notice the "cleaner" looking picture... the EO picture is far "busier" but has little usable info. Note... the screenshot quality is less than the actual game video. The IR picture has much less detail, but what is there is more valuable. In addition to the trucks, notice the buildings that are visible and were less so in the EO picture. The contrast between water (lake and rivers) is more obvious in the IR picture, making orientation to the target area easier.

I can fine-tune this attack picture even more by using the 6x magnification feature, called the "narrow field of view". I use the + key to switch to 6x magnification. Here is how it looks. When zooming in like this, you can clearly see target details. Use the – key to return to 3x.

One final note. At this range (6nm), we are very close to the max range of the EO missile... but well within the range of the IR missile. Max range has two parts... the aerodynamic ability of the missile to fly a given distance... and the ability of the missile seeker head to lock on to a target. You may well find in the game that the IR missile has a much better lock on success against small targets.

Weapon Select Panel

In real life, the Hog driver will spend some time with this panel making sure everything is set up right... in the game, the need is not quite so pressing. Use this panel and your keyboard to select the number of weapons you want to drop and the interval that you want them to be released at... but this is primarily for bombs and such. Not a big player when it comes for forward firing ordnance... at least not right now. I say that because the implementation of all weapons panel functions was not finished in the build that I am using for this article. I don't want to hold LOMAC's feet to the fire over real world switchology when it really isn't that important anyway.

Here is the weapons select panel. You will have control over gun rate, Master Arm, but apparently not station select. This means when you select a weapon, rockets for example, you get all stations that have rockets loaded on them... same for Maverick. At this time there is no selective station feature that I see. Perhaps in the gold release!

As I said, not that big of a deal... we're here to have fun... not be a switches weenie!

Maverick Employment Considerations and Techniques

Maverick Select/Reject Switchology

Now that you know what you have and where it's at, let's move on to locking the missile on to a target. I'll talk about tactical considerations in a bit... for right now, here's the lock on procedure.

You have three ways to do this... two using the HUD presentation, and the third using the TVM. When using the HUD, you can fly the jet so that the Maverick pipper overlays a target in the HUD and then command the lock on... or you may fly the Maverick pipper into the general area of the target and then use your Maverick seeker head slewing control to move the HUD pipper over the target. In the TVM example, you can also use the slew feature to slew the picture until the target is under the gap in the TVM crosshairs.

You slew the missile seeker head by using the keyboard semi-colon (;) to move the seeker up, the period (.) to move it down, the comma (,) to move it left, and the slash (/) to move it right. Each press of the key moves the pipper slightly, and it takes about 15 presses to move the pipper from the center to the edge. You may also press and hold the key down to move the pipper rapidly.

There may be a time when you want to break the lock and move to another target. You can do this several

ways. One way is to use the Ctrl-Tab combo to break the lock. You can achieve the same thing by cycling from A2G to A2A and then back again to A2G by pressing the number 6 key and then the number 7 key. A third way is to cycle the A2G weapons types by pressing the D key until to step back to the desired missile, but this is the slowest of the three options.

When selecting A2G weapons, you should expect the Maverick on station number 3 (the left pylon) to come up first. Use the D key to step to the right pylon (number 9 station) if desired. Fire the missile by pressing the spacebar or pulling the trigger.

Slew Limits and Good Lock Indications

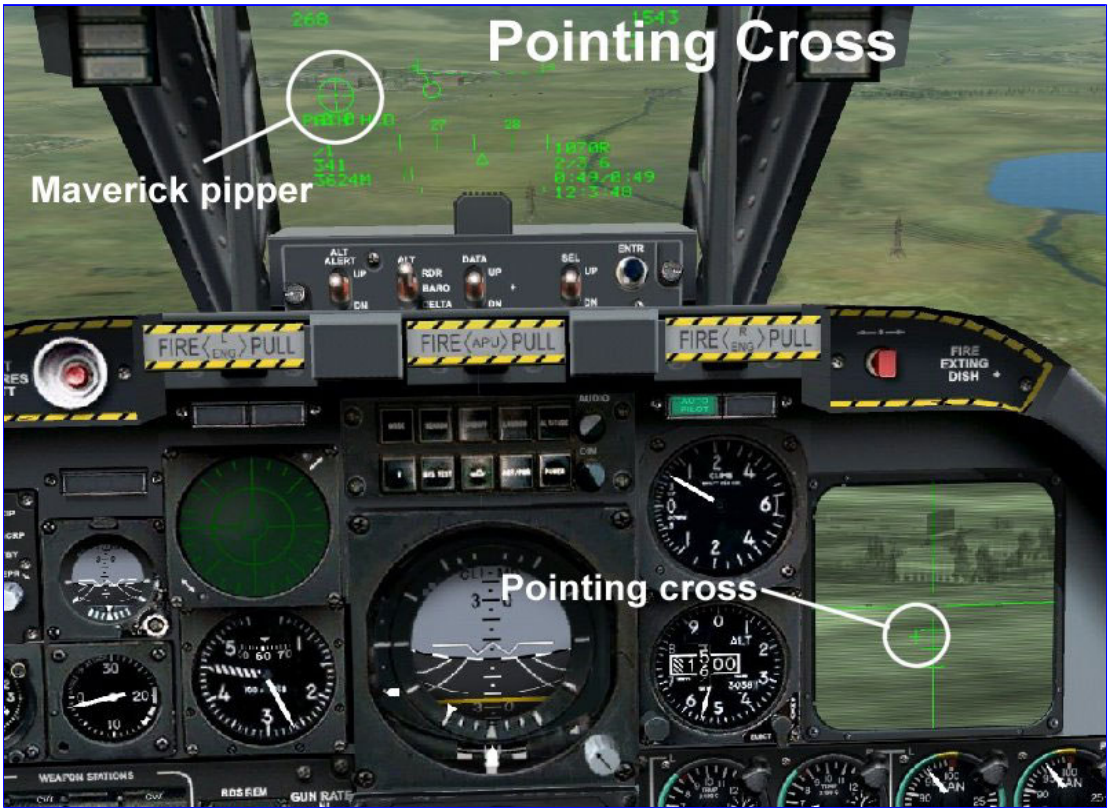
The seeker head on both types of missile can be slewed up/down and right/left within the limits of the seeker design. On the TVM display, the lateral limits are a little less than 30 degrees (the TVM is +/- 30 degrees from center to edge). When you slew the seeker head, the pointing cross will move to show you where the seeker is pointing relative to the missile boresight. Lock ups are possible out to the edge of the TVM, but I suggest that you limit your slewing to about 15 degrees in any direction. The seeker head takes time to move, and it is easier to hold the jet steady for a shorter time than longer! Therefore think of the area inside the brackets as being the practical slew limits, just as a matter of technique. For targets that fall outside these limits, turn the plane to move the targets inside the brackets (when in 3X). When you do this, don't turn using the TVM! Look up to the HUD, make a heading and/or pitch change, and then check the TVM to see if you got what you wanted. It's possible to overcorrect when maneuvering using the TVM.

As far as technique goes, I programmed the slew function to one of the hat switches on the top of my F-22 Pro flight stick. In the real A-10, this control is on the throttle quadrant, but for me, the F-22 control was easier to use than the TQS throttle slew control button.

When to shift magnification when using the IR missile? A good technique is to search and acquire in 3X... and lock in 6X. 6X gives you a better and more precise look at the target array... that way you may be able to isolate that ZSU from a grocery truck!

