# Hughes/Raytheon AIM-120 AMRAAM Operations Guide*

* This guide applies to the eF-16 aircraft

This guide is written for eFalcon v1.10

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## *Introduction*

The AIM-120 also referred to as the AMRAAM (Advanced Medium Range Air to Air Missile) is widely regarded as the best medium range air-to-air missile in existence. It however is perhaps the most misunderstood as well. The joint Hughes/Raytheon development team started to look at the initial design of the AIM-120 in 1975.

The AIM-120 is an all weather, beyond visual range missile; it uses a combination of target detection modes, depending on the circumstances in which it is fired. Capable of using active, home-on jam and inertial guidance the missile has gained a revered status within the fighter pilot community. It gives a 'big stick' capability to any aircraft that can use it. It has been adapted through various upgrades to be vehicle mounted, so that its advanced capabilities can be employed for Surface to Air engagements.

The AIM-120 is used by many nations as the primary air-to-air weapon, these countries include:

USA

UK (Royal Navy Sea Harriers)

Germany

Other NATO Countries such as Belgium and the Netherlands

This guide is split into five sections, first a brief history of the missile is discussed, and then a basic run down of the design features and the different variants of the AMRAAM is discussed. In the Weapons System Integration section the interface for using the AIM-120 is discussed, whilst in the employment guide, tactics for using the AMRAAM are discussed.

## *History*

The AIM-120 was developed as a follow on to the AIM-7 'Sparrow' series of missiles, the design goal was to create a faster, smaller, lighter and more deadly air-to-air missile for employment ranges between 7-45nm. Development started on the AIM-120 in 1975 with a study by the US Department of Defence and a few other nations, this conceptual phase was completed in 1979, were two out of five competing manufacturers were selected to continue development.

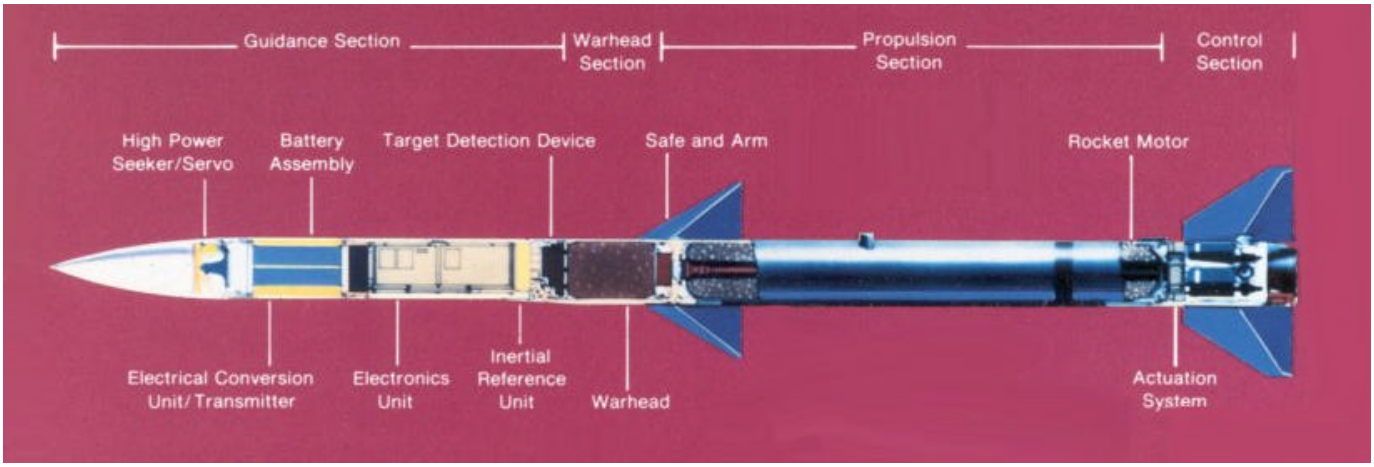
The AMRAAM went into initial production in 1987, when 200 units were produced for the purpose of operational testing, which was carried out at Eglin AFB, White Sands Missile Range and Point Muga. Initial Operational Capability was achieved in the USAF in 1991, whilst the Navy received its IOC in 1993. Full contracts were awarded in 1992 for the delivery of 800 units.

In December of 1992, a USAF F-16 claimed the first kill with the AMRAAM, shooting down a MiG-25 Foxbat during a scuffle over Southern Iraq. The AIM-120 was called upon to gain another kill early in 1993, also over Southern Iraq. In Feb 1994, another F-16 gained an AMRAAM kill over Bosnia, also a Dutch F-16 downed a MiG-29 using the AMRAAM, this time on the first day of operation Allied Force.

## *Missile Configuration*

The AIM-120 is currently being manufactured in two variants, 'B' and 'C'. The first 'A' series of AIM-120 were first delivered to Eglin AFB for testing in 1988. Specifics of the different variants can be found later on in this section.

The AIM-120 consists of Guidance, Propulsion, Control and Armaments components (See the diagram below)




(Diagram courtesy of Raytheon Systems Company)

The AIM-120 has four moving fins that provide directional control (located at the rear of the missile, and four fixed wings that provide longitudinal stability to the missile in flight (located half-way down the missile body). The AIM-120 has a solid rocket propellant missile motor. The rocket motor is as highly advanced as the guidance systems on the AIM-120, utilising a smokeless motor system, and uses a hydroxyl terminated, polybutadiene propellant that gives the missile a superb boost-sustain capability on long-range engagements.

