

NAVAL AIR TRAINING COMMAND



NAS CORPUS CHRISTI, TEXAS

CNATRA P-1276 (Rev. 10-09)

FLIGHT SUPPORT LECTURE GUIDE



AIR COMBAT MANEUVERING FLIGHT PROCEDURES T-45C TS, TAILHOOK, AND IUT

2009



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CHIEF OF NAVAL AIR TRAINING
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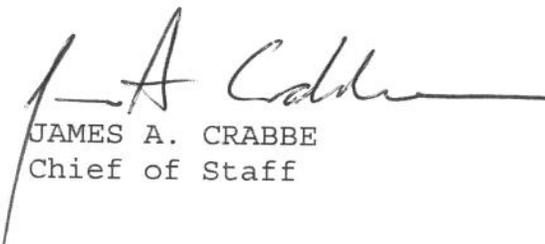
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Subj: FLIGHT SUPPORT LECTURE GUIDE, AIR COMBAT MANEUVERING
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1. CNATRA P-1276 (Rev. 10-09) PAT, "Flight Support Lecture Guide Air Combat Maneuvering Flight Procedures, T-45C TS, Tailhook and IUT" is issued for information, standardization of instruction, and guidance for all flight instructors and student aviators within the Naval Air Training Command.
2. This publication shall be used as an explanatory aid to support the T-45 Strike Flight Training Curriculum. It will be the authority for the execution of all flight procedures and maneuvers herein contained.
3. Recommendations for changes shall be submitted via CNATRA TCR form 1550/19 in accordance with CNATRAINST 1550.6E.
4. CNATRA P-1276 (05-98) PAT is hereby cancelled and superseded.


JAMES A. CRABBE
Chief of Staff

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COMTRAWING ONE (20)
COMTRAWING TWO (20)

FLIGHT SUPPORT LECTURE GUIDE
FOR
AIR COMBAT MANEUVERING FLIGHT PROCEDURES
T-45C TS, TAILHOOK, AND IUT
P-1276



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**CHAPTER ONE
INTRODUCTION TO ACM**

100. INTRODUCTION – N/A

COURSE/STAGE:

- TS, TAILHOOK & IUT/Air Combat Maneuvering

LESSON TITLE:

- Introduction to ACM

LESSON IDENTIFIER:

- T-45C TS, ADV & IUT ACMFP-01

LEARNING ENVIRONMENT:

- Classroom

ALLOTTED LESSON TIME:

- .8 hr

TRAINING AIDS:

1. T-45 Scale Model
2. Figures
 - Figure 1: Vertical Plane Maneuvering Egg
 - Figure 2: Horizontal Plane Maneuvering Egg
 - Figure 3: Oblique Plane Maneuvering Egg
 - Figure 4: V_n Diagram
 - Figure 5: ACM Strategies
 - Figure 6: ACM Symbology
 - Figure 7: Declutter Options

STUDY RESOURCES:

1. T-45C NATOPS Flight Manual, A1-T45AC-NFM-000
2. Air Combat Maneuvering Flight Training Instruction (FTI)

LESSON PREPARATION:

- Read:
 - T-45C ACM FTI “Introduction” and “Background” sections with special attention to symbology and terminology.

REINFORCEMENT:

- N/A

EXAMINATION:

The objectives in this lesson will be tested in ACMFP 05X.

101. LESSON OBJECTIVES

1. Relate environmental components to ACM performance
2. Relate fixed aircraft factors to ACM performance
3. Relate variable aircraft factors to ACM performance
4. Identify energy management components for the T-45C
5. Recall procedure for the performance characteristics exercise
6. Identify the proper use of descriptive/directive commentary
7. Define basic ACM strategies
8. Recall steps involved in preflight planning
9. Recall training rules for ACM exercises
10. Recall procedure for lost comm situation in ACM
11. Recall procedure for lost sight situations in ACM
12. Recall procedure for entering air-to-air gun data into display unit

1-2 INTRODUCTION TO ACM

102. MOTIVATION

Play Motivation Video

As a major element of America's first line of defense, pilots involved in incidents like this one spend many hours, day and night, to be prepared for that moment. They already know what you are about to find out.

ACM is not something that you learn quickly. You will not become an ace by the end of the ACM block of instruction. You will, however, learn several concepts that will take years to perfect: 1) speed is life — never reach a point where you end up out of airspeed and ideas; 2) know your aircraft to make the enemy fight your fight, not vice versa; 3) your game plan and your reactions in an engagement must be executed automatically; 4) the best fighters press the edge of their operating envelope all the time.

103. OVERVIEW

This lesson enables you to utilize ACM principles, terminology, and symbology during your preparation for ACM engagements.

In this lesson you will be studying:

1. ACM overview — real world and training command
2. ACM considerations
3. ACM analysis
4. ACM terminology and symbology
5. ACM training rules
6. ACM use of HUD

104. REFRESHER

This lesson builds on information presented previously. In particular, recall:

- T-45C TacForm FTI
 - a. Mutual support concepts
 - b. Communications and strategies in loose deuce maneuvering

105. PRESENTATION**ACM Overview**

1. Goal
 - a. Overall (real world)
 - i. Gain firing solution and destroy aircraft
 - ii. Deny firing solution to another aircraft
 - b. Training Command — to execute maneuvers and practice engagements necessary to reach a firing solution or deny bandit firing solution
2. ACM environment
 - a. Three dimensions — defined by longitudinal, lateral, and vertical axes
 - i. Can describe an infinite number of ACM planes from vertical through oblique to horizontal

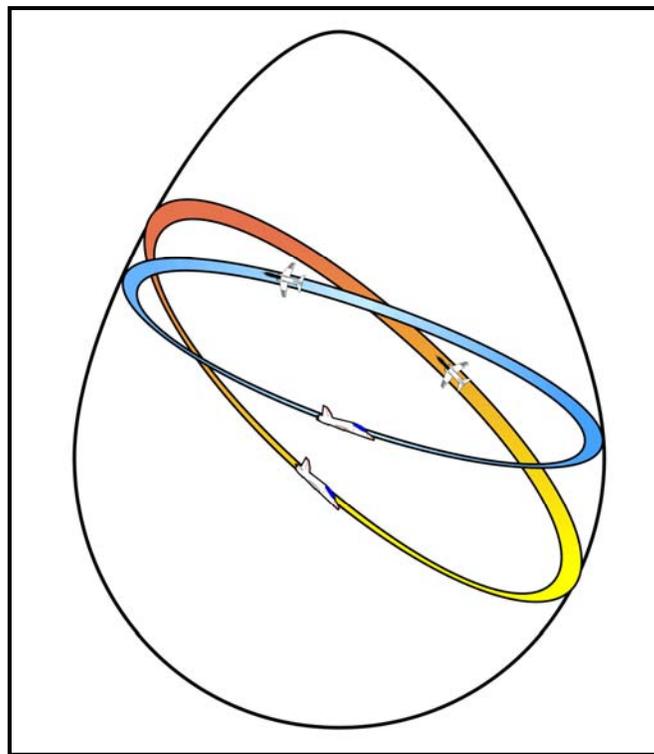


Figure 1-1 ACM Environment & T-45 Scale Model

- ii. Force of gravity
 - (a). Gravity — pulls downward on aircraft
 - (b). Load factor (indicated G)
 - (1). Oriented perpendicular to aircraft wing
 - (2). Vertical component (effective lift) offsets gravity
 - (3). Horizontal component (radial G) used to turn aircraft
- b. “The egg” — represents three dimensional sphere showing effects of gravity and lift vectors on maneuvering
 - i. Vertical maneuvering
 - (a). Represents theoretical loop in vertical plane at constant TAS and constant indicated G
 - (b). Radial G — sum of indicated cockpit G and force of gravity
 - (c). When lift vector above horizon (bottom of egg), radial G lower because of gravity
 - (1). Larger turn radius

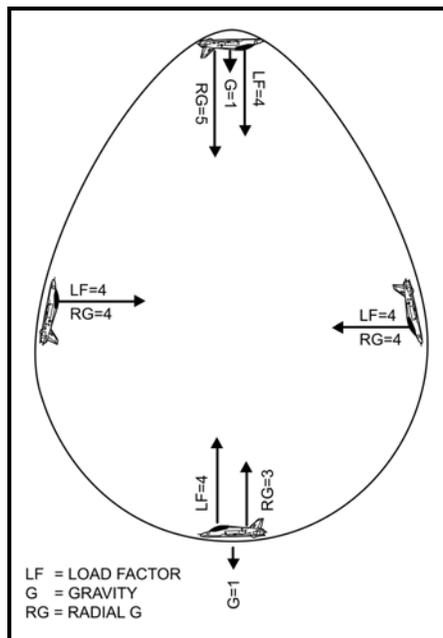


Figure 1-2 Vertical Plane Maneuvering Egg

- (2). Slower turn rate
- (d). When lift vector below horizon (top of egg — fighter inverted), radial G higher because gravity adds to load factor
 - (1). Smaller radius
 - (2). Faster turn rate
- (e). Aircraft pure vertical (side of egg)
 - (1). Load factor equals radial G
 - (2). Results in intermediate turn performance
- ii. Horizontal maneuvering

LESSON NOTES

The instructor/SNP may refer to the Figure in the ACM FTI for a more thorough explanation of horizontal maneuvering.

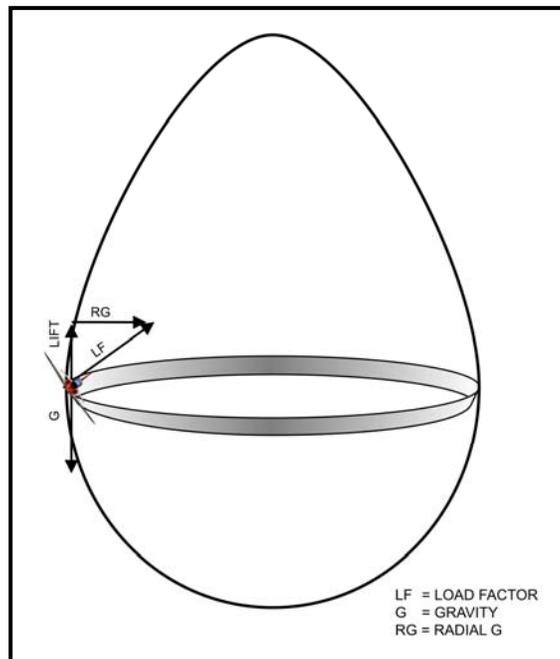


Figure 1-3 Horizontal Plane Maneuvering Egg

- (a). Represents theoretical circle in horizontal plane at constant TAS and constant indicated G
 - (b). Effect of gravity affects horizontal turn performance significantly
 - (c). Load factor
 - (1). Lift component overcomes gravity
 - (2). Remaining radial G component enables turn
 - (d). Results in reduced turn performance due to forces being divided
- iii. Oblique maneuvering
- (a). Gravity affects oblique maneuvering in similar manner as it does in the vertical and the horizontal depending upon steepness of maneuvering plane

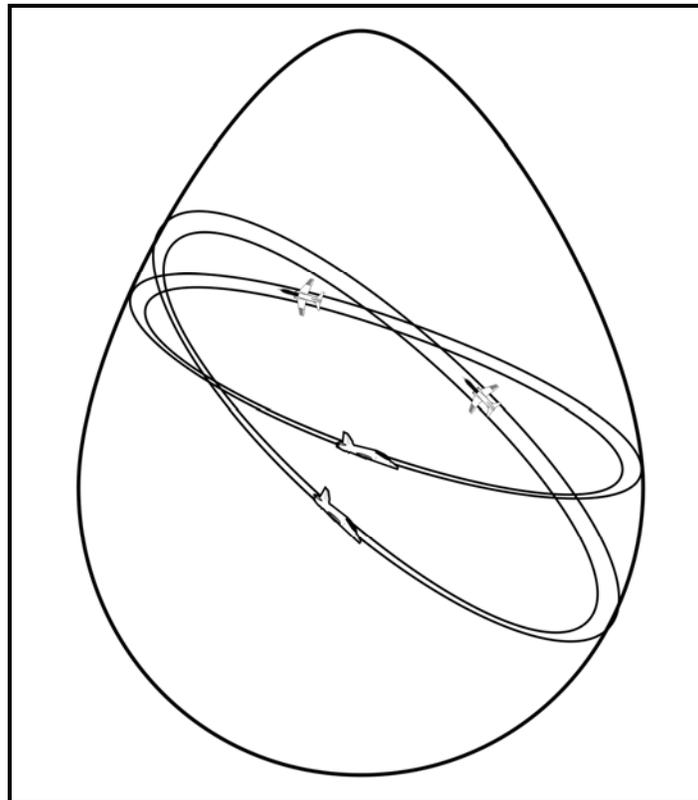


Figure 1-4 Oblique Plane Maneuvering Egg

- (b). Regardless of plane of maneuver
 - Lift vector above horizon — detracts from turn performance
- (c). Lift vector below horizon — helps turn performance
- iv. Geometry of tactics — effective ACM, both offensive and defensive, requires timely and dynamic use of multiple planes of maneuvering

LESSON NOTES

Emphasize the importance of maneuvering in the oblique plane to capitalize on the bandit's horizontal turn performance.

- 3. Operational maneuverability — changes in altitude, airspeed and direction limited by fixed and variable factors
 - a. Fixed factors
 - i. Structural limitations
 - (a). Maximum lift that can be supported by airframe structure without yielding
 - (b). Maximum G capability — lift/gross weight (limitations vary with fuel/ordnance loads)
 - (c). Operating envelope (V_n diagram) displays load factor G limitations

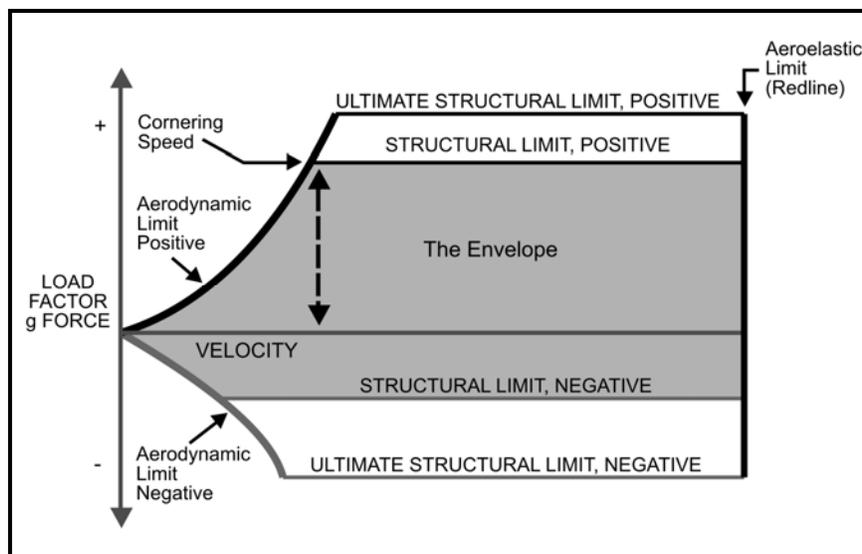


Figure 1-5 V_n Diagram

- ii. Thrust-to-weight
 - (a). Thrust varies with altitude and temperature
 - (b). Independent of airspeed (jet aircraft)
 - (c). Ratio equals aircraft thrust divided by combat weight
 - (d). Used to compare performance of aircraft
- iii. Wing loading — combat weight/wing area
 - (a). Aircraft with higher wing loading has larger turn radius and slower turn rate
 - (b). Aircraft with lower wing loading has smaller turn radius and faster turn rate
- b. Variable factors
 - i. Altitude — provides potential energy (PE) for maneuvering
 - ii. Airspeed — kinetic energy (KE): as altitude increases, TAS increases for constant KIAS airspeed
 - iii. Angle-of-attack (AOA)
 - (a). At a given AOA, coefficient of lift and drag is constant regardless of airspeed, gross weight, and altitude
 - (b). In an engaging turn (energy sustaining turn), corresponding AOA reflects optimum lift to drag ratio

NOTE

Optimum AOA's are explained in the following energy management section.

- iv. G loading
 - (a). Ratio of lift to weight
 - (b). In turns or direction changes, lift must exceed weight, and G loads greater than 1 G are necessary
 - (c). At constant TAS, as G is increased so does AOA

- (d). Radial G — determines turn radius and rate
- (e). Instantaneous G
 - (1). Maximum lift a wing may generate at a given airspeed
 - (2). Dependent upon aircraft airframe/wing
 - (3). Displayed on velocity load factor (V_n) diagram
 - (4). ACM relationship — used to generate maximum rate of turn
- (f). Sustained G
 - (1). A function of aircraft thrust available with respect to wing loading
 - (2). Maximum G capability in level turn with constant airspeed
 - (3). Increases with higher thrust-to-weight ratio
 - (4). ACM relationship — to maintain energy throughout an engagement
- v. Turn radius
 - (a). Distance that aircraft displaces laterally in turn
 - (b). Dependent on TAS and G with constant altitude — TAS^2/G
 - (c). TAS has a greater effect on turn radius than rate
 - (d). Sustainability — given two aircraft at constant TAS, the aircraft that can sustain most G will have the smallest turn radius
- vi. Turn rate
 - (a). Equates to pitch rate in horizontal plane
 - (b). Dependent on TAS and G with constant altitude (G/TAS)
 - (c). Given two aircraft at a constant TAS, the aircraft that can sustain most G will have fastest turn rate
 - (d). Instantaneous — maximum available turn rate at any given airspeed without regard to energy sustainability
- c. Total energy (TE) — combination of aircraft's altitude (PE) and airspeed (KE)

NOTE

Determining the TE advantage determination for a given aircraft is difficult because of the possible speed differences between fighters.

- i. Specific excess power (P_s) — measures ability of aircraft to increase its energy state by using excess thrust
- ii. Cornering speed

NOTE

Cornering speed has previously been referred to as maneuvering speed.

- (a). Minimum airspeed at which maximum structural G can be attained (airspeed for maximum turn rate and minimum turn radius)

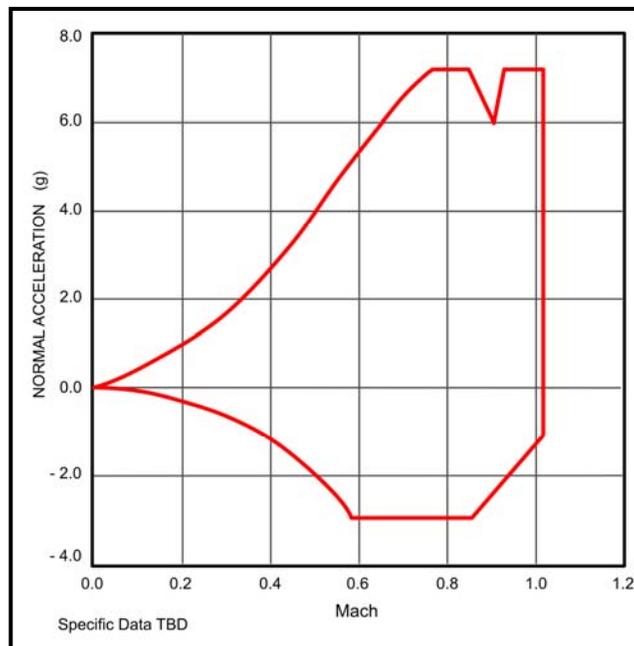


Figure 1-6 V_n Diagram

- (b). Below this speed
 - (1). Buffet or stall exists at aerodynamic limit
 - (2). Turn radius increases and turn rate decreases at aerodynamic limit

- (c). Above this speed with increased available G
 - (1). Structural limits exceeded resulting in overstress at structural limit
 - (2). Turn radius increases and rate decreases at structural limit

NOTE

Remember that V_n diagrams show only instantaneous turn performance.

- 4. Energy management for the T-45C
 - a. Cornering speed is 300 kts
 - b. Optimum AOA
 - i. Sustained performance 13-14 units
 - ii. Optimum performance 16-18 units
 - iii. Instantaneous turn rate 19-21 units
 - iv. Extension/optimum energy addition 5-10 units
- 5. Performance characteristics exercise
 - a. Purpose — to demonstrate timed turns, timed accelerations, and zero-air-speed departures
 - b. Application
 - i. Set-up — separate from wingman, climb to 15,000 ft MSL, establish desired airspeed and level flight
 - ii. Execution
 - (a). Timed turns
 - (1). At 300 kts, fly a cardinal heading
 - (2). Execute an energy sustaining turn (13-14 units) at MRT for 180 degrees, maintaining 300 kts (IP will record time)

- (3). Reestablish cardinal heading, execute hard turn (17 units) at MRT for 180 degrees of turn, maintaining 300 kts (IP will record time and energy loss)

NOTE

The nose will have to be below the horizon to maintain 300 kts.

- (4). Climb back to 15,000 ft and reestablish cardinal heading, execute maximum performance turn (break turn 19-21 units) at MRT for 180 degrees of turn, attempting to maintain 300 kts (IP will record time and energy loss)

NOTE

The nose will have to be below the horizon to maintain 300 kts.

- (b). Timed acceleration

- (1). From 250 kts at level flight, go to MRT and accelerate in level flight to 300 kts (IP will record time)
- (2). Reestablish airspeed at 250 kts, go to MRT, and unload the aircraft to 5-10 units to arrive at 300 kts (IP will record time)

- (c). Zero airspeed departures: same as in OCF

- c. Common errors

- Problem: during maximum performance turn, failing to maintain 19-21 units due to unfamiliarity with aircraft performance

Correction: avoid tendency to relax back stick

PROGRESS CHECK

Question 1 — The “egg” represents a three dimensional sphere showing the effects of _____ and _____ on maneuvering.

ANSWER: gravity, lift vectors

Question 2 — When the aircraft’s lift vector is above the horizon, it has a _____ turn radius and _____ turn rate.

ANSWER: larger, slower

Question 3 — Gravity affects oblique maneuvering in the vertical and horizontal plane depending upon the _____ of the maneuvering plane.

ANSWER: steepness

Question 4 — What are the fixed aircraft factors which affect ACM?

ANSWER: Structural limitations, thrust-to-weight ratio, and wing-loading capabilities

Question 5 — What are three of the variable aircraft factors which affect ACM?

ANSWER: Any three of the following: altitude, airspeed, AOA, G, sustained G, turn radius, or turn rate

Question 6 — What are the optimum AOA’s for sustained performance, instantaneous turn rate, and for energy addition?

ANSWER:

1. Sustained 13-14 units
2. Instantaneous turn rate 19-21 units
3. Energy addition 5-10 units

ACM Considerations

1. Because bandit is unpredictable element in any engagement, it is imperative to develop game plan to force bandit into predictability allowing accurate anticipation of his next move
2. Every move or maneuver involves trade-off, e.g., trading airspeed for altitude
3. Three-dimensional environment
 - a. Certain aircraft have advantages over other aircraft when employing particular dimension
 - b. Maneuvering in all three dimensions forces bandit to choose between two targets in section engagements
4. Directive/Descriptive commentary concepts
 - a. Use clear concise radio calls
 - b. Concentrate on quality not quantity
 - c. Acknowledge all transmissions

1.	Tactical:	Murph
2.	Directive:	Hard right
3.	Descriptive:	
	a. Detection:	Bandit
	b. Direction:	Right 2
	c. Elevation:	30 high
	d. Range:	3 miles
	e. Remarks:	180 out
4.	Response:	Tally or No joy

Figure 1-7 Directive/Description Comm

- d. Commentary should include tactical, directive and descriptive calls
 - i. Tactical “Murph”
 - ii. Directive “Hard right”
 - iii. Descriptive
 - (a). Detection “Bandit”
 - (b). Direction “Right 2”
 - (c). Elevation “30 high”
 - (d). Range “3 miles”
 - (e). Remarks “180 out”
 - iv. Response “Tally” or “No joy”
5. Strategies
 - a. General strategies

NOTE

More will be said about specific strategies in their respective lessons.

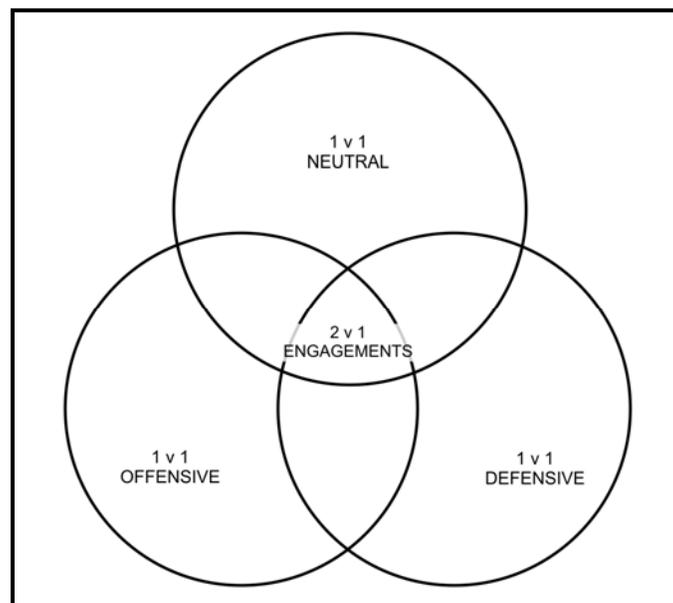


Figure 1-8 ACM Strategies

- i. Maintain sight — good lookout doctrine is essential
 - ii. Maintain highest possible energy package
 - iii. Force opponent to make mistakes — ACM engagements are won by capitalizing on opponent's mistakes
 - iv. Avoid predictability
 - v. Be aggressive, never give up!
 - vi. Fly by feel of aircraft to sense airspeed, AOA, and pitch attitude
- b. Offensive maneuvering
- i. Objectives
 - (a). Maintain advantage
 - (b). Force bandit into predictable flight path
 - (c). Maneuver into weapons envelope
 - (d). Kill bandit
 - ii. Tactics
 - (a). Decrease angle off and align fuselages
 - (b). Employ weapons within appropriate range
 - (c). Use all three dimensions to achieve firing solution and maintain element of surprise
 - (d). Maintain high energy state
- c. Defensive maneuvering
- i. Objectives
 - (a). Deny offensive firing solution
 - (b). Defeat weapon
 - (c). Gain neutral position

- (d). Gain advantage or disengage
- ii. Tactics
 - (a). Increase angle off
 - (b). Use range in conjunction with angles to deny firing solutions
 - (c). Use all three dimensions
 - (d). Maintain highest possible energy package
- d. Neutral starts
 - i. Objectives
 - (a). Ensure at least a neutral first pass
 - (b). Gain advantage
 - (c). Maneuver into weapons envelope
 - ii. Tactics
 - (a). Minimize lateral separation
 - (b). Employ early turns
 - (c). Optimize energy package
- e. Section engagements
 - i. Objectives
 - (a). Maintain mutual support
 - (b). Achieve quick-kill
 - ii. Loose-deuce tactics
 - (a). Establish roles of engaged fighter and free fighter
 - (b). Force bandit to split section whenever possible
 - (c). Force bandit into predictable flight path

PROGRESS CHECK

Question 7 — Give an example of directive/descriptive commentary used in ACM?

ANSWER: The answer may vary; however, each at a minimum must include tactical or directional information.

Question 8 — Identify at least four general ACM strategies.

ANSWER:

1. Maintain sight.
2. Maintain high energy package.
3. Force opponent to make mistakes.
4. Avoid predictability.
5. Be aggressive.
6. Fly by feel of aircraft.

Question 9 — Identify at least two offensive objectives.

ANSWER:

1. Maintain an advantage.
2. Force the bandit into a predictable flight path.
3. Maneuver into a weapons envelope.
4. Kill the bandit.

Question 10 — Identify at least two defensive objectives.

ANSWER:

1. Deny an offensive firing solution.
2. Defeat the weapon.
3. Gain a neutral position.
4. Gain the advantage or disengage.

ACM Analysis

1. Analyze background data

NOTE

The analysis of background and the analysis of situational data are not mutually exclusive processes.

- a. Compare aircraft performance characteristics
 - b. Weapons — capability of your weapons and opponent's
 - c. Training/tactics
 - i. Aircrew proficiency
 - ii. Force mix (F-14, F-18, section/division, etc.)
 - d. Intelligence
 - i. Order-of-battle
 - ii. Real time
2. Analyze situation
- a. What is your mission?
 - b. Where are you in relation to bandit?
 - i. Environment — terrain, weather, IMC/VMC
 - ii. Posture
 - (a). What is my angle off the tail (AOT)?
 - (b). What is my track crossing angle (TCA)?
 - (c). What is my range?
 - (d). What is my relative energy state?
 - c. Predictability

- i. How am I making bandit predictable?
- ii. How is bandit making me predictable?

ACM Terminology and Symbology

1. Terminology

- a. Angles
 - i. Angle off the tail (AOT)
 - (a). Angle between defender's longitudinal axis and attacker's line-of-sight
 - (b). Attacker's position off defender's tail
 - ii. Track crossing angle — angular difference in velocity vectors at any instant
- b. Angels — altitude of aircraft in thousands of feet
- c. Atoll
 - i. Soviet IR missile
 - ii. Missile call used by bandit
- d. Bandit — identified enemy air contact
- e. Blind — I do not see my lead/wingman
- f. Bogey— unidentified air contact
- g. Break — maximum rate turn (20 units AOA) executed to destroy firing solution
- h. Bug out — disengage from ACM to exit safely from fight
- i. Buster — fly at MRT
- j. Contact — initial and subsequent detections of object by any detecting device
- k. Eyeball — in section forward quarter tactics, fighter who has tally/radar contact and will take bogey close aboard to obtain visual identification (VID) and facilitate his wingman acquiring tally for shot
- l. FOX-2 — AIM-9 IR missile firing solution

- m. GUNS — rear quarter steady state or snap guns firing solution
- n. Hard turn — compromise between maximum rate turn and energy conserving turn (300 kts at 17 units AOA)
- o. Heads up — Enemy got through (part or all) or I am not in position to engage target
- p. Joker — fuel state preparatory to bug out followed shortly thereafter by bugout call
- q. Knock it off — Stop fight or current maneuvers
- r. Line of Sight (LOS) — bearing to bandit relative to fighter
- s. Lufbery — horizontal or slightly oblique stalemate engagement with both aircraft across the circle from each other, turning in same direction at low energy state
- t. Merge plot — radar tracks have come together, cannot be distinguished from each other
- u. Mil lead — the flight lead
- v. No joy — I do not see the bandit
- w. On the deck — at minimum altitude
- x. Padlocked — I have tally and can't take my eyes off bandit for fear of losing contact due to visibility/range, etc.
- y. Pigeons — the magnetic bearing and distance of home base (or unit indicated)
- z. Pitchback — pulling vertically 60 degrees nose-high at 17 units AOA, used to attempt to meet the bandit head-on with minimum lateral separation in situations where the bandit is less than 1 mile, high above horizon, or at your dead six
- aa. Popeye — in clouds or area of reduced visibility
- bb. Range — linear distance between two aircraft stated in nm or feet
- cc. SA (situational awareness) — cognizance of all factors in a tactical arena that affect mission success
- dd. Say state — transmit fuel remaining
- ee. Shackle — turn made to redress section by crossing member to other side, thus resuming proper combat spread position

- ff. Shooter — as applied to section forward quarter tactics, fighter pulling for shot as his wingman passes close aboard and VIDs the bandit
 - gg. Slice turn — a radical change in direction with minimal lateral displacement and energy/speed bleedoff performed by rolling to place the lift vector below the horizon at some oblique angle and applying G
 - hh. Steady — I am on prescribed heading
 - ii. Steady up — Roll out immediately on present heading
 - jj. Tac (tactical) Lead — member of flight having best SA and directing section maneuvers (not always the Mil lead)
 - kk. Tally — bandit visually sighted
 - ll. Visual — wingman in sight
2. Symbology
- a. Fighter
 - b. Bandit
 - c. Climbing turn
 - d. Descending turn
 - e. Extension
 - f. Pitchback
 - g. Pure vertical

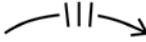
1. FIGHTER	
2. BANDIT	
3. CLIMBING TURN	
4. DESCENDING TURN	
5. EXTENSION	
6. PITCHBACK	
7. PURE VERTICAL	

Figure 1-9 ACM Symbology

ACM Training Rules

1. General

NOTE

The following ACM training rules apply to all ACM training and shall be strictly observed. These rules include those found in OPNAVINST 3710.7; however, pilots are responsible for knowing that directive.

- a. ACM training shall be conducted only in designated areas.
- b. All ACM participants shall attend face-to-face briefings and debriefings for each flight. Brief items shall include.
 - i. Conduct of flight
 - ii. CNATRA training rules
 - iii. Selected safety of flight aspects

- iv. Maneuvers flown
- v. Spin avoidance and recovery procedures
- c. Termination of maneuvering shall be signaled by “Call sign” and “Knock it off.”