When it comes to locking targets, be careful to look for two things... the area actually under the crosshairs and a flashing pointing cross. It is not unusual for either seeker type to not lock the exact target you intend to lock. The EO seeker is particularly susceptible to locking a contrasting area that is not the desired target. You have three lock on indications... a HUD Maverick pipper with the lock on cross inside it, a TVM picture with the crosshairs centered on the target, AND a flashing pointing cross.

Here is a shot of a slewed Maverick pipper... it's down and to the left of the gun cross. Notice the position of the pointing cross in the TVM.



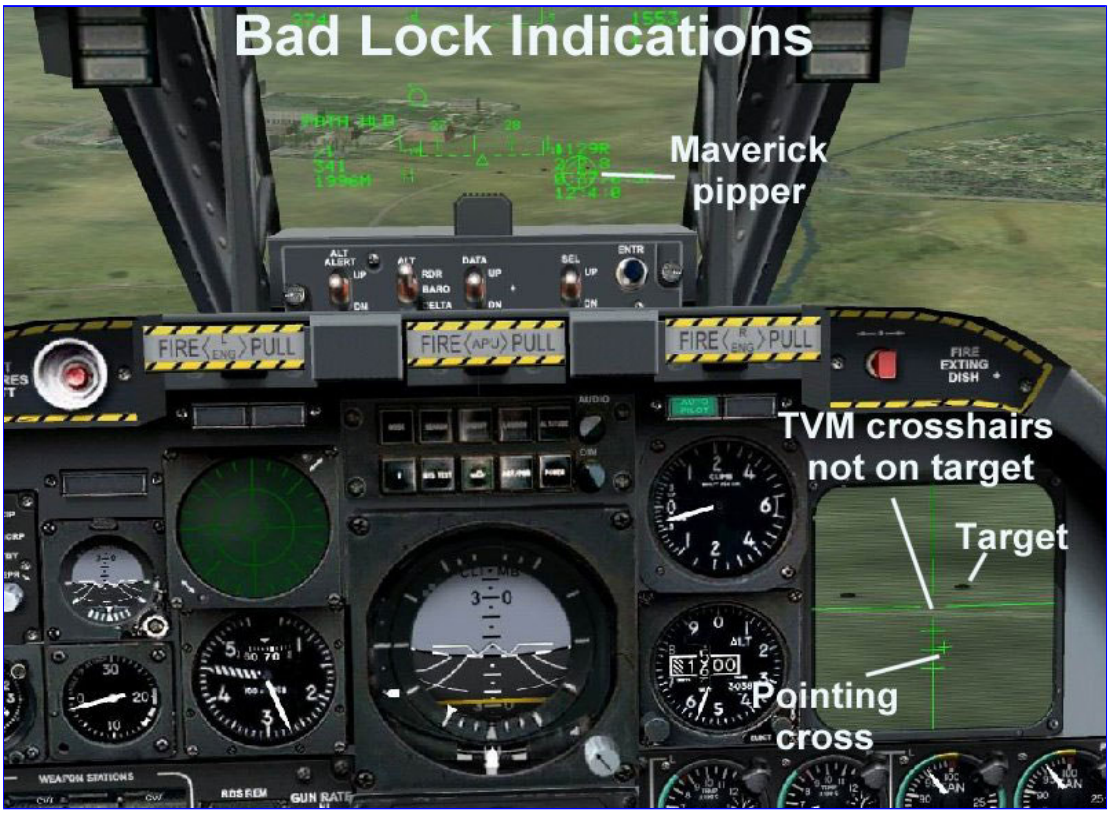
The “normal” position is centered on the 6 o’clock axis and just above the 5 degree depression mark. In this situation, the slewed pipper is close to the flight path, resulting in a pointing cross that is above and right of its normal position. When you slew the HUD pipper, the TVM pointing cross moves in the same direction, up to the +/- 30 degrees of allowable travel.

If locking while using the HUD to point with, once you get the HUD pipper cross, immediately crosscheck your TVM to verify what actually is locked... you want the tank... not the shrub next to it!! (In real life, we referred to these as tactical bushes)!! Then double check to make sure the pointing cross is flashing and visible.

The next shot (below left) shows a slewed pipper with a lock cross symbol and a TVM with the crosshairs centered on the target. The pipper is slewed down and to the left, as is the pointing cross.

What does a “bad lock” look like? Here’s one (below right). The TVM crosshairs are not on a target. The pointing cross is low and offset right as is the HUD pipper. With a picture like this, do not shoot! The Maverick will not self-correct!

Good Lock Indications



Bad Lock Indications

The A-10 Pave Penny laser receiver capability can be used with great effect in LOMAC. Pave Penny targets are placed in the mission during the route and target building process. There is no airborne laser designation capability once the mission is begun... you must program this when the mission is built.

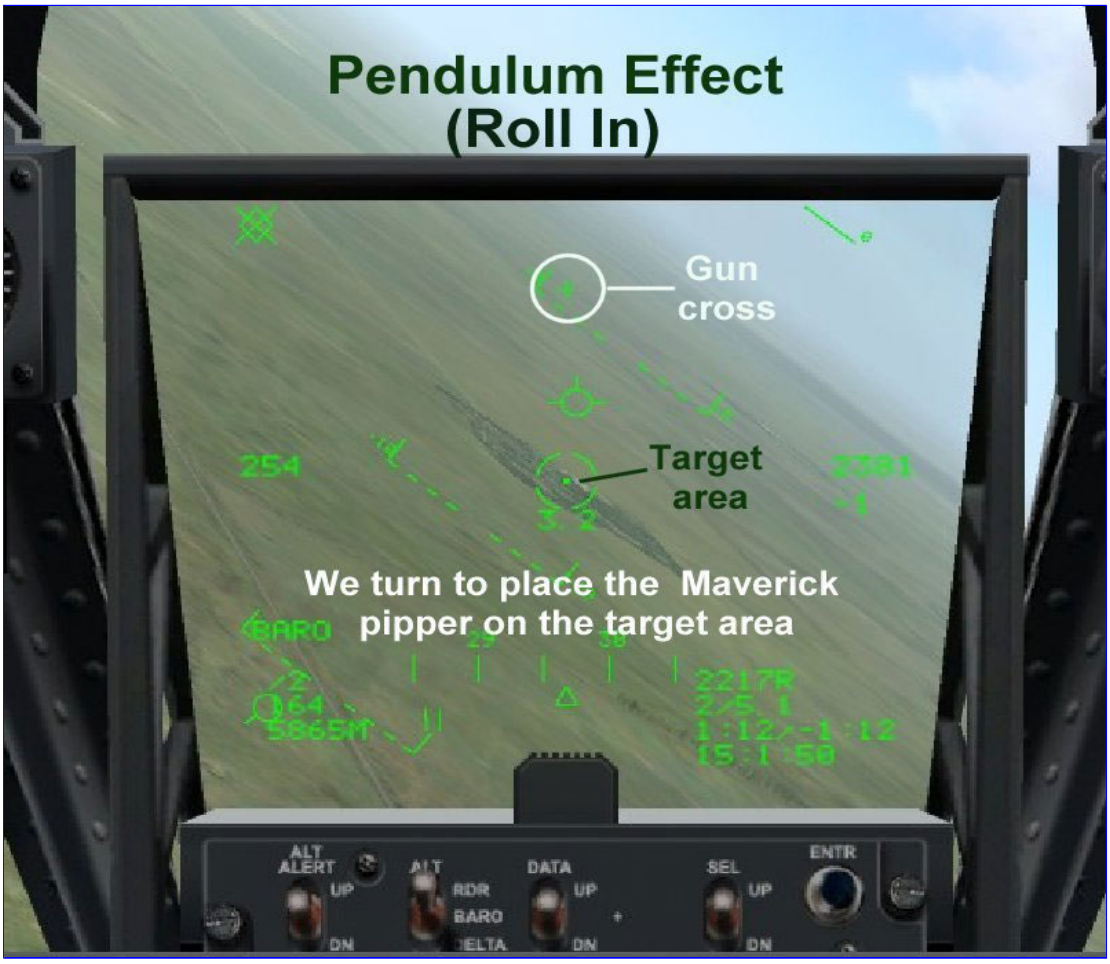
Pave Penny designated targets will be identified by a diamond that appears over the target's location. Often, the diamond (known as the TISL symbol... for Target Identification System, Laser) will be visible long before the actual targets are.