The AIM-120s guidance system (WGU) consists of the radome, seeker, servo, transmitter receiver, electronics unit, inertial reference unit and Target Detection Device (TDD). All of these components can be seen in the diagram above. The WGU is all contained (with the exception of the TDD) within a sealed structure at the front of the AIM-120. This facilitates independent testing of WGU functions whilst on the ground. In the 'B' and 'C' models, the WGU also contains the EEPROM (Electrically Erasable Programmable Read Only Memory) that allows software updates to the missile to be applied. In the earlier 'A' model, the whole WGU would have had to be upgraded to accomplish the same.

The AIM-120 consists of 45lb blast fragmentation warhead, that is proximity fused. This warhead is capable of downing most fighter-sized aircraft with one hit, however the strike must have full force to accomplish this. The warhead is part of the Weapons Detonation Unit (WDU-33/B), also in the WDU is the FZU-49/B safe-arm fuse device and the Mk44 Mod1 Booster. The fuse device also gives an external indication of its status, enabling ground crew to move the missile safely.

The missile is controlled in flight by the Weapons Control Unit, (WCU-11/B). It consists of the moving fins, four lithium-aluminium batteries, and other safety related devices that are required for the use on aircraft carriers. The control unit guides the missile by fin control only. It receives information from the guidance unit; this information is then turned into steering information and fed to the fin actuators.

The Active radar in the AIM-120 is of the monopulse type, using a hard-to-jam system of four receiving antennas and a single pulse emitter. This type of radar is completely different to that which is found in aircraft. The guidance unit measures the amplitude of the different signals that were received by the antennas, by adjusting the missile's trajectory so that the amplitude is the same on all four receivers, the missile can accurately track a target.

The AIM-120 has been designed to be a very safe missile for ground crews to operate. Many new techniques were first demonstrated in the AIM-120's development. These include the Thermally Initiated Venting System (TIVS) that was needed for the missile to meet the Insensitive Munitions (IM) program. (For more on the IM programs see the appendix). The TIVS is designed to vent the rocket motor in the event that the missile is exposed to a missile fire. The TIVS ignites an external thermal cord, which activates the Out-of Line Device (OOLD), the OOLD then detonates a small linear charge that weakens the rocket motor, letting the rocket motor 'trickle' discharge.

The OOLD also provides protection of high impact booster ignition, reducing the chance of the AIM-120 suddenly deciding to chase after a weapons guy if dropped. The AIM-120 also has an additional feature that resets the missiles TIVS and OOLD device when fired (triggered by the high lateral G forces). This makes sure that the pressures of flight do not cause the safety devices to become active and interfere with the AIM-120 in free flight.

With the introduction of the AIM-120, three new missile rail launchers (MRL) were required; there is the LAU-127A/A that is used in conjunction with the LAU-115 for use on the F/A-18C/D aircraft, the LAU-128A/A for the F-15 and the LAU-129A/A on the F-16. The MRL's are compatible with the AIM-9 Sidewinder on all except the F/A-18C/D wingtip stations.

The AIM-120 also features a built-in test (BIT) that can check for full and correct operation whilst mounted to and aircraft. The system gains power through the AMRAAM Electronic Control Unit.

## *Variants*

There are currently four variants of the AIM-120:

**AIM-120A** – The first production model, used an older style of hardware that had to be changed with each software update.

**AIM-120B** – An improved variant that allowed the missile to be upgraded by using EEPROM, this allowed in the field modification to the missile. Guidance accuracy was improved via the use of a new signal-processing algorithm.

**AIM-120C** – Almost identical to the 'B' model, the 'C' is designed to fit in the internal carriage bays of the F-22, it has shorter fins with a cropped design. The missile also has all of the latest improvements in software.

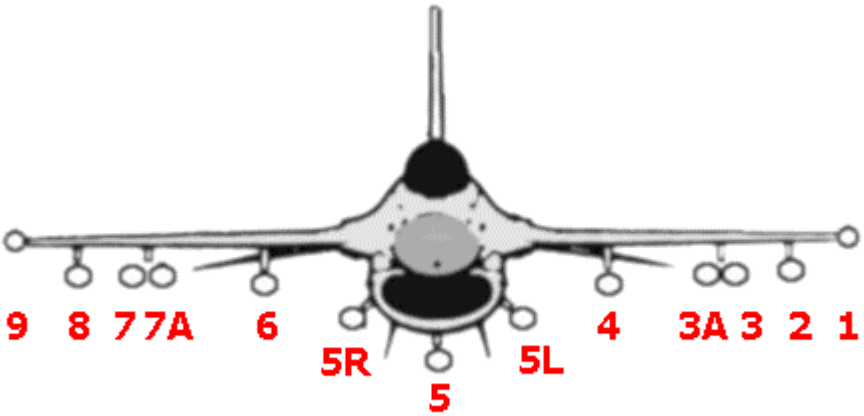
**AIM-120 P3I** – A new project to give the AIM-120 a much enhanced capability. Improvements in range, lethality and also crew safety are all being planned, as yet no P3I missiles are in active service, although missile testing is being carried out.

## *AIM-120B FCC Integration*

This section of the guide explains how the AIM-120 integrates itself within the eF-16 aircraft systems. The Fire Control Computer (FCC) overlays information on both the Heads-Up Display (HUD) and the Radar screen. The current status of the AIM-120 is available in the Stores Management System (SMS) screen.