NOTE

Upon hearing “Knock it off,” both aircraft should return to combat spread.

- d. The minimum altitude (deck) for ACM is 10,000 ft AGL. The engagement shall automatically cease when any aircraft descends below 10,000 ft, and that aircraft shall be considered a “kill.”
- e. An aircraft pursuing another aircraft in a descent shall monitor the defensive aircraft’s altitude/attitude and break off the attack with a turn away prior to either aircraft descending through the hard deck.
- f. Aircraft configuration changes are limited to use of speed brakes.
- g. Lost communications
 - i. Two-way radio communication lost
 - (a). Terminate maneuvering
 - (b). Rock wings
 - (c). Set up 30 degree AOB rendezvous turn
 - ii. Lost ICS with good radio
 - (a). Terminate maneuvering
 - (b). Transmit “Call sign” and “Knock it off”
 - (c). Set up 30 degree AOB rendezvous turn
- h. If lost sight, perform the following procedure
 - i. Transmit “Lost sight”
 - ii. Other aircraft in flight will transmit further instructions

- i. During horizontal scissors or weave, nose-high aircraft shall go high and nose-low aircraft shall go low. The low aircraft has the responsibility for maintaining flight separation. Always transmit “[Call sign] and [intent].”
- j. The aircraft in sun is responsible for safe separation.
 - i. If the “up-sun” aircraft loses sight, broadcast “Lost sight” and maintain a predictable course.
 - ii. If “down-sun” aircraft loses sight, break off the attack, lag the up-sun aircraft, and broadcast “Lost sight.”
- k. Maintain 500 ft bubble around your aircraft at all times; always assume the other aircraft does not see you.
- l. On head-on passes, both aircraft will maintain the established trend. Where no trend exists, each aircraft will give way to the right to create a left-to-left pass. Broadcast your intentions.
- m. No blind lead turns
- n. A “G awareness” maneuver is required prior to ACM. Aircrew who experience “GLOC” shall immediately terminate ACM and return to base.
- o. Minimum range for guns tracking is 1,000 ft, head-on guns are prohibited
- p. A “Knock it off” will be called for any of the following situations:
 - i. Any violation of training rules
 - ii. Dangerous situation/loss of situational awareness
 - iii. Radio failure/loss of ICS (see #g above)
 - iv. Airspeed less than 80 knots
 - (a). Nose-high and decelerating
 - (b). Departure
 - (c). Out-of-control flight
 - v. Unbriefed aircraft enters the flight
 - vi. Aircraft enters a cloud

- vii. BINGO fuel state reached
 - viii. GLOC (see #n above)
 - ix. Training objectives have been met
2. Weather — all engagements shall be conducted under VMC conditions with the following additions:
- a. Minimum 5 statute mile visibility with defined horizon
 - b. Above or between cloud layers only with distinct horizon
 - c. Minimum of 15,000 ft between broken/overcast layers
 - d. Horizontal minimum of 1 nm horizontally and 2,000 feet vertically from all clouds
 - e. Solo flight cloud tops shall not be higher than 7,000 ft AGL
 - f. Dual flight cloud tops shall not be higher than 8,000 ft AGL
 - g. Deck set at minimum 5,000 ft above all cloud tops

PROGRESS CHECK

Question 11 — What action do you take if you hear “Knock it off?”

ANSWER: Terminate maneuvering and return to combat spread

Question 12 — Head-on passes will be _____ unless the situation dictates otherwise.

ANSWER: left-to-left

Question 13 — Solo flight cloud tops shall not be higher than _____.

ANSWER: 7,000 ft AGL

Question 14 — What is the procedure if your two-way radio communication is lost?

ANSWER:

1. Terminate maneuvering.
2. Rock your wings.
3. Set up a 30 degree AOB rendezvous turn.

Question 15 — What is the procedure if you lose sight during ACM?

ANSWER:

1. Transmit “Lost sight.”
2. Wait for further instructions from other aircraft in your flight.

ACM Use of HUD

1. A HUD system is a vital fighter aircraft asset. It allows the pilot to safely monitor his aircraft and weapon parameters, while keeping his eyes aimed and focused mostly outside the cockpit. When flying ACM in the T-45C, it's imperative for you to establish situational awareness and to visually clear your operating area for other aircraft and hazards. To clear the area you must keep your head on a swivel.

NOTE

That the T-45C HUD has a stringent head position requirement. When aggressively maneuvering the T-45C, pilots find that the HUD is not easily visible as they shift and swivel their heads. For this and other reasons (navigation), it's necessary for T-45C pilots to periodically cross-check MFD displays and instrument panel gauges. Do not rely only upon the HUD. Remember that your first priority is to maintain situational awareness and flight safety. If you stay alert, flexible, and informed, you'll remain safe.

2. Aiming reticle — Used to track targets. Displayed in both RTGS and LAC gunsight modes
3. Modes — selected mode (RTGS or LAC) is indicated
 - a. RTGS — aiming reticle indicates where bullets fired 1/10th a second ago would have impacted

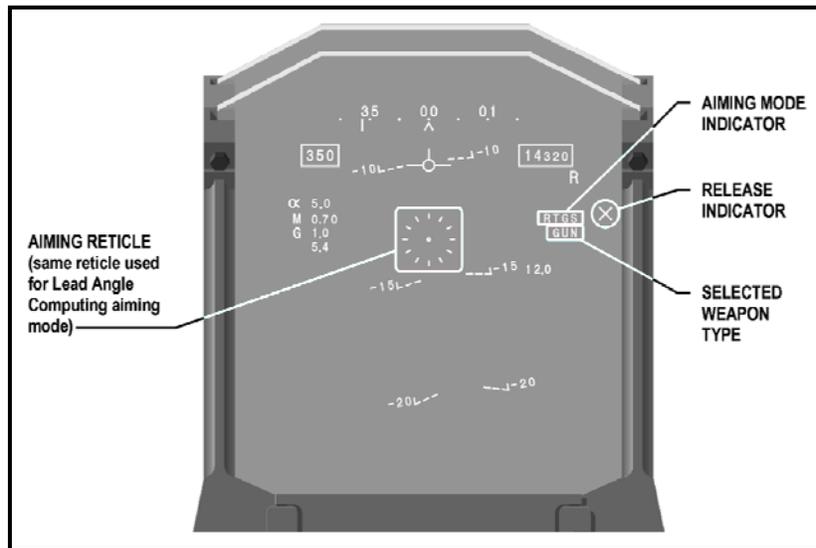


Figure 1-10 Aiming Reticle RTGS

- b. LAC — aiming reticle indicates where bullets fired now will impact

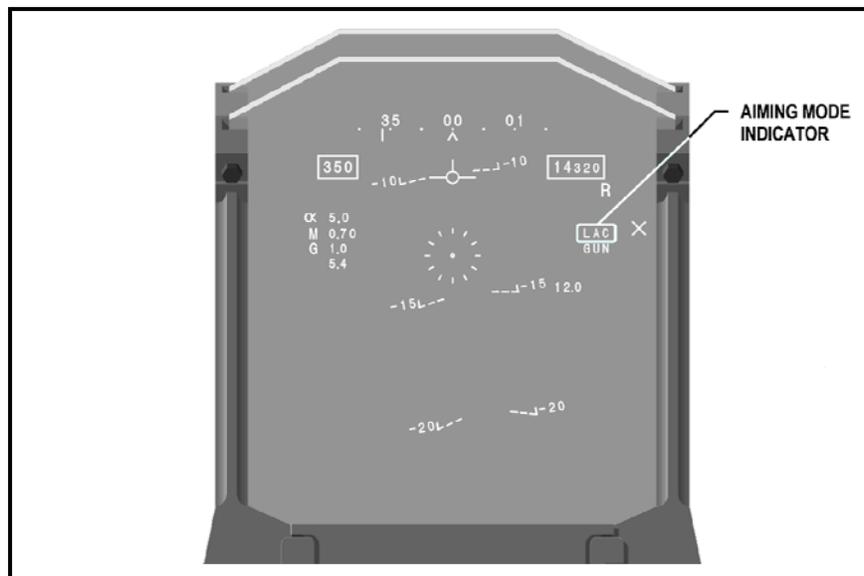


Figure 1-11 Aiming Reticle LAC

- c. All gunsight computations are based upon a 1,000 feet range-to-bandit parameter

4. Gun weapons selection — the display always indicates GUN which is crossed out until Master Arm is activated. The release indicator symbol (x) displays for two (2) seconds each time the trigger or weapons release buttons are depressed

5. Velocity vector

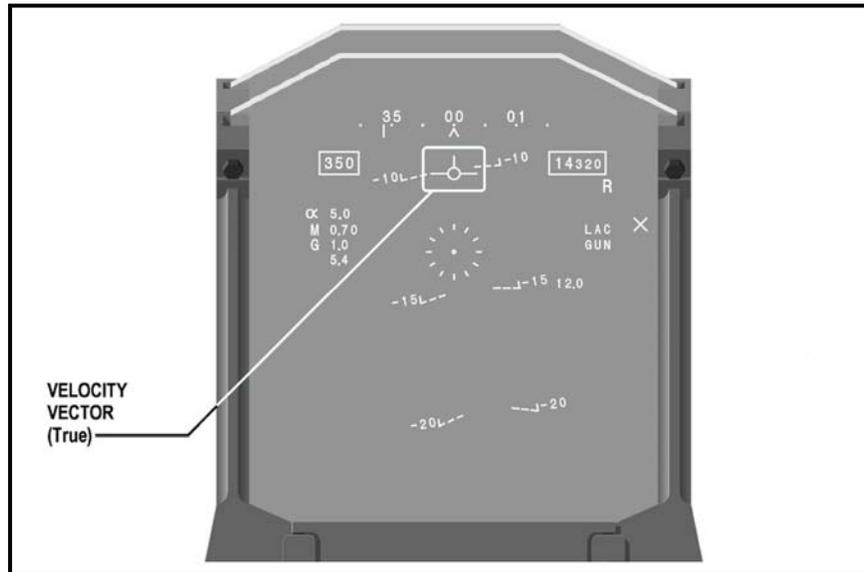


Figure 1-12 Velocity Vector (Uncaged)

a. Uncaged

Velocity vector (true) — solid-circle symbol indicates the aircraft's actual flight path at that precise point in time: 10 below the horizon in this graphic view; no lateral drift on slip

b. Caged

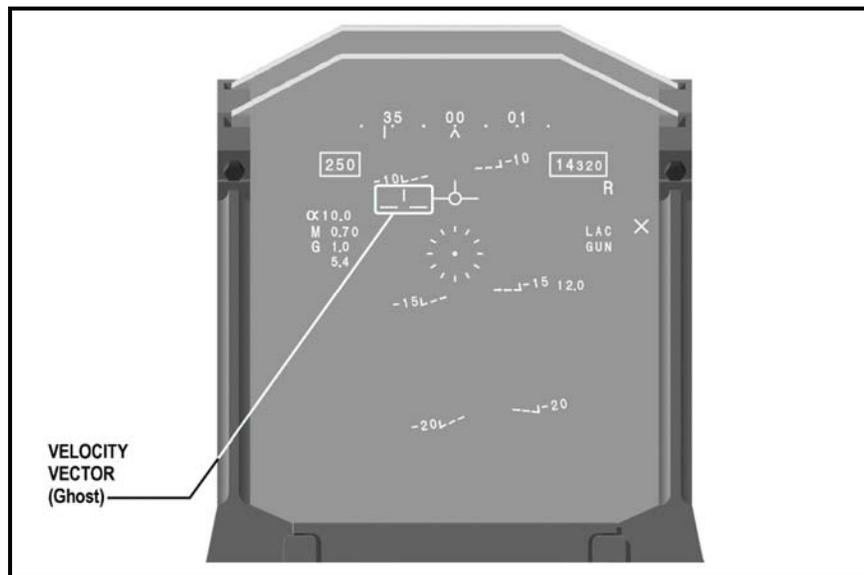


Figure 1-13 Velocity Vector (Caged)

- i. Velocity vector (true) — solid-circle symbol does not indicate actual aircraft's flight path when a ghost velocity vector is also displayed. If a ghost velocity vector is not displayed—the aircraft is operating below minimum ghost display parameters—then, the displayed solid-circle velocity vector (true) accurately represents the aircraft position
 - ii. Velocity vector (ghost) — a no-circle symbol that indicates the aircraft's actual flight path, when generated in addition to the caged solid-circle symbol
 - iii. Unless the ghost and/or true velocity vector are displayed flashing (limited position), they will both be at the same vertical degree angle on the pitch ladder
 - iv. A laterally displaced ghost velocity vector indicates side-slip and/or drift angle
6. HUD displays
 - a. Flight parameters

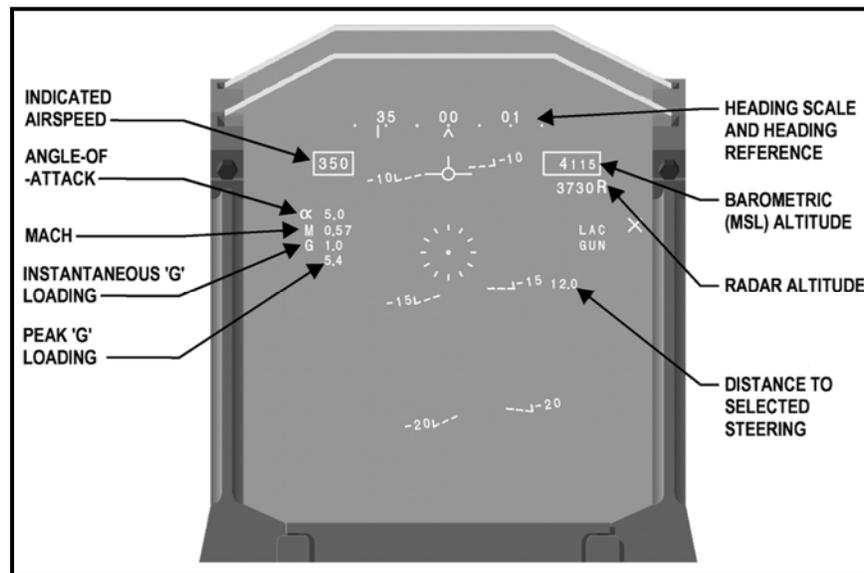


Figure 1-14 Flight Parameters and Navigation Data

- i. Heading — indicated by the aircraft heading reference mark

NOTE

Heading bug is not displayed on the HUD.

- ii. Attitude (bank and pitch)
 - (a). Bank angle is indicated via image rotation, but the bank angle scale at bottom of the display is removed
 - (b). Pitch ladder is displayed with pitch bar "wings" pointing to the horizon and angled inward 1/2 the degrees of aircraft pitch
- iii. Indicated airspeed — only digital read-out
- iv. Mach number
- v. AOA — units, not degrees
- vi. Altitude — only digital read-out
 - (a). MSL
 - (b). Radar AGL

- vii. G-loading
 - (a). Instantaneous — reading varies with aircraft G-loading
 - (b). Peak G indication — displayed when exceeding +4.0 G threshold. Declutter level-1 removes the peak G indication and the G threshold is reset to +4.0 G
- b. Navigation — sparse information on HUD

NOTE

Navigation within training areas can be facilitated by setting a series of waypoints to define boundary limits; especially helpful in absence of ground references at night, over water, and above undercasts. Waypoint outlines and aircraft position can be easily monitored on the HSI's PLAN display. If air-to air TACAN is used, distance and bearing information to homeplate may be obtained by using the waypoint to homeplate. The HUD will display either TACAN or waypoint steering distance

- i. Waypoint — may be set to any desired location (homeplate, alternate, mission destination, etc.)
 - ii. A/A TACAN — a helpful inflight assist (formation, ACM, etc.) and debriefing aid
 - (a). ETE to steering point is not displayed in air-to-air mode
 - (b). Selected steering mode is not displayed in air-to-air mode
7. Data entry panel (DEP)

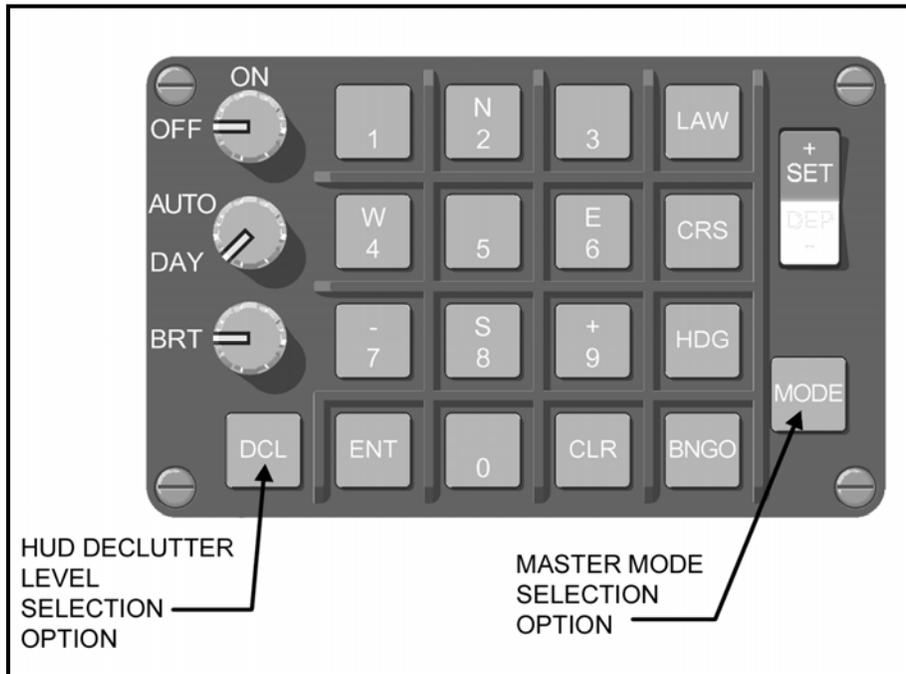


Figure 1-15 Data Entry Panel

- a. Select A/A mode
- b. Select declutter option
- c. Select waypoints
- d. Set/reset BNGO fuel, LAW, CRS, HDG

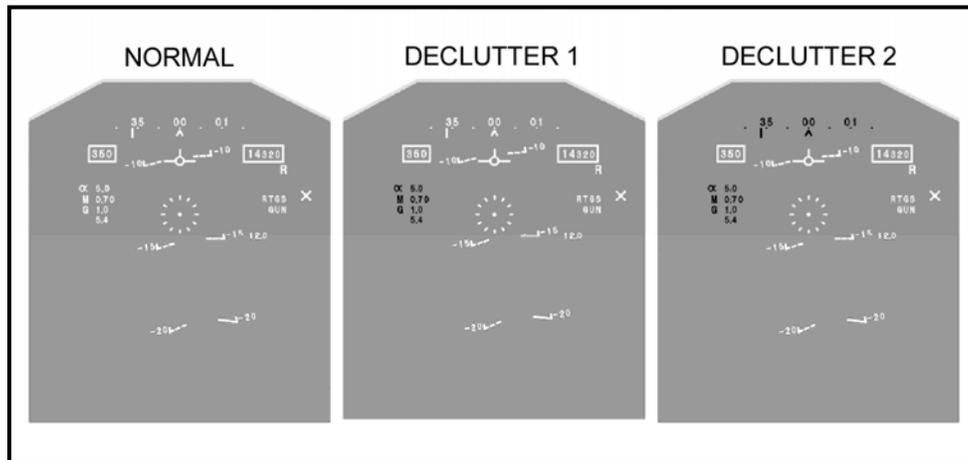


Figure 1-16 Declutter Options

PROGRESS CHECK

Question 16 — With RTGS mode selected, what does the aiming reticle indicate about fired bullets?

ANSWER: Where bullets fired 1/10th a second ago at a range of 1,000 feet will impact.

Question 17 — With LAC mode selected, what does the aiming reticle indicate about fired bullets?

ANSWER: Where bullets fired now will impact upon reaching a range of 1,000 feet.

Question 18 — In level flight where will the velocity vector be positioned?

ANSWER: On the horizon bar.

Question: 19 — What HUD information is lost with declutter option #1?

ANSWER:

1. KIAS
2. AOA
3. Mach number
4. G loading (instantaneous and peak)

Question: 20 — Is it possible to see only a “ghost” velocity vector on the HUD; no “true” velocity vector?

ANSWER: Yes. This will occur in the caged mode when the digital computation for AOA has been lost. That value is required for computation and positioning of caged velocity vector.

106. SUMMARY

This lesson has focused on the following topics:

1. An overview of ACM goals, principles and strategies
2. ACM considerations
3. Analysis of ACM scenarios
4. Terminology and symbology
5. Training rules
6. HUD usage

107. CONCLUSION

This concludes the introductory lecture for the ACM block of instruction. Following lectures will present offensive and defensive strategies. You will have an opportunity to practice these tactics in the air. Grasping the concepts presented in this lesson is key to understanding the material in later lectures and to performing safely and victoriously during ACM engagements.

CHAPTER TWO
ACM 1 V 1 OFFENSIVE MANEUVERING

200. INTRODUCTION – N/A

COURSE/STAGE:

- TS, TAILHOOK & IUT/Air Combat Maneuvering

LESSON TITLE:

- ACM 1 v 1 Offensive Maneuvering

LESSON IDENTIFIER:

- T-45C TS, ADV & IUT ACMFP-02

LEARNING ENVIRONMENT:

- Classroom

ALLOTTED LESSON TIME:

- 1.0 hr

TRAINING AIDS:

- Figures
 - Figure 1: Snap Guns Exercise
 - Figure 2: High Yo-Yo
 - Figure 3: Low Yo-Yo
 - Figure 4: Break Turn Exercise
 - Figure 5: Horizontal Scissors
 - Figure 6: Displacement Roll
 - Figure 7: Barrel Roll Attack
 - Figure 8: Rolling Scissors
 - Figure 9: Rolling Scissors Positions

STUDY RESOURCES:

1. T-45C NATOPS Flight Manual, A1-T45AC-NFM-000
2. Air Combat Maneuvering Flight Training Instruction (FTI)

LESSON PREPARATION:

- Read:
 - T-45C ACM FTI “Offensive Flight Procedures” section

REINFORCEMENT:

- N/A

EXAMINATION:

- The objectives in this lesson will be tested in ACMFP-02.

201. LESSON OBJECTIVES

1. Recall the concepts and tactics applicable to offensive ACM
2. Recall the purpose and application of the snap guns exercise in ACM (offensive)
3. Recall the procedure for performing the snap guns exercise (offensive)
4. Recall the purpose and application of the high yo-yo in ACM
5. Recall the purpose and application of the offensive counter to the defensive pitch back
6. Recall the purpose and application of the low yo-yo in ACM
7. Recall procedure for the “break turn” exercise (offensive)
8. Recall the purpose and application of the horizontal scissors (offensive)
9. Recall procedure for performing horizontal scissors (offensive)
10. Recall the purpose and application of the displacement roll in ACM
11. Recall the purpose and application of the barrel roll attack
12. Recall the procedure for performing a barrel roll attack
13. Recall the purpose and application of the rolling scissors (offensive)

2-2 ACM 1 V 1 OFFENSIVE MANEUVERING

14. Recall procedure for performing rolling scissors (offensive)
15. Recall the offensive considerations for disengagement
16. Recall the procedures for execution of offensive disengagement
17. Assess the offensive 1 v 1 tactical situation

202. MOTIVATION

Play Motivation Video

Fighter tactics exist to defeat other aircraft. The airplane itself may be considered a weapons platform designed to bring the weapons system into position for firing. Meeting these weapons-firing requirements must, therefore, be the goal of all fighter tactics and maneuvering.

You have just seen glimpses of the air war in Vietnam and Desert Storm. Naval fighters ended the Vietnam war with a 12.5:1 kill ratio. Before you make your first ACM flight, you must understand that your success as a fighter pilot depends on your commitment to be the victor not the victim.

203. OVERVIEW

This lesson prepares you to fly offensive 1 v 1 air combat maneuvering.

In this lesson you will be studying:

1. Offensive considerations
2. Snap guns exercise
3. High yo-yo
4. Low yo-yo
5. Break turn exercise
6. Horizontal scissors
7. Displacement roll
8. Barrel roll attack
9. Rolling scissors
10. Disengagement
11. Assess 1 v 1 tactical situation

204. REFRESHER

This lesson builds on information presented previously. In particular, review:

- Procedures for high/low yo-yo and displacement roll found in TFFP-03

205. PRESENTATION**Offensive Concepts/tactics**

1. Angle off
 - a. Primary offensive objective is to reduce angle off
 - b. Angle off determines instantaneous position advantage
 - c. Angle off determines choice of maneuver
 - d. Low angle off can be traded for decreased range and increased closure (low yo-yo)
2. Range
 - a. Primary offensive objective is to reach heart of weapons envelope
 - b. Range determines weapon selection
 - c. Range impacts choice of maneuver
 - d. Range affects assessment of fight
3. Three-dimensional environment
 - a. Visualize fight in three dimensions to keep advantage
 - b. Fight in three dimensions in order to win
 - c. Exploit aircraft's capabilities in three dimensions to maximize assets and minimize liabilities
 - d. Use three dimensions to avoid predictability
4. Energy state

- a. Use higher energy to control fight
- b. Use high total energy to climb, turn, and accelerate for offensive advantage
- c. Trade excess airspeed for altitude to avoid overshoot (high yo-yo)
- d. Trade altitude for airspeed to reach weapons envelope (low yo-yo)
- e. Keep energy high to exploit opportunity to disengage

PROGRESS CHECK

Question 1 — In an offensive situation, low angle off can be traded for _____ range and _____ closure.

ANSWER: decreased, increased

Question 2 — In an offensive situation you can trade excess _____ for _____ to avoid an overshoot.

ANSWER: airspeed, altitude

Question 3 — In an offensive situation you can trade _____ for _____ to reach the weapons envelope.

ANSWER: altitude, airspeed

Offensive Maneuvers

NOTE

In this lesson, offensive maneuvers are viewed from the attacker's perspective. Therefore, the attacker is the "fighter" (SNP) and the defender is the "bandit" (IP). The associated diagrams are labeled "Defender" and "Attacker" according to aircraft position in the fight, not according to role.

1. Snap guns exercise
 - a. Purpose — practice reaching snap guns envelope against maneuvering bandit
 - b. Application

- i. Setup: level combat spread
- ii. Procedure

LESSON NOTES

Whenever a topic is supported by both a screen projection and animated video, you will have a menu. Choosing "Animation" will begin the animated sequence. You can exercise full control over the animation to show it all, pause the sequence whenever you want to point something out, and repeat the sequence as necessary. Choosing "Diagram" will call up the screen projection, which will be a ribbon diagram or spaghetti diagram of the maneuver. Use your discretion as to which you show first, and continue the lesson by choosing "Continue" at the end of the menu.

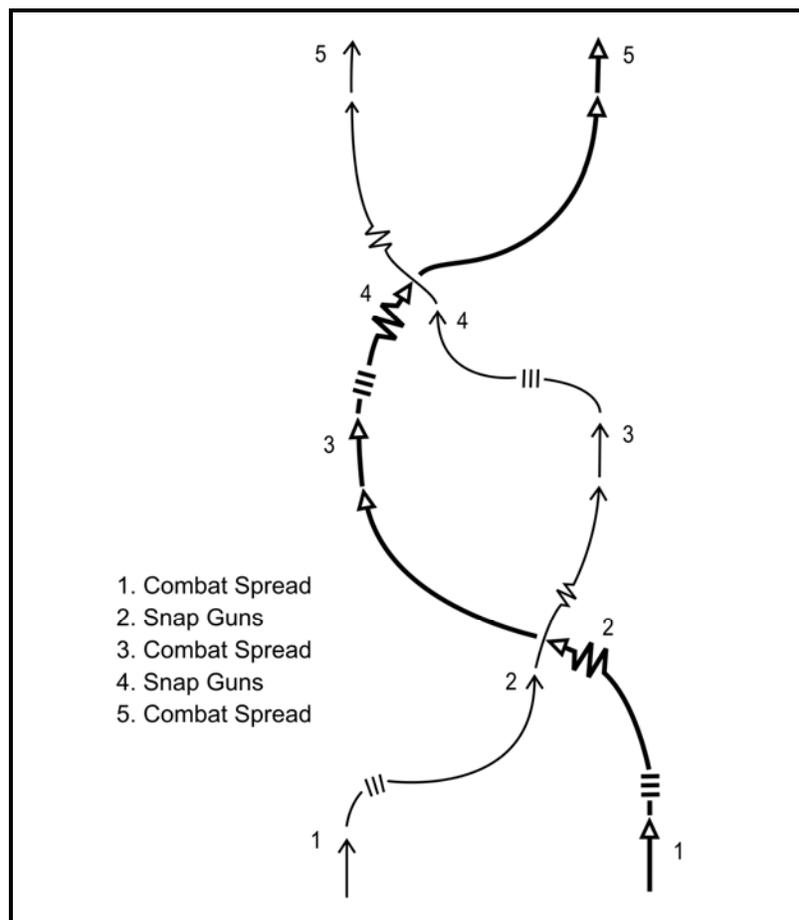


Figure 2-1 Snap Guns Exercise

- (a). Bandit calls “In as the target” and turns with 45-60 degree AOB into fighter
 - (b). Fighter calls “In as the shooter” and hard turns into bandit
 - (c). Fighter reverses as bandit reaches 10 or 2 o’clock to achieve a snap guns solution of 60-90 degrees AOT
 - (d). Bandit maneuvers out-of-plane to defeat gun solution
 - (e). Fighter overshoots bandit because of high track crossing angle (TCA)
 - (f). Bandit reverses back to approximately original heading as fighter overshoots
 - (g). Both aircraft finish in combat spread ready to initiate subsequent attempts
- c. Common errors
- i. **Problem:** delaying reversal and overshooting without reaching gun solution
Correction: reverse sooner and use back stick, and rudder to position nose into snap guns envelope
 - ii. **Problem:** reversing early and passing too close with too high AOT
Correction: turn away and pass outside of bandit’s turn to avoid midair collision
- d. Variations: N/A

NOTE

This section shows the variations that can happen based on the bandit’s reaction to a maneuver. Since this is an exercise, no variations will occur.

- 2. High yo-yo
 - a. Purpose
 - i. Prevent overshoot of bandit’s flight path
 - ii. Reduce AOT, stop closure, and maintain/increase range

- b. Application
- i. Setup — usually follow on from low yo-yo
 - ii. Execution — same procedures used in tactical formation gun sight tracking exercise
 - (a). As excessive closure is apparent, quarter roll away from bandit's plane of maneuvering (lag pursuit)

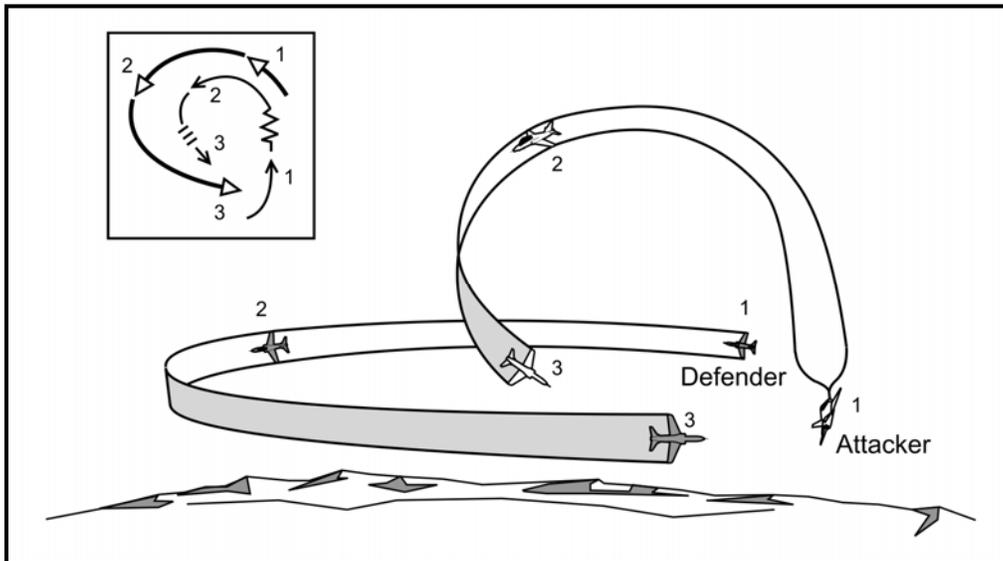


Figure 2-2 High Yo-Yo

- (b). Pull nose up
- (c). As airspeed bleeds off and appropriate nose-to-tail distance acquired, roll back toward inside of turn
- (d). Over bank, allowing nose to fall through horizon, and pull to appropriate pursuit (pure or lead pursuit)
- (e). Close to weapons envelope

LESSON NOTES

Point out that yo-yo's may be employed in any maneuvering plane.

