

CVW-14 INITIAL TRAINING

Week 8: BASIC FIGHTER MANEUVERS





OVERVIEW

- Welcome to week 8! Tonight we will discuss:
 - **BASIC FIGHTER MANEUVERS** – Doing that pilot shit. You know. You've seen movies.
 - **OFFENSIVE BFM** – Kill him! Come on! Kill him! Put the nose on him and kill him!
 - **DEFENSIVE BFM** – Mistakes will be made. Let's try to make sure they're not fatal.
 - **HIGH ASPECT BFM** – 1v1 me, bro!
- This one's going to be a lot of fun.
 - If you've been thinking about how much you want to blow your IPs' brains out the last two months, well, have I got good news for you...

TOPIC 8.1 – BASIC FIGHTER MANEUVERS

"What is BFM, and why is it important that I know it?"

"What are the most useful weapons in a BFM engagement?"

"What are the various types of fights I might find myself in?"

"When do I show them a little trick I learned?"





BFM 101



- ***Basic Fighter Maneuvers*** – WVR A2A combat. *Dogfighting.*
 - While we try to avoid WVR engagement, sometimes you've got to take it to the merge!
 - BFM skills are useful outside of a dogfight as well!
- This is another huge subject, and it's something that can be difficult to teach in the classroom setting
 - We'll give you some foundational knowledge, but you're going to have to hop in the jet and get shot down a bunch before it really clicks!
 - It's a perishable skill, so practice often!



WEAPONS & SYSTEMS



- Most useful weapons in BFM include:
 - ***M61A2 20mm Gun*** – Switching to Guns
 - ***AIM-9X Sidewinder*** – Heat seeking "dogfight" missiles, capable of high off-boresight shots when combined with the JHMCS
- The ***JHMCS*** is incredibly useful in BFM
- Play around with the ***ACM*** radar modes as well – can be very useful to pick up bandits in a fast-moving engagement!



SOME TERMINOLOGY

- **3-9 Line** – The line running from 3 to 9 o'clock on the airplane, wingtip to wingtip
- **Turning Circle** – The path the jet cuts through the sky when it makes a circle
- **LOS Rate** – How fast you see the other A/C moving across your canopy
- **Aspect Angle** – Degrees from the tail of the target to your aircraft
 - For example, head on is 180 degrees, tail-chase would be 0
- **Turning Room** – Offset distance from the bandit
 - Can be subdivided into *horizontal* or *vertical* turning room
- **Control Zone** – An area approx. 2000-4000ft behind the defending aircraft; ideal place to employ weapons!



ENERGY



- ***Kinetic v. Potential Energy***

- ***Kinetic*** – How fast are you actually going?
- ***Potential*** – How high are you?
- Summed up these two form your total energy

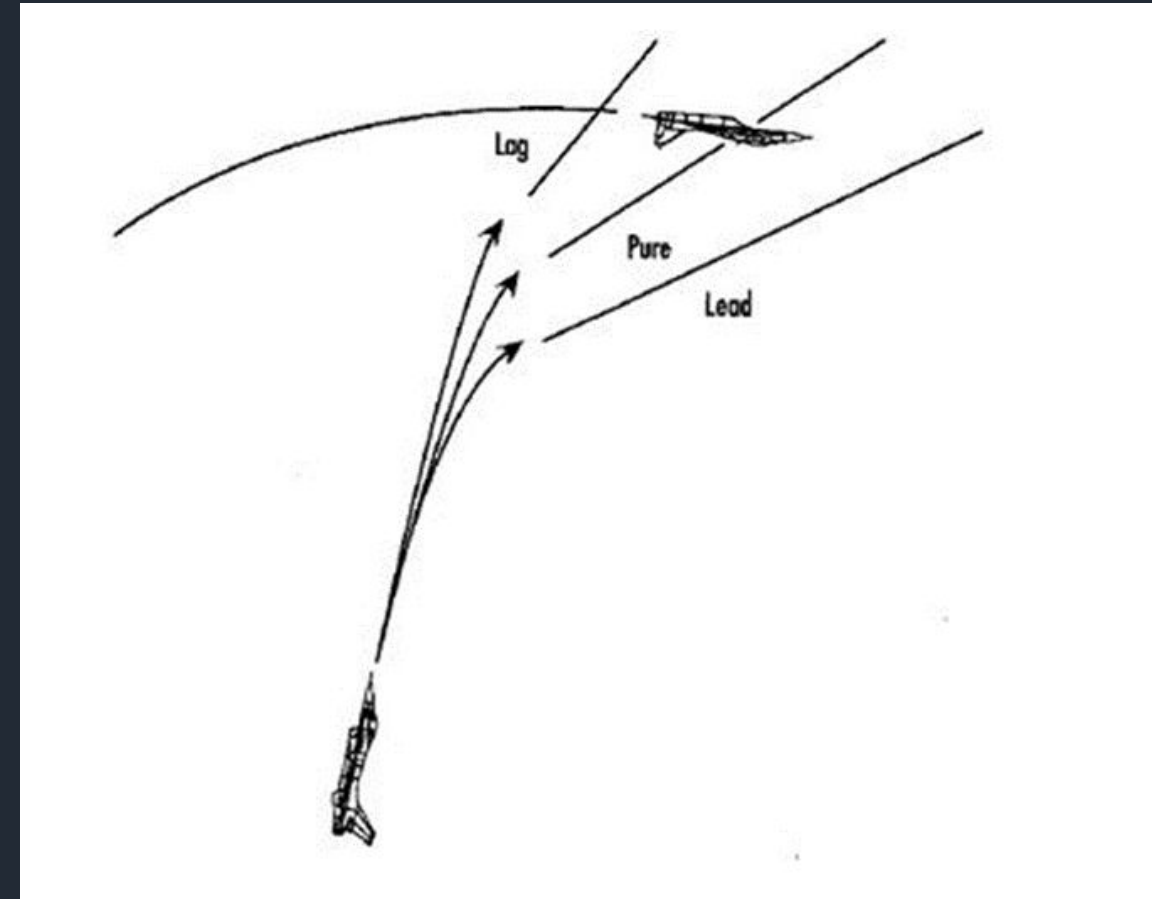
- ***BFM is all about managing energy and nose position***