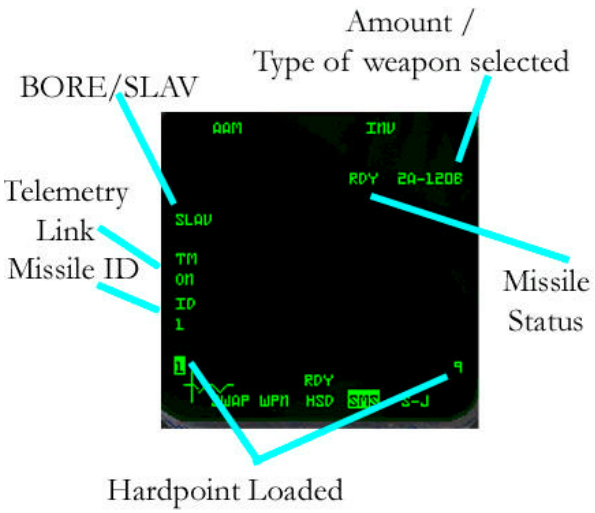
### Stores Management Integration

The eF-16 can carry up to 6 AIM-120B's, on pylons # 1,2,3,7,8,9 (See diagram below). Diagram courtesy of www.fas.org



The Stores Management screen is the main point of reference for weapons configuration information; as such the AIM-120B related information is covered here. For more information on the Store Management System, see the Operations Guide – OG-F16BACSYS.

The diagram below shows the stores management screen, it has been labelled to show the different components.



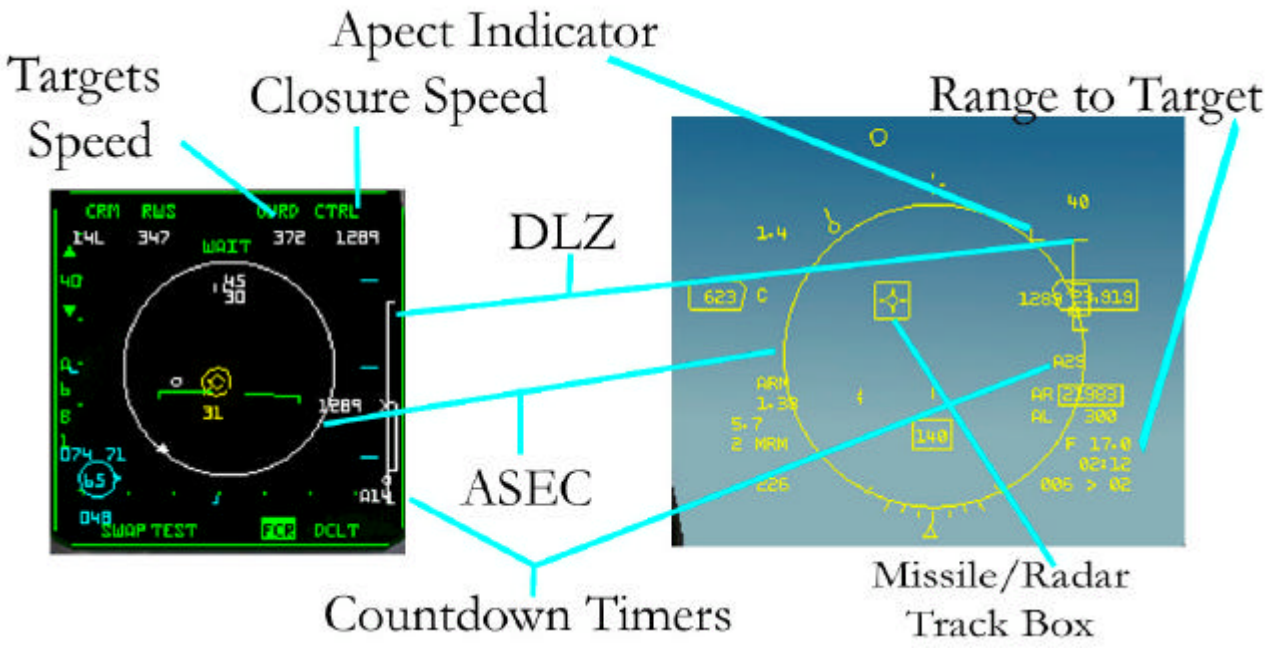

The Amount and type of weapon that are selected appears on the top right hand side of the screen. The number in front of the A-120B is the amount of the missiles that you have loaded. The Missile Status indicates whether the missile is ready to fire (RDY), Safe (SAF), in simulation mode (SIM) or has a problem (MAL). If the status shows MAL then you will be unable to fire it.

Along the bottom of the stores management screen is the numbers of the hard points loaded for with the missiles. The currently selected missile is highlighted (1 in the example above). This information is important to know if you have a problem, being able to see which missile is selected makes it easier to find a missile that works if you need to by using the missile step command (Shift+/)

Along the Left side of the Stores Management screen are operational controls. In e1.10 the bottom two (Missile ID + Telemetry link) are not implemented, even though they ID will change when pressed. The BORE/SLAV option is you main launch mode control option. This indicates the current launch mode (more information can be found below).

### *HUD/Radar Integration*

Using the AIM-120B overlays some extra features onto the HUD and the radar, understanding these overlays is vital to understanding how to use the AIM-120B AMRAAM. The screenshot of the HUD and MFD below has been labelled to show you the new components that are over-layed. Don't be put off though, well cover all them in this guide.




The first indicator that you need to pay attention to is the FCC mode indicator underneath the airspeed on the left. When the AIM-120B is selected the text changes to inform you of this. In this example you can see that the weapon is indicated as MRM (Medium Range Missile). In front of this is the amount indicator, which tells you how many of that weapon you have loaded at that time, in this case two.

