A-A Engagements
General Strategy and Tactics

Introduction

This document is written to introduce the pilot to general Air to Air strategy and tactics and offer suggestions to improve survivability and efficiency in the air combat arena. As with any guide to air combat operations, this should not necessarily be taken as a step by step process that will ensure success in each and every situation. Given the dynamic nature of air combat, various scenarios will require interpretation and adaptation of the tactics discussed herein. More specifically, this document will server as a fundamental outline of the areas a good combat pilot should study, rather than specifically providing all the detailed context of those areas themselves.

Air to Air Engagement Elements

If I had to name the elements required to successfully complete an air to air engagement (and I suppose I do have to, otherwise why write this), I would list them in order of execution as follows

Locate targets
Identify targets
Prioritize targets
Sort targets
Engage targets
Separation

These elements should be familiar to all but the most novice pilots. However, what might be new to many pilots is the order of planning and execution of each element. Activities related to some of these elements should happen before you even climb into the jet. Planning is an invaluable tool that can make the difference between success and failure in any mission. While all of the elements listed are carried out tactically while in the air using AWACS, radar and the MK1 Eyeball, strategies developed during planning will increase the speed and efficiency with which a pilot can execute these tactics. Other than Sorting and Engagement, which are purely tactical, look at how these planning strategies will help.

Mission Planning Strategy

In modern air combat, the success of failure of an air to air engagement can not only be decided BVR (and is often the case), but before the pilot gets in the jet in the first place. It is typically not the pilot who is the better dogfighter that comes out on top, but the pilot who has a better situational awareness, recognizes and prioritizes his targets and plans his escape vector before the fight's on.

Target Location

Obviously when in the air we locate targets using visual scans, instrument scans and AWACS. However, the sky is a big place. We can't scan and look everywhere at once. If we can anticipate where targets should be, then we can increase our target acquisition efficiency. Anticipation begins with planning.

The simplest form of using mission planning to locate targets has been and will always be to view enemy flights already in flight using our planning map. As an example, we all

know that if we are taking off from Seoul on a BARCAP directly north of our airbase over the FLOT and our station area is showing a group of MiG-29s in flight, we can pretty much expect to run into them in the air if our take-off time is reasonably soon. We know where to look for them right away. Easy. But what if there aren't any enemy flights showing on our planning map? Does that mean we should not expect to gain any efficiency in locating targets from planning? No, we can still gain a significant advantage from planning. This takes the form of recognizing the location of enemy airbases in relation to your mission flight path.

As in the last example, when reviewing your flight plan for the BARCAP over the FLOT, you will know that Koksan airbase is off the northeast of your BARCAP station. If you don't see any flights in the air in your planning map and you don't pick up targets when you get airborne, you should probably focus your eyes and your radar in that direction in anticipation of something showing up. You will also have Haeju to your west. You would want to continue to scan in that direction as well.

Things can and do get disorienting when you're in the thick of it up in the air. One method of ensuring you know where threat airbases are in relation to your flight path or station is to recon them for bullseye location. Once in the air, slew your radar cursors to that bullseye position and create a Mark point. Then you can quickly and easily refer to your HSD and know where these threat locations are in relation to your position.

It is true that threats don't come just from airbases near your flight path and planning will never be the only tool you need to know where threats are. When it comes down to it, you must defer to VIA location when airborne. But, having a good idea of the directions from which threats might appear gives you those focal points that will increase your target location efficiency.

Target Identification

Everyone uses the most basic of planning strategies to anticipate target identification whether they know it or not. We all instinctively know that if targets are up in North Korea headed south, they're most likely enemy aircraft. Sure, these could be returning friendlies, but you get the general idea. We anticipate the target's identity because we know where the bad guys are stationed. Let's look at another situation. Most pilots will know that when they see a flight near their flight path in the mission planning map, they can recon that flight to determine what those targets are. If they turn out to be MiG-29s, then the pilot knows that they will have to be on their toes as they approach the point in their flight were those MiGs are shown. Again, planning can be used to anticipate the identity of targets in a certain area. This can be taken further to give even more detailed information and allow for greater anticipation of target ID.