- It's like a bank account – you can spend energy to move the nose
- Like with real money, don't just spend it for no reason.
- By the same token, you can't take it with you – don't die with energy!



PURSUIT

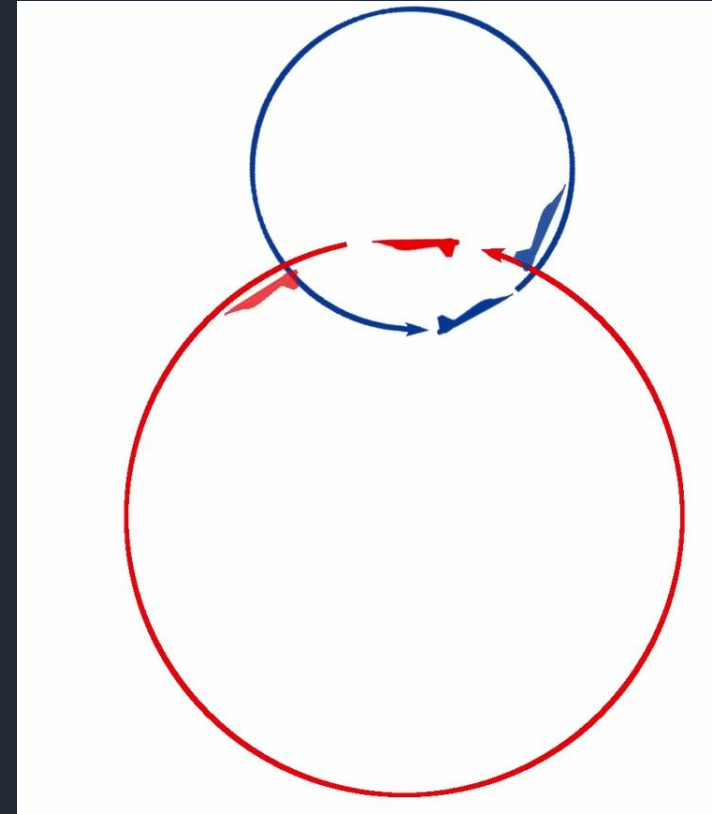
- **Pursuit Curves** are all about where your nose is pointing relative to the bad guy
 - **Lead Pursuit** – Your nose is pointing ahead of the target, useful for guns but can cost a lot of energy!
 - **Pure Pursuit** – Nose pointed at the target, useful for missile shots
 - **Lag Pursuit** – Nose pointed behind the target. Energy efficient, but you can't employ weapons and it can result in overshoots





RATE V. RADIUS

- **Rate** – How fast the jet moves around the circle
- **Radius** – The distance in which you can bring the nose around
- Both are important for different reasons – there are situations in which one matters but not the other!



Which is more important here, rate or radius? Why?

TOPIC 8.2 – OFFENSIVE BFM

"How do I get behind a bad guy in a BFM engagement?"

"Once I'm behind a bad guy, how do I stay there?"