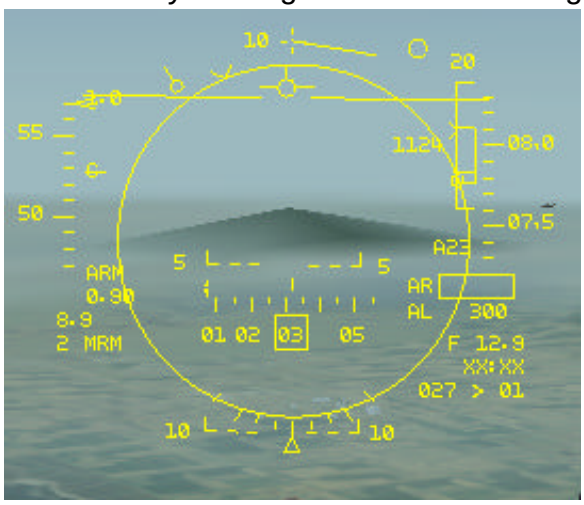
## HUD/Radar Integration - ASEC

On the HUD and replicated on the radar screen is the ASEC (Allowable Steering Error Cue). This appears as circle. The circle changes size depending on the chance of the missile actually hitting the target, this is based upon Missile Kinematics, target aspect and the line-of-sight (LOS) to the target is calculated. The ASEC is a dynamic indicator, that means as all of the factors in a successful missile launch change, so does the size of the ASEC.

When the ASEC is at its smallest (see screenshots below), the chances of hitting the target are very low; the smallest size will often appear if the target is out-of engagement range, or moving at high speeds away from you. The ASEC will also shrink when the LOS track rate is too high for a successful launch, this will only affect close in launches.



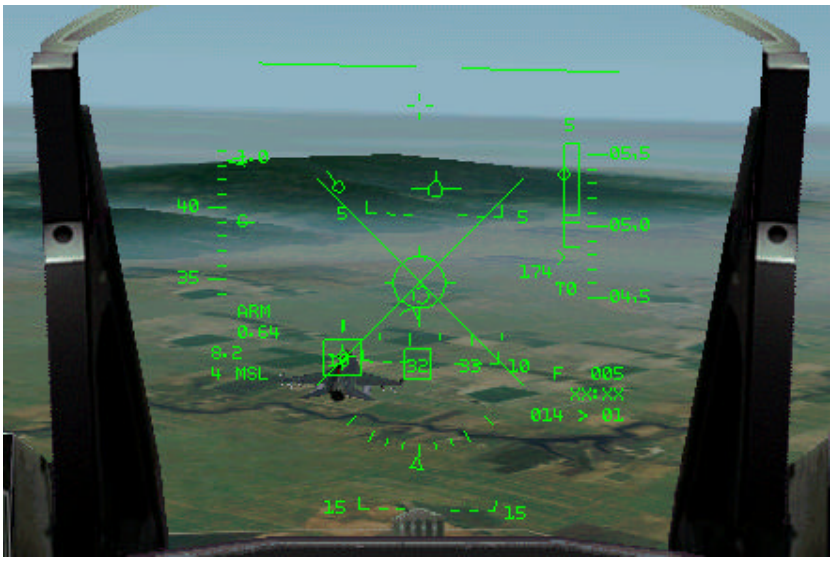
The ASEC will be at its largest when the contact is heading towards you. The chances of successful missile engagements are greater when you are head-on to your target and closure is high.




The ASEC will start to flash when the FCC calculates that the target is within missile manoeuvring and line-of-sight requirements. When the ASEC flashes, take it as a cue to fire. (Sorry I can't do a screenshot of it flashing! I would get complaints if it did not keep flashing after printing! ☺)

Another part of the ASEC is the aspect indicator. This little bracket moves around the outside to give you an indication of your aspect from the target. To find out more about aspect and target geometry, see the appendix for a brief guide.

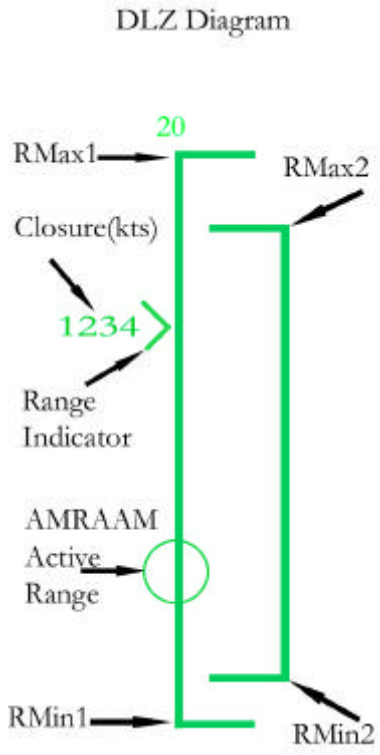
Finally the ASEC can display a break X symbol if the target is outside of the AIM-120B's maximum Field of View of 45°. The break X will also appear if the closure rate is negative (the target is moving away from you) so that you receive visual notice that you are in a chase down situation, limiting the range of the AIM-120B.




## HUD/Radar Integration – Target Track Box

When a target is locked on the radar, the FCC calculates where about it is in the HUD field of view. It then draws a box around this point, indicating visually to the pilot the position of the contact. An example of this can be seen to the left. The FCC also adds a missile diamond and tracking indicator, for the AIM-120B this is located within the target box whilst the missile is in slave mode, as seen in the above diagram. When both sets of symbols appear over the target it means both AIM-120B and radar are tracking correctly.