When planning, we have covered the need to review the location of enemy airbases in relation to your flight plan. Taking that a step further, the pilot can see the type of aircraft at those airbases. Using the Order Of Battle screen in mission planning, you can expand the list of enemy airbases and expand the individual airbases themselves to see what squadrons are located there.

Using our running example, if we investigate Koksan and Haeju we could find that Koksan is home to a squadron of 14 MiG-29s and that Haeju is home to 11 MiG-21s. Additionally, we might also look to the northwest of our station area and see Mirim airbase. We check that airbase and find nothing but AN-124s. Now we can anticipate not only the location of targets, but their type as well. I typically make a habit of checking all major enemy airbases during the progression of a campaign for this very fact. It is important to keep general theater awareness high so you will know when you're exposing yourself to capable enemy fighters or when you're going to be flying around fat, dumb and soon-to-be unhappy transports.

Target Prioritization

Target Prioritization is both strategic and tactical. Granted, you'll have to react to located and identified targets when you're finally in the air, but you should know before you ever leave the ground, what targets are going to be your focus. There are two factors that govern target prioritization in the planning stages of a mission. There are target type and the nature of your current mission.

All things being equal, target identification will determine priority in the following order; fighters, attack, and support. If an enemy fighter and an enemy attack flight are inside their WEZ of your jet, then the fighter is always the priority. Anything that can kill you will demand your attention first. Additionally, target identification can be expanded upon to determine that more capable fighters take priority over older fighters. Fighters with the capability of carrying modern BVR missiles take priority over those that can't, etc. However, this basic rule can be altered by tactical situations and mission types.

Mission type can determine priority by shifting the typical priority progression based on the goal of your mission. A BARCAP will dictate that even if you've got a flight of MiG-21s on your radar 40 miles away, you leave them alone (unless they're inbound obviously) and guard your station. A Sweep mission would alter that priority again and you might engage those MiGs. If you're flying CAP in defense of ground targets, then attack aircraft would gain priority over fighters if (and only if) your aircraft is not already in the WEZ of the enemy fighters.

This is a complicated trade off between each component and it takes a while to learn how to combine them into an effective prioritization strategy. However, the worst time to try to learn this is when you're in the air with multiple enemy flights buzzing around you. It must be developed in a planning stage!

Separation

While it can be argued that separating from an engagement is purely tactical, there are planning elements that will have significant impact on a pilot's ability to separate effectively and safely. The mistake most commonly made is not to plan for separation and all, and once executed, finding oneself "out of the frying pan and into the fire".

As you perform your other planning exercises, you should be paying attention to the overall threat environment in which you will be flying. Not only will this include the aforementioned review and anticipation of enemy air activity, but ground threats as well. The last thing you will want to do is dive out of a fight to avoid a missile shot only to fly right into the threat circle of a SAM site!

Plan escape vectors at potential engagement locations along your flight path. Sometimes you cannot help but turn towards another threat while trying to survive your current threat, but reviewing known threats and prioritizing them will give you a better anticipation of your path of separation.

A-A Mission Tactics

Now that you've planned your mission and have your strategies in hand, it's time to execute the mission in the air. As has been said in many publications by many authors, air combat is not rocket science. It is fairly easy to understand. It is the execution of that understanding that is that hard part. While this may be true, it is still important to constantly review the elements of air to air tactics so that they may be executed by

second nature.

Target Location

When a flight is finally in the air, scanning for targets becomes the first important aspect of a mission. You cannot attack or defend against something you can't locate! In mission planning, you recognized where to look for targets. Now you need to decide how to look for them. Three tactics were mentioned; Visual, Instrument and AWACS. Let's start with these tactics in order of their coverage. The further out you acquire a target, the better.

AWACS

AWACS can typically give the location of targets further out than your own radar and obviously further out than you can locate them visually. As such, if you can use AWACS to acquire targets before then enter airspace around you or your intended path of flight, you should. However, AWACS has the potential of being a crutch on which many pilots become too dependent.

There are specific limitations for AWACS that should keep it from being anything more than a guide when you're blind. First, AWACS will only give you the location of one target or group of targets. Then, it will only give you the location of the closest target. If you're in a situation in which you are flying towards a station area that has 3 groups of MiG-29s inbound, an AWACS call will only let you know that you have one inbound group in a given location. If the other 2 groups are coming from other directions, then you could be in big trouble if you depend only on AWACS for acquisition. Besides, AWACS may not even be present.