OFFENSIVE BFM



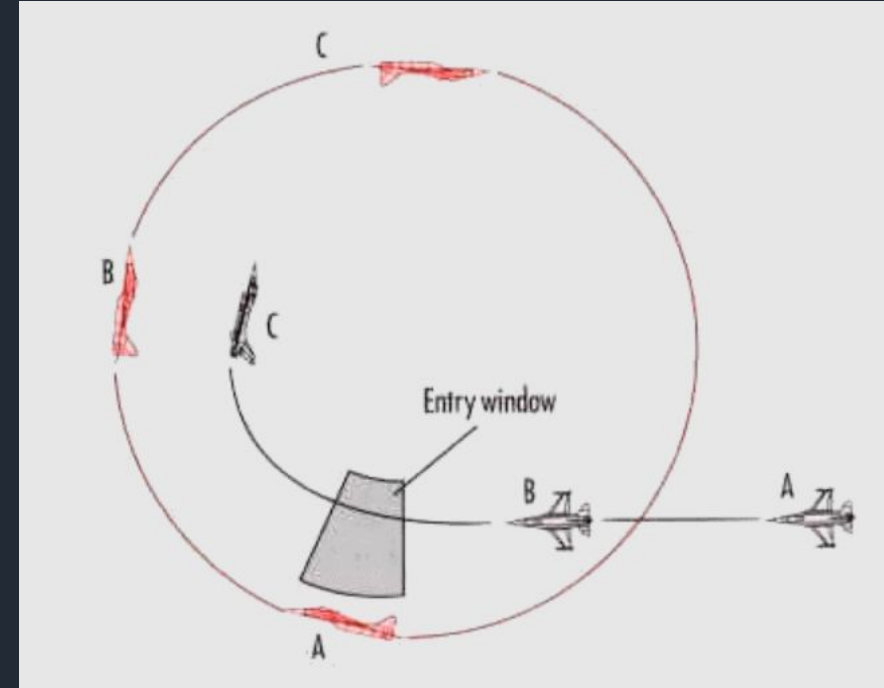
- ***Offensive BFM*** (OBFM) is the part of the dogfight when you're in the position of advantage behind the bandit.
 - *Kill him! Come on! Put the nose on him and kill him!*
- ***Goals of OBFM***
 - ***Avoid an overshoot!*** Manage closure/angles so you don't end up out in front.
 - ***End the fight as quickly as possible.*** This guy might have friends inbound.
 - ***Whittle down the bandit's energy while preserving your own.*** By the same token, don't push for the guns kill too quickly if you can stay in control for a safer shot a few seconds later.



TURN CIRCLE ENTRY



- Let's say the bad guy sees you behind him. He's going to start to turn.
 - If you turn now, you're outside his turn circle – he can come around and potentially meet you head on for a shot!
- ***Turn Circle Entry***
 - Drive to where the guy turned on you
 - Watch for ***rapidly increasing LOS rate on the canopy, then pull!***





MANAGING YOUR POSITION

- Remember, more than anything you want to make sure the bandit doesn't turn the tables on you!
- Watch for the bandit to create **BFM Problems**
 - Watch the closure rate; don't end up in front!
 - Watch for angular problems that could give the bandit a potential **reversal opportunity**
- You need to balance this with the other goal of ending the fight as soon as possible
 - Don't take unnecessary risks that might get you killed, but also don't sit and play with the guy all day – his friends are coming and they're unhappy!

TOPIC 8.3 – DEFENSIVE BFM

"What do I do if I've made a mistake during a BFM engagement?"

"How do I present BFM problems for my opponent in a defensive situation?"

"How does the ejection seat in the Hornet work? Asking for a friend."





DEFENSIVE BFM

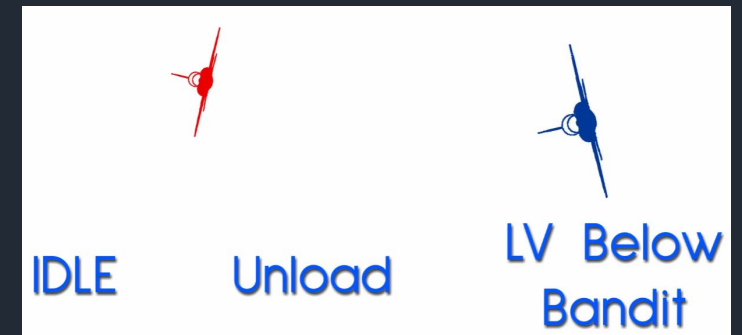
- **Defensive BFM** is what happens if when you make a mistake during an engagement and wind up out in front
- **Goals of DBFM**
 - **Don't Die** – Just being alive keeps the bandit busy. **Do something.**
 - **Stay Alive Until Help Arrives** – The longer you last (so to speak) the greater the possibility of some friendlies showing up
 - **Go Offensive, Separate or Neutralize** – If you can turn the tables, do that. If you can get out, get out. If you can't do either, keep him from killing you.
 - **Get Him Out In Front** - If the bandit is in front of your 3/9 line, he isn't shooting you.