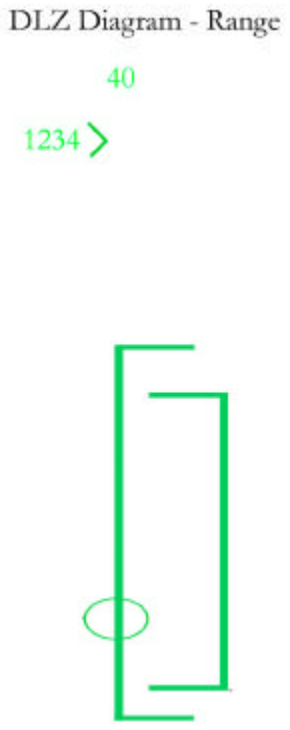
## HUD/Radar Integration - DLZ




The Dynamic Launch Zone (DLZ) is a set of brackets on the side of the HUD and the Radar screen. The DLZ is comprised of two separate brackets, a distance indicator, and a closure meter. (Note the DLZ will only appear when you have a target selected). The diagram to the left labels the components of the DLZ.

The two brackets face each other and represent range two differing sets of ranges. The bracket on the left shows the maximum (RMax1) and minimum (RMin1) ranges for the missile against a NON-manoeuvring target. The smaller brackets on the right show the maximum and minimum (RMax2 + RMin2) ranges for a target that is manoeuvring. Shots fired in the areas between RMax2 and RMax1 are more likely to miss that those shot between RMin2 + RMax2.

The DLZ also has a range indicator. The range of the DLZ is linked to the range selected for the radar, so if the radar is set to 20nm, the DLZ will represent 20nm from top to bottom. Note however that if the range is set to 40nm, or even 80nm, the left bracket will still show the maximum engagement range for the missile, not the maximum range for the radar. The range indicator is used to determine your current range and how that relates to the missile engagement zone.




The diagram to the right shows what happens when the radar range is set further than the weapons range. Note how the DLZ brackets have become smaller now that the range is set to 40nm. The range indicator is ‘floating’ above the brackets, this is still indicating a range (around 37nm in this case) but the target is way outside of the engagement zone, and the AMRAAM will miss if you fire now.

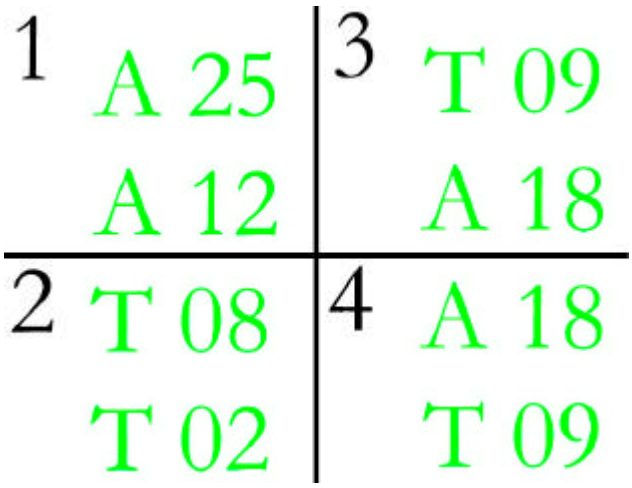
The numbers next to the range indicator are NOT the range. These numbers represent the closure rate of the target in knots. If there is a ‘–‘ in front of the number, the target is moving away from you. Finally with the DLZ is the AMRAAM Active Range. This little circle gives you am indication of how far away the AMRAAM will transition from inertial to active tracking. More on this later

## HUD/Radar Integration – Timer Cues

The FCC adds a set of timer cues to the HUD and radar screen. The timers have a letter prefix in front of them to indicate what they are counting down to. If you recall the AMRAAM uses inertial guidance to begin with for ranges of over 12nm. When an AIM-120B is released and is using its inertial guidance, the timers will show 'A' in front of the time in seconds. If the AIM-120 is using its own radar, the timer will have the prefix 'T' in front.

When you first call up the AIM-120B, only one timer will appear. This timer shows the estimated time for a missile to reach the target/radar activation point at that time. If the target is in range of the AIM-120B's own radar this timer will prefix with the 'T'. If the target is outside of the AIM-120B's own radar range, the timer will prefix with an 'A'.

When you fire an AIM-120, another timer will appear. This timer represents the missile that you just fired. The time will countdown to the estimated time of radar activation (if fired outside of the AIM-120B's own radar range) or the time to impact (remember it will prefix 'T'). The top line is once again estimating the time for the next missile to be fired.




The diagram to the left shows four different sets of countdown timers. Set 1 shows that the next missile to launch will take 25 seconds to reach the activation point (Top Line), and that the last missile that was fired is 12 seconds from going active.

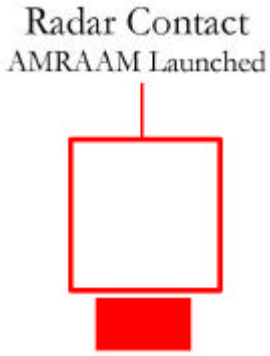
In set 2 the timers show that the next missile to launch will take 8 seconds to reach the target, and the missile will be using its own radar to track target immediately after launch, it also shows that the last missile that was fired is 2 seconds from impact.

In set 3 the timers show that the next missile to be launched will take 9 seconds to reach its target, and that the missile will be using its own radar immediately. The last missile that was launched is 18 seconds from its activation point where it will use its own radar.