Because of this, you can maneuver to place the Maverick HUD pipper in the area of the TISL diamond and then check the TVM to see if the targets are visible. This is particularly true when using the IR missile. Use the Pave Penny system to increase your stand off distances and thereby reduce the threat level! However... one note of caution. It's not as simple as pointing the HUD Maverick pipper at the TISL, locking, and firing. You must use the TVM to verify what is locked... or if a lock exists at all! You need a steady crosshairs over the intended target and a visible and a flashing pointing cross.

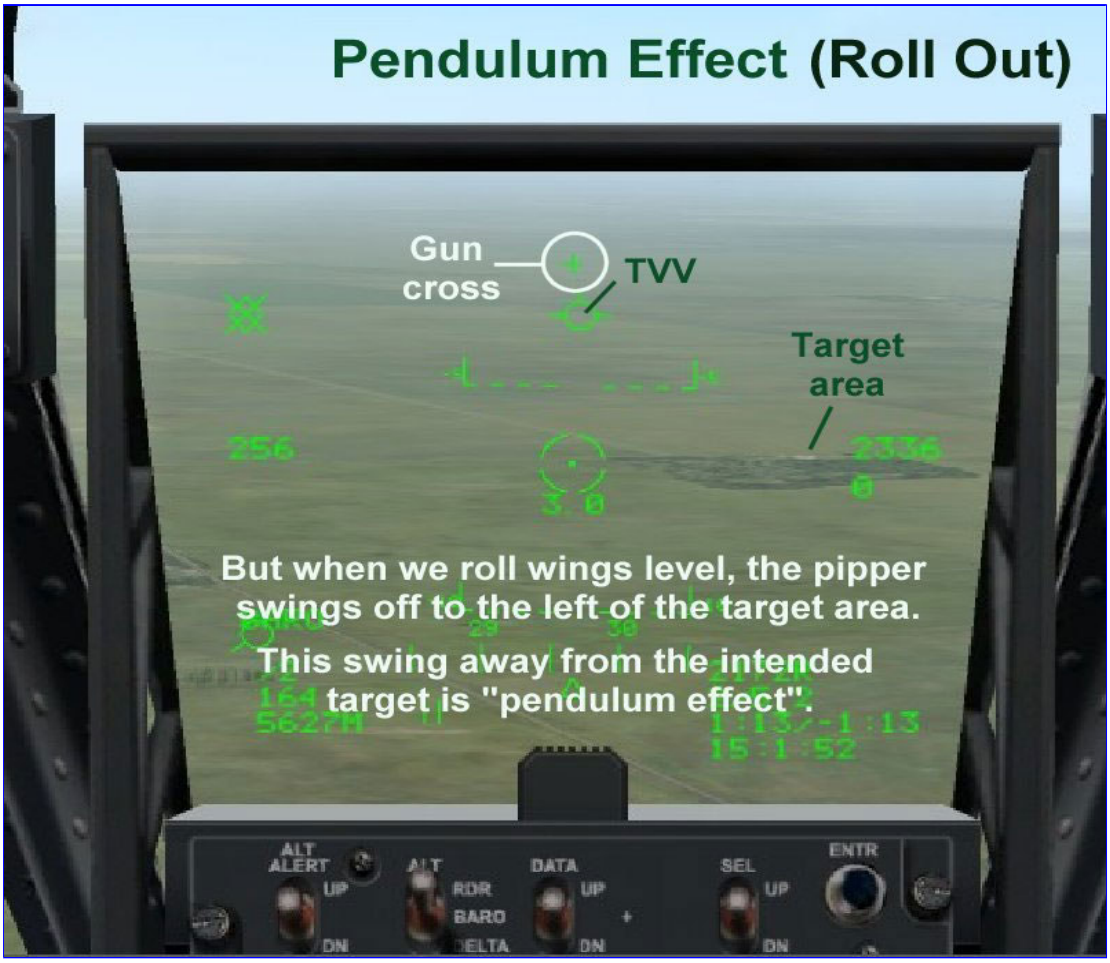
Maneuvering Techniques

When you want to maneuver to aim the jet into a target area, avoid using the Maverick HUD pipper as an aiming cue. Note the top of the HUD display... there is a small cross... this is the gun cross symbol. It is also very close to the aircraft flight path when in one g flight. My suggestion is that you initially maneuver using the gun cross to aim with. The gun cross is close to the roll axis of the aircraft and is a reliable maneuvering and aiming reference. Once you have the gun cross in the general target area, then use the HUD Maverick pipper or the TVM to complete the missile lock. If you try to maneuver with the HUD pipper, you will likely experience "pendulum effect" because the Maverick pipper is well below the roll axis of the jet. Consequently, if you try to place the pipper on the target while in a bank, pendulum effect will often result in lateral overshoots when you roll wings level.

In the next two pictures, I turn to put the Maverick pipper on my intended target area. But when I roll wings level, the pipper swings left to end up a fair distance away. This swing is the “pendulum effect” Note the gun cross position in both pictures. When wings level, the pipper is always under the gun cross (assuming you have not slewed the pipper).



Pendulum Effect (Roll In)



Pendulum Effect (Roll Out)

Here is my technique for quick and effective Maverick aiming. Once the general target area is visible in the HUD, I roll and then pull the gun cross symbol to that target area. I then relax g and roll wings level. The gun cross should remain on or close to the target area... and the Maverick pipper should be pretty much directly below the target area. Now I smoothly add back pressure to raise the nose so that Maverick pipper moves up into the target area. Then I stabilize the aircraft attitude and retrim if needed.

Gun Cross Aiming (Roll In)

Gun Cross Aiming (Roll Out)

Next, I check the HUD or TVM to visually acquire and isolate the desired target. If the target is not under the Maverick pipper or TVM crosshairs (and chances are probably pretty good that it isn't), then I have two options. I can reposition the aircraft or I can reposition the Maverick seeker head. I find the second option... the use of the slewing feature to reposition the seeker head... to be the quickest and easiest. I strongly suggest that you become proficient at slewing the seeker head... it is the quickest way to adjust the seeker head position. Trying to reposition the seeker head by maneuvering the jet takes time... and time is your enemy in a Maverick attack. The longer you take to get a lock, the closer you get to the bad guy's weapons envelope.

OK... let's wrap up this Maverick discussion by restating the high points. Here are the "biggies":

1. Understand how to operate and interpret the Maverick HUD and TVM displays and associated controls, particularly the slew function.

2. Understand the differences in employment of the EO and IR missiles.

3. Understand pendulum effect and why not to maneuver using the Maverick pipper as an aiming device.

4. Be able to lock and reject lock both types of missiles.

5. Understand good lock techniques and indications.

Rockets

In the A-10, you will normally shoot the Hydra 2.75” unguided rocket in both explosive and target marking versions. These rockets are carried in pods that will be loaded directly on to armament pylons.

The major difference between firing a Hydra and firing a Maverick is in their names. The Hydra is a rocket... this means it is unguided. The Maverick is a missile... this means it is guided. The point is not to be taken lightly.