DBFM TIPS AND TRICKS



- **Watch for Lead Pursuit** – Do you see the bad guy's belly? He's pulling lead and probably about to go guns!
 - **JINK!**
- **Maneuver Out Of Plane** – Unload, reset your lift vector, move onto a new plane of motion
 - It's difficult for the bandit to follow, or at least for him to keep his guns pointed at you!
- **Tighten Down** – Pull harder. This will bleed speed and potentially introduce closure BFM problems for the bandit!
 - This can potentially force an **overshoot!**





REVERSALS

- ***Reversals*** can turn the tables of a fight
 - If done wrong, they give the bad guy an easy kill
 - Opportunities to get them right are very rare
 - ***If in doubt, DO NOT REVERSE***
- **Very Specific Sight Picture** to watch for
 - ***High Heading Crossing Angle***
 - ***Rapid LOS shift aft on the canopy***
 - "Does it look like he'll cross behind the tail with a little help from me?"



TOPIC 9.4 – HIGH-ASPECT BFM

"What do I do at the merge?"

"What is the difference between a
1- and 2-circle fight?"





HIGH ASPECT BFM

- **High Aspect BFM**
 - Aspect measured off bandit's tail, so head on with you, that's as high an aspect as you'll be able to get!
 - Not incredibly common in combat, but generally how we train!
- The classic **merge** is the best example of a High Aspect situation
 - At the merge, you'll have some decisions to make that will dictate the course of the fight to follow

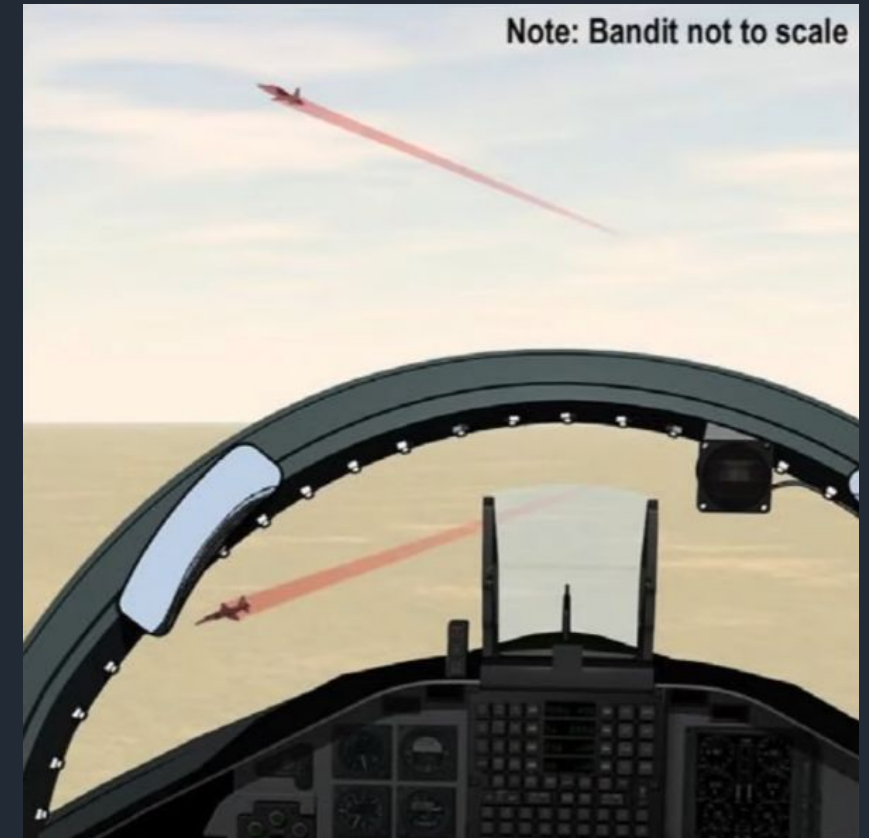
180 Aspect Angle





LEAD TURNS

- At the merge, you'll want to perform a ***Lead Turn*** – turning to start the fight before the bandit passes your 3-9 line
 - Pull too early and you give the bad guy a potential easy shot
 - Pull too late and you give up valuable seconds in which you can gain angles
- Watch for ***rapidly increasing LOS rate*** from about 10-11 o'clock on a left side pass, or 1-2 on the right
 - Once he starts moving more rapidly across the canopy, start your turn!