- c. Common errors
 - i. **Problem:** overshoots because of 1) failure to recognize closure rate, and 2) late execution of high yo-yo
Correction: anticipate need for reducing closure and execute high yo-yo to prevent overshoot (could result in possible horizontal scissors)
 - ii. **Problem:** holds high portion of yo-yo too long and allows bandit to increase nose-to-tail separation, thus losing advantage
Correction: with closure controlled and overshoot prevented, bring nose down to maintain nose-to-tail (could result in possible low yo-yo)
- d. Variations
 - i. Turn rate
 - (a). If bandit increases turn rate
 - (1). Continue to trade airspeed for altitude
 - (2). Maintain sight
 - (3). As closure rate decreases, roll toward bandit and align fuselages without bleeding off excessive energy
 - (4). Avoid excessive nose-low attitude
 - (b). If bandit decreases turn rate to extend, lower nose and roll toward bandit to maintain nose-to-tail
 - ii. Bandit successfully generates high AOT and attempts to disengage
 - (a). Fighter forces bandit into defensive pitch back by pulling nose down in slice turn reducing AOT, minimizing separation, and arriving at bandit's 6 in phase prior to bandit's pitch back

NOTE

Minimum lateral separation will force the bandit into a defensive nose-high pitch back and make it difficult for the bandit to keep sight.

- (b). When bandit initiates nose-high pitch back into direction of fighter, fighter times his vertical move to maintain offensive advantage

- (1). If bandit generates only minimum lateral separation, fighter attempts to remain in phase with bandit using combinations/variations of high and low yo-yo's for guns solution
- (2). If bandit generates lateral separation, fighter attempts to lead-turn bandit in the vertical, using proper control input to align fuselage

NOTE

If the fighter creates lateral separation by positioning below and offset of the bandit's extended 6 prior to the bandit's pitch back, such separation will allow the bandit to slice turn into the fighter without substantial energy loss.

3. Low yo-yo
 - a. Purpose — decrease range or increase rate of closure in low closure/low angle off situations
 - b. Application
 - i. Setup — usually a follow on from a high yo-yo
 - ii. Execution

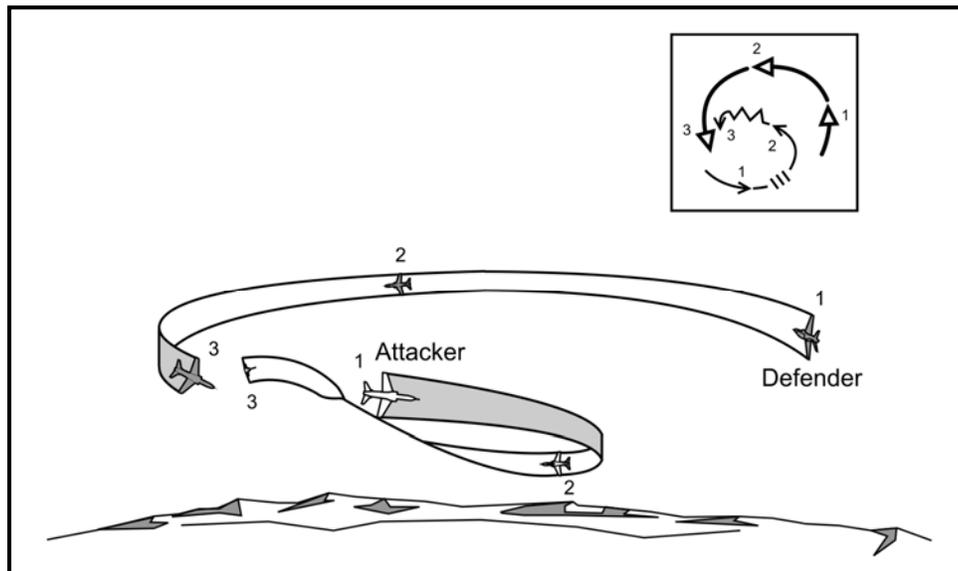


Figure 2-3 Low Yo-Yo

- (a). Over bank to lower nose relative to bandit
 - (b). Pull inside of bandit's turn (lead pursuit)
 - (c). Upon approaching desired weapons range
 - (1). Work nose up toward bandit
 - (2). Avoid heavy buffet
 - (3). Align fuselages
 - (d). Fire weapon when within weapons envelope
- c. Common errors
- i. **Problem:** bleeding excessive energy while pulling inside bandit's turn
Correction: once lead pursuit is established, ease AOA to regain energy and regain closure
 - ii. **Problem:** lowering nose too far resulting in excessive closure
Correction: lower nose less while learning to judge closure and relative speeds
- d. Variations
- i. Turn rate: if bandit increases turn rate resulting in higher angle off, bring nose up to reduce closure and to prevent overshoot (high yo-yo)
 - ii. Vertical move: if bandit pitches nose-high into vertical, bring nose up to reduce closure and to prevent overshoot
4. Break turn exercise
- a. Purpose: simulate section defeating long range missile shot while maneuvering to guns firing solution
 - b. Application
 - i. Setup — combat spread with bandit attacking between section from 6 o'clock and spotted by high wingman
 - ii. Execution
 - (a). Wingman simulates missile defense

- (1). Calls lead to break into missile

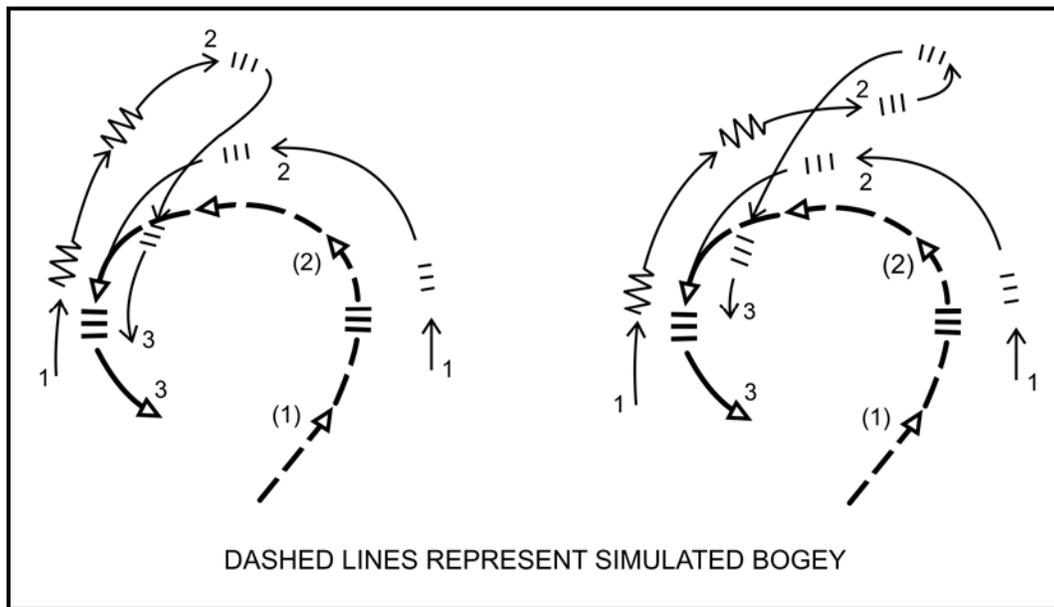


Figure 2-4 Break Turn Exercise

- (2). Simultaneously pulls nose up 30 degrees and then slow rolls in lead's directions as lead executes a break turn into missile
 - (3). Calls lead to ease turn, simulating missile defeat
- (b). Simulated counterattack — preferred option

NOTE

The lead now assumes the role of a passive bandit.

- (1). Wingman continues roll, keeping bandit in sight
 - (2). Increases rate of roll, relaxes backstick pressure slightly to establish nose-low in the oblique, and ends up in nose-low slice turn in lag pursuit
 - (3). Maintains G until pure pursuit position for Fox-2
- (c). Simulated counterattack — option 2
- (1). Reverses turn nose-high prior to bandit passing underneath fighter resulting in momentary lost sight

- (2). Over banks aircraft to engage bandit in nose-low slice turn in lag pursuit
 - (3). Maintains 17 units AOA until reaching pure pursuit position (avoid heavy buffet)
 - (4). Maneuvers to Fox-2
- c. Common errors

NOTE

The common errors and corrections exist in both the preferred and optional execution of the break turn exercise.

- i. **Problem:** rolling too slowly causing buried nose at bottom
Correction: increase roll rate enough to prevent burying nose
 - ii. **Problem:** using too high AOA causing excessive energy bleed off
Correction: release back pressure and maintain 17 units AOA
- d. Variations — defensive pitch back

NOTE

See section 2.d.ii. under high yo-yo.

5. Horizontal scissors

- a. Purpose: prevent fighter from going defensive following in-close overshoot and subsequent bandit reversal — reactive, not initiated offensively
- b. Application
 - i. Setup: low-angle perch, 1000 ft above bandit, 30-degree AOT, 1/2-3/4 nm range
 - ii. Procedure

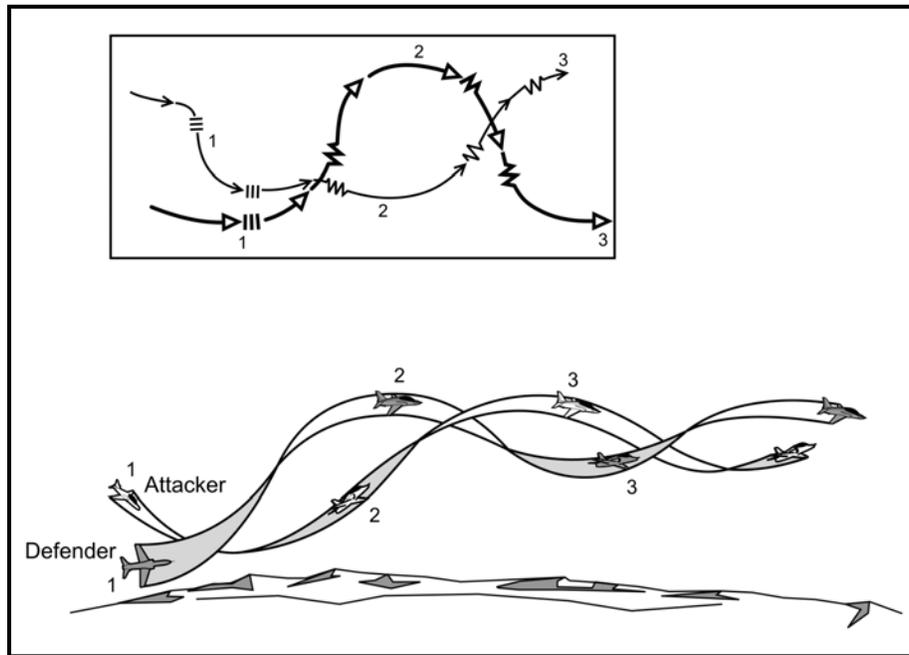


Figure 2-5 Horizontal Scissors

- (a). Fighter: attacks bandit as in TacForm gun sight tracking exercise
 Bandit: breaks into fighter
- (b). Fighter
- (1). Places velocity vector one wingspan below and one plane length in front of bandit and keeps it there until nearing 1000-ft min gun range
 - (2). Approaching 1000 ft, levels wings and pulls nose up to avoid bandit horizontally and vertically
 - (3). Clearing bandit, initiates 17-unit AOA pull up to 45-60 degrees nose-high to decrease down-range travel
- Bandit: continues pull into fighter to ensure overshoot, then pulls up vertically and reverses into fighter
- (c). Fighter
- (1). Turns into bandit using 16-17 units AOA with lift vector aft of bandit

(2). Adjusts attitude as airspeed reaches 140-150 KIAS

Bandit: turns into fighter attempting to gain neutral or offensive position

(d). Fighter: once behind bandit's wingline, reverses and attempts to align fuselages while maintaining 19-21 units AOA

Bandit: reverses as fighter passes his 6

(e). Fighter stabilized in scissors at approximately 120 KIAS, 10-15 degrees nose-high, 45 degrees AOB, and 20 units AOA

c. Common errors

i. **Problem:** on initial overshoot, delaying turn back into bandit results in excessive down-range travel and possible loss of offensive advantage

Correction: initiate turn into bandit as soon as 30 degree nose-high attitude is reached

ii. **Problem:** on initial overshoot, failing to get nose-high enough resulting in excessive down-range travel and loss of offensive advantage

Correction: Continue to pull with lift vector aft of the bandit

iii. **Problem:** using excessive AOA that causes reduced directional control and aircraft acceleration, resulting in excessive down-range travel and loss of offensive advantage

Correction: release back pressure and avoid excessive buffet

iv. **Problem:** delaying reversal, resulting in increased lateral separation allowing bandit opportunity to increase AOT, compromising offensive position

Correction: anticipate subsequent reversals and turn early to align fuselages and stop overshooting

v. **Problem:** remaining perched high on bandit resulting in going blind on bandit and perpetuating overshoots

Correction: pull power while maintaining other parameters to position for guns

NOTE

The ideal position to work a bandit in a horizontal scissors is below and behind his wingline with your guns sweeping through his aircraft.

- vi. **Problem:** using excessive AOB during reversal causes nose to drop and aircraft to accelerate resulting in excessive down-range travel and loss of offensive advantage

Correction: when low wing breaks horizon on way down, apply top rudder to stop roll at 45 degrees

NOTE

At approximately 120 KIAS, the rudder is the primary control surface used to induce or stop rolling moments.

d. Variations

- i. Bandit with low energy — on initial overshoot with altitude advantage, fighter rolls into barrel roll attack
- ii. Bandit attempts to disengage
 - (a). Bandit's extension fails to generate sufficient nose-to-tail separation
 - (1). Fighter pulls nose down in slice turn to reduce AOT and minimize separation
 - (2). Fighter remains in phase with bandit using combination and/or variation of high and low yo-yo's for guns solution

NOTE

The fighter should be cautioned not to descend too far below the bandit during the disengagement. This will allow the bandit to use altitude and radial G to his advantage.

- (b). Bandit generates sufficient nose-to-tail separation, bugs out successfully, or performs defensive pitch back

NOTE

See section 2.d.ii under high yo-yo.

6. Displacement roll
 - a. Purpose
 - i. Reduces excessive closure rate
 - ii. Displaces fighter to different plane of maneuvering (lag pursuit)
 - iii. Maintains energy and gains/retains firing position in low to medium AOT and medium-range situations

LESSON NOTES

The instructor/SNP may refer to the ACM FTI for information on a variation of the displacement roll, the lag pursuit roll.

- b. Application
 - i. Setup — none (usually occurs from low yo-yo)
 - ii. Execution — same procedures used in Tactical Formation

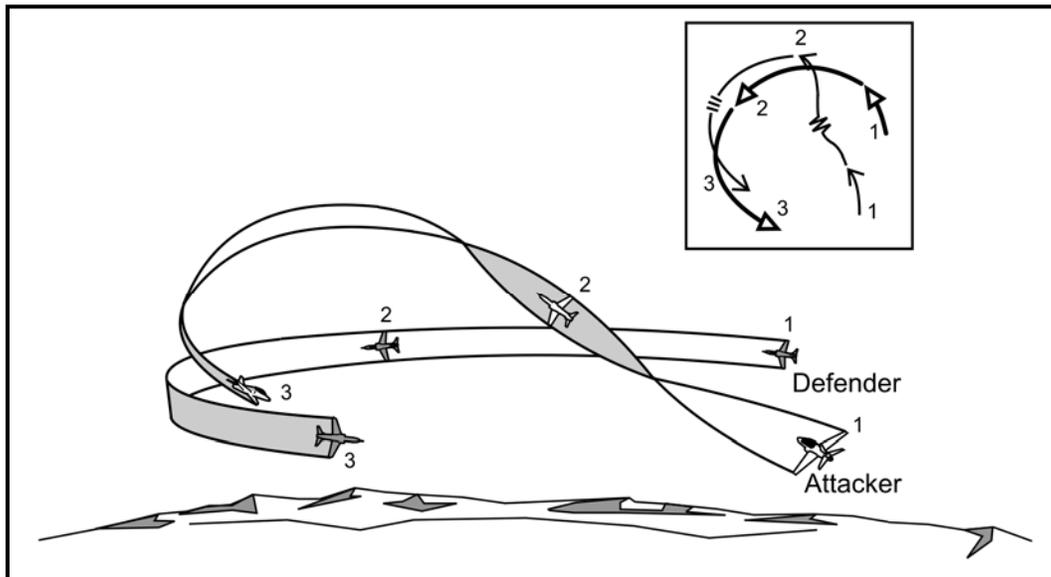


Figure 2-6 Displacement Roll

- (a). Align fuselages on inside of bandit's turn
- (b). Raise velocity vector above bandit
- (c). Roll away from turn toward bandit's six (lag pursuit)

- (d). Use rudder to maintain alignment of fuselages
- (e). Control rate of roll to arrive in desired firing envelope (lead or pure pursuit)
 - (1). Slow rate of roll for increased nose-to-tail
 - (2). Fast rate of roll for maintaining nose-to-tail
- c. Common error
 - **Problem:** failing to align fuselages prior to roll results in increased TCA and range

Correction: position velocity vector inside turn to align fuselages prior to initiating maneuver
- d. Variations
 - i. Turn rate — if bandit increases turn rate, roll more rapidly and increase G to maintain fuselage alignment
 - ii. Vertical move — if bandit pitches nose-high into vertical, increase rate of roll and pull nose up to prevent vertical overshoot
- 7. Barrel roll attack
 - a. Purpose
 - i. Reduce AOT, closure rate, and turn radius
 - ii. Minimize energy loss in high (60-90 degree) AOT situations outside 4000 ft

NOTE

The barrel roll attack is a marginal tactic against a distant, counter-maneuvering bandit.

- b. Application
 - i. Setup — medium-angle perch: 1000 ft above bandit, 70-80 degrees AOT, 1/2-3/4 nm range
 - ii. Procedure

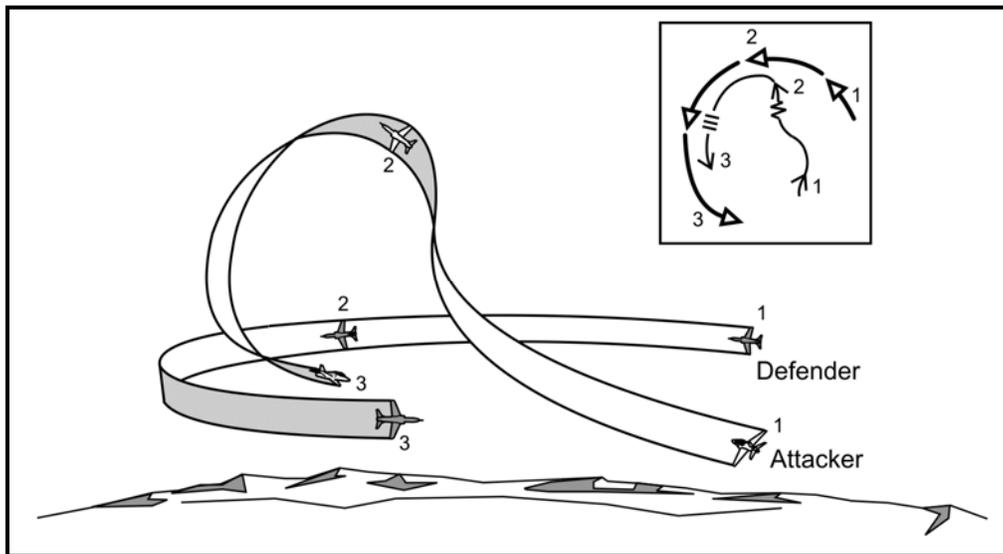


Figure 2-7 Barrel Roll Attack

- (a). When cleared in, pull approximately 30 degrees nose up while pulling into bandit and aft toward his 6 o'clock
 - (b). Continue to raise nose using 17 units AOA rolling toward bandit's 6 o'clock
 - (c). Passing inverted, use positive G and rudder to align fuselages
- c. Common errors
- i. **Problem:** improperly aligning fuselage resulting in high TCA and excessive horizontal overshoot
Prevention: attempt to align fuselages prior to beginning barrel roll
 - ii. **Problem:** taking too much time in attempt to align fuselage resulting in reduced nose-to-tail and possible loss of offensive advantage
Correction: aggressively pull nose up while turning to align fuselages
 - iii. **Problem:** insufficient nose-high attitude resulting in horizontal overshoot
Correction: ensure sufficient nose-high attitude

- iv. **Problem:** holding excessive nose-low attitude at bottom allowing bandit to pitch back vertically causing overshoot
Correction: increase roll rate to prevent excessive nose-low attitude
- d. Variations
 - i. Turn rate — if bandit increases turn rate as fighter reaches maximum climb attitude, increase roll rate to prevent overshooting bandit's flight path
 - ii. Direction
 - (a). If bandit executes simultaneous barrel roll into fighter, keep nose coming up higher than bandit's

NOTE

If the bandit can get his nose higher than the fighter, the bandit may be able to reach a rear-quarter position on the fighter after completing the roll resulting in a possible horizontal scissors.

- (b). If bandit pitches up near end of your maneuver, increase G to keep AOT from increasing, resulting in possible rolling scissors
- 8. Rolling scissors
 - a. Purpose: generally initiated by bandit to counter barrel roll attack — reactive, never initiated offensively
 - b. Application
 - i. Setup: following medium-angle perch to barrel roll attack
 - ii. Procedure

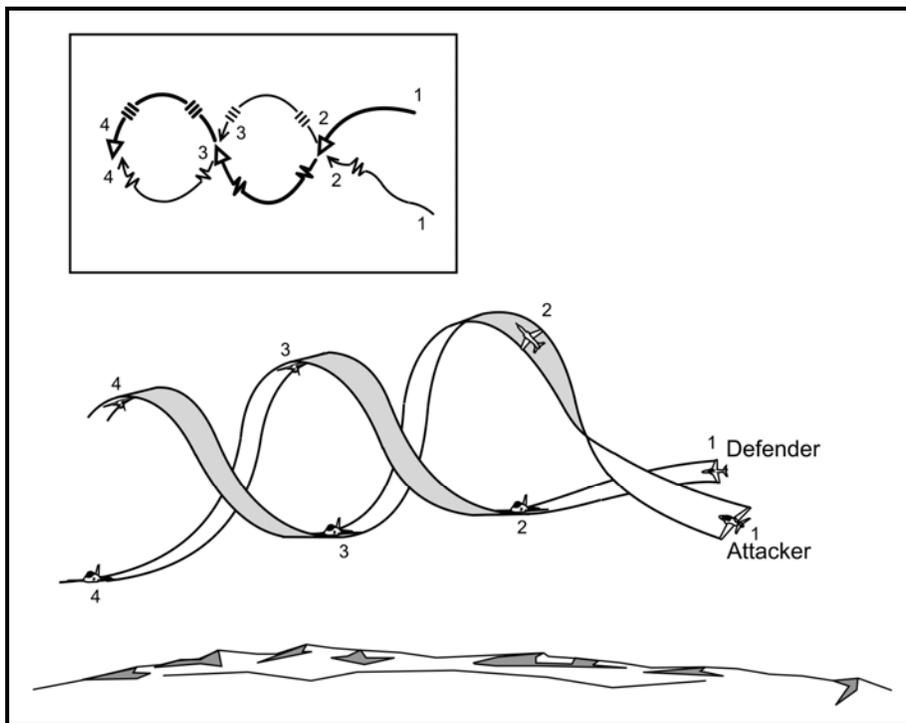


Figure 2-8 Rolling Scissors

(a). Fighter: starts conversion over top of barrel roll attack

Bandit: hard turns into fighter to cause horizontal overshoot and then pitches up vertically to generate vertical overshoot

(b). Fighter

(1). Rolls in order to place lift vector on bandit

(2). Keeps lift vector on bandit using 17 units AOA until wings level on bottom

Bandit: attempts to generate a horizontal overshoot on top while executing barrel roll attack on fighter

(c). Fighter

(1). Holds lift vector aft of bandit's 6 o'clock

(2). Pitches vertically 40-60 degrees nose-high depending on energy state

(3). Uses 17 units AOA in pitch up

- (4). Rolls toward bandit in barrel roll attack to place lift vector on bandit

Bandit: overshoots vertically

- (d). Both aircraft now locked in series of vertical and horizontal overshoots

iii. Energy considerations

- (a). Manage energy by using vertical/oblique plane

NOTE

In similar aircraft, the steepness of the climbs and dives determines the horizontal movement more than does the absolute speed differential.

- (1). Pull up wings level into vertical
- (2). Make all heading changes (horizontal turns) by rolling off after reaching desired vertical attitude

- (b). Trade airspeed for altitude to reduce forward vector
- (c). Amount of acceleration depends on bandit's relative position to fighter

NOTE

Keep the lift vector perpendicular to other aircraft throughout maneuver except when taking advantage of vertical to reduce forward vector.

- (1). Monitor AOA to avoid buffet
 - (2). Control airspeed gain in pullout to maintain the advantage
- (d). Maintaining the advantage
- (1). Use 17-21 units AOA (lead pursuit) over top of each loop
 - (2). Maintain 14-17 units AOA (lag pursuit) along bottom of each loop, i.e., max AOA without buffet

iv. Effects of radial G

- (a). Neutral — illusory advantages/disadvantages

- (1). Perspective as bottom aircraft — greater airspeed and bigger turn radius gives appearance of being forced out in front of top aircraft

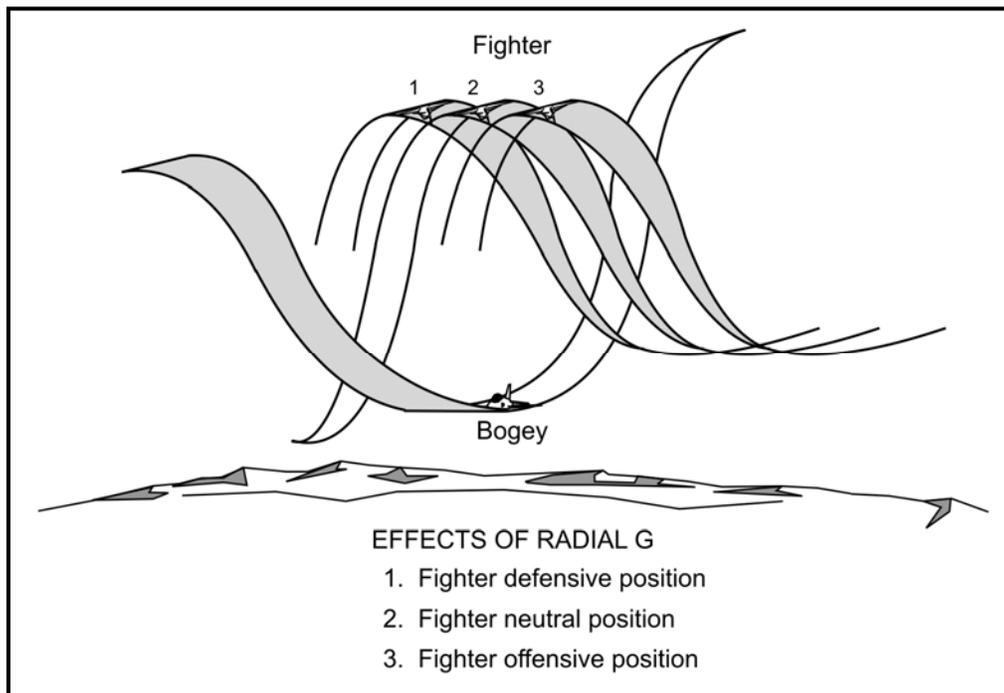


Figure 2-9 Rolling Scissors Positions

- (2). Perspective as top aircraft — less airspeed and smaller turn radius gives appearance of sliding back behind bottom aircraft
- (b). Defensive and offensive — real advantage/disadvantage
 - (1). Perspective as bottom aircraft — greater airspeed and bigger turn radius gives appearance
 - i) Defensive — being in front of bandit forced to look aft when commencing vertical move
 - ii) Offensive — bandit forward of neutral point on your canopy
 - (2). Perspective as top aircraft — less airspeed and smaller turn radius gives appearance
 - i) Defensive — bandit aft of your aircraft
 - ii) Offensive — bandit directly underneath or forward of your aircraft

NOTE

If your nose is in-phase with the bandit, you are offensive, e.g., bandit nose-low approaching bottom; fighter established nose-low over the top.

- c. Common errors
 - i. **Problem:** rolling too rapidly placing lift vector in front of bandit
Correction: counter roll rate with opposite control force to keep lift vector on or slightly behind bandit
 - ii. **Problem:** rolling with insufficient rate resulting in excessive nose-low attitude
Correction: increase roll rate
 - iii. **Problem:** maintaining insufficient AOA over top resulting in nose-low attitude
Correction: increase AOA
- d. Variations
 - i. Conversion to horizontal scissors

NOTE

Approximately 2500 ft above the hard deck is needed for a successful nose-low roll through the vertical to continue the rolling scissors.

- (a). Aircraft at top of roller remains nose-high and continues to pull back toward opponent's aircraft to generate horizontal overshoot
- (b). Instead of rolling through vertical, opponent's aircraft on top will reverse nose-high and pull back toward aircraft beginning vertical pull up resulting in horizontal scissors
- ii. Bandit attempts disengagement from top of roller
 - (a). Bandit fails to generate sufficient nose-to-tail separation
 - (1). Fighter rolls off his vertical move early to reduce airspeed loss and minimize nose-to-tail separation

- (2). Fighter pulls for shot and remains in phase using combination and/or variation of high and low yo-yo's
- (b). Bandit generates sufficient nose-to-tail separation, disengages successfully, and performs pitch back

NOTE

See section 2.d.ii under high yo-yo

PROGRESS CHECK

Question 4 — The offensive purpose of the snap guns exercise is to practice reaching _____ against a maneuvering bandit.

ANSWER: a snap guns envelope

Question 5 — In the offensive snap guns exercise, after the bandit calls “In as the target,” what action does the fighter take?

ANSWER: The fighter calls in as the shooter and reverses with the bandit at 10 or 2 o'clock to achieve a snap guns solution of 60-90 degrees AOT.

Question 6 — In the offensive snap guns exercise, after the bandit maneuvers out-of-plane to defeat the gun solution, what happens to the fighter?

ANSWER: The fighter overshoots the bandit because of a high TCA.

Question 7 — What is the purpose of the low yo-yo in ACM?

ANSWER: Decrease range or increase rate of closure in low closure/low angle off situations

Question 8 — What is the purpose of the high yo-yo in ACM?

ANSWER: To prevent an overshoot of the bandit's flight path

Question 9 — When a bandit generates minimal lateral separation during a defensive pitch back, the fighter attempting an offensive counter attempts to remain in phase with the bandit by using combinations/variations of _____ for a guns solution.

ANSWER: high and low yo-yo's

Question 10 — When a bandit generates lateral separation during a defensive pitch back, the fighter attempting an offensive counter attempts to _____ the bandit in the _____, using proper control input to align fuselages.

ANSWER: lead turn, vertical

Question 11 — What are the two methods for the wingman to simulate a counterattack on the lead (bandit) during the offensive break turn exercise?

ANSWER:

1. The wingman continues his roll, keeping the bandit in sight.
2. The wingman reverses his turn nose-high, prior to the bandit passing underneath the fighter.

Question 12 — What is the purpose of the horizontal scissors?

ANSWER: The horizontal scissors is a reactive maneuver flown off a low-angle perch which prevents the fighter from going defensive, following an in-close overshoot and subsequent bandit reverse.

Question 13 — What action should the fighter take during the initial overshoot of a horizontal scissors?

ANSWER: The fighter should pull his nose up 45-60 degrees and initiate his turn placing his lift vector aft of the bandit.

Question 14 — What is the purpose of the displacement roll in ACM?

ANSWER: The displacement roll reduces excessive closure rate while displacing the fighter to a different plane of maneuvering.

Question 15 — During a displacement roll, how does the rate of roll affect arrival in the desired firing envelope?

ANSWER: A slow rate of roll is applied for an increased nose-to-tail distance. A fast rate of roll is applied for maintaining the nose-to-tail distance.

Question 16 — The barrel roll attack reduces _____, _____, and _____.

ANSWER: AOT, closure rate, turn radius

Question 17 — What action should the fighter take to correct for reduced nose-to-tail and possible loss of offensive advantage, because the fighter took too much time attempting to align the fuselages during a barrel roll attack?

ANSWER: The fighter should aggressively pull his nose up while turning to align fuselages.

Question 18 — What is the purpose of the rolling scissors?

ANSWER: The rolling scissors is usually initiated by the bandit to counter the barrel roll attack. The fighter never initiates the maneuver in an offensive situation.

Question 19 — What is the defensive perspective as the bottom aircraft in the rolling scissors?

ANSWER: The fighter's defensive perspective, as the bottom aircraft, is being in front of bandit. The fighter is forced to look aft when commencing the vertical move.