At the most, AWACS should be used only when you cannot locate targets on your instruments. When AWACS is used, calls should be made for not just targets, but specifically for threats as well. This will at least ensure that if the closest group to you is a support flight, you'll still get an AWACS indication of a fighter flight that might be further away than that support flight.

Instrument Scans

The radar, HSD and RWR are the most important tools a pilot has at their disposal for target acquisition. Using them effectively will be the difference between advanced warning and control of an engagement and being ambushed. It is also this section that will provide the larger part of information which a pilot will need to learn to be efficient The radar is the primary instrument for target acquisition of course. The primary modes used are RWS, TWS and ACM and each has specific benefits and should be employed for specific results. We begin with employement for target location only. With this in mind, when you're looking for targets, RWS is your primary mode. ACM in the slewable submode is also an appropriate radar mode for searching for targets in a close in area of sky.

RWS is your "fastest" long range mode while covering more airspace in general than TWS. While TWS might give you more information about a target, we're just trying to find them first. Using RWS, you can reliably begin to pick up targets 60+ miles out. This can be enhanced by reducing your azimuth and/or bar scan patterns to force the radar to search smaller patches of sky, but uncover targets further out. additionally, RWS has the benefit of being able to burn through long range jamming contacts far better than TWS. Interestingly enough, this is coupled with a smaller observability. That means RWS is less likely to be picked up by enemy RWR than TWS is. As such, always begin your radar scan in RWS and do not limit yourself to 40 miles out. The further away you locate targets the more time you have to manuever for advantage. It is often helpful to split up radar duties between multiple ships in a formation, with one scanning long and another scanning short.

While many pilots think ACM is only used for close-in combat and pointing your weapons, ACM is interestingly enough another great radar mode to use for target location in certain tactical situations. On egress from an attack, or in turning maneuvers, it is often best to go into ACM Slewable to quickly check airspace around you for targets. RWS is too slow for this. By slewing around, you will easily pick up anyone in your immediate area. It is important to do this quickly to clear immediate airspace, then go back to long range scans. Another benefit of doing this is that if you do locate a target in your airspace, by going ACM you're immediately going to lock him up and be able to bring weapons to bear if it is hostile.

Another tool at the pilot's disposal for target location is the HSD. Obvisouly, this requires that another member of the flight has the target locked up. However, it does provide a very quick visual reference to allow other members of a flight to focus attention on a given target or group of targets. Just remember that to use this effectively, you must have your HSD range set out far enough to pick up the locked contact. If you're set too short, the contact will show as a closed triangle in the direction of the target. You will need to increase your HSD range until the target is a bracket with a velocity vector protruding from it.

The last and least effective instrument for locating a target is the RWR. Obviously, this instrument will give you a relative bearing to an emitting target. Unfortunately, by the time a pilot can use this instrument, they could already be in trouble. The benefit of the RWR really comes in identification and engagement phases, but it can still help point a tumbleweed at a target.

Visual Scans

Visual scanning is the last and of course, the most rudimentary way of locating a target. Some reading this might ask why I have even bothered to discuss this point given its basic nature. It is precisely because it is so basic that many pilots overlook (no pun intended) the use of visual scans in favor of ACM when they should not. Even in flying to a distant target waypoint, visual scans should be kept up religiously to make sure no enemy has snuck in low and popped up behind the pilot. Sharing the scanning workload in a flight often helps with this. One or two pilots work radar while the remaining scan cross-wise, across the flight to maintain an eye on their wingmen while looking beyond them for targets. Trailing pilots should not forgot to make small turns occassionally to check six.

Target Identification

Now that targets have been located, they must obviously be identified. The very same tools used to locate those targets are those used to identify the target; AWACs, Instruments and the MK-1 Eyeball.

AWACS Identification

In a perfect world, a pilot would call AWACS and always get an immediate, accurate response as to where and what his targets are. Unfortunately, it is not that easy and it requires a degree of skill to truly utilize AWACS to ID a target. The first level of target identification AWACS can provide is something all pilots are familiar with; the general picture. While this is primarily used to locate targets as discussed in the previous section, it will give a general sense of what the target may be. By calling for picture (Q1), the AWACS will at least tell you that a target in a given location is hostile. Helpful, but obviously not what we’re after.