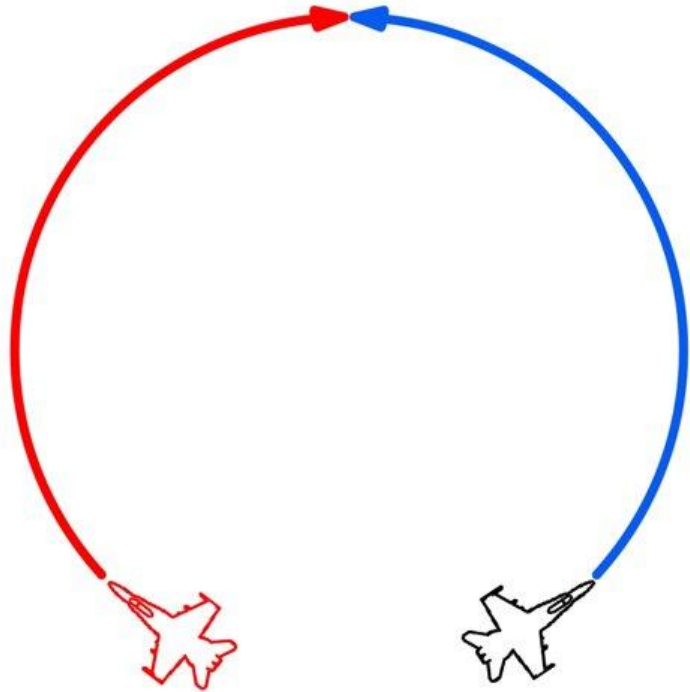
1 OR 2 CIRCLE?

- The biggest decision to make at the merge is whether or not you want a **1 or 2 Circle fight**
 - **1-Circle: "Radius Fight"** – Nose to Nose, tightest turn radius wins
 - **2-Circle: "Rate Fight"** – Tail Chase, best sustained turn rate wins
- This decision is based on a variety of factors
 - The Hornet's got great nose authority, so 1-circle can be a really good idea!
 - If you're coming into the merge really fast, you might want to force a 2-circle because your radius will be wider!
- **The last jet to turn decides the fight!**
 - Don't give up the advantages of a lead turn for free, but if you *really* want to force a certain fight, see what the bandit does and turn accordingly