Disengagement/bugout

1. Offensive considerations
 - a. Aircraft problems
 - i. Mechanical problems
 - ii. Guns misfire
 - iii. Hung ordnance
 - b. Ordnance expended
 - c. Bingo/Joker fuel
 - d. Time-to-kill becomes factor
2. Procedures for execution
 - a. Maintain sight of bandit and keep him at aft visibility limit
 - b. Reduce altitude to deck, if practicable, for terrain and weapons considerations
 - c. Attain high energy level as soon as possible after initiating bugout
 - d. Head for friendly territory when disengaging

- e. Once disengaged, do not allow bandit to close without making positive defensive response

PROGRESS CHECK

Question 20 — Identify at least three considerations for an offensive disengagement/bugout.

ANSWER:

1. Aircraft problems
2. Ordnance expended
3. Bingo/joker fuel
4. Time-to-kill becomes a factor

Question 21 — Once disengaged from the bandit, do not allow the bandit to close on you without making a _____.

ANSWER: positive defensive response

Integration of the Offensive 1 v 1 Tactical Situation

LESSON NOTES

The following engagement scenarios are designed to help the SNPs understand how an offensive maneuver may be applied and subsequently connected to other maneuvers in the air combat arena. The “Initial scenario” sets the conditions. The “Objective” identifies the SNP’s ultimate goal given those conditions. “Options” list the most logical choice of maneuvers to accomplish the goal.

Conduct an open-ended discussion, drawing answers from the SNPs on what and why they selected certain maneuvers. Discuss how that maneuver or combination of maneuvers will accomplish the objective. Continue and build on the “Bandit reactions” to link all the maneuvers in the lesson. Eventually, the discussions should lead the SNPs to more independent thinking.

Allow adequate time for discussion!

1. Engagement 1
 - a. Initial scenario: low angle off attack on maneuvering bandit
 - i. Objective: close to missile envelope and continue to gun envelope
 - ii. Options
 - (a). Maneuver 1: low yo-yo
 - (1). Advantage — decreases range by increasing closure
 - (2). Disadvantage
 - i) Increases AOT
 - ii) Causes possible high-speed overshoot
 - iii) Allows possible vertical move for bandit resulting in overshoot
 - b. Bandit reaction to low yo-yo: at Fox-2 bandit breaks into you
 - i. Objective: decrease angle off and prevent overshoot
 - ii. Options
 - (a). Maneuver 1: high yo-yo
 - (1). Advantage
 - i) reduces closure rate
 - ii) potential for overshoot
 - iii) AOT
 - (2). Disadvantage: may result in excessive nose-to-tail separation
 - (b). Maneuver 2: displacement roll
 - (1). Advantage: reduces closure and AOT
 - (2). Disadvantage: may cause overshoot to lag position

- c. Bandit reaction to high yo-yo: bandit generates in-close overshoot and executes nose-high reversal
 - i. Objective: decrease down-range travel to maintain offensive advantage
 - ii. Options
 - (a). Maneuver 1: enter horizontal scissors
 - (1). Advantage
 - i) Prevents losing all offensive advantage
 - ii) Bleeds bandit's energy
 - iii) Keeps bandit in predictable flight path
 - (2). Disadvantage
 - i) Loses energy
 - ii) Keeps fighter predictable
 - iii) Limits shot opportunities
 - (b). Maneuver 2: barrel roll over top of bandit if lateral separation in vertical exists and bandit has low-energy state
 - (1). Advantage
 - i) Uses vertical displacement to generate nose-to-tail separation and reduce AOT
 - ii) Provides higher energy state
 - iii) Enables rolling into immediate shot opportunity
 - (2). Disadvantage: miscalculation may result in vertical overshoot
- d. Bandit reaction to horizontal scissors: Bandit attempts disengagement
 - i. Objective
 - (a). Prevent disengagement
 - (b). Maneuver for weapons employment

- ii. Options
 - (a). Maneuver 1: fighter slice turns into bandit
 - (1). Advantage
 - i) Prevents excessive nose-to-tail separation
 - ii) Reduces AOT
 - iii) Provides possible immediate shot opportunity
 - (2). Disadvantage: miscalculation may result in follow on overshoot
 - (b). Maneuver 2: fighter disengages
 - (1). Advantage: creates maximum separation for fighter's bugout
 - (2). Disadvantage: allows bandit to escape
- e. Bandit reaction to slice turn: bandit executes defensive pitch back
 - i. Objective
 - (a). Reduce AOT
 - (b). Remain in phase with bandit
 - ii. Options
 - (a). Maneuver 1: fighter times vertical move to remain inside bandit's vertical turn
 - (1). Advantage
 - i) Allows fighter to reduce AOT by lead turning bandit in vertical
 - ii) Keeps offensive advantage
 - iii) Prevents bandit from generating 180-degree close-aboard pass
 - (2). Disadvantages: results in possible horizontal or vertical overshoots

- (b). Maneuver 2: fighter begins vertical move early to pass bandit head-on on top
 - (1). Advantage: generates 180-degree, close-aboard pass for subsequent disengagement
 - (2). Disadvantage: causes fighter to lose offensive advantage
- 2. Engagement 2
 - a. Initial scenario: medium angle off attack on maneuvering bandit
 - i. Objective: close to missile envelope and continue to gun envelope
 - ii. Options
 - (a). Maneuver 1: barrel roll attack
 - (1). Advantage
 - i) Reduces high AOT
 - ii) Uses all three maneuvering planes
 - iii) Provides minimum energy loss
 - (2). Disadvantage
 - i) Marginal tactic against maneuvering bandit
 - ii) Vertical overshoot possible
 - iii) May generate too much nose-to-tail separation
 - (b). Maneuver 2: low yo-yo
 - (1). Advantage: closes range by increasing closure
 - (2). Disadvantage
 - i) May cause high-speed overshoot
 - ii) Increases AOT
 - iii) May allow bandit vertical move resulting in overshoot

- b. Bandit reaction to barrel roll attack: bandit breaks into you
 - i. Objective: decrease angle off and prevent overshoot
 - ii. Options
 - (a). Maneuver 1: barrel roll attack
 - (1). Advantage
 - i) Reduces high AOT
 - ii) Uses all three maneuvering planes
 - iii) Provides minimum energy loss
 - (2). Disadvantage
 - i) Marginal tactic against maneuvering bandit
 - ii) Vertical overshoot possible
 - iii) May generate too much nose-to-tail separation
 - (b). Maneuver 2: high yo-yo
 - (1). Advantage: reduces closure and AOT
 - (2). Disadvantage
 - i) May result in too much nose-to-tail separation
 - ii) May result in close-aboard overshoot
- c. Bandit reaction to barrel roll attack: bandit generates vertical overshoot
 - i. Objective: decrease down-range travel to maintain offensive advantage
 - ii. Options
 - Maneuver 1: enter rolling scissors
 - (1). Advantage
 - i) Prevents losing offensive advantage

- ii) Keeps bandit in predictable flight path
- (2). Disadvantage
 - i) Keeps fighter predictable
 - ii) Limits shot opportunities
- d. Bandit reaction to rolling scissors: bandit attempts disengagement
 - i. Objective: prevent disengagement and maneuver for weapons employment
 - ii. Options
 - (a). Maneuver 1: fighter rolls off his vertical move early and pulls for shot
 - (1). Advantage
 - i) Reduces AOT and minimizes nose-to-tail separation
 - ii) Keeps bandit from regaining his energy
 - iii) Provides possible quick-kill on bandit
 - (2). Disadvantage: maintains continuous engagement
 - (b). Maneuver 2: fighter attempts disengagement in opposite direction
 - (1). Advantage: creates maximum separation for fighter's bugout if not observed
 - (2). Disadvantage: allows bandit to escape

206. SUMMARY

This lesson focused on the offensive aspect of the air combat arena including:

1. Offensive considerations
2. Snap guns exercise
3. High yo-yo
4. Low yo-yo
5. Break turn exercise

6. Horizontal scissors
7. Displacement roll
8. Barrel roll attack
9. Rolling scissors
10. Disengagement
11. Assess 1 v 1 tactical situation

207. CONCLUSION

Good fighter pilots must have this one outstanding trait — aggressiveness. Remember, the fighter pilot who wins is the pilot who makes the fewest mistakes.

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CHAPTER THREE
ACM 1 V 1 DEFENSIVE MANEUVERING

300. INTRODUCTION – N/A

COURSE/STAGE:

- TS, TAILHOOK & IUT/Air Combat Maneuvering

LESSON TITLE:

- ACM 1 v 1 Defensive Maneuvering

LESSON IDENTIFIER:

- T-45C TS, TAILHOOK & IUT ACMFP-03

LEARNING ENVIRONMENT:

- Classroom

ALLOTTED LESSON TIME:

- 1.0 hr

TRAINING AIDS:

1. T-45 Scale Models
2. Figures
 - Figure 1: Snap Guns Exercise--Defensive Perspective
 - Figure 2: Break Turn Exercise--Defensive Perspective
 - Figure 3: Defensive Counter to Low Yo-Yo
 - Figure 4: Defensive Counter to High Yo-Yo
 - Figure 5: Horizontal Scissors--Defensive Perspective
 - Figure 6: Rolling Scissors--Defensive Perspective
 - Figure 7: Diving Spiral

- Figure 8: High-G Roll Over the Top
- Figure 9: High-G Roll Underneath

STUDY RESOURCES:

1. T-45 NATOPS Flight Manual, A1-T45AC-NFM-000
2. Air Combat Maneuvering Flight Training Instruction (FTI)

LESSON PREPARATION:

Read:

- T-45C ACM FTI “Defensive Maneuvering Flight Procedures” section

REINFORCEMENT:

- N/A

EXAMINATION:

- The objectives in this lesson will be tested in ACMFP-05X.

301. LESSON OBJECTIVES

1. Recall the concepts and tactics applicable to defensive ACM
2. Recall the purpose and application of the snap guns exercise in ACM (defensive)
3. Recall the procedure for performing the snap guns exercise (defensive)
4. Recall procedure for the “break turn” exercise (defensive)
5. Recall procedure for defensive counter to high/low yo-yo
6. Recall the purpose and application of the horizontal scissors (defensive)
7. Recall procedure for performing horizontal scissors (defensive)
8. Recall the purpose and application of the rolling scissors (defensive)
9. Recall procedure for performing rolling scissors (defensive)
10. Recall the purpose and application of disengagement maneuvers

3-2 ACM 1 V 1 DEFENSIVE MANEUVERING

11. Recall the procedure for defensive disengagement
12. Recall disengagement follow-on options
13. Recall the purpose and application of the lufbery
14. Recall the purpose and application of the diving spiral
15. Recall procedure for performing a diving spiral
16. Recall the purpose and application of the high “G” roll
17. Recall the procedure for performing a high “G” roll
18. Assess the defensive 1 v 1 tactical situation

302. MOTIVATION

If the motto for TOPGUN, “You fight like you train,” holds true, being aggressive and persevering is essential to reaching the main goal of defensive maneuvering--survive to fight another day.

Since you’re involved in combat not just to save your skin, but to win, learn how to put the other guy on the run.

303. OVERVIEW

This lesson will enable you to perform the procedures for defensive maneuvering in the ACM environment.

This lesson covers defensive aspects of the following:

1. Concepts and tactics
2. Snap guns exercise
3. Break turn exercise
4. Counter to high/low yo-yo
5. Horizontal scissors
6. Rolling scissors
7. Disengagement/bugout

8. Lufbery
9. Diving spiral
10. High-G roll
11. Jink-out
12. Integration

304. REFRESHER

Review the procedures covered in ACMFP-01 and ACMFP-02.

305. PRESENTATION

Defensive Concepts/tactics

1. Angle off
 - a. Increase angle off tail (AOT) to reduce bandit's angular advantage in fighter's rear hemisphere
 - b. In difficult-to-keep sight situations, compensate for losing sight of bandit by projecting bandit's flight path by utilizing track crossing angle (TCA)
 - c. Utilize multi-plane dimension to your advantage
 - i. Long range--keep lift vector (in-plane) on bandit
 - ii. Close range--go out of plane to keep bandit out of weapons envelope
 - iii. Consider both horizontal and vertical positioning

EXAMPLE: The principle of opposing the nose--if you are going up in vertical and the bandit brings his nose to bear, bring your nose down. As the bandit follows bringing his nose down, bring your nose back up.

2. Range
 - a. Keep bandit at high angle off and high TCA to force overshoot, decreasing bandit's turning room (range) when he becomes threat
 - b. Maneuver to keep bandit outside of effective weapons envelope

3. Three-dimensional environment
 - a. Be aware of 3-D environment to use to your advantage
 - i. Force bandit to overshoot
 - ii. Strategically place your lift vector
 - iii. Defeat immediate firing solution
 - b. Use top of canopy to visualize lift vector right above head (alleviates difficulty in looking over shoulder)

EXAMPLE: For a nose-low slice turn, roll to place the top of the canopy below the horizon or the bandit, as applicable.
 - c. Maintain sight—lean forward, fly with either hand and learn to twist in seat to maintain a near-blind cone tally
4. Energy state (advantage)
 - a. Consider excess speed and/or excess altitude
 - b. Total energy advantage difficult to determine because of possible speed differences between fighter and bandit
 - c. Compare bandit's maneuvers in relation to own
 - d. Use of egg theory
 - i. Nose-low/nose-high pitchback into fight
 - ii. Unload to regain energy at every opportunity
 - iii. Use pure vertical only in advantageous situation

CAUTION

Horizontal flight and arcing turns are contradictory to an advantageous energy state.

PROGRESS CHECK

Question 1 — How can the fighter reduce the bandit's offensive angular advantage?

ANSWER: Increase angle off tail (AOT)

Question 2 — How can the fighter use the 3-D environment to his advantage?

ANSWER:

1. Force the bandit to overshoot.
2. Strategically place your lift vector.
3. Defeat the immediate firing solution.

Defensive Maneuvers**NOTE**

In this lesson, defensive maneuvers are viewed from the defender's perspective. Therefore, the defender is the "fighter" and the attacker is the "bandit." The associated diagrams are labeled "defender" and "attacker" according to aircraft position in the fight, not according to role.

1. Snap guns defense exercise
 - a. Purpose: practice defending against high angle-off guns attack while maintaining sufficient energy to counter next attack
 - b. Application

LESSON NOTES

Whenever a topic is supported by both a screen projection and animated video, you will have a menu. Choosing "Animation" will begin the animated sequence. You can exercise full control over the animation to show it all, pause the sequence whenever you want to point something out, and even repeat the sequence as necessary. Choosing "Diagram" will call up the screen projection, which will be a ribbon diagram or spaghetti diagram of the maneuver. Use your own discretion as to which you show first, and continue the lesson by choosing "Continue" at the end of the menu.

- i. Setup: level combat spread
- ii. Execution

- (a). Bandit calls “In as the shooter” and hard turns into attack
- (b). Fighter calls “In as the target” and turns with 45-60 degree AOB into attack
- (c). Bandit reverses as fighter approaches 10/2 o’clock to achieve a snap guns solution of 60-90 degrees AOT
- (d). Fighter
 - (1). Reduce planform by breaking out-of-plane and pulling hard to avoid bandit’s piper, prior to bandit’s nose coming on
 - (2). Maintains sufficient closure rate to force overshoot

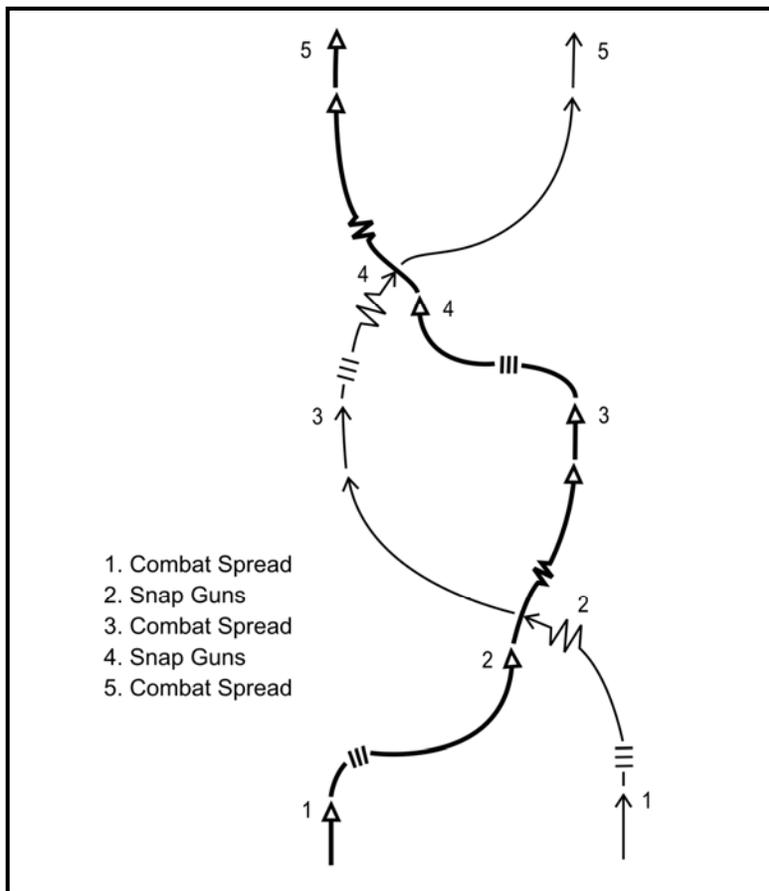


Figure 3-1 Snap Guns Exercise—Defensive Perspective

- c. Common errors
 - i. **Problem:** continuing to pull in-plane with bandit allowing greater shot opportunities
Prevention: maneuver aggressively out-of-plane
 - ii. **Problem:** allowing bandit to position nose on fighter prior to maneuvering out-of-plane
Prevention: recognize bandit's nose position and anticipate maneuver
 - iii. **Problem:** initiating an out-of-plane maneuver too early
Prevention: generate sufficient angles/closure to force an overshoot prior to out-of-plane maneuvering
- 2. Break turn exercise defense
 - a. Purpose—practice defensive maneuvering against long range missile shot and guns firing solution
 - b. Application
 - i. Setup
 - (a). Section in combat spread
 - (b). Simulated bandit attacking from 6 between section, spotted by lead (IP)

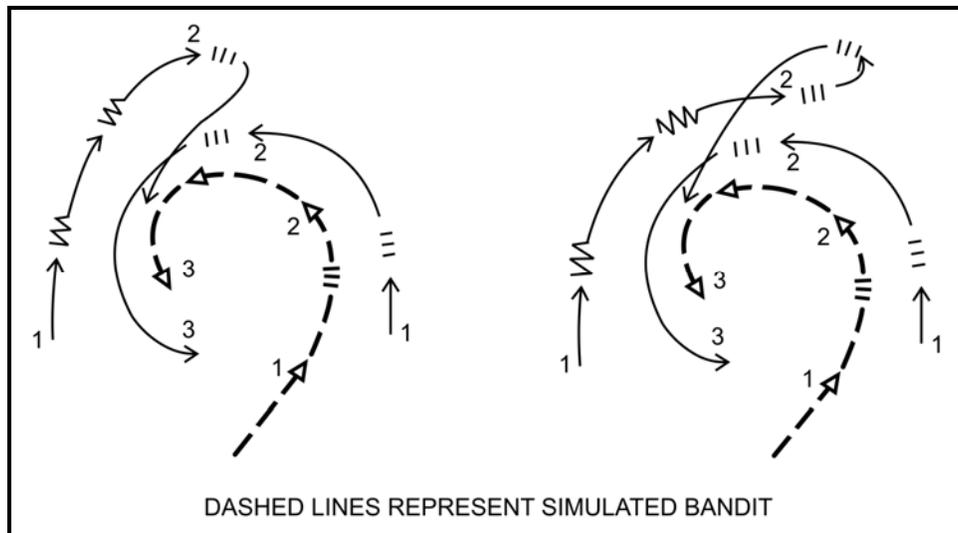


Figure 3-2 Break Turn Exercise — Defensive Perspective

- ii. Execution
 - (a). Lead
 - (1). Calls wingman to break into missile
 - (2). Simultaneously initiates nose-high roll into wingman
 - (3). Calls wingman to ease turn as he reaches 45 degrees of turn (simulating missile defeat)
 - (b). Wingman:
 - (1). Responds with a 19-21 unit AOA break turn into the simulated missile
 - (2). Becomes defensive fighter
 - (c). Lead: becomes offensive bandit--calls "Fox-2"
 - (d). Fighter
 - (1). Executes second break turn
 - (2). Continues pull until bandit acquired
 - (3). Defends against high and low yo-yos
- 3. Defensive counters to high/low yo-yo
 - a. Purpose: maintain out-of-phase with bandit's maneuver to avoid bandit's weapons

NOTE

In all defensive maneuvers, the fighter begins counters at the bandit's low reversal.

- b. Application
 - i. Setup: follow-on maneuver to break turn exercise, or a low angle off perch, if required
 - ii. Execution
 - (a). Execute a hard or break turn by placing lift vector on or slightly below bandit to increase AOT and closure rate

NOTE

The initial nose-low move is accomplished by overbanking slightly while maintaining G to redirect the lift vector down.

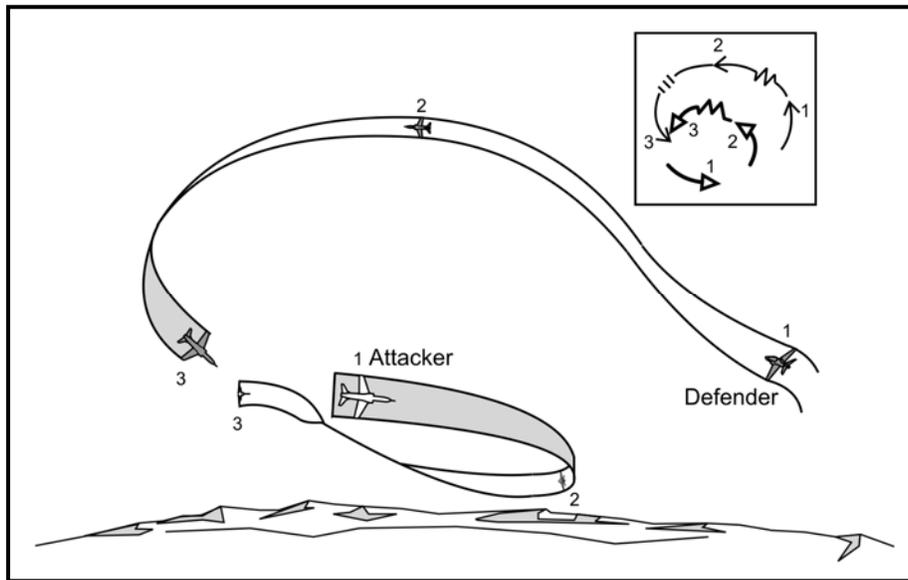


Figure 3-3 Defensive Counter to Low Yo-Yo

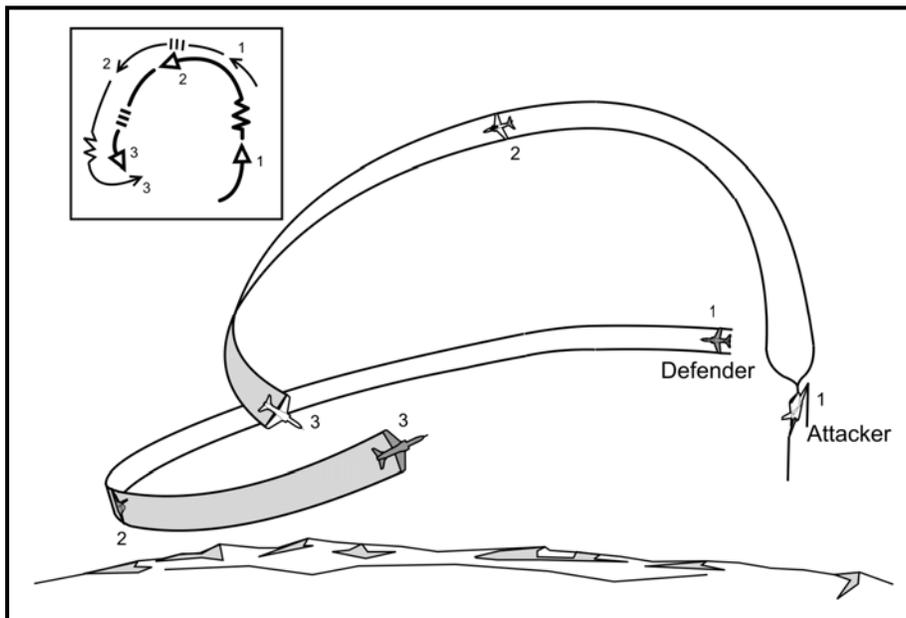


Figure 3-4 Defensive Counter to High Yo-Yo

- (b). Maintain nose-low hard turn until bandit's nose committed into vertical
- (c). Once bandit's nose committed up, unload aircraft 5-10 units AOA to optimize acceleration and separation
- (d). Maintain sight of bandit throughout maneuver

NOTE

If the bandit's flight path takes him significantly outside of the fighter's flight path, reverse turn direction and turn sufficiently to keep the bandit in sight.

- (e). Continue unloading until bandit commits nose-low but prior to weapon's threat
- (f). Execute pitchback
 - (1). If distance to bandit 1-1/4 nm or greater and lateral separation exists, execute lateral pitch back—nose-low hard turn
 - (2). If distance to bandit less than 1 mile or bandit at dead 6, execute vertical pitch back—execute at 60 degree nose-high, 17 units

NOTE

The goal is to meet the bandit with minimum lateral separation.

- (g). Unload to gain energy
 - (h). Bug out if possible or continue extension
- c. Common errors
- i. **Problem:** failing to turn hard into bandit to generate AOT and closure
Prevention: ensure hard or break turn is maintained
 - ii. **Problem:** placing lift vector above bandit in initial hard/break turn causing excessive energy bleed and in-plane maneuvering
Prevention: ensure lift vector is placed on or slightly below bandit

- iii. **Problem:** reducing turn rate prior to bandit committing nose up
Prevention: ensure bandit's nose is committed into vertical prior to attempting disengagement
- iv. **Problem:** unloading for separation too long allowing bandit to align fuselages for shot
Prevention: execute defensive pitchback prior to bandit's nose becoming a factor
- v. **Problem:** arcing in defensive pitchback
Prevention: continue hard turn, using coordinated control inputs to ensure minimum lateral separation
- d. Variations
 - i. If bandit continues to press, continue hard turn to force in-close overshoot to possible nose- high reversal
 - ii. Following transition from high yo-yo, pull up to force bandit into vertical overshoot to possible rolling scissors
- 4. Horizontal scissors
 - a. Purpose: to exploit an in-close horizontal overshoot
 - b. Application
 - i. Setup: normal low angle off perch
 - ii. Execution
 - (a). Force horizontal overshoot by making hard or break turn into bandit
 - (b). As bandit crosses your 6, pull up into vertical while reversing to maximize overshoot (nose-high reversal)

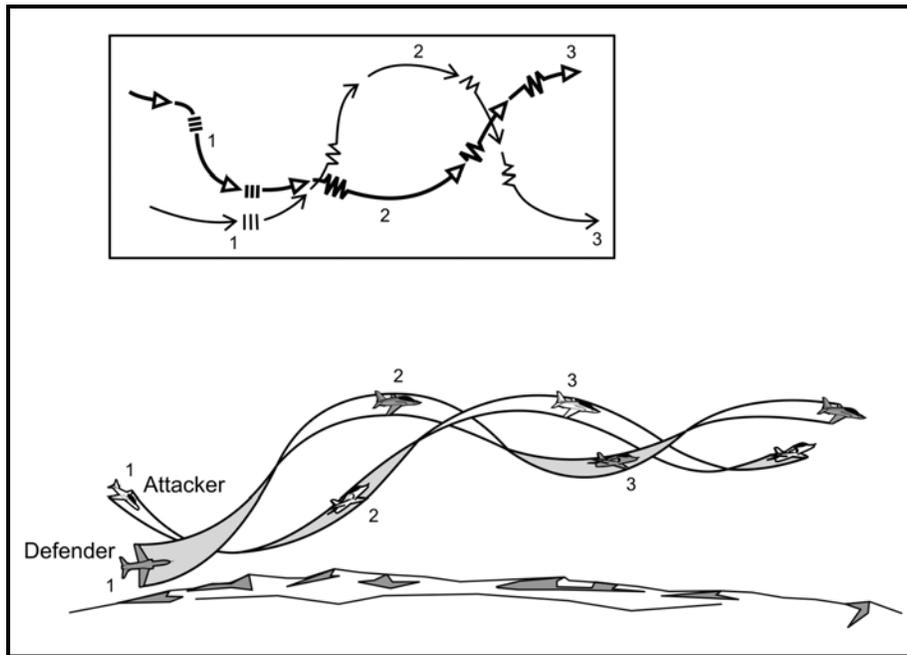


Figure 3-5 Horizontal Scissors — Defensive Perspective

LESSON NOTES

Stress holding the pullup well into the reversal, to maximize the overshoot.

- (1). Nose-high attitude attained depends on initial energy package, roughly 60-70 degrees
- (2). Acquire bandit at about 4 or 8 position
- (3). Pull toward bandit's 6 by placing lift vector aft of bandit
- (4). While rapidly decelerating through 200 kt
 - i) Continue roll to about 120 degrees AOB
 - ii) Allow nose to fall toward horizon, ensuring that nose does not fall to or below horizon
 - iii) Reduce bank angle to 45 degrees AOB
 - iv) Establish 140-150 kt and 20 units AOA

- (c). Attempt to fly behind bandit, while establishing minimum airspeed/AOA, by rolling back into bandit with lift vector slightly aft
 - (d). Pull hard, (140-150 KIAS and 20 units AOA will determine nose attitude) into bandit, forcing overshoot
 - (e). If bandit has achieved some nose-to-tail, do not reverse until bandit overshoots
 - (f). Continue series of reversals, using coordinated aileron and rudder
 - (g). Keep stick back to maintain maximum AOA without excessive buffet
 - (h). Avoid excessive AOB to prevent nose from falling through horizon and thus increasing airspeed
- iii. Common errors
- (a). **Problem:** commencing nose-high reversal prior to generating initial overshoot
Prevention: ensure bandit has overshoot prior to commencing nose-high reversal
 - (b). **Problem:** delaying reversal on initial overshoot or not reversing at all
Prevention: monitor bandit to overshoot and commence timely reversal
 - (c). **Problem:** while established in scissors reversing prior to bandit overshooting extended 6
Prevention: if bandit is reversing early to gain angles, delay reversal until bandit crosses 6
- iv. Variations
- (a). Crossing of paths, large TCA—if bandit near 180-degree pass, disengage
 - (b). Crossing of paths, decreased TCA—if fighter beginning to get bite on bandit (fighter becoming offensive), continue early turn to establish offensive advantage

5. Rolling scissors

a. Purpose

- i. To exploit in-close horizontal and vertical overshoot
- ii. To force opponent out in front by reducing forward vector

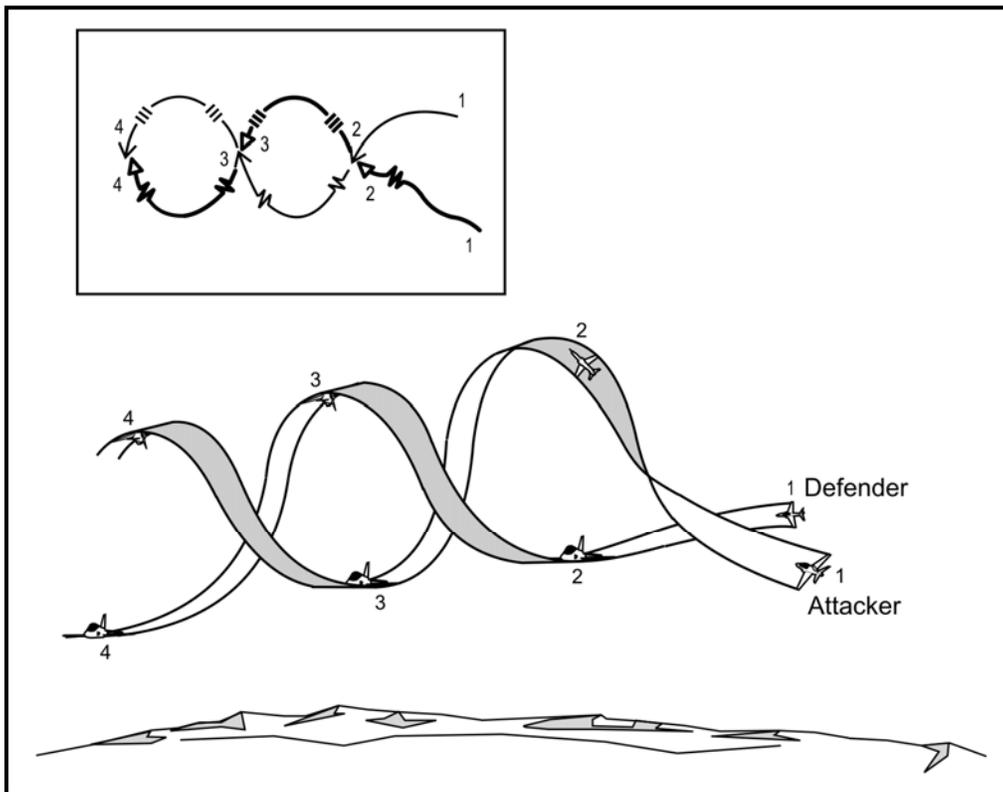


Figure 3-6 Rolling Scissors—Defensive Perspective

b. Application

- i. Setup: medium angle-off perch
- ii. Execution
 - (a). As bandit attempts barrel roll attack, execute slightly nose-low hard defensive counter turn into bandit
 - (b). Maintain turn until bandit crosses on top of your flight path
 - (c). At moment of overshoot, commence defensive pitchup

- (1). Level wings
- (2). Keep 17 units AOA
- (3). Execute vertical pitchup to approximately 60 degrees nose-high
- (d). As energy dissipates, commence roll-off (barrel roll) using aileron and rudder to complete roll
- (e). Once nose-high attitude established by fighter
 - (1). Pull for horizontal overshoot on top
 - (2). Maintain nose above horizon until commencing follow on rolls to avoid burying nose

NOTE

The remainder of the procedures identical to rolling scissors procedure appear in the offensive lesson ACMFP-02.

iii. Termination

- (a). Reason—lack of altitude
- (b). Reaction
 - (1). Flatten rolling scissors (shorten vertical separation)
 - (2). Convert into horizontal scissors
 - (3). Disengage

NOTE

As the rolling scissors progress, about 2500 ft above the deck is needed for a successful roll through to stay in the rolling scissors.

c. Common errors

- i. **Problem:** allowing bandit to pull behind 3/9 line caused by a weak nose-low hard counterturn in horizontal

Prevention: pull aggressively in the horizontal to force overshoot

- ii. **Problem:** allowing bandit to generate excessive nose-to-tail separation caused by a delayed or weak initial pull into vertical

Prevention: pull aggressively into vertical to force overshoot

- iii. **Problem:** reversing in opposite direction of horizontal overshoot

Prevention: recognize direction of horizontal overshoot

NOTE

Other common errors that are identical to offensive and defensive position are included in offensive lesson — ACMFP-02.

d. Variations

- i. Conversion to flattened rolling scissors—occurs when pressing to become offensive but run out of altitude to continue offensive pursuit

NOTE

Flattening the rolling scissors will work to the fighter's advantage only if the fighter's energy state is at least equal to the bandit's. If bandit's energy state is greater, the bandit can generate sufficient vertical displacement for his subsequent rolls, i.e., he will not be flattening his scissors, and therefore forcing the fighter farther in front.