The Maverick has a launch symbology that is only as complicated as is needed to get you into the general ballpark. Then the missile takes over. You shoot it and it does the rest. Not so for rockets.

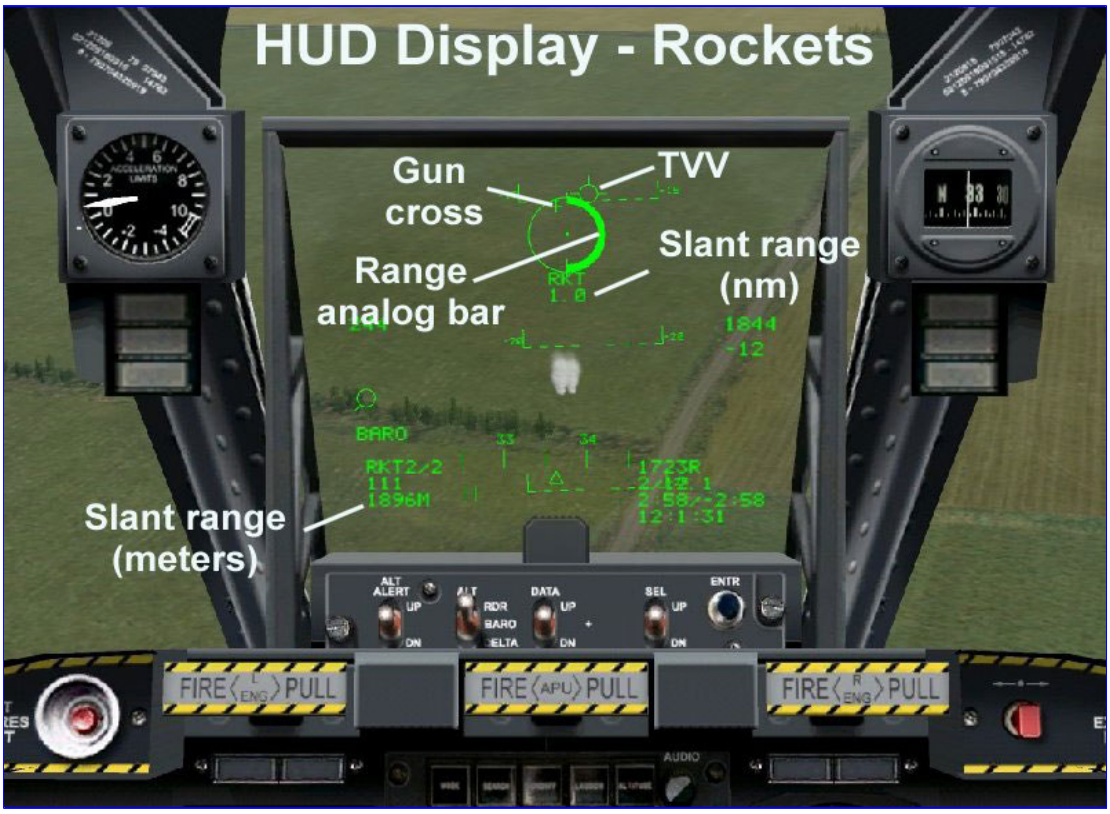
They are the proverbial dumb bunnies... they are only as good as your launch point... so it better be good!

That is why the Maverick only uses a fixed pipper firing reference... while the LOMAC A-10 rocket firing index is a full up continuously computed impact point (CCIP) display. If you can get the rocket pipper on the target and meet launch restrictions, you stand a good chance of getting a hit. Let’s talk a little about getting that pipper on the target and then about your chances of getting a hit.

I won’t go into rocket delivery academics... see the SimHQ article on A2G delivery techniques **here** in the Air Combat Corner Library for that info. Instead, let’s just review a general understanding of what the rocket actually is. Think of a rocket as a powered bomb... and it’s only powered for a brief time. Once fired, the rocket is on its own...like the bomb, it is now at the mercy of gravity and the initial direction that it was fired. It is unlikely that you will ever see a rocket that is the “golden BB”... meaning one release for a sure kill. You will carry lots of rockets... but not to kill lots of targets. Instead, you need a goodly number of rockets to up your hit probability. To use a hunting analogy, the rocket delivery is much more of a shotgun that it is a

scoped deer rifle. A rocket salvo is below.

Let’s start with the HUD symbology for rockets.



HUD Display

The first thing you notice is that the pipper is twice as big as the Maverick pipper (50 mils vs 25 mils), and it moves! That's because the rocket pipper attempts to show you a continuously computed impact point... sort of a "shoot now and this is where the rocket will hit". Next, the pipper has a moving arc...this is a range analog bar that shows slant range in feet to the target out to a maximum of 12,000'. Below the pipper is another range readout...this in nm.

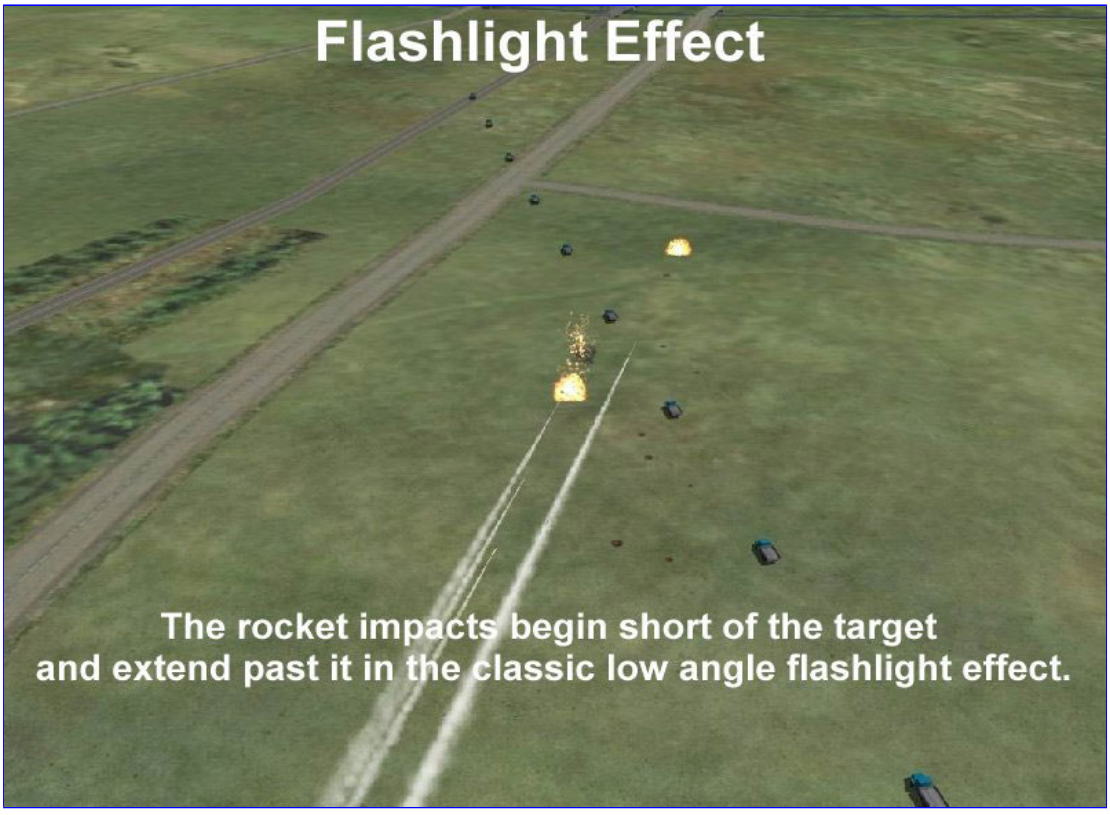
Now, here's a bit of technique and a bit of WAG also (WAG... wild a** guess!)... but I look at the analog bar in the pipper as a sort of maximum-optimum-minimum range indicator. 9 o'clock is max range, 6 o'clock is optimum, and 3 o'clock is minimum. In the following screenshot, I put myself into a dive to check out rocket dispersion. I fired as I was approaching a 6 o'clock analog bar indication.