In set 4 the timers show that the next missile to launch will take 18 seconds to reach its activation point where it will use its own radar to track the target. The last missile that was fired is 9 seconds from its target.

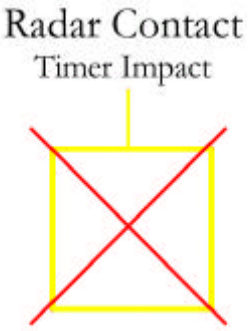
## HUD/Radar Integration – Radar Cues

In addition to overlaying the ASEC and DLZ cues on to the radar, the FCC also provides some visual 'helpers' on the radar screen, allowing you to more effectively employ you weapons.




These are in the form of colour-coded symbols. When an AIM-120 is fired at a contact, the symbol will turn red, and have a 'tail' (see diagram to the left).

When the FCC calculates that the AIM-120B should have impacted with the target (an event that is based on a variance of 0-3 seconds from when the timer = T0), a break X will appear over the contacts track on the radar screen, visually indicating that the missile should have impacted on the target. This occurs even if the missile has missed, so is not a 'confirmation of kill'. The impact X will remain on the contact for 5 seconds, then will flash and disappear. The symbol will look like the one depicted to the right.




## HUD/Radar Integration – Range Information

The range from the target can be assessed in two ways, the first is to look under the altitude scale at the range to target line (F 12.9 in the labelled diagram on page 9). The second method is to use the radar to estimate the range. For more information on using the radar refer to the Operations Guide – OG-APG68.

## HUD/Radar Integration – Target Information

The FCC displays other target information in the radar screen. When a contact is 'Bugged' a line appears underneath the radar mode indicators that contains four pieces of information, from left to right these are: Target Aspect, Heading, Speed (kts) and Closure. For more details on aspect refer to the appendix, for more details on radar operations, refer to the AN/APG-68(V5) operations guide (OG-APG68).

## *AIM-120B Modes of Employment*

The AIM-120B AMRAAM can be launched in two distinct modes, Radar slaved and Boresight. In addition to these user selectable modes, the AMRAAM itself can operate in three additional modes, active radar, inertial guidance, home on jam.

As the pilot you have the option as to whether the missile is 'slaved' to the radar contact that is currently designated, or if the AIM-120B locks up the first contact that it detects with its own radar by using the bore sight option. The various different launch modes possible are described below.

### AIM-120B – Boresight Mode

The boresight mode is essentially a 'snapshot' mode that can be used when you don't have enough time to go through the radar and lock-on the target. When you launch in the boresight mode, the AIM-120 will fly straight ahead and switch on its own radar immediately. The AIM-120 will then target the first contact that it detects with its radar. This is excellent if you need to distract an enemy, rather than to get a certain kill. There is no guarantee that the AIM-120 will track the intended target.

When launching in this mode, the missile diamond will show the current AIM-120 Field of View (FOV) for target engagement.

The catch to this is the AIM-120 does not have the ability to discern a contacts identity, so care must be taken otherwise you could well be responsible for friendly fire. Remember, if there are friendly aircraft in front of you, DON'T FIRE IN THIS MODE unless you are absolutely sure that the enemy is the contact that will be picked up first.

## AIM-120B – Slaved Mode

When the AIM-120B is in the slave mode, it uses the firing aircrafts radar to 'point' the missile in the correct location. The AIM-120B has the ability to use several methods of target tracking, depending on the targets range and whether or not it is attempting to use Electronic Counter-Measures (ECM) to deceive radars.

When the target is at ranges of over 12nm, the AIM-120B will use inertial guidance and data-linking systems to guide it to a point where it can use its own onboard radar. During the inertial guidance stages, the missile receives target location up-dates from the firing aircrafts fire control radar (FCR – in the case of the eF-16, that's the APG-68). You can tell that the missile is using its inertial guidance by looking at the countdown timers. (Described on page 14).

Once the AIM-120B reaches a point where it can use its own radar, it looks in the last known location of the target and attempts to find it. If successful the AIM-120B will then guide itself to the target and hopefully result in a successful kill.

If the AIM-120B fails to find the target when it goes active, it will search for another contact and engage that. However because the AIM-120B does not have the ability to discern between friend or foe, the missile is just as likely to engage a friendly target. Although the AIM-120B can be launched and left, it is generally advisable to guide it all the way to the activation point. Doing so will also decrease the chance of friendly fire. Failure to do so will decrease the probability of a successful kill (Pk).

If the AIM-120B is launched from within the 12nm range that its radar seeker uses, it will not use the inertial guidance system, instead going straight to active use of its own radar for tracking. The countdown timer will indicate when a launch is going to be active straight away by prefixing with a 'T'.

Once the AIM-120B has gone active you can break lock and fire at another contact without affecting the previous missiles Pk.

## AIM-120B – Home-On-Jam

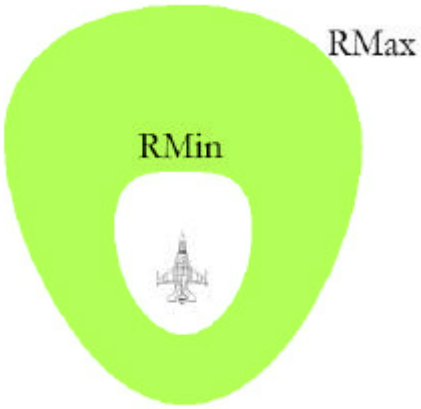
If at any point during the missiles time-of-flight the target starts to use electronic counter-measures (ECM) the AIM-120B can switch its tracking mode to home-on-jam. When this occurs the AIM-120B homes in on the location of the jamming signal, guiding it to the point where the onboard radar 'burns through' the jamming and re-acquires the radar. When in the home-on-jam mode the AIM-120B interlaces the active pulses of the radar with passive guidance from the home-on-jam equipment.