Every now and then, depending on AWACS capability, the alignment of the stars and what the pilot may have eaten for breakfast, the AWACS might call out what the target is when a pilot calls for picture. For example, you may receive "Falcon1-1, Chalice 1, nearest target is an AN-124. Bullseye 280, 120 miles". Or you might get "Falcon1-1, Chalice 1, nearest target is an enemy fighter. Bullseye 295, 60 miles". These calls are excellent because you now either have a specific ID, or at least know that the target is a threat or not. However, more often than not you will simply get a nearest target return with a bullseye location, requiring the pilot to use other methods to ID that target. Again, be wary of using only AWACS calls for picture for the reasons discussed in the previous section on target location. You will only get the closes target called by AWACS.

The next method of getting additional information from AWACS is by specifying your call for closes threat. By doing this, you are asking AWACS not for the closest target, but for the closest enemy threat (fighter). Note that enemy attack and support aircraft are not considered to be threats to the pilot unless they are capable of carrying A-A missiles. A MiG-23 is a threat. A SU-25 is not. Interestingly enough, a MiG-17 doesn't carry missiles either, but since it's a fighter it's considered a threat by AWACS (albeit not much of one). By simple volition of the fact that you asked for threats, if you get a positive AWACS return, then not only do you know the target in that location is hostile, but a threat to you and your package. AWACS may again give details as to the specific type of threat, but that is not common. As such, the pilot can get lucky and ID targets with general picture and threat calls, but more often than not the pilot will need to lock a target to get AWACS to identify the target with any degree of detail.

By locking the target and calling for a declaration, the pilot is truly asking AWACS whether or not the target is hostile. However, it is common not only for AWACS to make that declaration, but to denote the specific aircraft type as well. This does not always happen though and even with a target locked, the pilot may have to resort to his instruments or eyeballs for final identification of a target.

Instrument Identification

There are only two methods of identifying targets using your instruments. They are the use of Non-Cooperative Target Recognition (NCTR), a function of your radar in STT mode, and the use of the RWR. We'll begin with NCTR.

NCTR is system that is built into your FCR. It is programmed with the radar return signatures given off by the target (specifically the targets turbine blades in the intake). The system queries these returns and gives the pilot a visual queue at the top center of your FCR page in your MFD. The system begins by showing a bar at the top of the MFD. As the bar moves right, the system is determining that the target is more likely to be a hostile. As the bar moves left, the system is determining that the target is more likely to be friendly. Once the system is certain of the target type, it will display the aircraft name (i.e. F16, MIG29, IL28, etc). This sounds great until you realize its limitations. First, it only works on jet aircraft. It can't determine prop driven target ID. This is not such a big problem. A prop aircraft isn't going to be a threat anyhow. The bigger issue is that you must be within a 20 degree cone head-on with the target so that your radar can "see" the targets turbines. That, coupled with the fact that it takes several seconds to process the radar returns and produce and ID often means the pilot will already be in harm's way once the identification is made. Lastly, you must be in STT mode for NCTR to work, so you will spike the target's RWR. You can see that while being a valuable tool, it is not a panacea.

The RWR is the second instrument that will identify a target. As we all know, the RWR will display a symbol representing the "class" of aircraft for which it picks up radar emissions. The issue with the RWR is that it is only useful for identification in conjunction

with your radar, since it does not denote specific target position and requires the target to be emitting a radar signal. The good thing is that it is never wrong.

Visual Identification

There's not much mystery here. When all else fails, the only way to identify any target with absolute certainty is to put your eyeballs on it and see what it is (or padlock in the world of Falcon). This is easier said than done in the world of BVR missiles, but if identification can be made in no other way, then you will have to look at your target before firing on them if there is any possibility of that target being a friendly. This being said, if a pilot can only ID visually and there are friendlies in the area, you may want to think twice about moving in to engage the target. It's better to separate from a bogey than to shoot down a friendly.

There are other tricks a pilot in the Falcon world can use to ID a target as friend or foe when in the air (firing some gun shots with the target locked up, telling a wingman to attack, etc), but the realistic methods above, when used together, should give a high rate of positive identification of any target aircraft. That is truly the secret to success; the combined use of these methods.