Note the slant range distance... 1.0nm... or about 6000'. Now rockets have not changed since before I was a Lieutenant (and that was a long time ago!)... so I pulled out my F-104 rocket ballistics tables to check slant ranges vs dive angle. Lo and behold, the tables had numbers very close to the 1.0nm in the screenshot. What does this tell me... well, at least the game has fairly realistic slant range values... and slant range is one of the primary determinants of rocket accuracy. Bottom line... I am a happy camper to see the game values where they are.

Now... how about dispersion? Dispersion is the enemy of forward fired ordnance. It's a fixed value and the further out you fire, the wider the impact area. So it is in the game. My advice on this is to not fire further out than a 6 o'clock analog bar, while avoiding shallow dive angles.

Why avoid shallow angles? Because of what is called the "graze angle". Dispersion acts in all directions... but at lower dive angles, the 6-12 o'clock dispersion is actually spread out along a much further distance than the impacts at 3-9 o'clock. This is known as the "flashlight effect". As the angle of a flashlight beam is shallowed out, the beam pattern elongates... the pattern is the smallest at an angle of 90 degrees and gets progressively larger as the angle lessens. This flashlight effect happens when we shoot rockets at a shallow angle. In this next screenshot, I shoot a salvo of rockets at a convoy. While the pipper placement looks good, the actual rocket impact points are spread out quite a ways due to the flashlight effect.

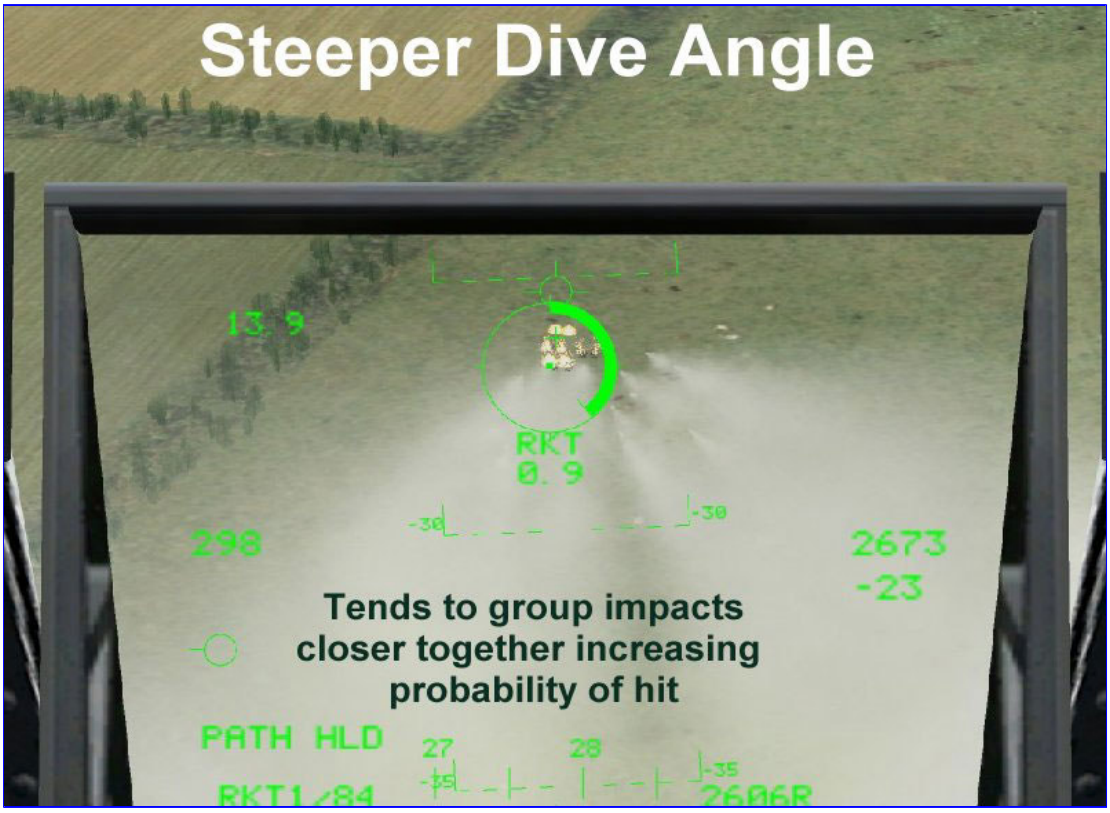
Rocket Firing



Flashlight Effect

In this example, I attack at a shallow angle and the rocket impact area is strung out along the 6-12 axis of my attack flight path. Very small changes in pitch attitude result in relatively large miss distances on the ground. What is the cure for this? Steeper dive angles... and shoot more rockets! Your probability of hit is going to increase with the number of rockets fired.

Here is what a steeper dive angle produces.



Here is another consideration... but a less significant one. Rockets fire straight ahead. They are not “harmonized” like WW2 wing machine guns (no convergence). The rocket pods on the Hog can be as much as 20’ apart... when the rockets impact, they will still be 20’ apart. Can you... or should you take this into account. I don’t think so. Instead I mention it only to reinforce the idea that the rocket is not a surgically precise weapon... it’s an area weapon, and you need to aim carefully and shoot more than one to have a chance at a hit.

Rocket Switchology

Select A2G by pressing the 7 key and then cycle the D key as needed to get Rockets to appear on the HUD. Check your cockpit weapons panel to confirm that your rocket stations are “greened up”

Fire the rockets with the spacebar or stick trigger. In the build that I am using, the weapons select panel does not seem to control the number of rockets fired. The longer I hold the trigger or spacebar down, the more rockets are fired. Perhaps this will be changed in the release version. Not a big deal for me... a half second of trigger pull gives me a good 6-10 rockets on the way... and that is good for a typical pass.

Aiming and Firing Considerations

With the Maverick, we had pendulum effect to deal with. Not so with rockets... but we're not out of the woods by a long shot. The HUD weapons mode for rockets is a CCIP pipper. This is a good news/bad news kind of a thing. Yes, you get a computed aiming symbol that can really take the guesswork out of shooting rockets... but... and this is important... the CCIP pipper brings with itself other issues.

The main issue with the CCIP pipper is that you should avoid using it to maneuver with as you bring your nose to the target. The CCIP pipper responds to stick movement... pull g and the CCIP will move in the HUD... usually opposite the nose movement. You need a fixed maneuvering cue, not one that moves. That cue is the gun cross symbol.

Point your jet using the gun cross just as you did with a Maverick pass. Pull the gun cross to the target... somewhere along the target's 6-12 o'clock axis. Roll wings level and check the CCIP position. It should be close to the gun cross in azimuth and probably a little below it. Bank gently to maneuver the CCIP to place it on the target's 6-12 o'clock axis. My technique is to place the CCIP pipper below the target so that I get a clear look at the target area.