(a). Continue roll through

(b). Put lift vector in front of bandit to shallow slice turn and miss deck

(1). If bandit rolls through without being aware of altitude problem, bandit is scraped off

(2). If bandit aware of altitude and your tactic, bandit forced to put lift vector in front resulting in reordering relative geometry

- ii. Conversion to horizontal scissors

NOTE

About 2500 ft above the hard deck is needed for a successful nose-low roll through the vertical to continue the rolling scissors.

- (a). Fighter/bandit at top of roller will remain nose-high and continue to pull back toward bandit/fighter to generate overshoot
 - (b). Instead of rolling through vertical, aircraft on top will reverse nose-high and pull back toward aircraft beginning vertical pullup resulting in horizontal scissors
- iii. Disengagement from top of roller

NOTE

The opportune bugout time occurs when the bandit is going up and the fighter is going down.

- (a). Ensure bandit's noseup attitude
 - (b). Instead of performing roll
 - (1). Continue pull to nose-low attitude generating maximum AOT and minimum lateral separation
 - (2). Unload toward bandit's extended 6
 - (3). Disengage and bug out
6. Disengagement/bugout
- a. Defensive considerations (purpose and definition)
 - i. Purpose
 - (a). Take advantage of maximum angles off
 - (b). Increase separation for purpose of bugout or pitchback/slice turn into fight
 - ii. Conditions for disengagement
 - (a). Fighting a better plane(s) and/or pilot(s) (disengage and bug out)
 - (b). Running low on fuel (disengage and bug out)
 - (c). Sustaining a hit (disengage and bug out)
 - (d). Up against superior numbers (disengage and bug out)
 - (e). Wanting to redefine fight (disengage)

- iii. General disengagement factors/techniques—apply to various defensive maneuvers
 - (a). Disengage at maximum TCA, minimum lateral separation, then lower nose and extend
 - (b). Unload immediately with 5-10 units AOA
 - (c). Attempt to keep bandit in sight at all times
 - (1). If necessary, maintain AOB (wing down/top rudder technique)
 - (2). Avoid arcing
 - (d). Altitude awareness
 - (e). With sufficient energy, make pitchback or hard turn to reengage if unable to avoid bandit's weapons envelope
 - (f). Seek low altitude, high-speed regime
 - (g). Remain unpredictable—perform belly checks in random directions every 4 seconds
- b. Application
 - i. Setup: rolling/horizontal scissors
 - ii. Execution
 - (a). Initial move leading to extension
 - (1). Rolling scissors—opportune time when bandit going up and fighter going down
 - (2). Horizontal scissors—opportune time when bandit is high (belly up in his reversal), or when bandit is low (crossing fighter's 6)
 - (b). Extension—for bugout/to regain energy (extension parameter depends on amount of energy needed)

NOTE

Try to regain at least cornering speed.

- (1). Execute max performance turn away from bandit, placing bandit at aft visibility limit
 - (2). Accelerate to max speed using 5-10 units AOA
 - (3). Fly as straight a line as possible until no longer threatened
 - (4). If necessary to maintain sight or change extension direction after it has begun (reduce geometric closure)
 - i) Keep bandit near aft visibility limit
 - ii) Make series of small, hard turns in desired direction—each turn followed by period of straight-line flight allowing bandit to drift back
 - iii) Repeat until desired heading attained
- (c). Rolling scissors bugout
- (1). Ensure bandit is in noseup attitude
 - (2). Instead of performing roll
 - i) Continue pull to nose-low attitude generating maximum AOT and minimum lateral separation
 - ii) Unload toward bandit's extended 6
- (d). Horizontal scissors bugout
- (1). Maneuver to largest out-of-phase condition possible
 - (2). Maintain AOB until lateral separation is minimized to avoid highlighting your intentions
 - (3). Roll and pull to bandit's extended 6
 - (4). Unload 5-10 units AOA
 - (5). Keep bandit in sight at all times, using wing down top rudder, if necessary, to avoid arcing
 - (6). If unable to fully disengage, pitchback to avoid bandit's missile threat

- c. Common errors
 - i. **Problem:** extending in a loaded-up condition
Prevention: unload 5-10 units AOA
 - ii. **Problem:** failing to maintain sight during disengagement, absorbing shots or executing untimely pitchbacks
Prevention: keep sight of bandit
 - iii. **Problem:** arcing during disengagement
Prevention: extend in a straight line; if necessary to keep sight use wing down top rudder technique
 - d. Variation: pitch back/nose-high reversal
 - i. Purpose
 - (a). Get away from fight with option of returning to neutral start
 - (b). Deny opponent turning room inside your turn radius with minimum radius defensive turn
 - ii. Execution
 - (a). Perform wings level pull into vertical (nose-high attitude will vary with energy)
 - (b). Maintain back stick while applying aileron and rudder in bandit's direction until nose back on bandit
 - (c). As nose returns to bandit, roll upright
 - (d). Force a high-TCA and minimum-lateral separation pass
 - (e). Early turn at the pass if bandit allows
7. Lufbery
- a. Description
 - i. Results from neutral situation or one developing from defensive situation against similar performance bandit

- ii. Considered a stalemate
- b. Disengagement—especially in low-altitude situation

NOTES

1. This disengagement maneuver requires a great amount of time and fuel. Normally during your syllabus flights, the lufbery will be terminated early.
 2. A one-move disengagement should not be performed as the lateral separation and AOT are usually not great enough to prevent the bandit from gaining the advantage.
- i. Begin series of unloads and pullbacks to gain airspeed and nose-to-tail separation
 - (a). Reduce AOA momentarily, to an unloaded condition
 - (b). Maintain AOB to disguise extension maneuver
 - (c). Pull back into bandit to stabilize AOT
 - ii. With sufficient airspeed and nose-to-tail separation, execute bugout or defensive pitchback
 - iii. If disengagement is unsuccessful, then another guns defense maneuver can ensue

PROGRESS CHECK

Question 3 —What is the purpose of the snap guns defense exercise?

ANSWER: The purpose is to practice defending against high angle-off guns attack while maintaining sufficient energy to counter the next attack.

Question 4 — The defensive snap guns exercise is initiated from combat spread, as the bandit calls _____, and _____ into the attack.

ANSWER: “In as the shooter,” hard turns

Question 5 —What does the fighter execute to avoid the guns shot?

ANSWER: The fighter reduces planform by breaking out-of-plane.

Question 6 — During the defensive break turn exercise, what action does the lead execute as he calls for the wingman to break into the missile?

ANSWER: The lead simultaneously initiates a nose-high roll into the wingman.

Question 7 — What is the purpose of the defensive counter to high/low yo-yo's?

ANSWER: To remain out-of-phase with the bandit's maneuvers

Question 8 — During a defensive counter to a high/low yo-yo, when the bandit comes off the low angle perch, why does the fighter execute a hard or break turn?

ANSWER: To increase AOT and closure rate

Question 9 — During a defensive counter to a high/low yo-yo, after coming off the perch and breaking into the bandit, once the bandit's nose is committed to the vertical, the fighter should _____.

ANSWER: unload the aircraft 5-10 units to optimize acceleration and separation

Question 10 — What is the purpose and setup for a defensive horizontal scissors?

ANSWER: The purpose is to exploit an in-close horizontal overshoot. The setup is a normal low angle off perch.

Question 11 — After making a hard/break turn into the bandit, when should the defensive fighter pull up into the vertical, initiating the horizontal scissors?

ANSWER: As the bandit crosses his 6, he should pull up into the vertical while reversing to maximize the overshoot.

Question 12 — During the horizontal scissors, when the defensive fighter attempts to fly behind the bandit, he strives to establish _____.

ANSWER: minimum sustainable airspeed

Question 13 — What is the purpose of the rolling scissors?

ANSWER: The rolling scissors is designed to exploit in-close horizontal and vertical overshoots by forcing the opponent out in front, by reducing the forward vector.

Question 14 — During the start of a rolling scissors, how would the fighter prevent the bandit from pulling behind the 3/9 line?

ANSWER: Pull aggressively in the horizontal to force the overshoot.

Question 15 — During the initiation of an overshoot, leading to a rolling scissors, what would the fighter do to commence the defensive pitchup?

ANSWER: The fighter would commence the defensive pitchup by leveling his wings, pulling 17 units AOA, and executing the vertical pitchup to approximately 60 degrees nose-high.

Question 16 — Identify at least three conditions for a defensive disengagement.

ANSWER:

1. Fighting a better aircraft and/or pilot
2. Running low on fuel
3. Sustaining a hit
4. Up against superior numbers
5. Wanting to redefine the fight

Question 17 — Identify at least three general defensive disengagement factors.

ANSWER:

1. Disengage at maximum TCA, minimum lateral separation, and then lower the nose and extend.
2. Unload immediately with 5-10 units AOA.
3. Attempt to keep the bandit in sight at all times.
4. Be aware of your altitude.
5. If unable to avoid bandit's weapons envelope, make a pitchback or hard turn to reengage with sufficient energy.
6. Seek a low-altitude, high-speed regime.
7. Remain unpredictable by performing belly checks in random direction every four seconds.

Question 18 — What is the procedure for extending for bugout or to regain energy?

ANSWER:

1. Execute a maximum performance turn away from the bandit placing the bandit at the aft visual limit.
2. Accelerate to maximum speed using 5-10 units AOA.
3. Fly as straight a line as possible until no longer threatened.
4. If necessary to maintain sight or change extension direction after it has begun, keep the bandit near aft visibility limit, and make a series of small hard turns until the desired heading is attained.

Question 19 — What are the disengagement follow-on options?

ANSWER: Pitchback or nose-high reversal

Question 20 — How does a lufbery develop?

ANSWER: The lufbery is a stalemate resulting from a neutral situation, or from a defensive situation against a similarly performing bandit.

Last-ditch Maneuvers**NOTE**

Last-ditch maneuvers should only be employed as a last resort to defeat a shot by the bandit.

1. Defensive diving spiral

NOTE

A diving spiral is essentially a tight two-circle fight extremely nose-low. (Two-circle fights are explained in neutral starts.)

- a. Purpose
 - i. Counter in-close, medium-to-low angle off gun attack while retaining maneuvering potential
 - ii. Offers escape opportunity
 - iii. Drive bandit into deck
- b. Application
 - i. Setup: bandit nears gun employment position and fighter's hard or break turn proves ineffective
 - ii. Conditions
 - (a). Sufficient altitude (10,000 ft above deck)
 - (b). Cooperative bandit (follow into spiral)
 - (c). Max deceleration (power/speed brakes)

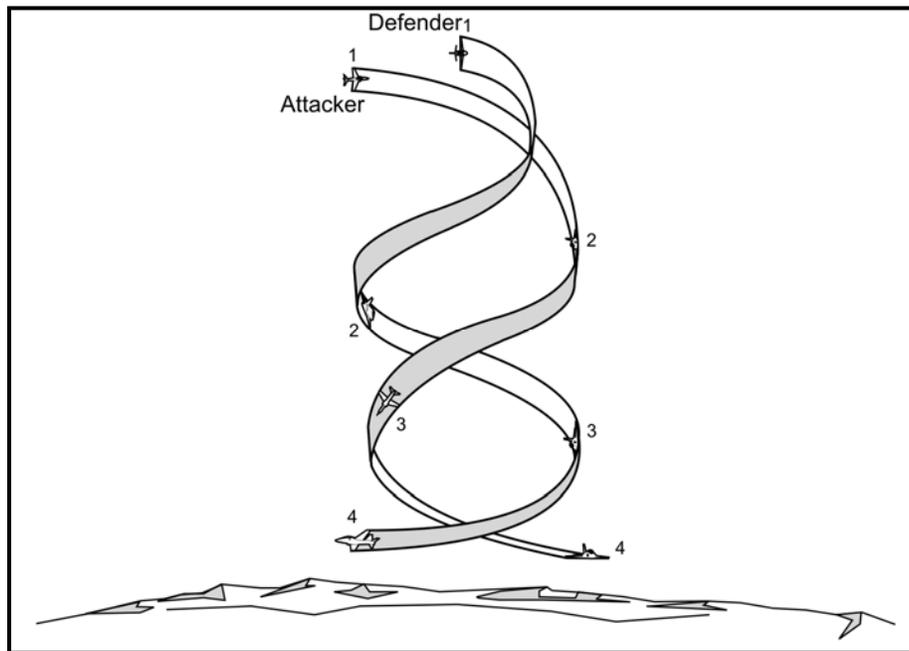


Figure 3-7 Diving Spiral

iii. Execution—fighter

CAUTION

Descent rates in excess of 30,000 fpm may occur. Late pullout must be avoided, especially if padlocked on a bandit in the rear quadrant. Typically 8,000 plus ft of altitude loss per 360 degrees of turn can be expected. Be aware of deck proximity.

(a). Executing spiral

- (1). Continue hard turn into bandit, over-bank utilizing aileron and rudder to place lift vector on bandit
- (2). Use aileron and rudder to roll aircraft to maintain lift vector on the bandit throughout spiral

(b). Pullout of maneuver

CAUTION

Begin pullout prior to 1500-3000 ft above the deck, depending on nose attitude.

- (1). If bandit begins pullout first, roll aircraft about own axis and gain angles on bandit
 - (2). If bandit doesn't pull out earlier, judge own successful pullout above deck so as to force bandit into deck
 - (3). If spiral fairly even, exit by leveling wings and pulling out at max power and best AOA, without accelerated stall or overstress (this will depend on airspeed--approximately 14-18 units)
- iv. Common errors
- (a). **Problem:** highlighting initial move, allowing bandit to delay committing his nose

Prevention: bait bandit into committing his nose-low by initially lowering nose slightly, prior to entering excessive nose-low attitude
 - (b). **Problem:** delaying pullout to avoid deck

Prevention: monitor altitude and time pullout
- v. Variation: if bandit overshoots vertically in spiral, maintain offensive advantage and be aware of deck
2. High-G roll
- a. Purpose
 - i. Use against low angle off attack, when bandit at close range, to force overshoot by quickly reducing velocity vector (maximum deceleration)
 - ii. Make tracking difficult due to dramatic changes in three axes (pitch, yaw, roll) and increase in closure
 - iii. Spit bandit to outside resulting in a possible neutral scissors

NOTE

Maneuver involves uncoordinated flight techniques (snap roll), power reduction, and drag increase (parasite and induced) as available in order to increase bandit's closure.

- b. Over the top
 - i. Setup—speed is greater than 275 KIAS and bandit within 1500 ft

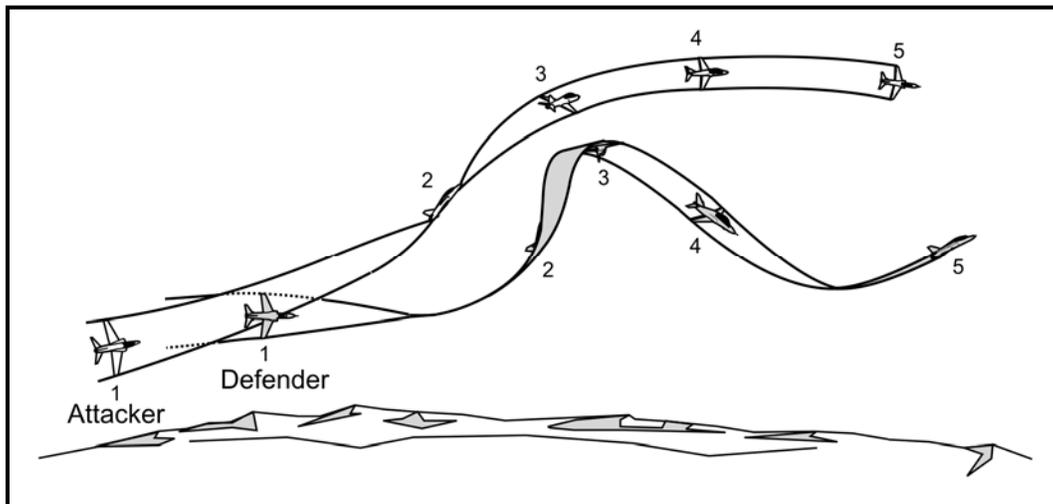


Figure 3-8 High-G Roll Over the Top

- ii. Execution—fighter
 - (a). From hard turn, increase back pressure to force overshooting situation
 - (b). Reduce power and extend speed brakes while keeping back stick pressure
 - (c). Roll opposite to plane of attack (initiated with ailerons but continued with fully deflected rudder)
 - (d). While inverted in roll
 - (1). Increase rate of roll
 - (2). Continue back pressure
 - (3). Continue rudder use to keep nose from getting too low
 - (e). At 270 degrees into roll, continue to play top rudder to control nose and check opponent
 - (f). Recover nose-high into bandit by retracting speed brakes and adding max power
- iii. Advantage: usually results in greater overshoot, possibly allowing fighter to gain offensive position by reversing back toward bandit as overshoot occurs
- iv. Disadvantage: causes greater speed and energy loss

NOTE

If the high-G roll over the top is begun at too low a speed, it may leave the fighter too slow and unmaneuverable on top, thus unable to successfully complete the maneuver and avoid a close-range snapshot.

c. Underneath

- i. Setup—roll underneath if speed is less than 275 KIAS, altitude is at least 2000 ft above deck, and bandit within 1500 ft

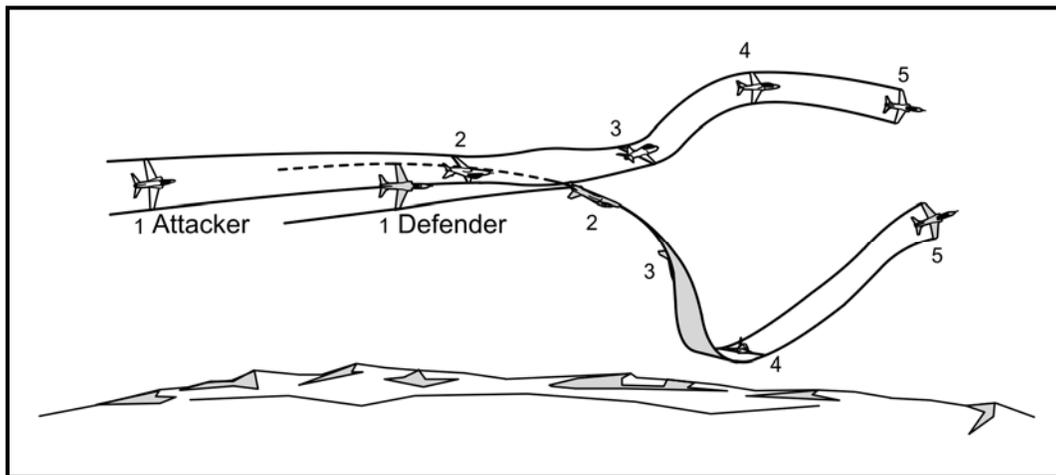


Figure 3-9 High-G Roll Underneath

- ii. Execution—fighter
 - (a). Continue hard pull in defensive turn until bandit is at highest possible angle off, then pull to buffet
 - (b). Start rolling underneath into direction of defensive turn — use full bottom rudder to roll
 - (c). Reduce power, extend speed brakes to increase closure, maintain neutral ailerons
 - (d). Using rudder, but not ailerons, roll below bandit's projected flight path in same direction of turn
 - (e). Maintain rudder in direction of turn throughout roll, along with back pressure on stick

- (f). When lift vector starts above horizon (halfway through the roll), maintain 19-20 units AOA while adding full power and retracting speed brakes
 - (g). Continue roll to wings level
 - (h). Neutralize rudder to stop roll, maintain back stick to achieve nose-high attitude
 - (i). Check for bandit's position
 - iii. Advantages
 - (a). Gravity assists in early stages
 - (b). Reduces speed loss during maneuver—possibly providing better maneuverability
 - iv. Disadvantage: results in considerable loss of altitude
 - d. Common errors
 - i. **Problem:** failing to force bandit into overshoot
Prevention: increase closure and AOT with break turn and reduce power
 - ii. **Problem:** failing to maintain loaded-up condition resulting in flat or extremely nose-low situation
Prevention: keep aircraft loaded up throughout roll
 - e. Variations
 - i. If bandit overshoots outside radius of turn, then continue to pull up and into bandit in order to
 - (a). Increase AOT
 - (b). Force bandit into horizontal scissors
 - (c). Look for opportunities to disengage
 - ii. If bandit inside radius of turn, then continue max performance turn into bandit and attempt another maneuver
3. Jink-out

- a. Purpose
 - i. Destroy gun solution while maneuvering to out-of-phase situation
 - ii. Retain potential to neutralize follow-on or seek disengagement
- b. Application
 - i. Setup: bandit approaches medium-to-low angle off, in-close, firing cone
 - ii. Execution
 - (a). Increase turn to create overshoot
 - (b). Assuming overshoot does not occur and bandit begins to pull lead
 - (1). Apply negative G to push aircraft out of bandit's predicted guns tracking solution

WARNING

Due to the risk of structural damage to the aircraft, negative G should be limited to one negative G in training. In combat, maximum negative G available can be used.

- (2). Maintain negative G for approximately 2 sec
 - (3). Establish positive-G break turn for 2-4 sec back into bandit's position
 - (4). Establish out-of-phase overshoot by maximum rate of roll reversal and positive-G turn
- iii. Common error
 - **Problem:** not unloading aircraft to a negative-G situation
Prevention: ensure unload is at least one negative G (limit to one G in training), practice and acquire a feel for negative-G flight
 - iv. Variation—out-of-phase overshoot occurs
 - (a). If insufficient angle off and lateral separation occur, then use rolling reversal

- (b). If initially you have greater amount of angle off and lateral separation, then use connecting maneuver such as diving spiral or maneuver for airspeed and lateral separation

PROGRESS CHECK

Question 21 — The diving spiral is a last-ditch maneuver designed to counter an in-close, _____ to _____ angle-off gun attack while retaining maneuvering potential.

ANSWER: medium, low

Question 22 — When is the diving spiral employed?

ANSWER: The last-ditch diving spiral is employed when the bandit is very close to gun employment position, and the fighter's hard or break turns prove ineffective.

Question 23 — Why must a late pullout be avoided when performing a diving spiral?

ANSWER: To avoid breaking the deck

Question 24 — When is the last-ditch high-G roll employed?

ANSWER: The high-G roll is used in a low angle off attack, when the bandit is at close range to force the overshoot by quickly reducing velocity vector.

Question 25 — Why is the high-G roll employed?

ANSWER: The high-G roll is used to spit out the bandit to the outside of the turn resulting in a possible neutral scissors. It makes tracking difficult due to the dramatic changes in all three axes and an increase in closure.

Question 26 — What are the significant differences in the execution of the high-G roll on top vs. underneath?

ANSWER:

1. Entry speed
2. Direction

Integration

LESSON NOTES

The following engagement scenarios are designed to help the SNPs understand how a defensive maneuver may be applied and subsequently connected to other maneuvers in the air combat arena. The "Initial scenario" sets the conditions. The "Objective"

*identifies the SNP's ultimate goal given those conditions.
"Options" list the most logical choice of maneuvers to accomplish the goal.*

Conduct an open-ended discussion, drawing answers from the SNPs on what and why they selected certain maneuvers. Discuss how that maneuver or combination of maneuvers will accomplish the objective. Continue and build on the "Bandit reactions" to link all the maneuvers in the lesson. Eventually the discussions should lead the SNPs to more independent thinking.

Allow adequate time for discussion.

1. Goal: to react with appropriate defensive maneuver in order to turn a defensive situation to neutral situation or better
2. Engagement 1
 - a. Initial scenario: bandit pursues from low to medium AOT and commits to low, then high yo-yo (bandit outside weapons max range/envelope)
 - i. Objective: neutralize bandit's offensive situation
 - ii. Options
 - (a). Maneuver 1: hard turn nose-low into bandit
 - (1). Advantages
 - i) Increases angle off
 - ii) Decreases range
 - iii) Creates possible overshoot situation
 - iv) Minimizes energy loss
 - (2). Disadvantage: N/A
 - (b). Maneuver 2: break turn
 - Advantages
 - i) Increases AOT
 - ii) Decreases range

- iii) Creates possible overshoot situation
- iv) Disadvantage: loses unnecessary energy if bandit outside weapons envelope

NOTE

Choosing between a hard or a break turn depends on distance between aircraft and rate of closure.

- b. Bandit reaction to hard turn nose-low into bandit: bandit forced into in-close overshoot
 - i. Objective: neutralize bandit's offensive situation
 - ii. Option
 - Maneuver 1: nose-high reversal
 - (1). Advantage: exploits bandit's overshoot and can force entry into horizontal scissors
 - (2). Disadvantage: in horizontal scissors, the angle off and lateral separation decrease with each cross, making bugout more difficult
- c. Bandit reaction to nose-high reversal: horizontal scissors with fighter in defensive position
 - i. Objective: attain neutral position or disengage
 - ii. Options
 - (a). Maneuver 1: continue horizontal scissors
 - (1). Advantage: possibly reverses roles and fighter gains offensive position
 - (2). Disadvantages
 - i) Remains in slow-speed fight with low-energy state
 - ii) Presents possible raking guns opportunity for bandit
 - iii) Remains predictable
 - iv) Longevity/proximity may negate disengagement options

- (b). Maneuver 2: disengage
 - (1). Advantages
 - i) Prevents getting shot
 - ii) Regains energy
 - (2). Disadvantages
 - i) Presents difficulty in keeping sight
 - ii) Allows bandit to regain energy
 - iii) Possibly presents extension into missile envelope
 - iii. Bandit reaction to continued horizontal scissors: fighter unable to generate sufficient nose-to-tail separation for successful bugout
 - Maneuver 1: defensive pitchback
 - (1). Advantages
 - i) Allows fighter to meet bandit with higher angles off
 - ii) Avoids bandit's missile envelope
 - iii) Allows for possible bugout if neutral pass achieved
 - (2). Disadvantages
 - i) Forces continual engagement
 - ii) Causes possible lost sight
3. Engagement 2
- a. Initial scenario: bandit pursues from medium to high AOT situation and is forced into barrel roll attack
 - i. Objective: neutralize bandit's offensive situation
 - ii. Options
 - Maneuver 1: hard turn nose-low into bandit aircraft

- (1). Advantages
 - i) Increases angle off
 - ii) Decreases range
 - iii) Creates possible overshoot situation
 - iv) Minimizes energy loss
 - (2). Disadvantage: N/A
- b. Bandit reaction to hard turn nose-low into bandit: bandit performs barrel roll attack
- i. Objective: neutralize bandit's offensive situation
 - ii. Maneuver: nose-high rolling reversal
 - (a). Advantage: increases angles off and forces fight into possible rolling scissors
 - (b). Disadvantage: none
- c. Bandit reaction to nose-high rolling reversal: rolling scissors with fighter in defensive position
- i. Objective: neutralize bandit's offensive position
 - ii. Options
 - (a). Maneuver 1: continue rolling scissors
 - (1). Advantages: may gain offensive advantage
 - (2). Disadvantages
 - i) Remains predictable
 - ii) Longevity/proximity may negate disengagement options
 - (b). Maneuver 2: bug out when bandit committed nose-high and fighter committed nose-low
 - (1). Advantages

- i) Catches opponent in nose-high attitude with decreasing airspeed
 - ii) Allows fighter to regain energy
- (2). Disadvantages
- i) Causes possible lost sight
 - ii) Allows bandit to regain energy
 - iii) Possible extension into missile envelope
- (c). Maneuver 3: horizontal scissors
- (1). Advantage: generates horizontal overshoot and possible offensive advantage
- (2). Disadvantages
- i) Remains in slow-speed, low-energy fight
 - ii) Remains predictable
 - iii) Longevity/proximity may negate further disengagement options

306. SUMMARY

This lesson covered the defensive aspects of the following:

1. Concepts and tactics
2. Snap guns exercise
3. Break turn exercise
4. Counter to high/low yo-yo
5. Horizontal scissors
6. Rolling scissors
7. Disengagement/bugout
8. Lufbery

9. Diving spiral
10. High-G roll
11. Jink-out
12. Integration

307. CONCLUSION

You've learned maneuvers for creating overshoots and staying out-of-phase to save your skin and to put the other guy on the run in 1 v 1 air combat maneuvering. You've taken another step toward becoming an ace.

CHAPTER FOUR
ACM 1 V 1 NEUTRAL STARTS

400. INTRODUCTION – N/A

COURSE/STAGE:

- TS, TAILHOOK & IUT/Air Combat Maneuvering

LESSON TITLE:

- ACM 1 v 1 Neutral Starts

LESSON IDENTIFIER:

- T-45C TS, ADV & IUT ACMFP-04

LEARNING ENVIRONMENT:

- Classroom

ALLOTTED LESSON TIME:

- 0.8 hr

TRAINING AIDS:

1. T-45 Scale Model
2. Figures
 - Figure 1: Two-Circle Fight
 - Figure 2: One Circle Flight
 - Figure 3: Vertical Fight

STUDY RESOURCES:

1. T-45C NATOPS Flight Manual, A1-T45AC-NFM-000
2. Air Combat Maneuvering Flight Training Instruction (FTI)

LESSON PREPARATION:

- Read:
 - T-45C ACM FTI “1 v 1 Engagement Concepts and Tactics” section

REINFORCEMENT:

- N/A

EXAMINATION:

The objectives in this lesson will be tested in ACMFP 05X.

401. LESSON OBJECTIVES

1. Recall the concepts and tactics applicable to neutral ACM
2. Recall the parameters which constitute a neutral position
3. Recall the actions which lead to a two-circle fight
4. Recall the advantages/disadvantages of a two-circle fight
5. Recall the actions which lead to a one-circle fight
6. Recall the advantages/disadvantages of a one-circle fight
7. Recall the actions which lead to a vertical fight
8. Recall the advantages/disadvantages of a vertical fight
9. Assess the neutral 1 v 1 tactical situation

402. MOTIVATION

What would your game plan be in a one-on-one engagement? What planning will you do before climbing into the cockpit? You have learned specific maneuvers, but now you have to consider more of the fight. Will you use energy or angles to make your fight? Are you aware of your aircraft capabilities? Are you aware of your opponent’s capabilities? What is your optimum AOA for extension or energy conservation? You must consider many variables as you prepare for your fight.