Target Prioritization

As discussed earlier, general strategy and mission parameters will set rules of target prioritization before a pilot even gets into the jet. However, once airborne, there are tactical situations that will alter these rules. Again, air combat is a dynamic exercise and things are constantly changing. The tactical progression of target prioritization once you are airborne is determined by proximity and vector.

All things being the same, proximity of an enemy target to your jet, your package or your defensive objective obviously determines priority. Closer is higher priority. Farther away is lower priority. Vector also determines priority by relative heading. A target headed towards you or another friendly is a higher priority than one headed away. No one component will determine priority though. It is the combination of the strategic rules and tactical situation that will finally dictate what your priority is.

Let's take an example of two separate enemy flights on your scope at the same time. One is a 4 ship of MiG-29s and the other is a 4 ship of Su-25s. You are on your BARCAP mission north of Seoul. Both flights are headed towards your station 40 miles out. Obviously, the 29s become your priority since you fight the biggest threat first. What if the 29s were headed away from you? The 25s now become the priority because of their vector towards your defensive station. If both flights were vectored at you, the 25s were at 20 miles from your station and the 29s were at 50 miles, wouldn't the 25s be your priority? Yes, most likely. However, if the 29s were 35 miles out and the 25s were at 20 miles out, the 29s would still be higher priority. Their threat at 35 miles is still greater than the 25s at 20 miles. Throwing mission type into this mix, if your mission were suddenly an escort, you would be ignoring the 25s in each of the listed scenarios. An Escort mission dictates that your priority is the target that can harm your package. 25s aren't a threat in this case. Another variation on this situation would be that the mission is a Sweep. The 29s are headed away from you. You would still take out the 29s first, even if the 25's were closer. A Sweep mission is designed to airspace of enemy aircraft that can harm follow-up missions. 29s can do this; 25s can't.

You can easily see how a simple change in mission or scenario will alter your priority between two flights/types of enemy aircraft. Again, the situation you find yourself in the air will be the final determination of priority, but you've got to think this through before you even jump in the jet.

Target Sorting

Now that you've located, identified, prioritized and selected your target enemy flight, you must sort individual aircraft before you can engage them. Fundamentally, sorting is simple, but the tactical reality of burning through jamming, separating individual aircraft in a flight, and communicating individual targets to members of your flight can be an overwhelming task at times.

In a typical progression, you will have isolated a single group of enemy aircraft as your target using your radar. Hopefully you have accomplished this before that group is inside effective threat range. With this being the case, a flight of enemy aircraft often shows up as a single radar return outside 35 miles. While you could bug that single return and drive it to engage with a missile shot, there is no telling then if that return is a single ship, 2 or 4 ship flight. Much less possible is then being able to effectively distribute multiple targets to other members of your own flight for engagement.

In order to get a clear picture of the numbers and orientation of aircraft in an enemy flight, you must first get a clear radar return on each of them. By using RWS and reducing the Azimuth scan, you can put more directed radar energy on the enemy flight. This will help produce individual radar returns on your MFD faster. Additionally, if the enemy flight is jamming, RWS with a reduced azimuth will burn through that jamming much further out than any other method. At this point, you should now have a clear idea of the number and orientation of the enemy aircraft in the target flight. You could try to engage at this point, but most times, an additional degree of detail is needed to truly separate enemy aircraft and make sure your own flight is targeting separate enemies so as not to overlap shots. The best thing to do at this point is call/assign individual aircraft to your flight using relative position calls (i.e. "engage symmetrical", or "1 has lead, 2 take 2nd, 3 take second element", etc), but do not go hard lock at this point and lose the total picture.

Once the enemy flight comes within 40 miles, you should be able to pick them up using TWS. Once you can, bind the radar cursors to one of the enemy aircraft, but do not bug it. Then, go into Expanded mode (EXP) to get a close-up picture of the enemy flight. At this point, radar cursors can be slewed to individual enemy aircraft with precision. Once slewed to the appropriate aircraft, bug the target and you will be able to call precise bullseye locations of your individual target. Now the entire flight knows who has what target. A bullseye location of your target should be called before you fire to ensure that no other member of your flight is doubling up on that aircraft, wasting a missile and valuable time needed to retarget the correct aircraft.