The FCR in the F-16 will inform the FCC if the target is jamming the radar, if this is the case, then 'HOJ' will appear on the HUD. Note however that there is no communication between the F16 and the AIM-120B to indicate this fact; it is a 'guess' on the part of the F-16 FCC.

The HOJ mode does not provide as good a Pk the normal active guidance however, and it is still possible that ECM in combination with defensive manoeuvres will cause the AIM-120B to miss its target.

## *AIM-120B Employment Tactics*

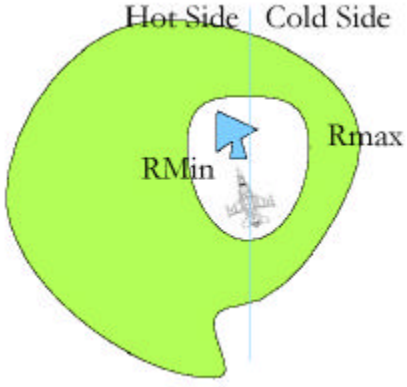
### Weapon Engagement Zones




The first thing that needs to be understood when using any air to air missile is the concept of the weapon engagement zone (WEZ). The WEZ is the area around the target where the missile can reach and destroy the target. The diagram to the left shows an example WEZ for a non-manoeuvring target. The AIM-120B has a maximum (RMax) and a minimum (RMin) firing range, the diagram represents the area between these two as a green 'doughnut'.

Any area within the doughnut represents the AIM-120B ability to reach the target. Notice that the shape is not a circle, in front of the target, the engagement area is much bigger than at the rear, this is because if you are shooting at a target from the front, the target will be moving towards your missile, thereby reducing the amount of work the missile needs to do to intercept the target, if however you are shooting at the rear of the target, the missile will have to 'tail chase' the target in order to intercept it. Because of the lower closure speed between target and AIM-120B, the maximum firing range is lower.

The diagram above shows the WEZ for a non-manoeuvring target, if the target is manoeuvring against you, the WEZ will change shape drastically. The diagram to the right shows a sample WEZ for a target that is turning to the left. The WEZ for a manoeuvring target will always be changing dependent on aspect and the amount of manoeuvring, so the diagram to the right is a 'snapshot'.




The main difference between the shapes is that now the WEZ is much smaller on three sides, however the WEZ has expanded on the 'hot side' of the turn. (Hot Side / Cold Side are terms to describe if you are on the side that the target is turning to, or from respectively). This means that the AIM-120B has a better ability to intercept the target if launched within this area. The frontal area to the WEZ has shrunk to almost the same as the rear area, showing that if the target is turning from you, the maximum range will deteriorate very quickly.

## Maximise your shooting range.

The strength of the AIM-120B comes from its ability to reach distances of up to 40nm. However to reach that kind of distance is unusual in normal engagements. There are methods however that can be used to extend the range of the AIM-120B before you commit a weapon to the target.

Any missiles range is dependent on its energy state, and its fuel. The fuel is easy enough to figure out, the less fuel the smaller the distance that the missile can fly. The energy state of a missile is a little harder to understand, but in its most simple terms is the ability to move through the air. The AIM-120B gains energy whilst its rocket motor is burning, however when that runs out, the AIM-120B has to trade the energy it has gained for movement and the ability to intercept the target.

Now not all of the energy that the AIM-120B has comes from the rocket motor – just like aircraft, a missile can trade altitude for speed, gaining kinetic energy through the use of gravity. The speed of the AIM-120B gives it kinetic energy that allows it to travel further.

Energy = Altitude + Speed = Range.

So what does this mean, well, you can provide a lot of energy (and therefore range) to the missile before it even leaves the launch rail, simply by flying higher and faster! Giving the missile both kinetic energy and potential energy! Good stuff ☺.

Remember however that the targets aspect also plays an important part in range, so even if your bordering space and travelling at Mach 10, if the target is pointing away, the maximum firing range will still be lower than if the target is pointing towards you. (ok, you caught me, slight exaggeration!).

It is the principle of maximising shooting range that the bread and butter Beyond Visual Range (BVR) tactics of F-Pole and A-Pole fights are based upon. These are discussed in the next section.

Remember:

- Altitude gives Potential Energy to the AIM-120B
- Speed gives kinetic energy to the AIM-120B
- Get HIGH and FAST to maximise your shooting range.

## A-Pole and F-Pole

Right, I am not talking telegraph poles here, rather the types of missile that the opponent carries. It is important to remember, whilst you are trying to shoot the target, he might very well be trying to do the same to you. This fact effects the tactics that you use, and the basics of A-Pole and F-Pole tactics take this into account.

So what is A-Pole and F-Pole, well the Pole means missile (simple what!) the A or the F describes the type of missile fired. The A refers to active radar homing missiles, like the AIM-120B and the Russian AA-12. The F refers to semi-active radar homing missiles, which require a constant lock on the target, like the AIM-7. The eF-16 can only carry AIM-7 when specially modified to do so.

A-Pole vs. A-Pole

We'll start by looking at A-Pole vs. A-pole. In this situation, both you and your target have a launch and leave capability, after a certain point you do not need to support your missile. The other important consideration is that the targets radar-warning receiver will not detect a missile launch until the missile goes active (when the missile starts to use its own radar).