403. OVERVIEW

This lesson will enable you to employ appropriate tactics in a neutral engagement.

4-2 ACM 1 V 1 NEUTRAL STARTS

This lesson addresses:

1. Neutral start concepts and tactics
2. Head-on pass
3. Engagements
 - a. Two-circle
 - b. One-circle
 - c. Vertical
4. Integration

404. REFRESHER

The maneuvers you learned in offensive/defensive ACM lessons are applied during engagements resulting from neutral starts.

405. PRESENTATION

Neutral Engagement Concepts and Tactics

1. Neutral position definition—two aircraft positioned 180 degrees out-of-phase approaching head-on pass (forward quarter attack), neither having tactical advantage
2. Position (angle off) fight
 - a. Fighter attempts to quickly get angular advantage over bandit to arrive in weapons envelope
 - b. Tactical objective—achieve angular gains without losing excessive energy/critical maneuverability (turn harder or turn smarter)
 - c. Consider energy management while attempting to gain angles
 - d. Advantages
 - i. Decreases angles off early in engagement, placing bandit in defensive posture
 - ii. Fight develops quicker than rate (energy) engagements
 - iii. Most useful if bandit is not aggressive

- iv. If bandit turns level, fighter may use oblique turns to decrease angles off
- e. Disadvantages
 - i. Reveals game plan
 - ii. Possibly depletes energy reserves quickly
 - iii. Once committed difficult to change game plan
- 3. Separation
 - a. Pass with minimum lateral separation to deny bandit angles
 - b. Any lateral separation at the pass gives the bandit turning room to gain angles
 - c. Early turn at the pass produces tactical advantage
- 4. Rate (energy) fight
 - a. Fighter may gain energy advantage while not yielding decisive position advantage, and eventually converting energy advantage into lethal position advantage
 - b. Attempt to enter the merge at or near corner (V_c) velocity. If you are:
 - i. Below corner velocity, perform an unloaded extension until airspeed increases to V_c
 - ii. At corner velocity, perform a nose-low energy-sustaining turn
 - iii. Above corner velocity, perform a nose-high pitchup maneuver in the vertical until airspeed decreases to V_c
 - c. Strive to maintain cornering speed during energy engagements
 - i. Higher speeds cause arcing turns
 - ii. Lower speeds reduce turn rate
 - d. Advantages of energy tactics
 - i. Maintains higher energy state
 - ii. Presents possibility of separation and disengagement
 - iii. Provides greater opportunity for weapons employment

- e. Disadvantages of energy tactics
 - i. Requires finesse and proficiency in
 - (a). Speed/g control
 - (b). Ability to judge bogey's energy state
 - ii. Time to kill
- 5. Three-dimensional environment
 - a. Never limit yourself to single-dimension fight
 - b. Offensive
 - i. Three-dimensional maneuvering is generally required except during guns tracking
 - ii. Project bogey's plane of maneuvering to optimize follow-on tactics
 - c. Defensive
 - i. Medium to close range—use three-dimensional maneuvering
 - ii. Long range—single-plane maneuvering may be necessary
 - d. Turn radius
 - i. Minimized in vertical plane
 - ii. Poorest in horizontal plane
 - iii. Varies with steepness of oblique maneuvering plane
 - e. Turn rate
 - i. Enhanced with lift vector below horizon
 - ii. Degraded with lift vector above horizon

PROGRESS CHECK

Question 1 — During a position (angle off) fight, if the bandit turns level, the fighter may use _____ to decrease angle off.

ANSWER: oblique turns

Question 2 — In a head-on pass, the pilot should deny the bandit angles by _____ at the pass, minimizing _____.

ANSWER: early turning; lateral separation

Question 3 — During a rate (energy) fight, the fighter should strive to maintain _____ during the engagement.

ANSWER: cornering speed

Question 4 — A neutral pass is a _____ attack with neither aircraft having a tactical advantage.

ANSWER: forward quarter

Head-on Pass**LESSON NOTES**

Whenever a topic is supported by both a screen projection and animated video, you will have a menu. Choosing “Animation” will begin the animated sequence. You can exercise full control over the animation to show it all, pause the sequence whenever you want to point something out, and even repeat the sequence as necessary. Choosing “Diagram” will call up the screen projection, which will be a ribbon diagram or spaghetti diagram of the maneuver. Use your own discretion as to which you show first, and continue the lesson by choosing “Continue” at the end of the menu.

1. Fighters pass canopy to canopy with minimum lateral separation

Play Video: Head-on Pass

WARNING

The potential for a midair exists during a head-on pass if pilots do not follow ACM training rules. Head-on passes will be left-to-left unless the situation dictates otherwise. Maintain a 500-ft bubble around your aircraft for safe separation.

2. Set up from co-altitude, co-airspeed, wide combat spread
3. Procedure
 - a. Upon flight lead's call, take 10-degree cutaway (if necessary) and climb to briefed altitude
 - b. Once on altitude and airspeed, confirm "Airspeed and angels"
 - c. Turn to parallel heading as directed by lead
 - d. Upon hearing "Fight's on" call from the bandit, over-bank and pull 17-unit nose-low turn toward bandit
 - e. Keep nose on bandit while adjusting to maintain 500-ft bubble
 - f. Call direction of pass, other fighter will acknowledge
 - g. Just prior to pass, begin early turn, taking out lateral separation in excess of 500 ft
4. Common error
 - **Problem:** failing to take out lateral separation at pass
 - Prevention:** pull to ensure close aboard 500-ft pass

Engagements

1. Two-circle

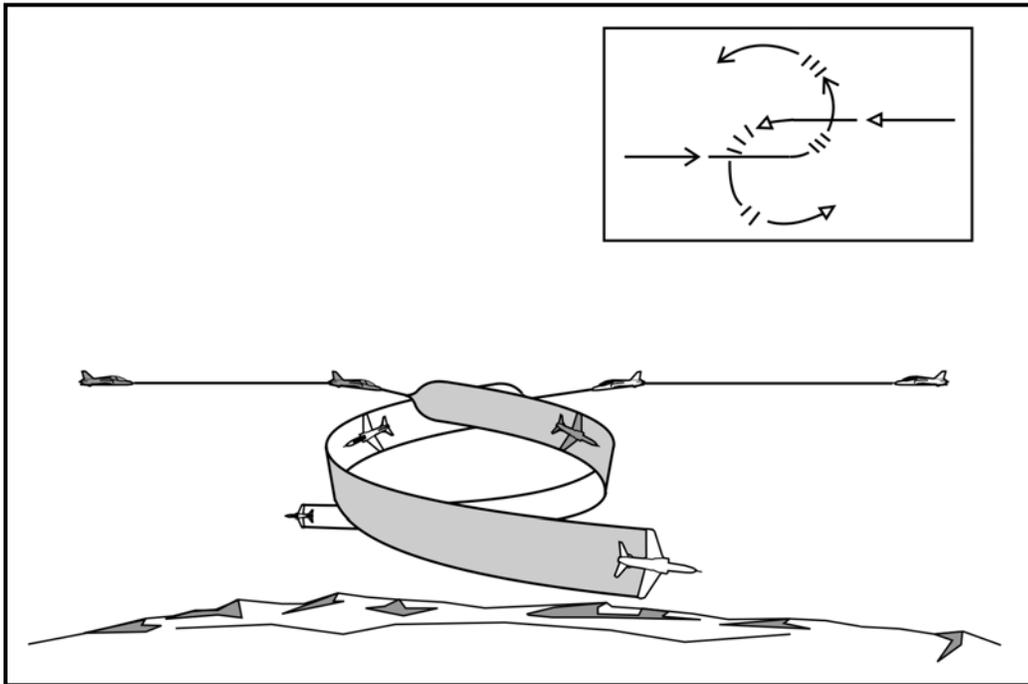


Figure 4-1 Two-Circle Fight

- a. Definition—at initial pass, fighter and bandit turn in same direction (both turn right or both turn left)
- b. Advantages
 - i. Allows fighter to maintain energy
 - ii. Provides ability to exploit superior weapon system capable of forward quarter kills
 - iii. Generally allows mistakes to be corrected
 - iv. Provides easier opportunity to bug out than one-circle fight
- c. Disadvantages
 - i. Usually higher g profile to fly—keeping sight under high g is more difficult than lower g profile
 - ii. Greater distance across circle further complicating visual tracking
 - iii. Difficult to assess bandit's energy state

- d. Execution
 - i. At pass
 - (a). Adjust lift vector taking out any lateral/vertical separation and early turn if possible (maintain 500-ft bubble)
 - (b). Turn to cross the bandit's tail nose-low
 - (c). Maintain cornering speed, maximum g, and approximately 20 degrees nose-low
 - ii. Look aft in direction of turn, to acquire bandit

NOTE

The bandit should first appear a quarter turn across the circle, and become progressively easier to see as the turn continues.

- iii. Adjust lift vector, taking out lateral/vertical separation and early turn if possible

NOTES

1. If you do not regain sight of the bandit within 90 degrees of turn, call "Lost sight." The instructor will begin talking your eyes back on to him. When you regain sight, call "Tally." Do not release the g on the aircraft (arc) while attempting to regain sight.

2. As the engagement progresses, the aircraft will probably lose altitude, and the hard deck will become a factor. Both aircraft will begin to lose airspeed, while they maintain altitude, and start to arc. A smart pilot will change to another type of fight at this point.

- e. Common errors
 - i. **Problem:** delaying turn across bandit's tail
Prevention: begin turn early to cross tail immediately after pass
 - ii. **Problem:** allowing airspeed to increase or not pulling maximum g available resulting in arcing turn
Prevention: maintain cornering speed at maximum g
 - iii. **Problem:** allowing airspeed to decrease resulting in loss of energy and reduced turn rate
Prevention: ensure nose-low turn to maintain cornering speed

2. One-circle

- a. Definition—at initial pass, fighter and bandit turn in opposite direction (one goes right, one goes left)

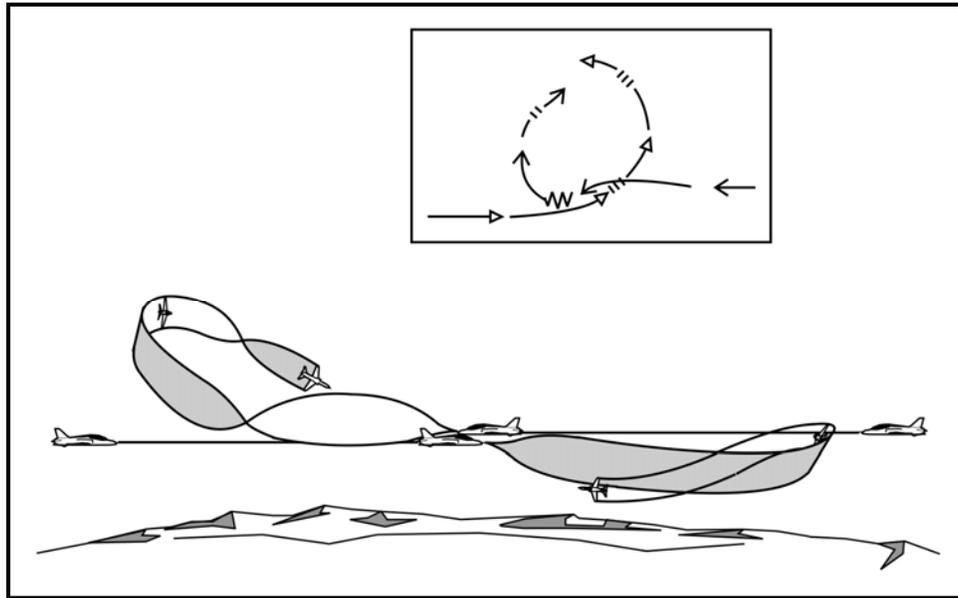


Figure 4-2 One-Circle Fight

- b. Advantages
 - i. Allows fighter to employ turn capability—relative turn radius largely determines potential angular advantage
 - ii. Fight develops quicker
 - iii. Easier to keep sight of each other
 - iv. Provides greatest angular gains per knot of speed loss because of reduced turn radius and slower speed
 - v. Keeps bandit from exploiting forward quarter missile capability
- c. Disadvantages
 - i. At less than cornering speed, turn rate is reduced
 - ii. Very unforgiving fight—mistakes may mean you lose

- iii. Difficult to disengage
- iv. Limits weapons capabilities
- d. Execution
 - i. At pass
 - (a). Adjust lift vector taking out lateral/vertical separation
 - (b). Reverse turn (nose attitude depends upon aircraft type and energy state)
 - ii. Look aft in direction of turn to maintain sight of bandit

NOTE

The bandit should first appear a quarter turn across the circle, and become progressively easier to see as the turn continues.

- e. Common errors
 - i. **Problem:** delaying reversal, resulting in bandit's gaining offensive
Prevention: reverse immediately after pass
 - ii. **Problem:** using excessive AOA, resulting in loss of energy and maneuverability
Prevention: reduce AOA
- 3. Vertical
 - a. Definition—one or both fighters pull up vertically and start/continue fight—typically ending in one-circle fight

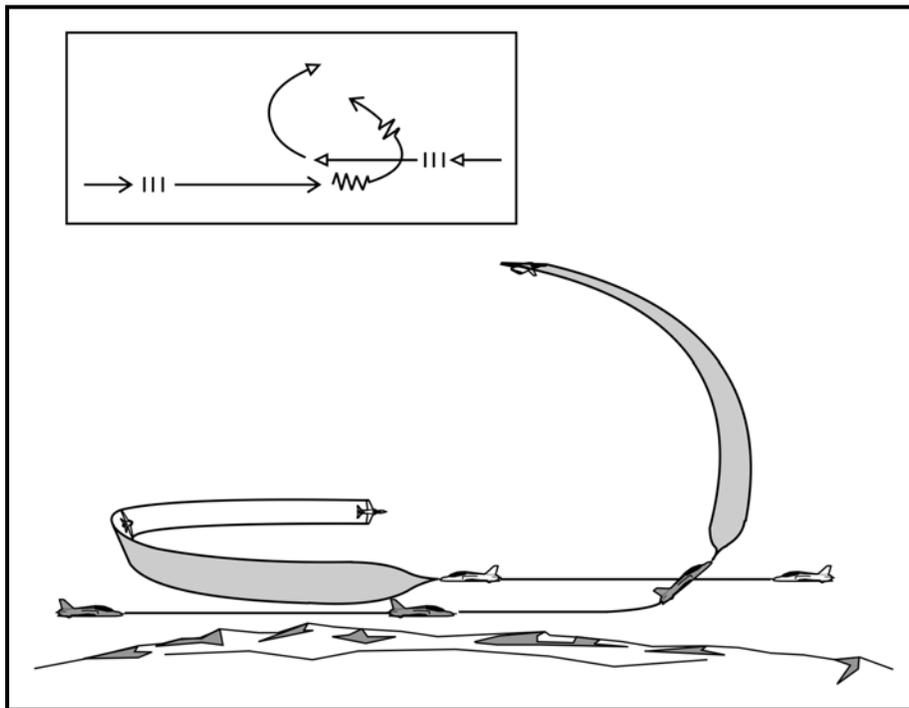


Figure 4-3 Vertical Fight

- b. Advantages
 - i. Trade airspeed for altitude in order to minimize turn radius and have potential radial g
 - ii. Generally, same advantages apply as in one-circle fight
- c. Disadvantages
 - i. Slow-speed fight
 - ii. Same disadvantages as one-circle
- d. Execution
 - i. Prior to pass
 - (a). Position aircraft to arrive below bandit's aircraft
 - (b). If separation allows, attempt to gain extra airspeed prior to pass
 - ii. Take out lateral/vertical by pulling up into bandit

- iii. At pass, arrive with nose committed into vertical
- iv. Continue wings-level, 17-unit pull into vertical
- v. Pull back toward bandit in shortest direction (one-circle)
- vi. If bandit remains nose-low
 - (a). Pull over top of bandit
 - (b). Maintain established vertical separation for possible early turn (radial-g and energy advantage)
- vii. If bandit pulls up into vertical
 - (a). Pass bandit, adjusting lift vector in order to take out lateral/vertical separation
 - (b). Early turn if possible
- e. Common error
 - **Problem:** pulling into pure vertical with insufficient energy resulting in loss of control
 - Correction:** recognize early and roll off in oblique plane

PROGRESS CHECK

Question 5 — What type of engagement results when the fighter and the bandit turn in the same direction at the pass (both in right turns)?

ANSWER: Two-circle

Question 6 — What type of engagement results when the fighter and the bandit turn in opposite directions at the pass (one in right turn, one in left turn)?

ANSWER: One-circle

Question 7 — What are the significant differences between the two-circle, one-circle, and vertical fights?

ANSWER:

1. The two-circle fight develops slower and is more forgiving than a one-circle fight.
2. During a two-circle fight, the pilot flies a higher g profile, covering more distance, and making it harder to keep sight.
3. The one-circle fight does not allow the pilot to use forward firing weapons; however, it does allow the fighter to employ a superior turn capability.
4. Since the one-circle fight is flown at less than cornering speed, the turn radius is reduced, thereby allowing the pilot to acquire angles on the bandit quicker than during a two-circle fight.
5. The vertical fight is a slow-speed fight in which the pilot trades airspeed for altitude to minimize his turn radius. The vertical fight has very similar characteristics as the one-circle fight.

Integration

LESSON NOTES

By now, the student will have had practice in several flights and should have an idea as to what his game plan should be based on two items: 1) his experience from practicing in the aircraft and 2) discussion of tactics from this lesson. Therefore, open-ended questioning techniques and multiple scenarios must be used to lead the student through the thought processes necessary to be successful in a neutral engagement.

Base the discussion upon one of the following techniques:

1. *The instructor gives the students a setup for a neutral pass and asks them to write their first move as well as why they would choose that move. Then, asking one student to read, the instructor can choose another student as the first student's opponent to simulate the fight. The students would write the follow-on maneuver, based upon the response from the opponent.*
2. *The instructor repeats this process, except the instructor becomes the opponent. Have the student respond to a preset scenario and change according to student response. Each time the instructor or the student makes a move, they explain the strategy and headwork as to why they chose the maneuver.*

3. Give the students the setup as before, only when you pair students to “fight” or choose a student as your opponent, have two students use planes on a stick to model the engagement. This way you get more students involved and see how well a student can plan or interpret another’s strategy.

The IP should use scenario 1—one-circle to initiate the integration section of this lesson. This scenario also serves as an example for scenario 2, which the instructor may develop on his own. Instructor questions (capitalized and boldface), placed in both scenarios, serve as sample questions. As appropriate, the IP should ask additional questions about overriding concerns of energy, angles, range, and dimensional plane. Instructor questions also serve as examples of questioning techniques for the IP. It is imperative that open-ended questioning techniques lead the student through the thought processes necessary to be successful in ACM. Appropriate responses have been listed for the instructor questions. These “correct” responses were selected by ACM SMEs. Throughout this lesson, several responses may be brought out by the student. The instructor must address those specific answers as they apply to the scenario.

1. Scenario 1—one-circle

Play Video: Integration

- a. Conditions
 - i. Disengaging from a fight, you lose sight of your wingman
 - ii. Proceeding to your briefed rendezvous point, you spot a bandit at 1 o’clock, level at 3 nm
 - iii. Bandit maneuvers his nose toward your aircraft
- b. Objective: minimize lateral separation and, if possible, maneuver for offensive advantage

NOTE

Given these circumstances and depending on your mission as a single fighter, if possible, disengage at the pass.

- c. Fighter action
 - i. **INSTRUCTOR QUESTION**—“What action do you take?”

- ii. Appropriate response—reverse and force bandit into one-circle fight
 - (a). Advantages
 - (1). **INSTRUCTOR QUESTION**—“How can that help you in your offensive engagement?” or “What does this do for you?” or “Why did you choose that action?”
 - (2). Appropriate responses
 - i) Keeps the bandit from exploiting his forward quarter missile capability
 - ii) Allows the fighter to employ turn capability
 - iii) Takes advantage of your superior skills learned in previous ACM lessons
 - (b). Disadvantages
 - (1). **INSTRUCTOR QUESTION**—“How can this hurt you in your offensive engagement?”
 - (2). Appropriate responses
 - i) Limits weapons capabilities
 - ii) Turn rate is reduced at less than cornering speed
 - iii) Difficult to disengage
- d. Bandit prediction
 - i. **INSTRUCTOR QUESTION**—“What do you think the bandit might do next?”
 - ii. Appropriate responses—various answers

NOTE

There are multiple predictions that could be brought up by the SNP. The instructor may comment on any or all of those; however, he should emphasize the most feasible prediction which is listed directly below under “new conditions.”

- e. New conditions—after executing nose-high reversal, look back to your left and find the bandit in a nose-low energy sustaining turn
- f. Objective: Use smaller turn radius to gain additional angles
- g. Fighter action
 - i. **INSTRUCTOR QUESTION—“What action do you take?”**
 - ii. Appropriate response—roll over the top of bandit maintaining established vertical separation and perform a nose-low slicing turn
 - (a). Advantages
 - (1). **INSTRUCTOR QUESTION—“Why did you choose that action?” or “How can that help you in your offensive engagement?” or “What does this do for you?”**
 - (2). Appropriate responses
 - i) Vertical separation allows for early turn using radial g and energy gain
 - ii) Possible lost sight situation for bandit
 - iii) Sun may mask your position
 - (b). Disadvantages
 - (1). **INSTRUCTOR QUESTION—“How can this hurt you in your offensive engagement?”**
 - (2). Appropriate responses
 - i) Low energy state prior to nose-low slice turn
 - ii) Bandit may generate a vertical overshoot
- h. Bandit prediction
 - i. **INSTRUCTOR QUESTION—“What do you think the bandit might do next?”**
 - ii. Appropriate responses—various answers
- i. New conditions—bandit remains nose-low in a possible lost sight situation

- j. Objective: maneuver into weapons envelope
- k. Fighter action
 - i. **INSTRUCTOR QUESTION**—“What action do you take?”
 - ii. Appropriate response—low and high yo-yo
 - (a). Advantages
 - (1). **INSTRUCTOR QUESTION**—“Why did you choose that action?” or “How can that help you in your offensive engagement?” or “What does this do for you?”
 - (2). Appropriate response—reduce remaining angles off and nose-to-tail separation
 - (b). Disadvantages
 - (1). **INSTRUCTOR QUESTION**—“How can this hurt you in your offensive engagement?”
 - (2). Appropriate response—fighter remains predictable

LESSON NOTES

Refer to the lesson notes at the beginning of Integration Section for instructional guidance on scenario 2.

- 2. Scenario 2—instructor’s choice
 - a. Conditions:
 - b. Objective:
 - c. Fighter action
 - i. **INSTRUCTOR QUESTION**—“What action do you take?”
 - ii. Appropriate response
 - (a). Advantages
 - (1). **INSTRUCTOR QUESTION**—“How can that help you in your offensive engagement?” or “What does this do for you?” or “Why did you choose that action?”

- (2). Appropriate responses
- (b). Disadvantages
 - (1). **INSTRUCTOR QUESTION**—“How can this hurt you in your offensive engagement?” or “Why did you choose that action?”
 - (2). Appropriate responses
- d. Bandit prediction
 - i. **INSTRUCTOR QUESTION**—“What do you think the bandit might do next?”
 - ii. Appropriate responses—various answers

NOTE

There are multiple predictions that could be brought up by the SNP. The instructor may comment on any or all of those; however, he should emphasize the most feasible prediction which is listed directly below under “new conditions.”

- e. New conditions—
- f. Objective:
- g. Fighter action
 - i. **INSTRUCTOR QUESTION**—“What action do you take?”
 - ii. Appropriate response—
 - (a). Advantages
 - (1). **INSTRUCTOR QUESTION**—“Why did you choose that action?” or “How can that help you in your offensive engagement?” or “What does this do for you?”
 - (2). Appropriate responses
 - (b). Disadvantages
 - (1). **INSTRUCTOR QUESTION**—“How can this hurt you in your offensive engagement?”

- (2). Appropriate responses
 - h. Bandit prediction
 - i. **INSTRUCTOR QUESTION**—“What do you think the bandit might do next?”
 - ii. Appropriate responses—various answers
 - i. New conditions—
 - j. Objective:
 - k. Fighter action
 - i. **INSTRUCTOR QUESTION**—“What action do you take?”
 - ii. Appropriate response—
 - (a). Advantages
 - (1). **INSTRUCTOR QUESTION**—“Why did you choose that action?” or “How can that help you in your offensive engagement?” or “What does this do for you?”
 - (2). Appropriate response—
 - (b). Disadvantages
 - (1). **INSTRUCTOR QUESTION**—“How can this hurt you in your offensive engagement?”
 - (2). Appropriate response—

406. SUMMARY

During this lesson we discussed:

- 1. Neutral-start concepts and tactics
- 2. Head-on pass
- 3. Engagements
 - a. Two-circle
 - b. One-circle
 - c. Vertical

4. Integration**407. CONCLUSION**

Building on your knowledge of offensive/defensive maneuvers, we have introduced and discussed how ACM fights may develop from a neutral start. In order to be effective from the start, use the tactics taught in this lesson to your advantage in the air. Start your game planning now! Check SIX!

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CHAPTER FIVE
THREE-PLANE AIR COMBAT MANEUVERING-PARTS 1 & 2

500. INTRODUCTION – N/A

COURSE/STAGE:

- TS, TAILHOOK & IUT / Air Combat Maneuvering

LESSON TITLE:

- Three-Plane Air Combat Maneuvering-Parts 1 & 2

LESSON IDENTIFIER:

- T-45C TS, ADV & IUT ACMFP-06

LEARNING ENVIRONMENT:

- Classroom

ALLOTTED LESSON TIME:

- 2.7 hr

STUDY RESOURCES:

1. T-45C NATOPS Flight Manual, A1-T45C-NFM-000
2. Air Combat Maneuvering Flight Training Instruction

LESSON PREPARATION:

- Read:
 - T-45C ACM FTI “2 v 1 Mission Procedures/Maneuvers” section

REINFORCEMENT:

- N/A

EXAMINATION:

- The objectives in this lesson will be tested in ACMFP-07X.

501. LESSON OBJECTIVES

1. Recall procedures/guidelines provided by ACM briefing
2. Recall rules of engagement (ROE) for conducting ACM training
3. Recall parameters of the weapons envelope used by CNATRA
4. Recall ACM working areas and enroute/RTB procedures
5. Identify energy components for the T-45
6. Recall procedures for conducting G-LOC turns
7. Recall engaged/free fighter tactical doctrine applicable to ACM
8. Describe actions of engaged/free fighter response to counterflow rear quarter attack
9. Assess 2 v 1 tactical situation (used for all engagements)
10. Recall responsibilities of each aircraft in the “call the bandit” exercise
11. Describe actions of engaged/free fighter response to no-switch rear quarter attack
12. Describe actions of engaged/free fighter to single-switch exercise
13. Describe action of engaged/free fighter in response to multi-switch exercise
14. Identify the proper use of descriptive/directive commentary in ACM
15. Recall procedures for 2 v 1 disengagement
16. Recall the 2 v 1 considerations for disengagement
17. Recall disengagement follow-on options
18. Recall the concepts and tactics applicable to 2 v 1 ACM
19. Recall method for regaining section integrity
20. Recall 2 v 1 mutual support tactical and procedural considerations
21. Describe actions of engaged/free fighter in VFQ attack
22. Recall the procedures for beyond visual range engagements
23. Describe actions of the engaged/free fighter in response to an abeam attack

5-2 THREE-PLANE AIR COMBAT MANEUVERING-PARTS 1 & 2

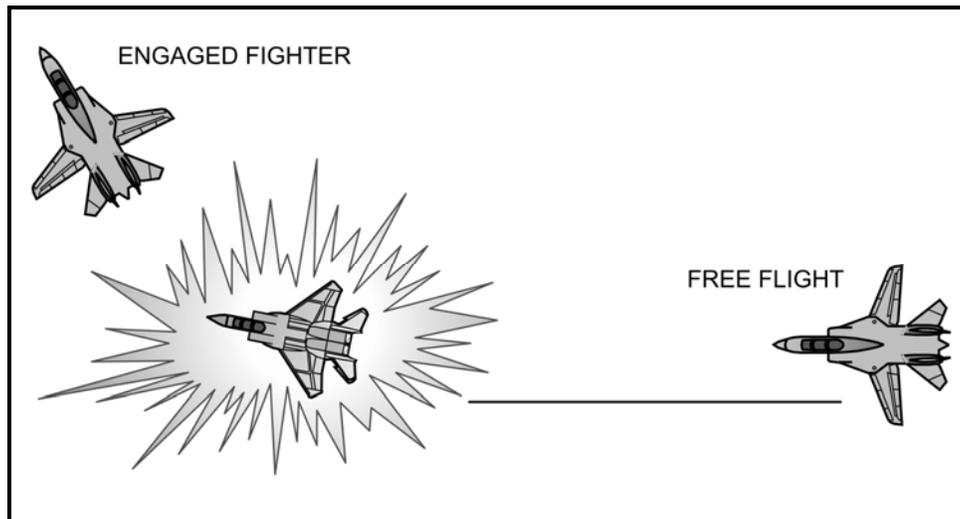
502. OUTLINE

1. Part 1
 - a. Training Rules
 - b. Fighter Engagement Videos
 - c. Pretest
 - d. Conduct of Hop
 - e. Engaged/Free Fighter Doctrine
 - f. Formations
 - g. Communication
 - h. Additional Considerations
2. Part 2
 - a. Engagements
 - b. Review

503. MOTIVATION

The relatively simple fighters of previous wars that relied solely upon the gun to kill have given way to the more sophisticated fighters of today that can employ missiles out to several miles. Through an evolutionary process, the tactical communities have developed a two-aircraft formation and a set of tactical principles that will optimize the section's combat potential in the visual combat arena.

As you begin your final ACM lesson, you must learn those tactics that support a section member in ACM engagements. In order to effectively defeat a bandit, you must maintain section integrity and mutual support. All of the skills you have learned thus far in your training will be put to critical scrutiny in the ACM environment.

THREE-PLANE ACM – PART 1**Figure 5-1 Three-Plane ACM****504. TRAINING RULES FOR THREE-PLANE ACM LECTURE**

1. Question and Answer Policy
2. Snacks and Drinks Okay
3. Breaks As Needed
4. Class Participation Required

505. OVERVIEW**Part 1**

1. Fighter Engagement Videos
2. 10 Question Pretest
3. Conduct of Hop
4. Engaged/Free Fighter Doctrine
5. Formations
6. Communication
7. Additional Considerations

5-4 THREE-PLANE AIR COMBAT MANEUVERING-PARTS 1 & 2

506. 10 QUESTION PRETEST

Figure 5-2 10 Question Pretest

Let's see if we are ready to jump into three-plane ACM.

NOTE

Pretest is on last few pages of lesson guide.