This entire procession is of course, thrown out the window when trying to sort targets close-in. As a flight moves into close-contact with enemy aircraft, sorting will have to be done visually. The most critical part of effective visual sorting is the communication of target location relative to the flight. As such, the flight cannot be broken up. Proper mutual support must be flown, if for no other reason, than to make sure the sight picture is relatively identical for all aircraft. If this is done, then a call of "single MiG-21, 10 o'clock, high" will mean the same thing for everyone in the flight that it does for the pilot making the call. In the case of a situation where the flight is broken up, visual sorting and communication of targets should be done relative to a common landmark such as a town, river, mountain, etc. Then call such as "single MiG-21, south west of town, low" will still have meaning to the rest of the flight.

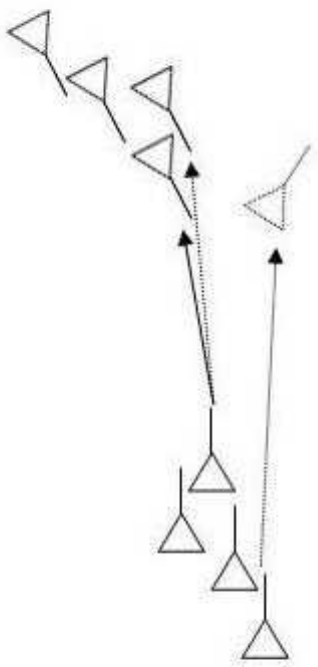
Target Engagement

<u>Engagement Sequence</u>

Once targets are sorted an order of engagement must be established as a direct result of tactical priority. Again, this is something a flight should be briefed on prior to finding themselves in a fight. For example, the classic order of engagement is a mirrored or symmetrical engagement. In a typical wedge 4 vs. wedge 4 scenario, flight lead would engage red lead, #2 would engaged red #2, etc. This ensures that each jet in the flight is engaging the correct and separate target as well as allowing for the max distance between the flight and their target of choice. If flight lead was to engage red #4 instead, it could put him inside the WEZ of the enemy flight lead and in danger before a shot could be put red 4.

However, as stated before, target distance is not the only factor that effects priority and, as a result, engagement sequence. Vector is just as important.

Taking the classic engagement setup discussed above, what would happen if the enemy lead executed a drag maneuver as illustrated?



In this case, if flight lead stayed on the enemy flight lead, he would be pulled into the WEZ of red #2. Since Red 1 is no longer the priority threat, then the engagement sequence needs to change. There are two options in this case, either Blue 1 can stay on Red 1, but notch right, away from the approaching Red 2 jet, or Blue 1 can retarget, which is perhaps the better choice as long as this target switch is understood and communicated with the rest of the Blue flight.

This is what I will refer to a "shift 1" scenario. In this case, the entire order of engagement would "shift" one aircraft in order. Blue 1 would now target Red 2. Blue 2 would engage Red 3. Blue 3 engages Red 4 and finally, Blue 4 would shift to take the original red lead jet that is now dragging. This keeps the all important separation to a maximum. This can repeat several times. If both Red 1 and Red 2 drag, then the situation would move to a "shift 2".

While these tactics can be communicated on the go during an engagement, this type of situation should be a common practice and briefed before flight. This way, the flight does not lose valuable time communicating intentions and can simply jump to the appropriate targets as the picture changes.

Engagement geometry/tactics

The tactical aspects of air combat engagement can fill a book themselves (and have, many times). I will not attempt to recreate these works given time and my own limited experience. However, there are a few key issues which bear mention and often cause problems for many pilots I have flown with.

The recurring theme in tactical engagement is maintaining separation from the enemy. This allows two things to happen. First, it can keep you outside the WEZ of the enemy. It will also give you room to maneuver against the bandit. Put simply, keep as much distance between your jet and the bandit as possible while still being close enough to employ your weapons effectively. This will dictate how a pilot should position his in relation to a maneuvering bandit and is also where we see many pilots fail to employ proper tactics.