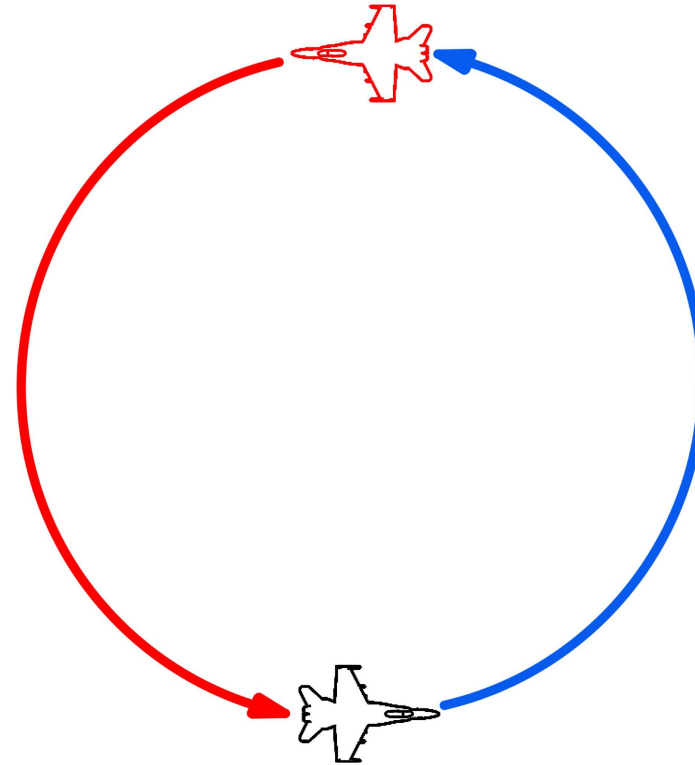


1 OR 2 CIRCLE?

ONE CIRCLE



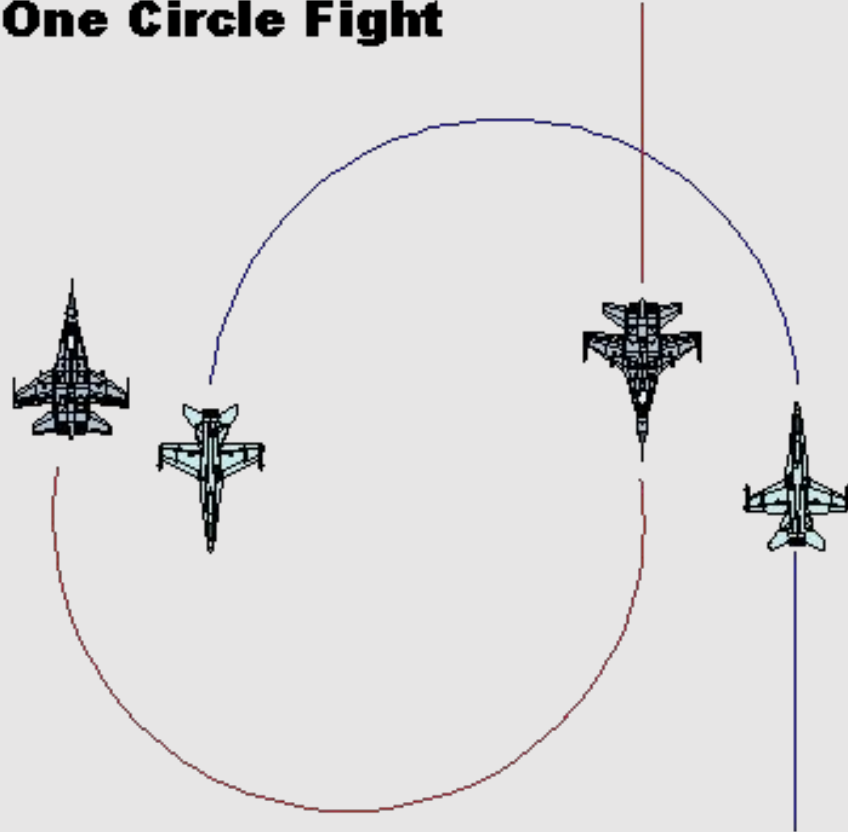
TWO CIRCLE



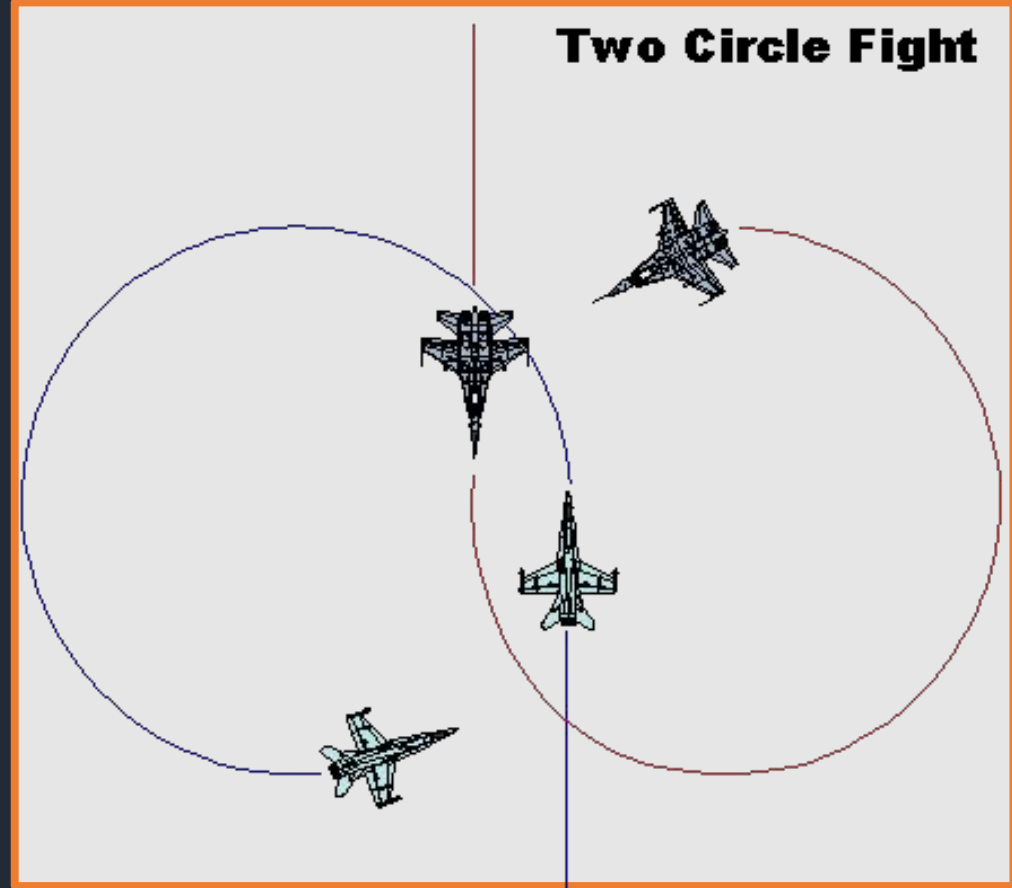


1 OR 2 CIRCLE?

One Circle Fight



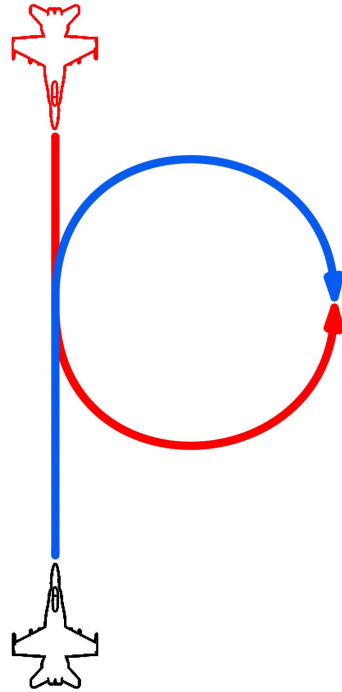
Two Circle Fight





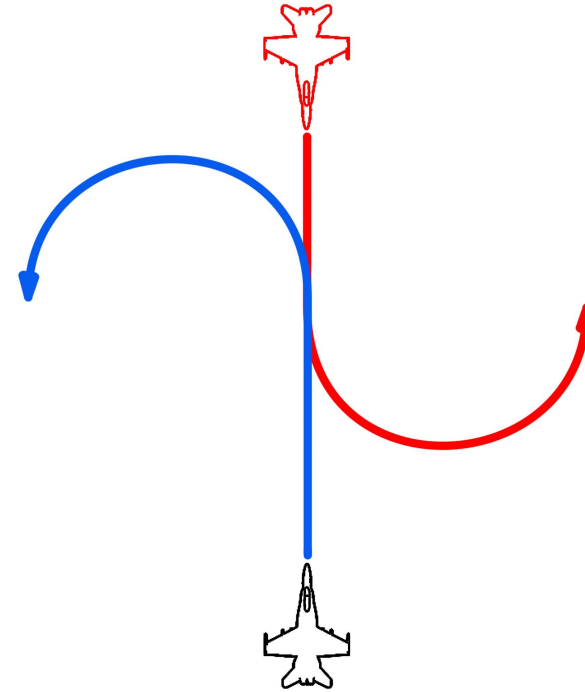
FORCING YOUR FIGHT

FORCING A ONE CIRCLE



1 Circle – Turn *opposite* (i.e. you turn to your right, he turns to his left) opponent at the merge

FORCING A TWO CIRCLE