Now check your analog bar range. You want to shoot no further out than a 6 o'clock bar as a matter of technique (in high threat situations, you may disregard this advice!!). As the range analog bar reaches the 6 o'clock position. I'll raise the nose slightly to position the CCIP pipper on the target... then I'll make a positive effort to relax g. I want to shoot at one g. Not 1.1 g... one g! I use the "Track-Shoot-Track technique... I put the pipper on the target... I relax g to hold it there. As I squeeze the trigger (or press the spacebar), I again get real serious about holding the pipper on my aiming point. Only when all rockets are fired will I begin my pull out.

Why this emphasis on g?

Because rockets are super sensitive to launch g. They are supposed to be fired at or very close to one g. If you are pulling more than one g when you shoot, you will get a short impact due to "tip off" errors. Read the rockets section of my A2G article for more info on tip off. DO NOT PULL g WHEN YOU SHOOT ROCKETS!

Next point... DO NOT USE THE RUDDER WHEN FIRING ROCKETS! Why? Because tip off occurs with yaw as well as pitch changes. Keep off the rudder when making a rocket pass!

Here are the major considerations when shooting rockets:

1. Understand rocket selection procedures and HUD display symbology.

2. Understand the effect of dive angle on rocket footprint (dispersion).

3. Shoot only when in range (6 o'clock analog bar or less).
4. Do not maneuver using the CCIP pipper. Use the gun cross to point the jet at the target.
5. Track-Shoot-Track!
6. Shoot at one g and avoid rudder inputs.

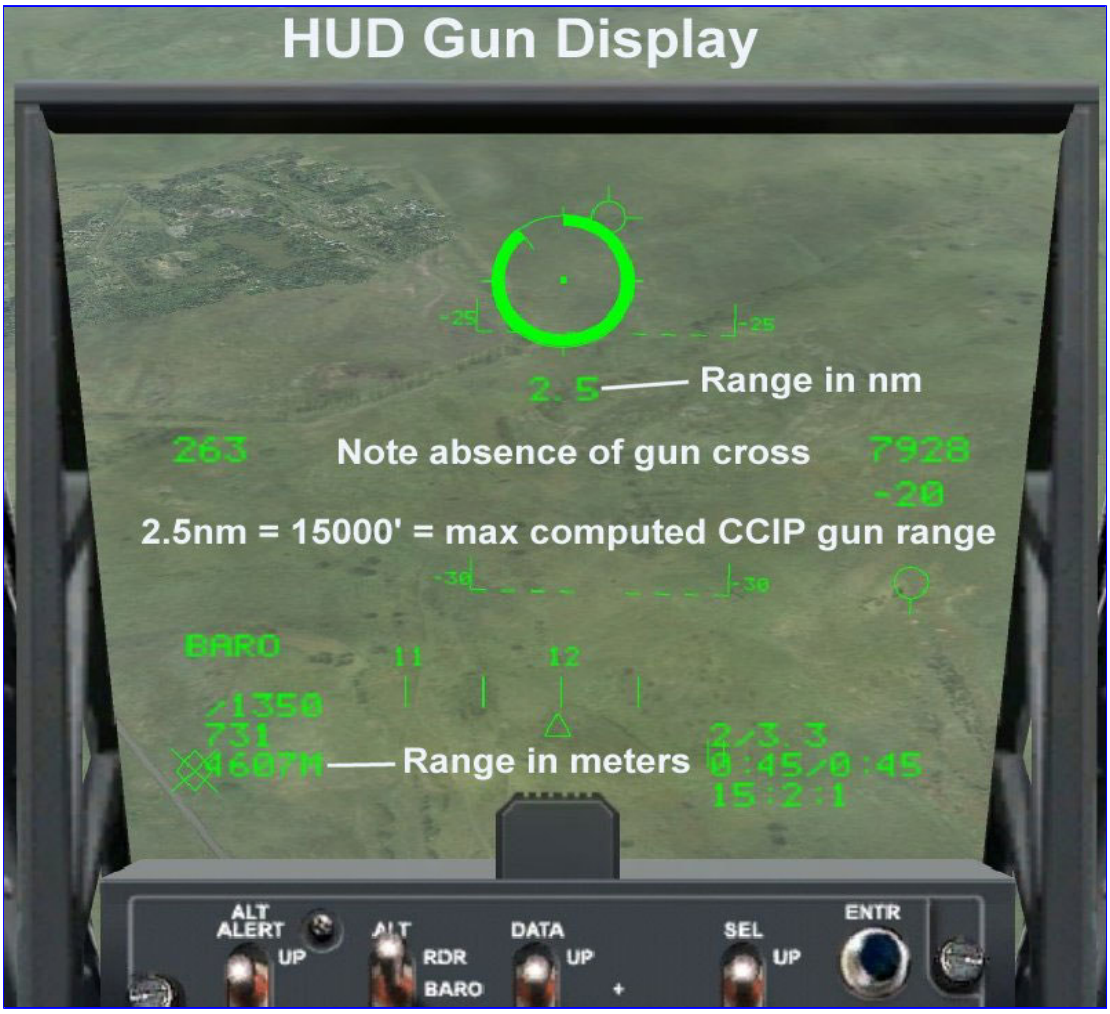
The Gun

And so we finally arrive at the whole point of the Hog... the GAU-8 30mm cannon. Why last? Because a number of the previous considerations apply as well to the gun... but may not be as well understood in Maverick or rocket employment. Having gone into detail earlier, I'll only briefly mention the subjects in this discussion.

HUD Display

The A2G gun display is a CCIP pipper similar in concept to the rocket pipper. Ideally, all you have to do is put the pipper on the target and fire. Maybe... maybe not.

First, the CCIP pipper. Like the rocket pipper, the gun pipper moves as a function of your flight control inputs. In this sense, it functions much like an A2A LCOSS. The gun CCIP includes a range analog bar that displays closing ranges inside a slant range of 12,000'. The 11 o'clock position is the "max range" or 12,000' indices... if outside 12,000', the analog bar remains fixed.



Range is computed as a function of dive angle and height above ground. The weapons computer does a quick trigonometry calculation to compute slant range as the hypotenuse of your dive angle triangle. Whoopee! Now that you know that, let's move on to killing tanks!

While the gun is good out to 12,000' or more, the dispersion of the gun and sight computational inaccuracies tend to gang up on us and result in low Pk (probability of kill). A better idea is to get a little closer, conditions permitting.

How close? Remember the 6 o'clock pipper in rockets? How about using the same gouge in guns! A 6 o'clock analog bar will work out to be a slant range of about 6000', and this is about as far out as I want to shoot. And then only at thin-skinned targets such as trucks. Tanks... I'll wait until I'm closer... inside 4000'. That equates to an analog bar close to 3 o'clock. So... technique says 6 o'clock bar for soft targets, 3 o'clock bar for hard targets.

HUD Clutter

The gun line is very close to your flight path when at one g. This good... it allows you to maneuver and have your firing symbol close to your roll axis (unlike Maverick and rocket deliveries). However... in our LOMAC HUD, things can get a little busy at times. A lot of symbols can compete for the same HUD location... symbols such as the pipper (naturally), and also the TVV (total velocity vector... your flight path indicator). You can also throw in the Pave Penny TISL if one is present.

What this means is that you can have a lot of symbology garbaging up your HUD as you roll in for the kill.

The roll in point is usually a fair distance away from the target... this means the target is pretty small... hard to see... and the last thing you need is HUD symbology that covers up the target! This is not hard to do since a tank at 12,000' is not much bigger than the pipper in the CCIP display (here, by pipper, I mean the little dot in the center).

What do I do about this? I declutter the HUD... meaning I remove some of the offending symbols. How? By beginning my gun attack in a weapons mode other than gun mode. Maverick mode, for example. The CCIP pipper is not in view, the Maverick pipper is displayed well down in the HUD, and the TVV will be displaced depending on how many g's I pull as I roll in. What's left?