The downside to this, is that the enemy can do the same to you, they can launch a missile at you and you wont know about it until it goes active. There are three main missiles in eFalcon that are classed as A-Pole, the AIM-120, the AIM-54 and the AA-12. Depending on which of these the opponent has will dictate your actions.

The AIM-54 is a huge missile, it is designed to be carried by the F-14 Tomcat, and can outrange any other A2A missile in the sim the only disadvantage is that its missile seeker is not as advanced as more modern designs. If you are fighting an F-14, they will be able to fire their missiles well before you can and will be able to leave the fight before you. This places you at a severe disadvantage. You have two options in this situation, you can turn and run to fight another day, or you can proceed with the engagement. If you turn and run, that is quite a wise decision! If you decide to continue, then you need to make sure that you follow the guidelines that were set out in the 'maximise your shooting range' section above, and be ready to take evasive action.

Onto the AA-12, also known as the Adder. This is the Russians AIM-120 equivalent, slightly larger than the AIM-120B; the AA-12 has a slightly longer range, allowing the user of the missile to launch before you can. However the inferior sensor that the AA-12 uses negates this longer range. The launching aircraft will need to support the AA-12 for longer than you will when supporting the AIM-120B. This means that you will be able to break lock and take evasive action before he can. Once again, you ideally need to maximise your shooting range, by flying higher than the target, you will also reduce his missiles maximum range.

Finally. If you ever find yourself up against an AIM-120, all you can really do is once again, maximise your shooting range, and fly a good missile defence when the AIM-120B that's heading your way goes active. Or you could turn tail and get out of there to fight another day!

After you have fired your missiles, try to slow down to around 430kts, this will lower closure, and make the targets missile have more work to do. You can slow down further than this, however it is advised to stay above 400kts for if your missiles miss, you will have an angry target closing with you very fast.

I will now re-iterate two important point that it is vital to remember:

- The chances are the target is going to shoot at you.
- You will not know for certain that an active radar homing missile has been launched until it goes active.

## A-Pole vs. F-Pole

In this situation, you will normally have a distinct advantage of your target. The target will have to support his missile all the way up until impact, giving you the chance to support you missile up until the point where they go active, then you can move to break his radar lock, thereby causing the missile to miss. Maximising your shooting range in these situations is not as important as in pure A-Pole engagements. However it would be advantageous to have an altitude advantage over the target.

The BVR SARH missiles in eFalcon are the AIM-7M, AA-6 Acrid, AA-7 Apex and the AA-10 Alamo (A and C models). The biggest threat to you in the A-Pole vs. F-Pole fight comes from the AA-10 series of missiles, particularly the AA-10C that is carried on the Su-27 Flanker. The AA-10C outranges the AIM-120, allowing the Su-27 to fire much earlier. Luckily you will know about the launch because the Su-27 will have to support the missile. The catch to fighting an AA-10C is that because its range is much greater, if you fired your AIM-120B at the target, the AA-10C would probably reach you before your missile turned active, making it very difficult for you to effectively support your own missile. The AA-10C's manoeuvrability is roughly on par with that of the AIM-7M.

The AA-10A is the original version of the Alamo, it has a lower range than that of the AIM-120B, however it is a manoeuvrable missile that still poses a huge threat if it is fired at you. You would be best gaining as much missile range as possible when engaging a Su-27, or any other aircraft that can carry the AA-10 series of missiles.

The AA-7 Apex is commonly used on the older MiG fighters, and is in the same range class as the AIM-7M. The AA-7 however is not very manoeuvrable, and runs out of energy very quickly. It still poses a threat, however it is not serious. It is easily defeated by a fast, sharp 6g turns into the missile. When targeting a contact that could carry this missile, flying

higher and extending your range will increase your advantage, however it is not absolutely necessary

The AA-6 Acrid is one of the fastest missiles that you will face. Under good circumstances the AA-6 has only a slightly shorter range than the AIM-120B. Its primary use however is to attack larger, high-flying, supersonic aircraft, where its speed is put to best use. The AA-6 is not particularly manoeuvrable, but if you are facing one, the amount of time you get to react is very short, you have to be very aware of this, and start to take evasive actions the moment the missile is fired at you. The missile will reach you a long time before your AIM-120B will be able to go active, so once again, get high and fast.

That wraps up the basics that you need to know to successfully employ the AIM-120B. A discussion about group engagement tactics is beyond the scope of this guide, so they will not be covered, however if you are looking for that kind of information, the original Falcon 4.0 manual, and Pete Bonanni's Strategy guide are good places to start.

# *Appendix*

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www.falcon40.co.uk Jagstangs website, excellent artwork mods are located here

## Authors Ramblings

This is the second in a series of guides that I hope will eventually provide comprehensive coverage of all of the avionics and the weapons systems that are modeled in eFalcon. I hope that this guide was helpful to you.

The documentation is split up into smaller operations guides, and they will be updated when required. The reason for splitting them up is that it is much easier in my own opinion to have a number of smaller specialist guides than one humongous block.

This guide would not have been possible without the generous help of members of the eTeam, thank you for being patient when I was nagging you for answers ☺!

*Thank You eTeam!!!!!!!*

LONG LIVE eFalcon

Thanks to the following people who have been invaluable to the creation of this guide.

Vexx
Horseman
Napoleon
Nighthawk
Jester
Viper

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Thanks – Stephen ‘HotDogOne’ French