507. CONDUCT OF HOP

1. Brief
2. Departure and En Route
3. Engagement Flow
4. RTB

BRIEF**ACM Training Rules**

NOTE

Required for all participants

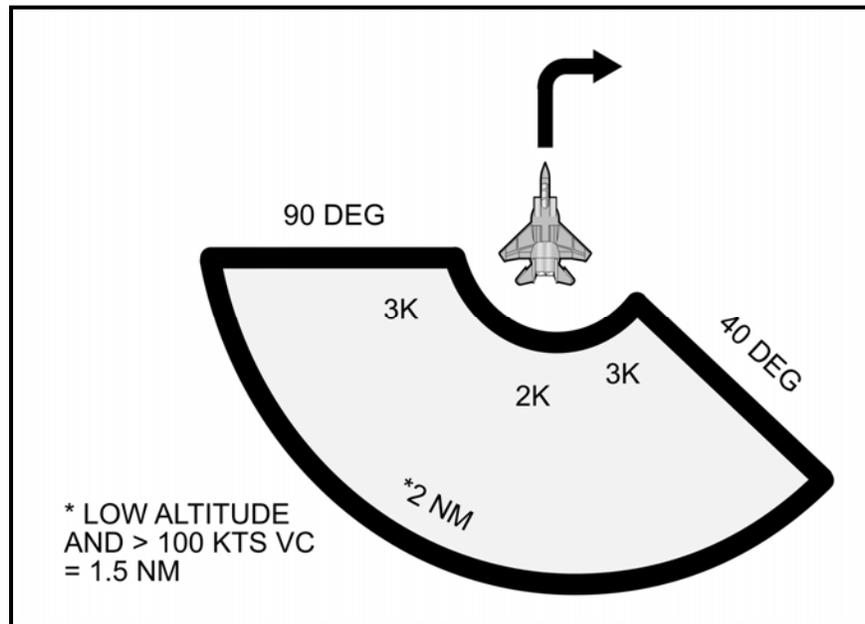


Figure 5-3 Weapons Envelope

Weather mins:

1. Remain 1 nm horizontal and 2,000 ft from all clouds
2. Must have 5 nm visibility with a defined horizon
3. Must have 15,000 ft min between cloud layers
4. Hard deck will be at least 5,000 ft above cloud tops

NOTE

Dual: OPNAV mins (max cloud tops 8,000 ft)

Solo: 1,000 ft/3 sm (max cloud tops 7,000 ft)

* CO can waive down to 500/2 for solos

Comm plan:

1. Start up with tactical freq in comm 2
 - a. Use it for admin enroute comm
 - b. Switch back to button 1 when clear of duty

2. Use area freq for all fighter comm

NOTE

Do not use button 5 for tactical comm

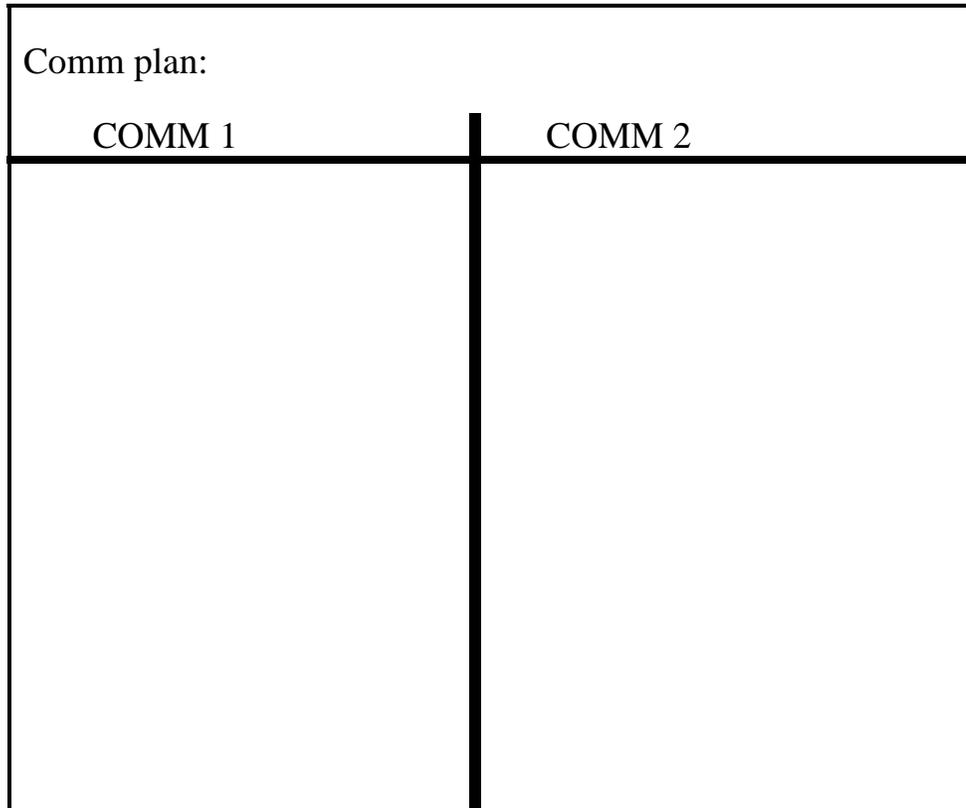


Figure 5-4 Comm Plan

Fuel:

1. “Joker Fuel”

A fuel state set far enough above bingo fuel to allow a successful disengagement.

2. “Bingo Fuel”

A fuel state at which the fighter must return to ship or home base.

Fuel:

1. Fuel is one of the most critical items that a fighter must monitor
2. Typical local area joker and bingo states = 1.2/1.0 to 1.0/800

Determining factors:

1. Distance to base
2. Weather
3. Mission (dual/solo)
4. Field status (FCLPs, PAR, single rwy?)
5. Threat (types and #'s of bandits and SAMS)

Emergencies:

1. Takeoff aborts
2. NORDO/ICS failure
3. Loss of NAVAIDS
4. Lost plane
5. Lost sig ht/LCLS
6. System failure
7. Midair
8. Ejection
9. Down plane/SAR

Brief board:

MISSION			
A/C	CALLSIGNS	SOE	EP'S
_____	_____		
_____	_____		
_____	_____		
WX			
AREA		COMM	QOD
JOKER/BINGO			
WEPS ENVELOPE			

Figure 5-5 Brief Board

DEPARTURE AND EN ROUTE

1. Takeoff Options
2. Lead Change
3. G-LOC Turns

Takeoff Options:

1. Section go for lead and “2” with “3” executing a 10-second running rendezvous
2. 10-second running rendezvous for dash “2” and “3” (crosswind limits)
3. Individual takeoffs with TACAN rendezvous for all (bad weather--need separate clearance)

Lead Change:

- Bandit will pass lead to “2” once confirmed that fighters have each other in sight
 - a. Fighter lead assumes flight lead and is responsible for area management. Bandit will now answer as “3”

- b. Fighter lead ensures bandit is outside formation before pushing wingman into combat spread

G-LOC:

1. OPNAV 3710.7 requires 180 degrees of turn to the maximum amount of g’s anticipated on that particular flight
2. TW-2 executes this G-LOC as two 90-degree turns at approximately 4 g’s

Kid, G-LOC left. . . “ 2” . . . “3” . . .

Kid, G-LOC right. . . “ 2” . . . “3”

ENGAGEMENT FLOW

ACM - 10 (Dual)	
Call the bandit	Do X 2
Counterflow	Demo/Do X 2
No switch	Do X 2
Single switch	Demo/Do X 2
Multi-switch bug	Demo X 1
Multi-switch kill	Do X 1
Multi-switch bug	Do X 1 (Gas permitting)

Table 5-1 ACM-10 (Dual)

ACM - 11X (Dual)	
Call the bandit	Do X 2
Counterflow	Do X 2
Single switch	Do X 2
Multi-switch bug or kill	Do X 2
VFQ	Demo/Do X 2
BVR	Demo/Do (Gas permitting)

Table 5-2 ACM-11X (Dual)

ACM - 12 (Solo)	
Call the bandit	Do X 2
Counterflow	Do X 2
Multi-switch bug or kill	Do X 2
VFQ	Do X 2
BVR	Do X ?

Table 5-3 ACM-12 (Solo)

ACM - 13 (Solo)	
Call the bandit	Do X 2
Counterflow	Do X 1
Multi-switch bug or kill	Do X 1
VFQ	Do X 1
BVR	Do X ?
NOTE: Conduct is at IP's discretion (may do more BVRs)	

Table 5-4 ACM-13 (Solo)

RTB

The fighter lead will lead back:

1. Dash 2 picks one side (bandit gets the other)
2. Bandit is Dash-3

Recoveries:

1. Stage II/4-second break
2. Individual tops IFR/tops GCA

508. ENGAGED/FREE FIGHTER DOCTRINE

SIMPLE DEFINITION: Engaged fighter keeps bandit tied up while the free fighter maneuvers into position to ambush the bandit.

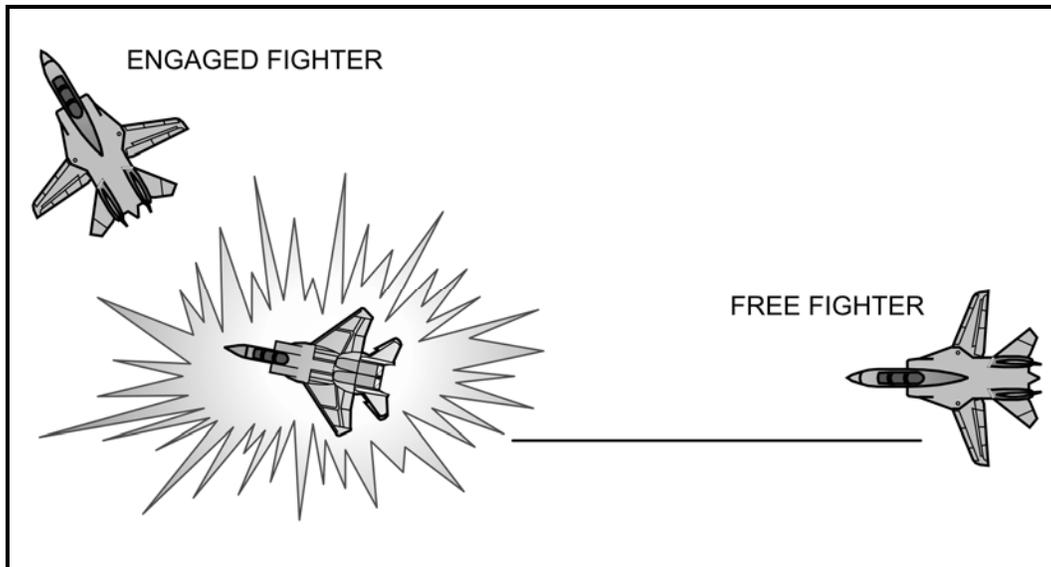


Figure 5-6 Engaged/Free Fighter

ENGAGED FIGHTER: That member of the section with the best capability of forcing the bandit into a predictable flight path (offensive or defensive).

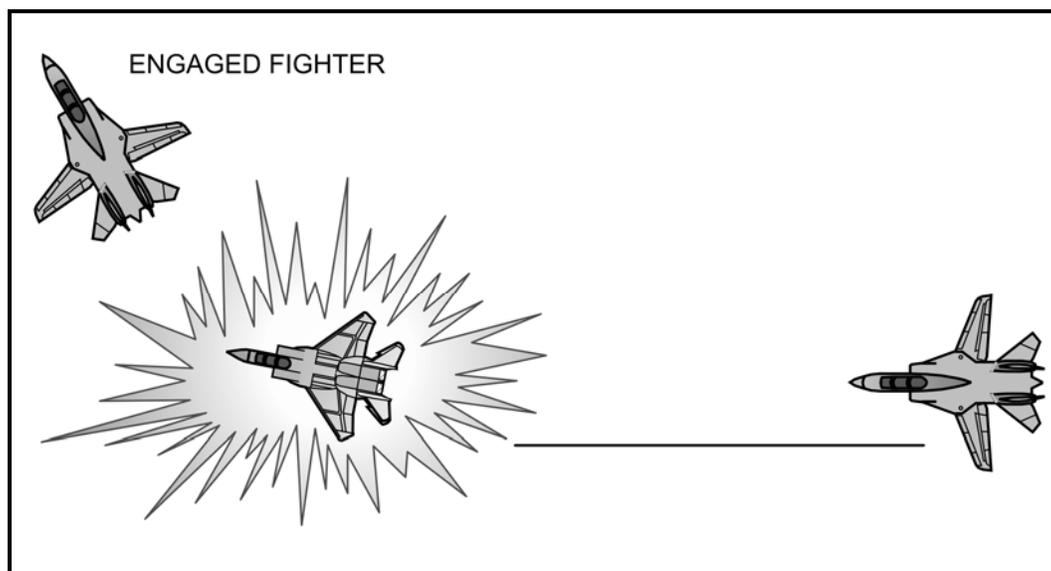


Figure 5-7 Engaged Fighter

FREE FIGHTER: That member of the section not pressing the bandit into a predictable flight path while he maneuvers for an offensive position to employ weapons.

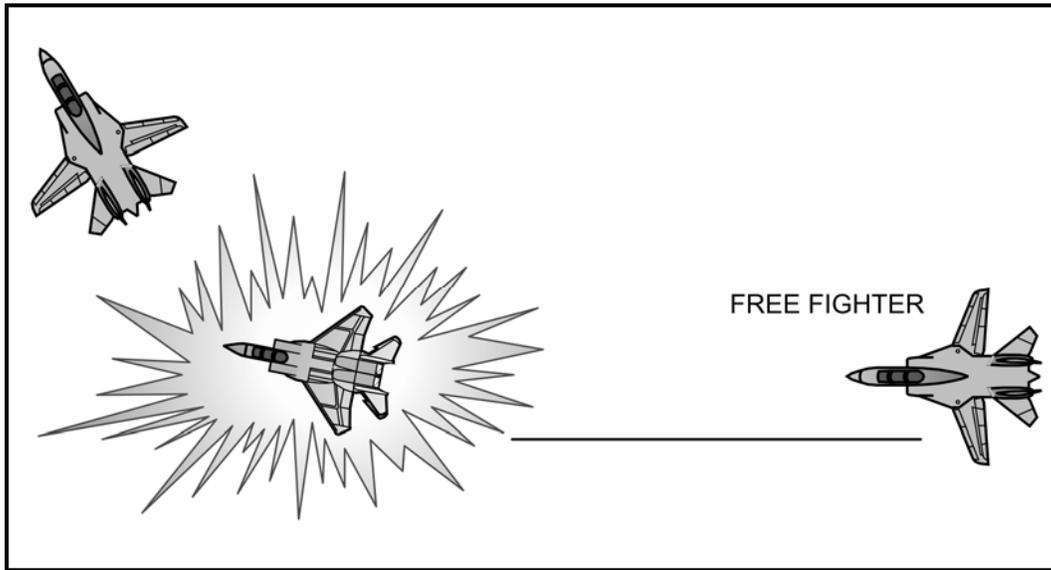


Figure 5-8 Free Fighter

Engaged Fighter Objectives:

(Defensive or offensive)

1. Kill the bandit
2. Keep the bandit in sight
3. Bleed the bandit's energy
4. Force the bandit to be predictable
5. Deny the bandit a shot opportunity
6. Force the bandit to fight your fight
7. Maintain high-energy level
8. Clear own "six"

Free Fighter Objectives:

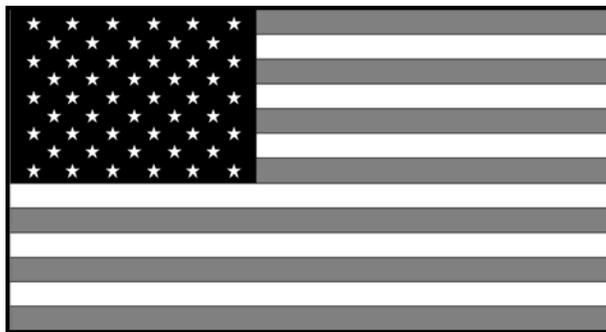
1. Kill the bandit
2. Keep track of engaged fighter and bandit
3. Clear engaged fighter's and own it "six"
4. Maintain high-energy state
5. Get out-of-plane and out-of-phase
6. Attempt to maneuver to bandit's blind spot
7. Direct the fight if required

Advantages:

1. Tactical capability of two aircraft more than doubles when a section works effectively together
2. Mutual support assists the section in engaging the bandit, achieving a quick kill, and regaining section integrity

NOTE

This assumes a high level of skill for both fighters.

Bottom Line

Team Work!!

Figure 5-9 Bottom Line

509. FORMATIONS

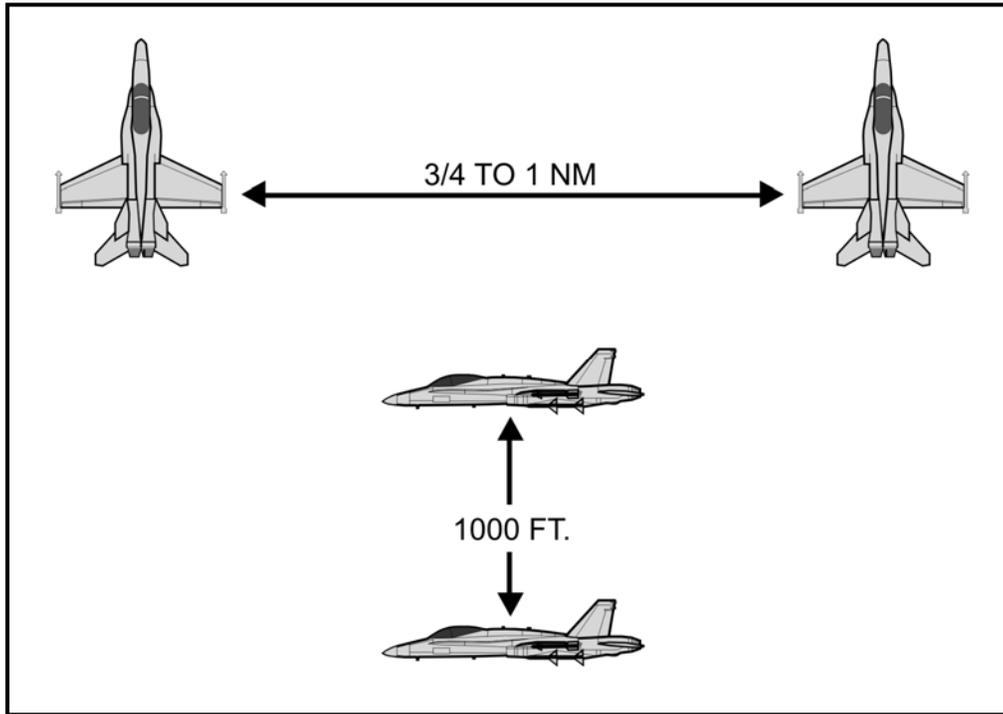


Figure 5-10 Combat Spread

Advantages of Combat Spread:

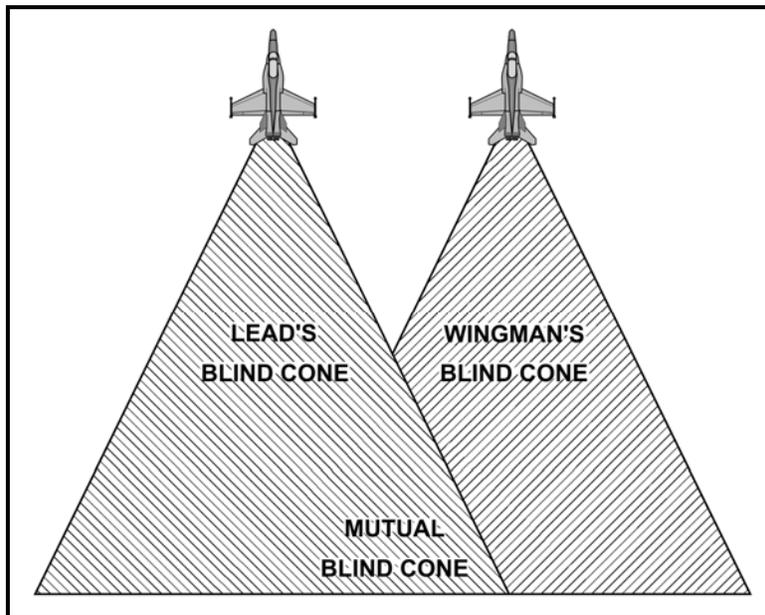


Figure 5-11 Advantages of Combat Spread

1. Visual limits are increased

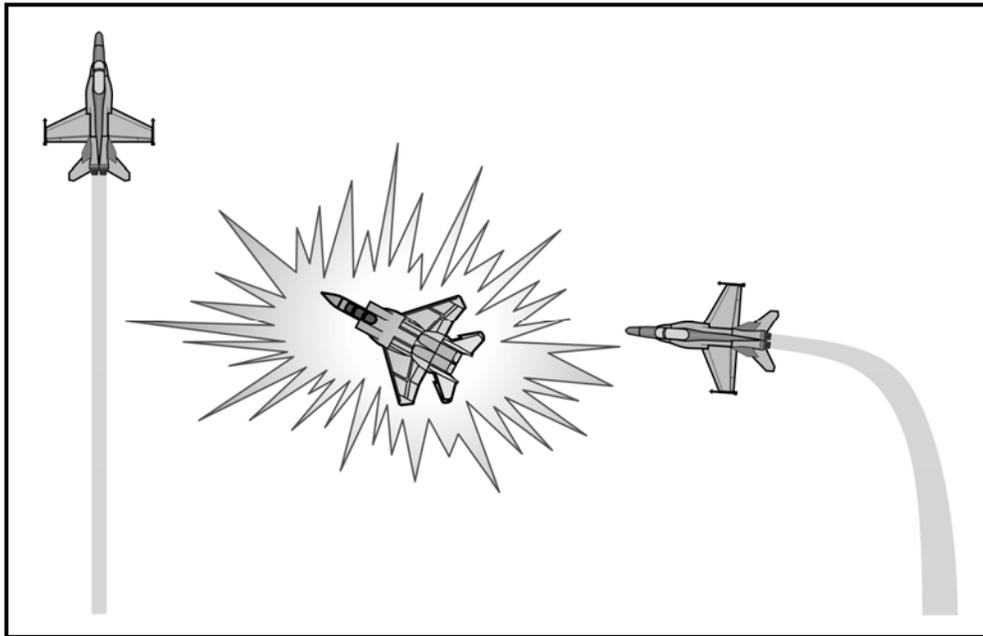


Figure 5-12 Advantages of Combat Spread 2

2. Detection more difficult for bandit

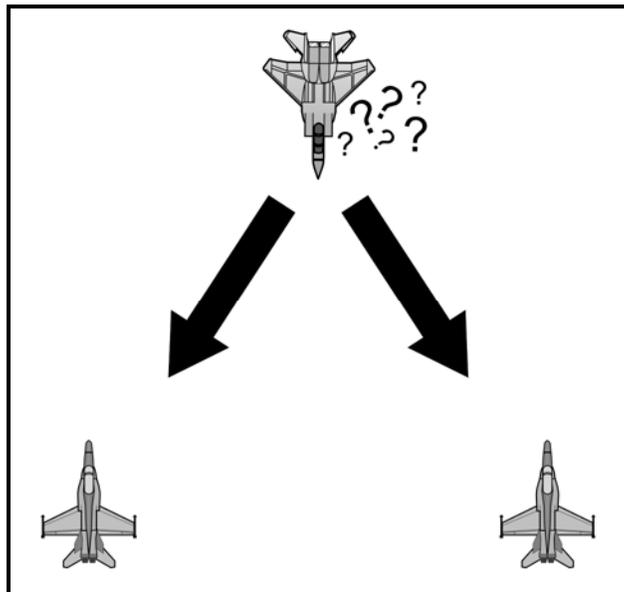


Figure 5-13 Advantages of Combat Spread 3

3. Forces early commitment on one fighter or the other by the bandit

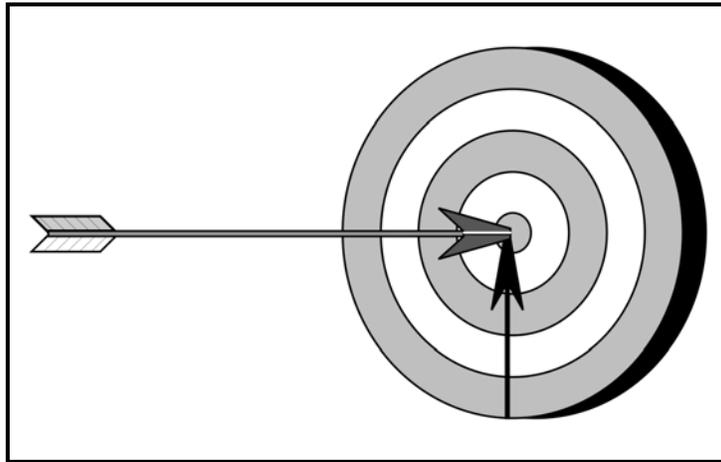


Figure 5-14 Advantages of Combat Spread 4

4. Weapons employment more effective
5. Maneuverability increases:
 - a. More time for lookout versus flying form
 - b. Fighters may use maximum performance turns with little risk of midair collision or losing sight of each other
6. Flexible:
 - a. When wingman has initial visual contact with the bandit, he directs the flight and assumes the tactical lead role.
 - b. Rapid role designation enables section to quickly employ full combat potential

Other Types of Section Formations

Lead-Trail:

1. Very offensive
2. Low mutual support
3. Wingman vulnerable
4. Difficult to stay together

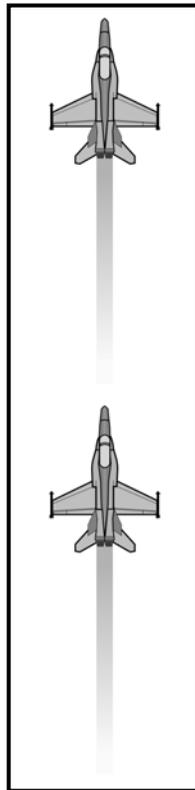


Figure 5-15 Lead-Trail

Fighter Wing:

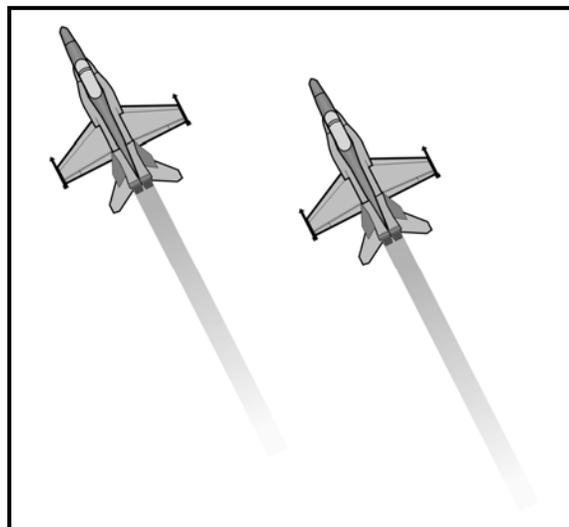
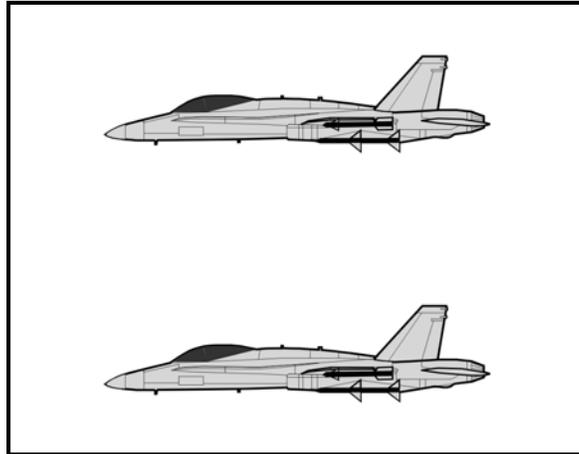


Figure 5-16 Fighter Wing

1. Easy to stay together
2. Wingman has low situational awareness
3. Poor mutual support
4. Easy for bandit to see both fighters

High-Low:**Figure 5-17 High-Low**

1. Offensive
2. Low mutual support
3. Wingman and lead vulnerable
4. Very difficult to stay together

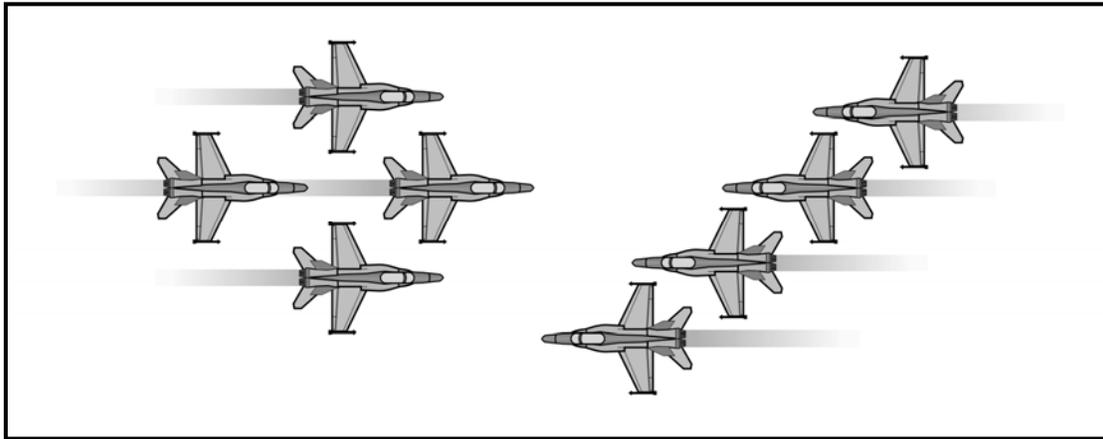


Figure 5-18 Formation

“Never break your formation into less than two-ship elements. Stay in pairs. A man by himself is a liability; a two-ship team is an asset. If you are separated, join up immediately with other friendly airplanes.”

Major Thomas B. “Tommy” McGuire, USAAF

510. COMMUNICATION



Figure 5-19 Communication

The most challenging aspect of three-plane ACM is good comm.

Communication must be:

1. Clear

2. Concise
3. Accurate

Talk and Turn:

1. When the bandit is detected close in (less than 3 nm), the section member with a “tally” must employ tactical maneuvering **while** communicating with his wingman--not after!
2. His wingman must execute the called maneuvering **while** responding--not after!

Standard Call:

- | | |
|--------------|----------------|
| 1. Call sign | “Blaze” |
| 2. Maneuver | “Hard right” |
| 3. Detection | “MIG” |
| 4. Direction | “Right 3” |
| 5. Elevation | “Slightly low” |
| 6. Range | “1 mile” |
| 7. Remarks | “Nose on” |

Standard Responses:

1. “No joy”
2. “Tally, engaged”
3. “Tally, free”
 - Update visual status as soon as bandit is sighted

Comm Priority

Most important comm is to define **free** and **engaged** roles **ASAP**.

Cadence:

1. Practice good cadence by transmitting, then pause for reply If no reply after a few seconds, transmit, then pause again

2. Do not step on each other Listen to what your lead/wingman is saying; think, then talk

Communication

Using verbal shorthand assists in clear, concise transmissions.

Provide a simple statement of intentions early to allow your section to work as a team.