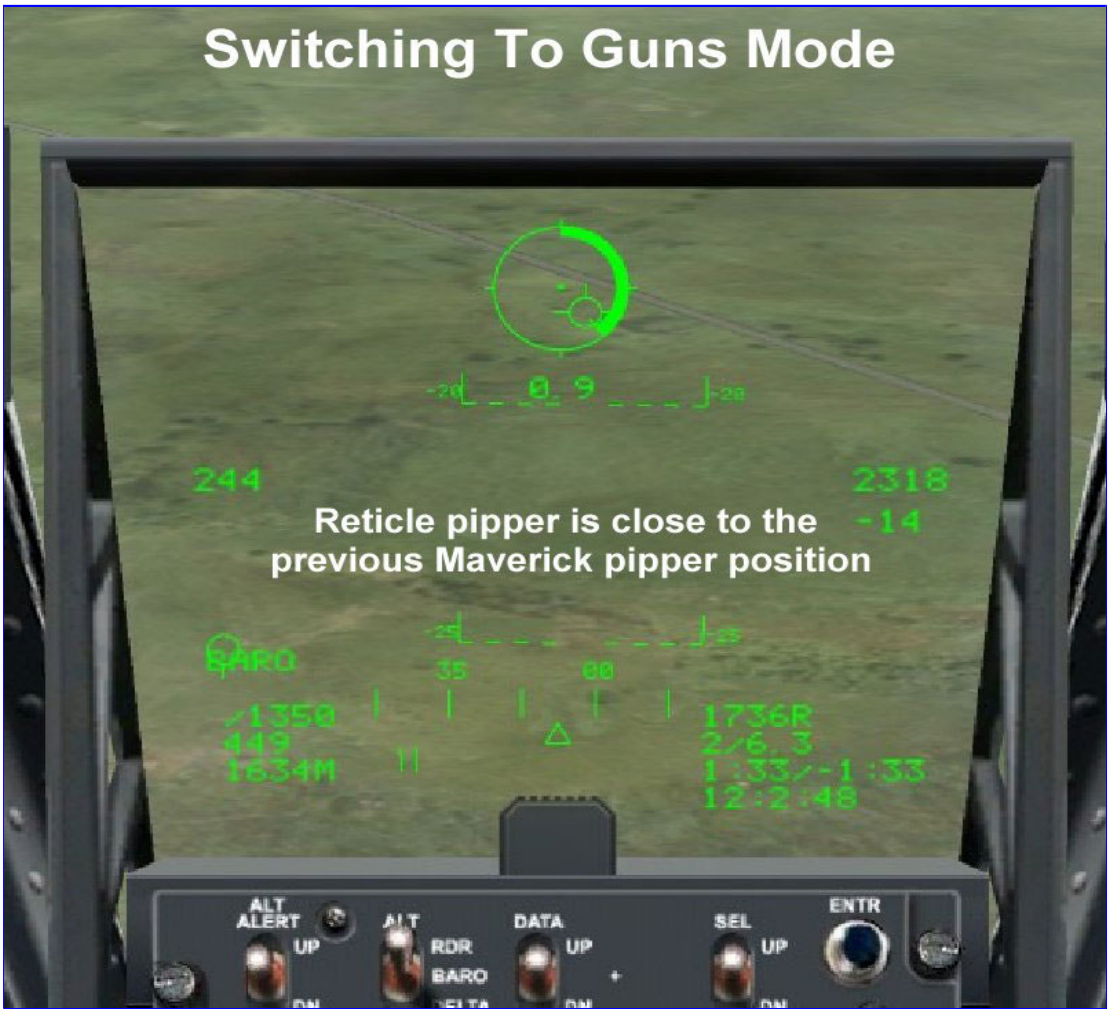
Good! I knew you were paying attention earlier! The GUN CROSS! The fixed little gun cross symbol that we can use to initially aim the jet at the target. It's small and unobtrusive and let's us have a good view of the target.

I roll in and place the gun cross below the target. I want to view the target at the top of the HUD with the gun cross below it. This gives me my best uncluttered view of the target. Then I bore in, using small bank angle changes to keep the gun cross lined up on the target's 6 o'clock axis.

What about range you say? You'll have the range on the HUD... remember, it's computed in all weapons modes. Personally, I don't use it. I'm far too busy lining the gun cross up as I observe target relative size. Look at that last screenshot again. See the Maverick pipper... the dot? Use it as a rough gauge of when to switch to guns mode. Wait until the target is at least twice as big as that pipper dot. For a typical tank or truck sized target, that works out to be around 5000' range.

Now... when the targets get this size, press the C key and get into gun CCIP mode. Your CCIP pipper should appear very close to the former position of the gun cross (it goes away in gun mode). In the next screenshots, note that when I switch to gun mode that the gun reticle appears very close to where my initial gun cross was.

Gun Cross Aiming



Switching To Guns Mode

If you had your gun cross below the target, chances are good that the CCIP pipper will be below as well. That's good. Here's why.

That old bugaboo, pendulum effect, can bite us on the butt in guns mode. Once you have selected the gun CCIP pipper, you may have to do some final lining up. Technique... use the top of the CCIP pipper as your roll axis... not the center dot itself. Using the top of the reticle will help minimize any pendulum effect.

Now... once you have corrected for any azimuth errors... check your analog bar range again and raise the pipper up to the target. It's showtime!

Press the trigger or the spacebar and fire a good burst. How much? At least one second's worth. Count "one potato, one" and release the trigger. And what is the firing technique? We're going to use the same technique that we did in our rocket delivery. Track, Shoot, Track! Put the pipper on the target... and while you pull the trigger, concentrate real hard on holding the jet rock steady. When the smoke clears, you want to see the pipper still on the target and the rounds impacting those godless little Commie heads. Then you can pull out of your dive... but not before. This technique is all about "follow through" and the importance of maintaining a stable and consistent aiming point.

One more thing... just like in rocket delivery, when strafing, stay off the rudder. "Kicking rudder" in a strafe pass is a bunch of baloney. If someone suggests this as an effective technique, don't believe it. It isn't... it's a lousy technique. Put your feet on the floor and leave the rudder alone!

Trim Technique

There is a lot happening in a strafe pass. The last thing you want to worry about is trim changes. I suggest you trim the jet slightly nose down before you begin your roll in... you want to hold a little bit of back stick pressure on final. Next, since trim is directly connected to airspeed, when you roll out with your nose pointed at the target, throttle back a little. Try not to be accelerating all the way through the pass... it only compounds your potential for trim changes. Increasing airspeed often means the tendency for the nose to rise... you do not want to compensate for a self-inflicted error just as you are about to pull the trigger! In any case, from a technique point of view, I find a slightly heavy stick much easier to deal with than one that requires me to push the stick forward to maintain my aiming point.