I am amazed at times, how many pilots will engage a bandit, fire a missile at the target and continue to fly directly at that target until the missile goes autonomous or even hits the bandit. This should never happen unless you're moving in on a fat, dumb and soon to be unhappy transport. Even then it shouldn't happen since you should be gunning those ducks instead of wasting missile shots. At any rate, separation should always be maintained to the greatest extent possible, even after a missile is fired. To this end, all pilots should be familiar with and employ a "Crank" maneuver when engaging enemy threat aircraft.

Cranking after a missile shot is done by turning away from an inbound bandit as far as possible while still keeping the banding inside radar gimbal limits ("on your scope"). By executing this maneuver, you reduce your rate of closure and keep as much distance between you and the bogey as possible. This may deny the bandit the distance needed to fire his own weapons at you and at very least will give you time. This time is used to let your missile go autonomous and then allow you maneuver directly away from the bandit and separate from the fight, or maneuver against a potential incoming missile shot from the enemy after depleting it of as much energy as possible.

Another rudimentary aspect of tactical engagement that is often not employed correctly is the use of speed advantage. It is easy to understand why this would be overlooked given its utter simplicity. As you move to engage a target with a missile, you will want to carry as much speed towards the bandit as possible. This will give your missile the advantage of starting out at higher speeds, allowing it to cover the distance to your target faster and allowing you to shoot from further out (again, maintaining separation). However, once the missile leaves your rails, the speed of your jet transforms into a disadvantage of increased rate of closure. As such, you should dump that speed as you crank, maintaining appropriate corner airspeed.

Separation

The saying goes "Discretion is the better part of Valor". There are times when engaging the enemy is unwise. At these times, it is far better to run away and fight again another day, lest you sacrifice your jet and yourself. When it comes to separation, there are only two questions; when and how.

When

When to separate should be the easiest thing in the world for a pilot to gauge. However, given human nature, especially the aggressiveness of the typical fighter pilot, this often becomes one of the hardest things to judge. Fundamentally though, this question can be answered with one simple statement, "When you don't have the advantage". The complexity begins when you attempt to define what a position of advantage is.

Number of threats, type of threats, speed, altitude, relative position and vector; these all dictate advantage. Recognizing them should be hard either with good SA. But in the heat of battle, we all know that SA is unfortunately one of the first things to go. Even when a pilot has a target locked and engaged, they should continually maintain SA on other threats. It is all to common that I see pilots get target fixed and drive right into situation where they are ridiculously outnumbered or have horrible positional advantage. Flying the jet isn't hard. Firing the weapons isn't hard. Keeping track of everything going on around you and reacting appropriately to it is hard. Recognize what situation you're in now and what situation you may end up in if you continue your current path. By doing this, it should be easy to know when to get out of Dodge.

You're in a 2 ship of F-16s and there is an inbound flight of 4 MiG-29s with a 5000 foot altitude advantage inside 30 miles. Separate! You're in a 4 ship flight and you're getting sandwiched between 2 other 4 ship flights. Separate! If you don't have tactical advantage, get your butt out of there and maneuver until you do have tactical advantage.

How

How to separate is simple in one respect; do it fast! But, like many other things, nothing is as simple as it may seem at first. Simply turning and running like a bat out of hell would be easy if you weren't there to do a job in the first place. To win a war, you can't always run away from a fight, even if you are at a disadvantage at first. To separate correctly, but still have a chance at fulfilling mission requirements, you must separate to even the odds, and then re-engage.

If you're that 2 ship of 16s being driven in on by 4 29s at altitude, you turn away, light the burner and climb. You separate from them while beginning to even the odds of position. Once outside their WEZ and at a similar or greater altitude advantage, you can turn back to engage. You're still outnumbered, so after an Rmax shot at the closes bandits, you separate again. If you're the flight getting sandwiched, you turn your flight path to flank one group of bandits to the opposite side that the other flight is located. Then, when no longer being in danger of being engaged by both bandit flights at the same time, you engage the closest group. Separating isn't always about running away. Think of it as "repositioning". Of course, sometimes the best "reposition" is back at home plate!

The last issue to keep in mind during separation is the tactical picture. Don't dive out of one fight into another. Where are the other enemy flights? Where are the SAMs? Choose your escape vector so you can separate cleanly or at least in a manner that puts you in an advantageous position against other threats you may have to engage as you separate from your first threat.