2 Circle – Turn *the same direction* as opponent at merge

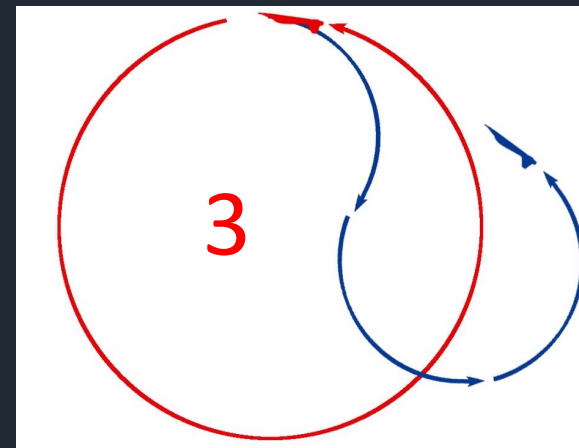
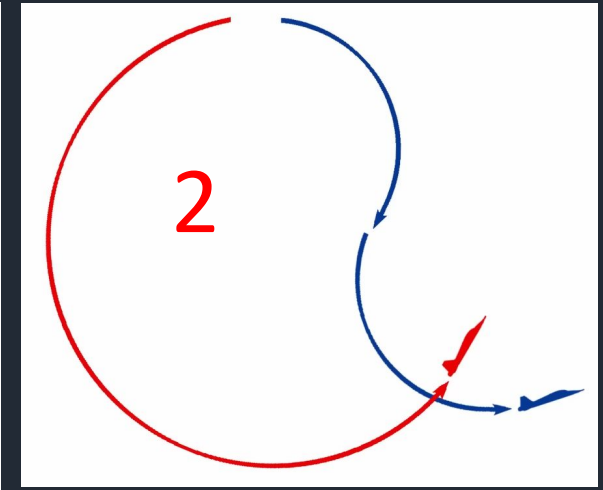
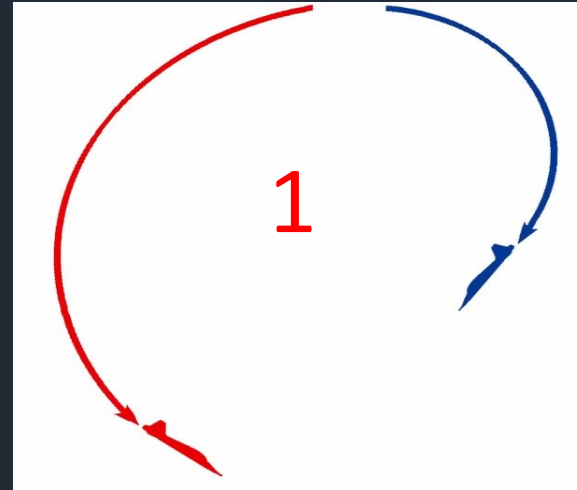


ONE CIRCLE FIGHTS



Radius is king in the 1-circle

1. These jets have the same turn rate, but by 1/3 of the way around blue already has better nose position because of superior turn radius
2. Blue performs another lead turn, gains better position
3. Blue is now in red's control zone – ideal weapons position!