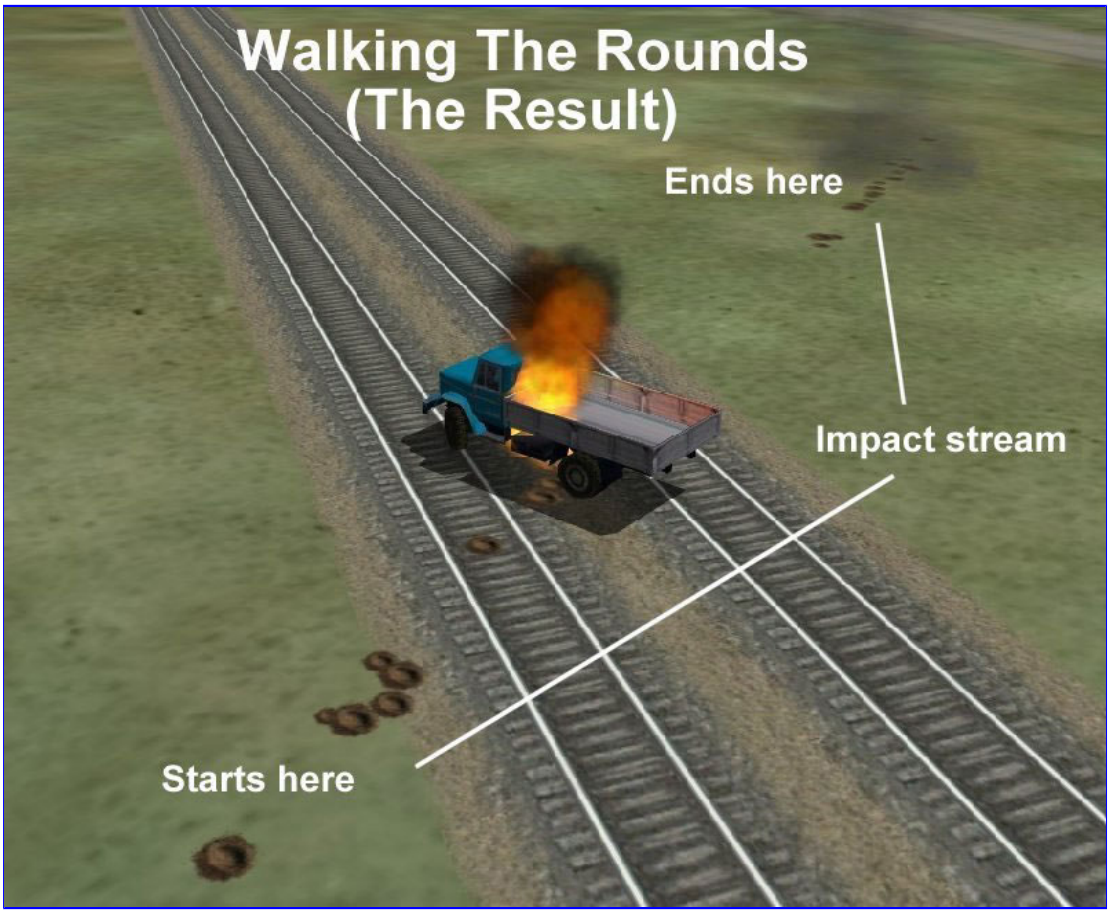
Flight Path and Dispersion

Low dive angles result in a tendency to walk your rounds through the target rather than concentrating them on it. Note this effect in the next screenshots... look at the impact marks and the distance between them. This grazing angle error is the same as we saw in rockets. The steeper the dive angle, the more likely you are to avoid walking your rounds.

I begin by firing with my pipper just below the target... and then fire a long burst. As my jet moves forward, the pipper “runs long”... meaning it moves up and through the target. The result is a long impact path running through the target... not a high Pk shot! Solve this by concentrating on pipper stability during firing... this is the heart of the “track — shoot — track” technique.

Walking The Rounds
(Open Fire)

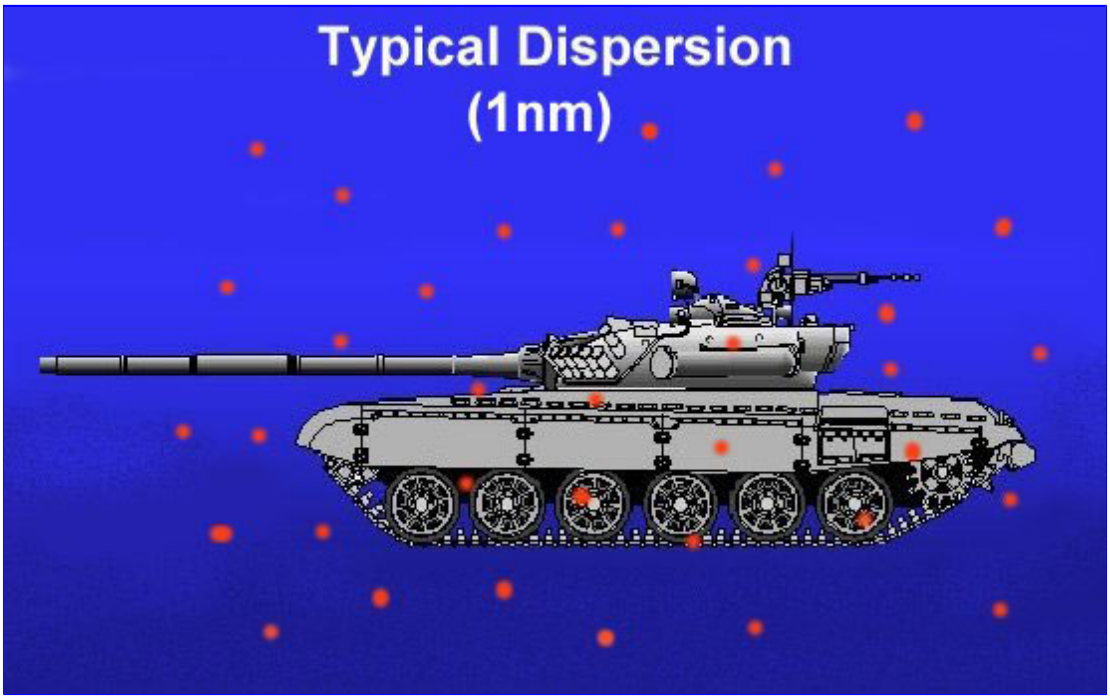
Walking The Rounds
(Cease Fire)



Walking The Rounds
(The Result)

This zipped avi video file (2.36MB) at **http://www.simhq.com/_air/video/a10-4.zip** shows "Walking the Rounds", and the audio captures the distinctive sound of the GAU-8 firing.

The GAU-8 is designed to shoot 80% of its rounds through a 5 foot diameter circle at a range of 1000'. That is a pretty tight group... but the further out you shoot, the wider the dispersion pattern gets. At 6000', that circle now has a diameter of 30'. Doesn't sound too bad until you realize a typical tank is only 20' long and about 10' high. To illustrate the problem of dispersion, here is a typical dispersion pattern. Surprise... I bet you thought every round was going through the target! Remember the analog bar and its relationship to range. Don't fire too far out! The image at right shows what a typical dispersion pattern looks like at about one mile.



Finally, shoot in high rate. The game gives you the option of selecting high or low rate (at least my beta version does). Don't even think about low rate. In real life, we didn't. Not in combat, at least.

All right... here are the high points for the gun:

1. Know your HUD symbology and gun switchology.
2. Understand dispersion and how dive angle affects that.
3. Know how to deal with HUD clutter.
4. Know how to recognize target range using target relative size and the HUD analog bar.

5. TRACK, SHOOT, TRACK!
6. No rudder... and minimize trim problems by trimming early and setting your power in the roll in.

That's It! You all have fun out there!

Test System Specs

This is the computer that I used in this article.

- Pentium 4, 2.0 GHz processor
- ASUS P3V4X/533 FSB motherboard
- On-board sound
- 512MB RAM
- Windows 2000
- VisionTek GeForce4 Ti4400 (1024x768, 32-bit color)
- Detonator 29.60 drivers
- Direct X 9.0a
- HOTAS: TM F-22Pro (digital), TM TQS throttle, and TM Elite rudder pedals
- LOMAC Beta 15 and Gold versions were used in this article