TWO CIRCLE FIGHTS

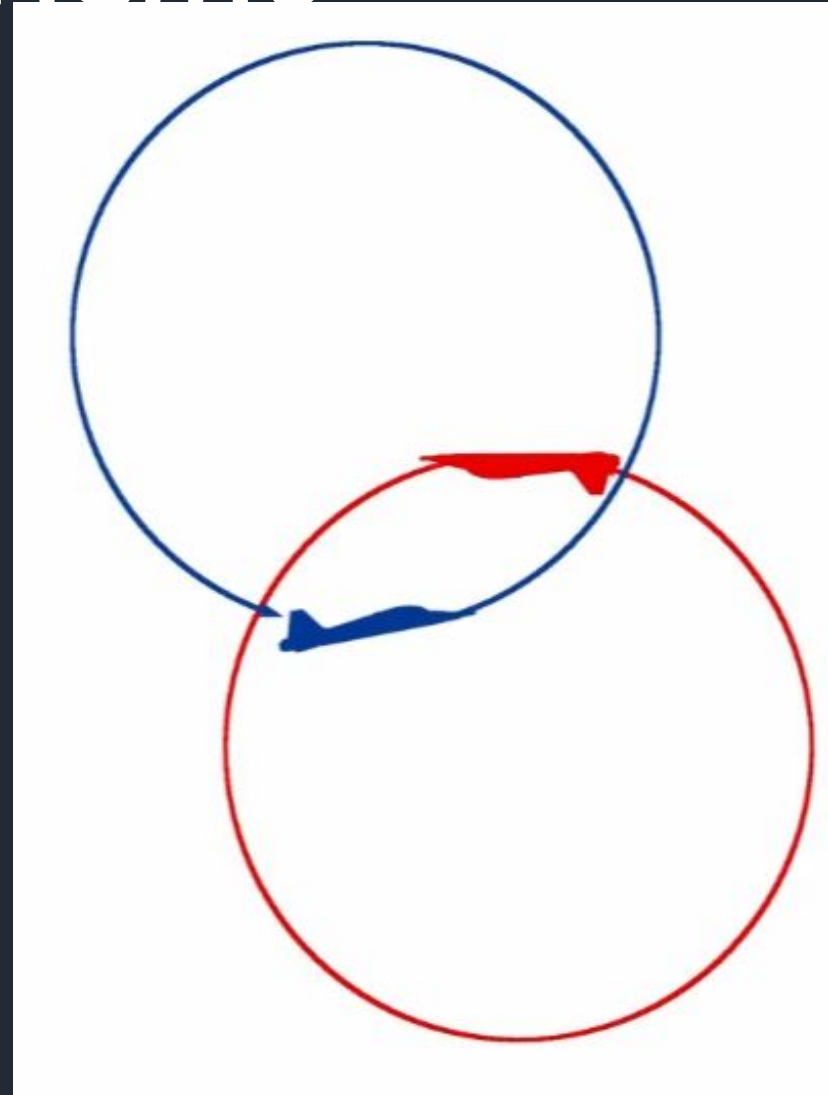


Rate is king in the 2-circle

- 2-circle fights are simple in concept – faster rate eventually gets around behind slower rate
- Radius does not matter!

Shoot for **350-400 knots** for max sustained turn performance

- If you need more speed, put the nose down! If fast, pull the nose up and climb!
- Be patient!





HORIZONTAL OR VERTICAL?



- We've explained these fights in terms of a basic, single-plane horizontal fight, but obviously this all happens in 3D!
 - Vertical 1-circle fights are very common – Hornet Pirouette!
 - In a 2-circle, use the vertical to adjust speed. Too fast? Climb. Need to get up to max sustained turn rate? Dive a little!



A FINAL NOTE

Remember, we're talking about basic concepts here; *it's damn near impossible to say "do this maneuver in this situation and you'll win 100% of the time"* because it just doesn't work like that

Remember the fundamentals and
practice, practice, practice!



WHAT QUESTIONS DO WE HAVE?



Don't Think, Just Do