511. ADDITIONAL CONSIDERATIONS

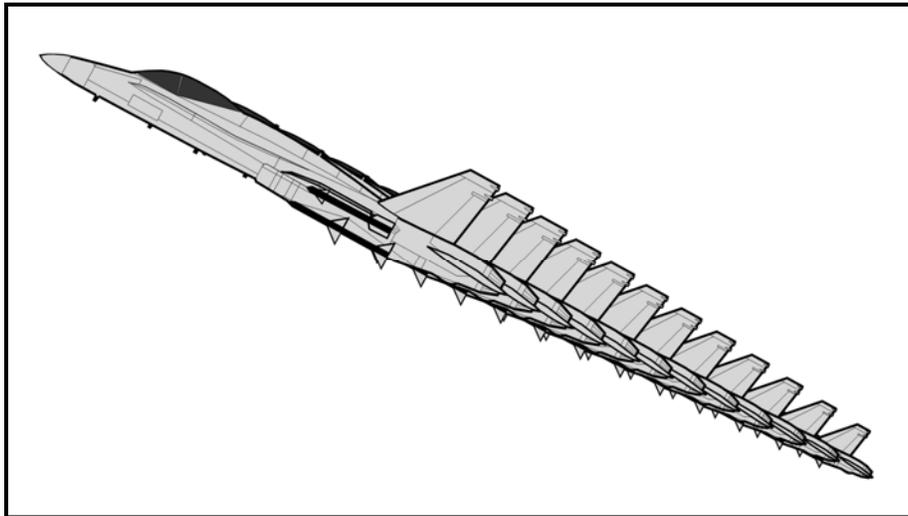
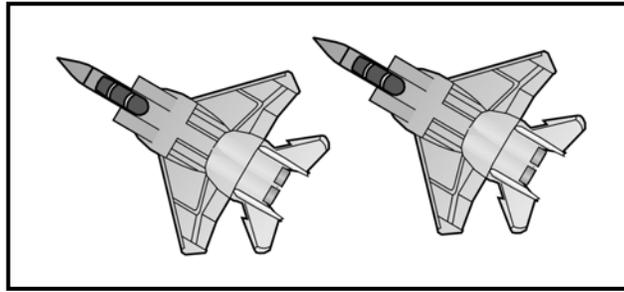


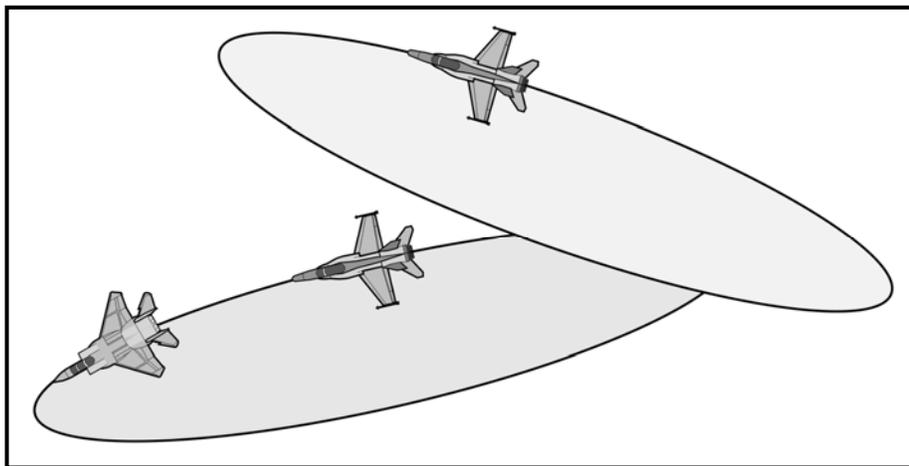
Figure 5-20 Additional Considerations

Weather:

1. Undercast/Overcast. . .
 . . .improves visual range
2. Bad weather. . .
 . . .increases joker/bingo
3. IFR weather. . .
 . . .is bandit VFR only
4. Hide in a cloud. . .
 . . .IR/radar will find you

The Bandit:**Figure 5-21 The Bandit**

1. Type of bandit aircraft?
2. Weapons load?
3. Fuel load?
4. GCI required for bandit?
5. What tactics does bandit use?

Maneuvering Out of Plane:**Figure 5-22 Maneuvering Out of Plane**

1. Forces early commit
2. Difficult for bandit to shoot free fighter
3. Difficult for bandit to keep sight

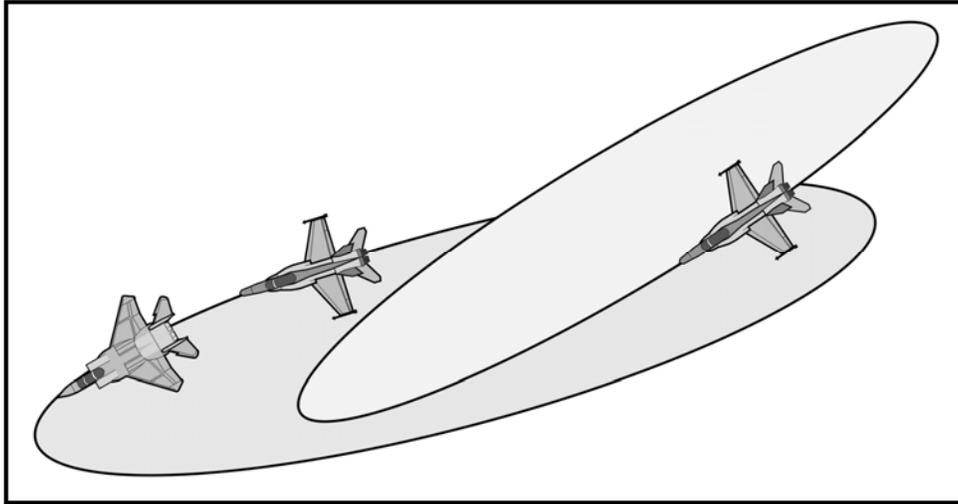
Maneuvering Out of Phase:

Figure 5-23 Maneuvering Out of Phase

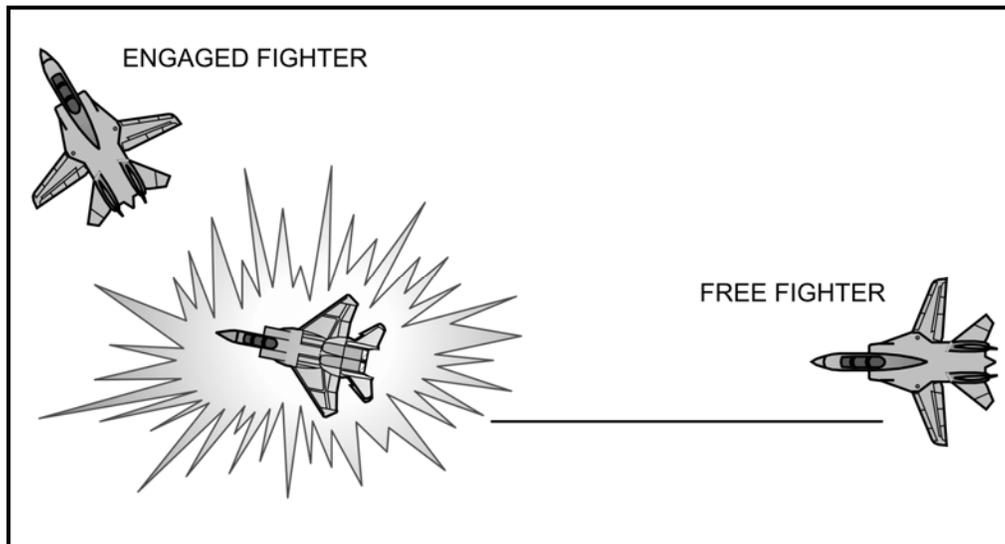
1. More flexibility to maneuver for shot
2. Free fighter able to keep high energy state
3. Difficult for bandit to keep sight of or shoot at the free fighter

Maneuvering Don'ts:

1. Staying in the same dimensional plane
2. Meeting wingman close aboard
3. Losing sight (especially on bugout)

Maneuvering Do's:

1. Force bandit to commit early
2. Avoid splitting into singles
3. Go for quick kill
4. Attempt to bracket bandit

THREE-PLANE ACM - PART 2**Figure 5-24 Three-Plane ACM – Part 2****Part 2 – ACMFP-06**

1. Engagements
2. Review

512. ENGAGEMENTS

1. Call the Bandit
2. Counterflow
3. No Switch
4. Single Switch
5. Multi-Switch Bugout
6. Multi-Switch Kill
7. Visual Forward Quarter (VFQ)
8. Beyond Visual Range (BVR)

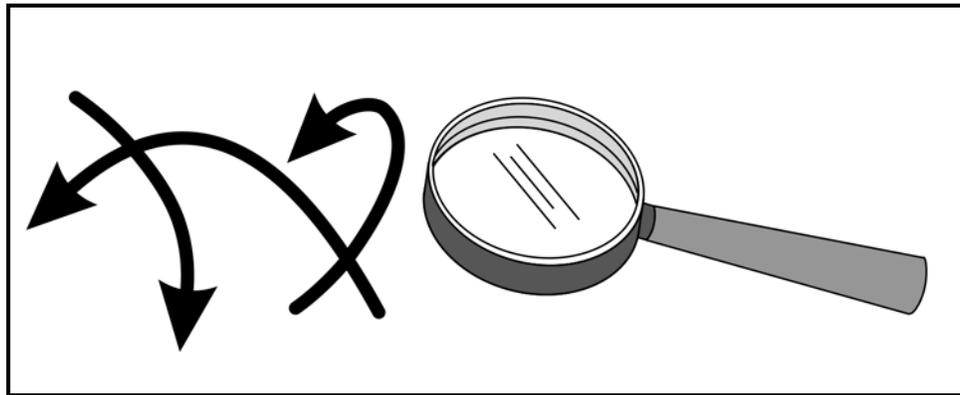


Figure 5-25 Engagements

Now we will cover each of the individual engagements on the white board.

Call the Bandit (No Switch):

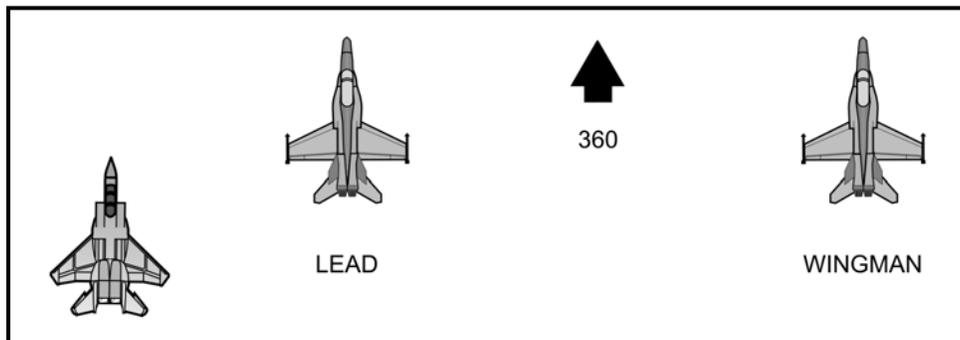
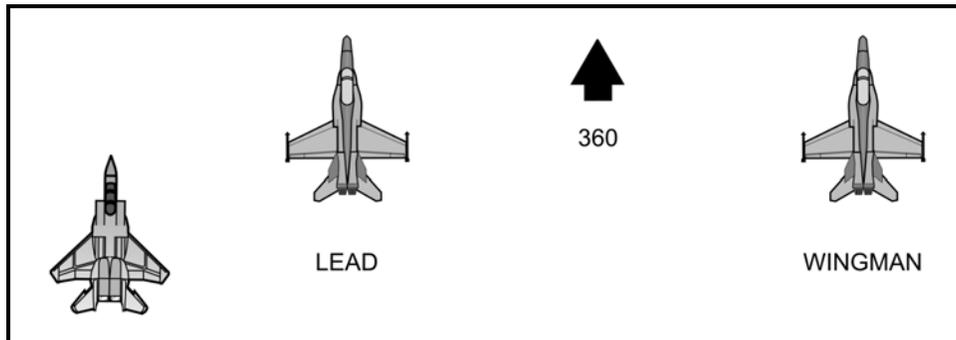


Figure 5-26 Call the Bandit (No Switch)

Need two volunteers to come up front and demo call the bandit no switch.



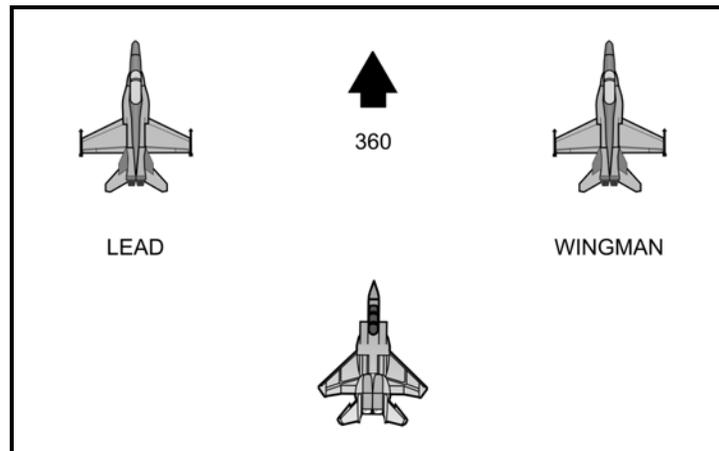
Call the Bandit (Single Switch):**Figure 5-27 Call the Bandit (Single Switch)**

Need two new volunteers to come up front and demo call the bandit single switch.



Remember:

1. Know comm cold
2. Fly good platform as lead

Counterflow**Figure 5-28 Counterflow**

Draw and discuss on white board.

Remember:

1. Talk and turn
2. Good break turn and defensive 1 v 1
3. Don't arc
4. Bandit planform +1 for horizontal/+5 for vertical
5. Do not get into pitchbuck on turn in
6. "Tally visual" before Fox-2

No Switch

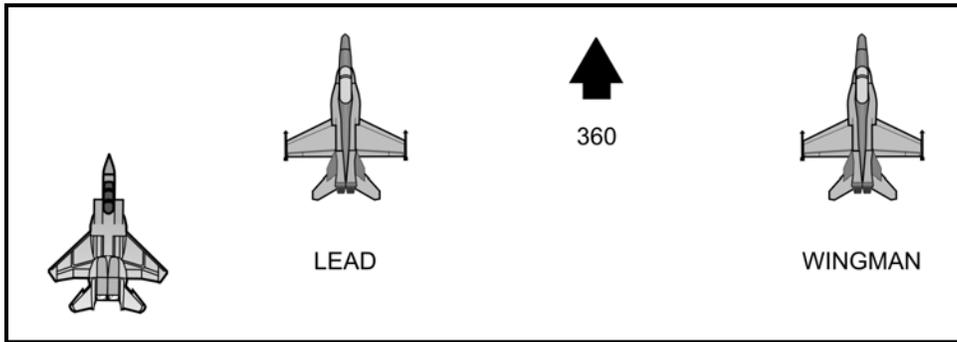


Figure 5-29 No Switch

Draw and discuss on white board.

Remember:

1. Talk and turn
2. Good break turn
3. KIO (Knock it off) heading

Single Switch

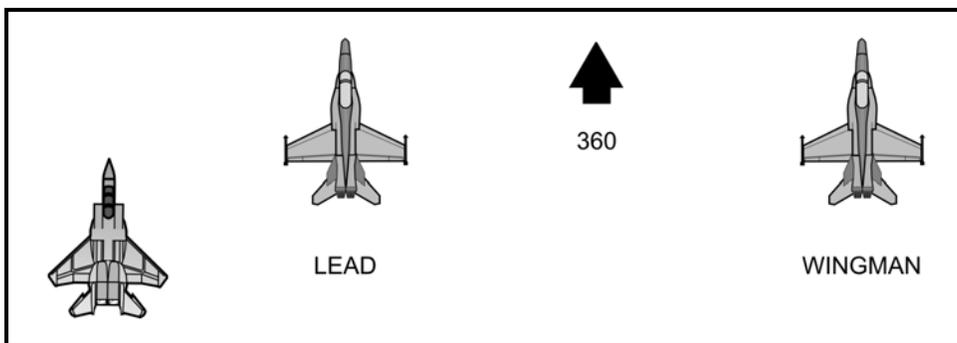


Figure 5-30 Single Switch

Draw and discuss on white board.

Remember:

1. Talk and turn
2. Good break turn
3. Call the pass you see
4. Fight good scissors
5. "Tally visual" before you shoot

Multi-Switch Bugout

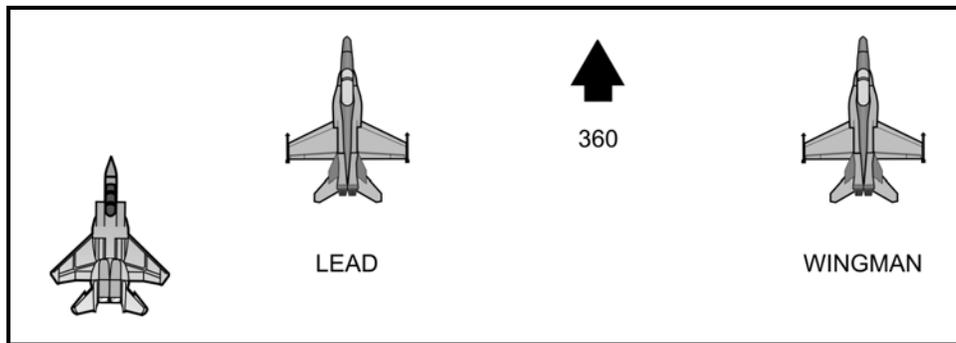


Figure 5-31 Multi-Switch Bugout

Draw and discuss on white board.

Remember:

1. Talk and turn
2. Good break turn
3. Call the pass you see
4. Fight good scissors
5. Free fighter call pass ASAP!
6. Kick fight across the tail and get nose down
7. Regain combat spread and mutual support

Multi-Switch Kill

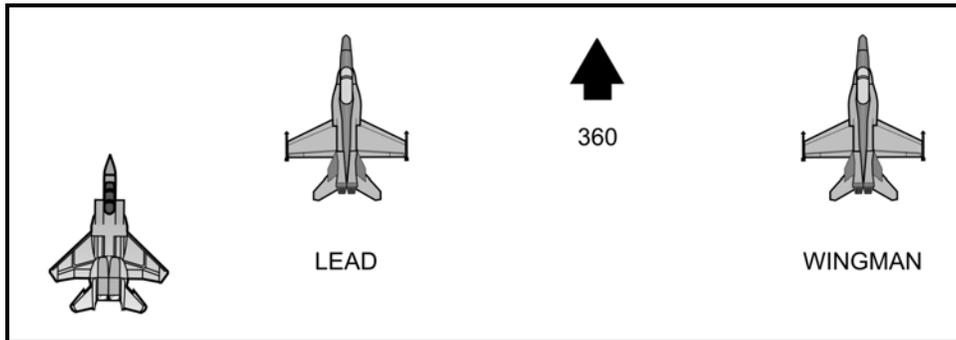


Figure 5-32 Multi-Switch Kill

Draw and discuss on white board.

Remember:

1. Talk and turn
2. Good break turn
3. Call the pass you see
4. Fight good scissors
5. Free fighter call pass ASAP!
6. Kick fight across the tail and get nose down
7. Force the bandit 1 circle

Visual Forward Quarter (VFQ)

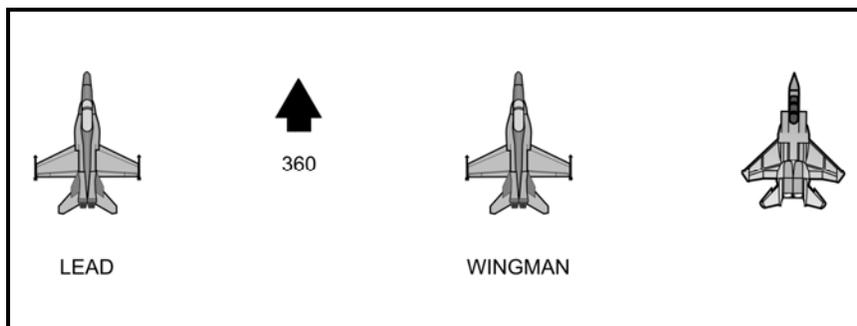


Figure 5-33 Visual Forward Quarter (VFQ)

Draw and discuss on white board.

Remember:

1. Get comm out quickly
2. Turn 120 degrees at 6 o'clock before lead turn
3. Shoot at pass if you can
4. Call direction of engaged turns
5. Deconflict engaged fighter when taking Fox-2

Beyond Visual Range (BVR)



Figure 5-34 Beyond Visual Range (BVR)

BVR gives you a chance to use everything you have learned up to this point.

You will practice:

1. Formation management
2. Lookout doctrine
3. Engaging turns
4. Communications
5. Defining roles (free and engaged)

6. Forcing the bandit to be predictable
7. Staying out of phase and out of plane
8. Killing the bandit
9. Bugging out



Figure 5-35 Beyond Visual Range (BVR) 2

1. Select caps about 10-15 nm apart--either TACAN radials or ground gouge will work fine.

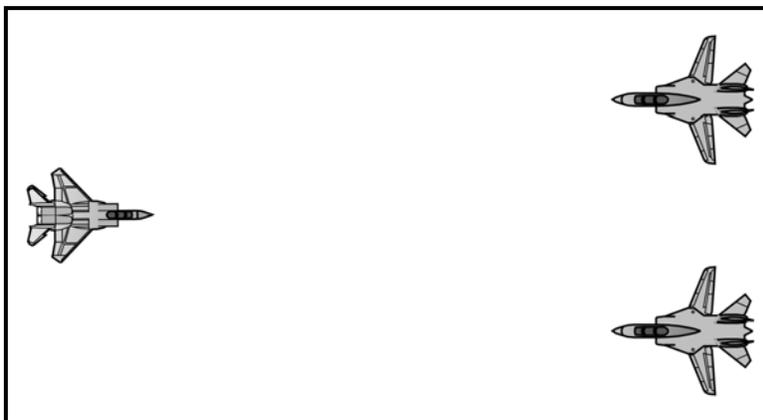


Figure 5-36 Beyond Visual Range (BVR) 3

2. Choose your block. The low block is 10,000-15,000 ft and the high block is 16,000-20,000 ft--you may leave your block when either you or your wingman has sight of the bandit

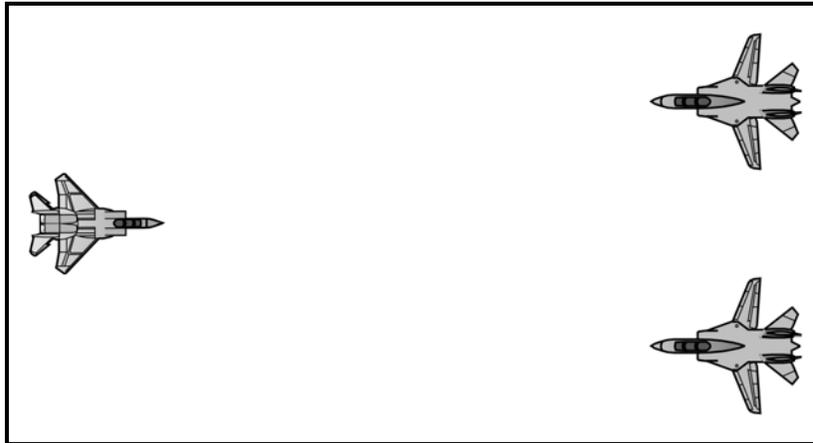


Figure 5-37 Beyond Visual Range (BVR) 4

Now you have to get sight of that wily bandit ASAP!

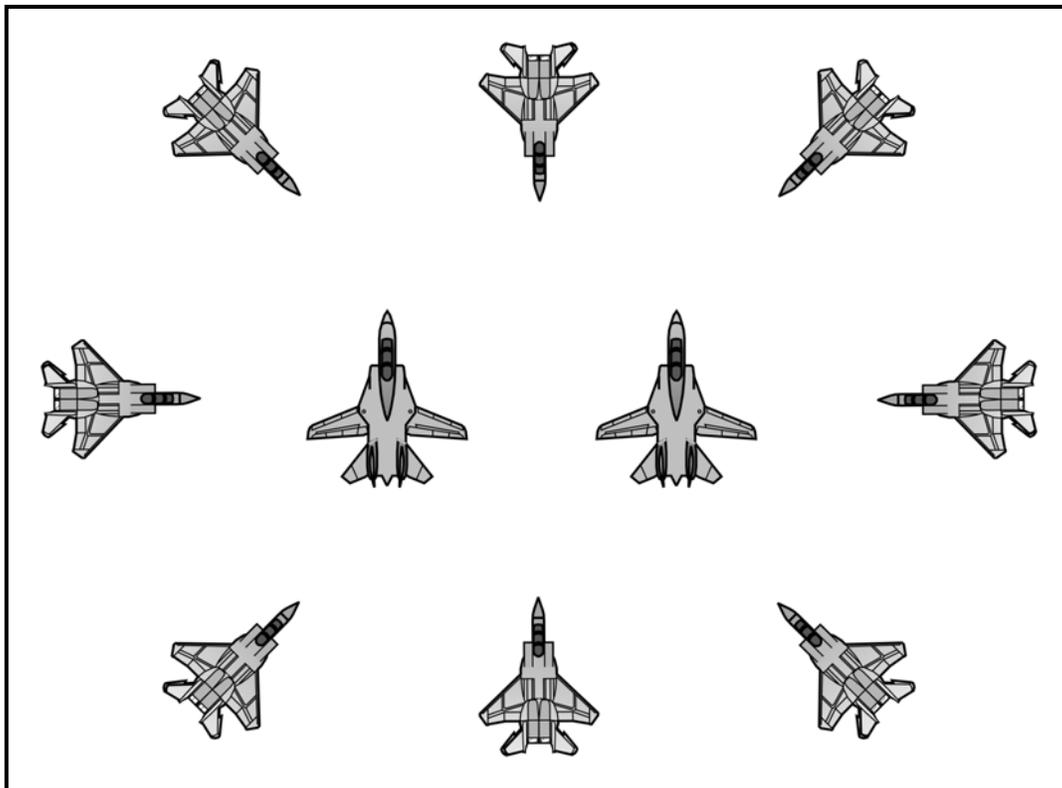


Figure 5-38 Beyond Visual Range (BVR) 5

Let's see if we know what to do for all the above possibilities.

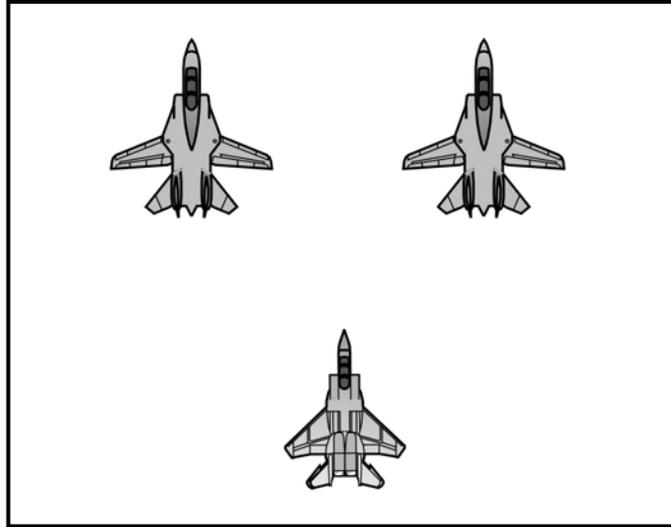


Figure 5-39 Beyond Visual Range (BVR) 6

How could you handle this?

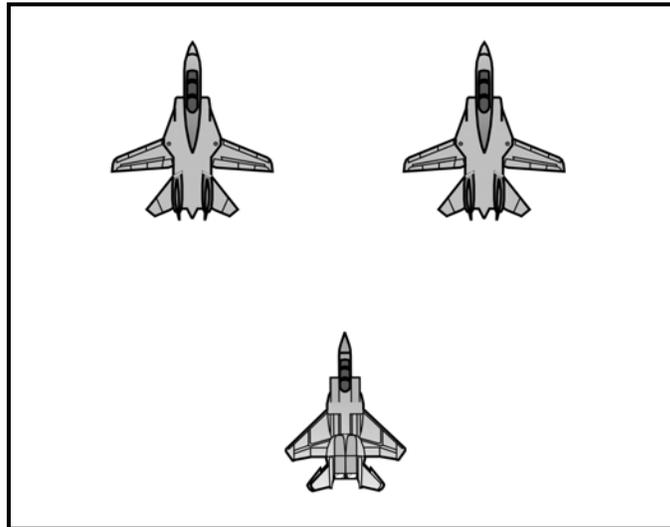


Figure 5-40 Beyond Visual Range (BVR) 7 - Counterflow

Counterflow

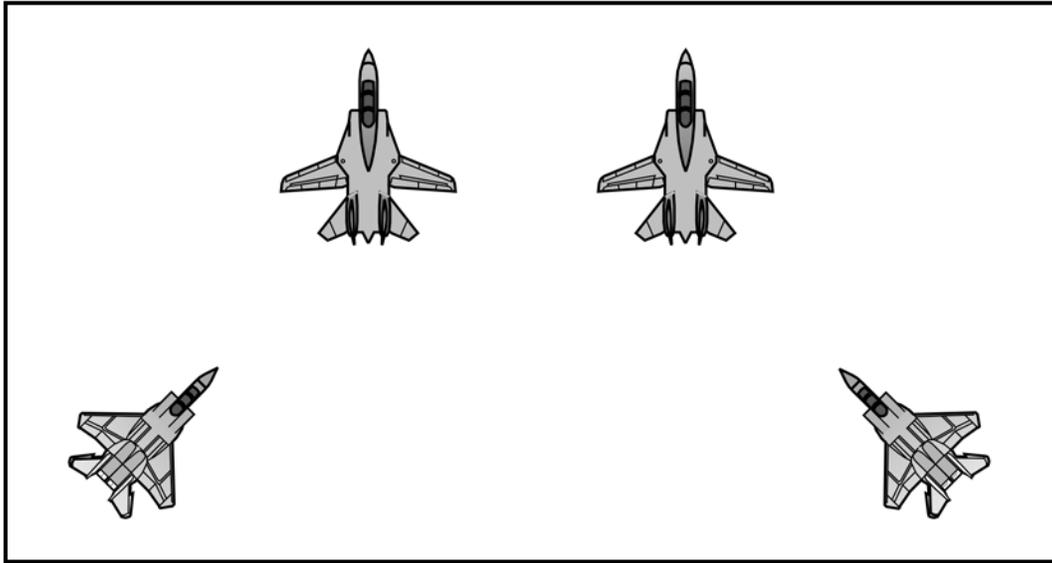


Figure 5-41 Beyond Visual Range (BVR) 8

How could you handle this?

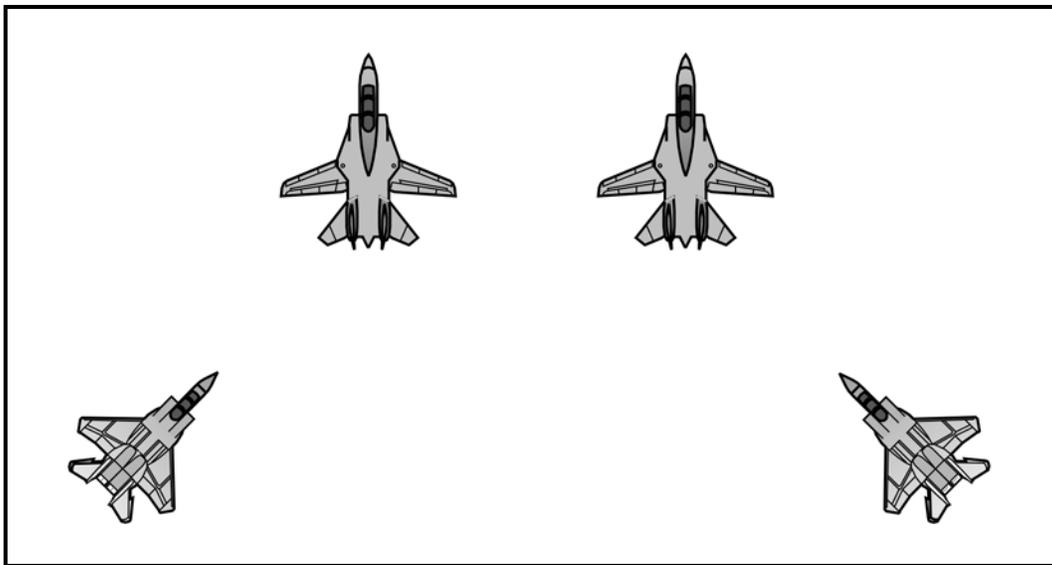


Figure 5-42 Beyond Visual Range (BVR) 9

No-switch or multi-switch

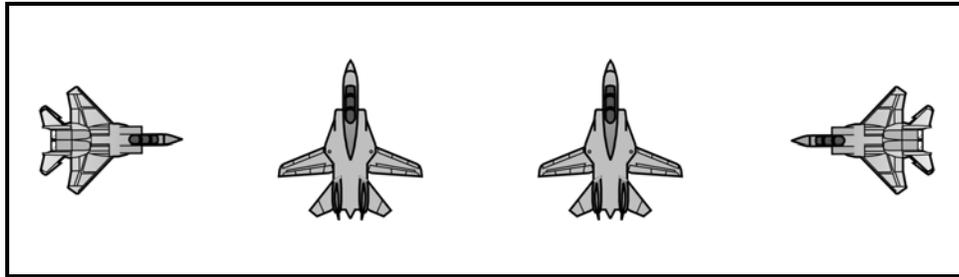


Figure 5-43 Beyond Visual Range (BVR) 10

How could you handle this?

VFQ

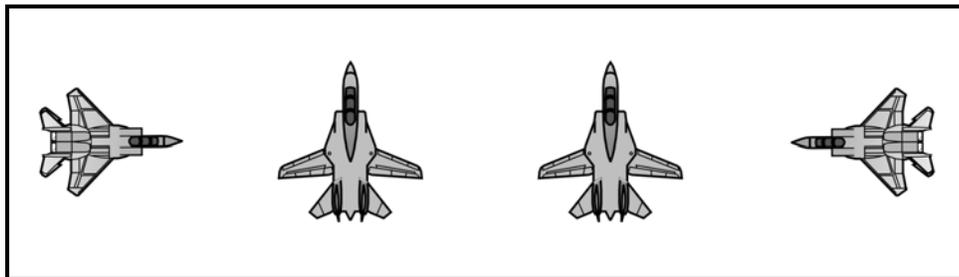


Figure 5-44 Beyond Visual Range (BVR) 11 - VFQ

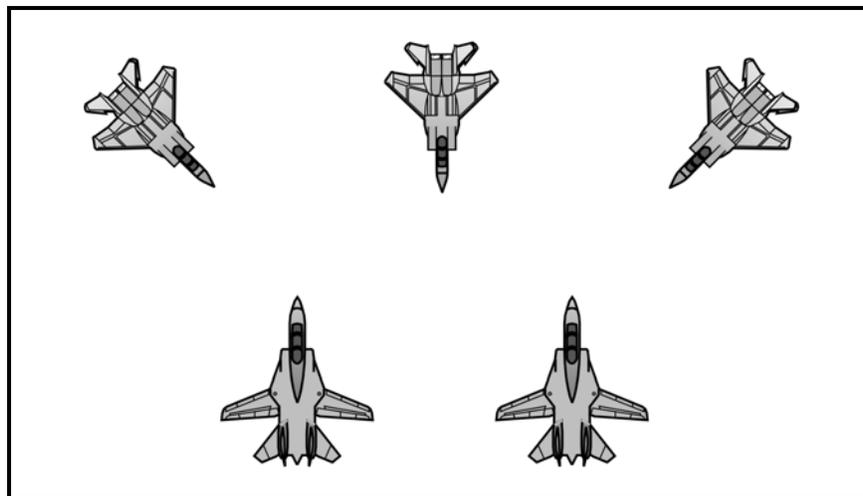


Figure 5-45 Beyond Visual Range (BVR) 12

How could you handle this?

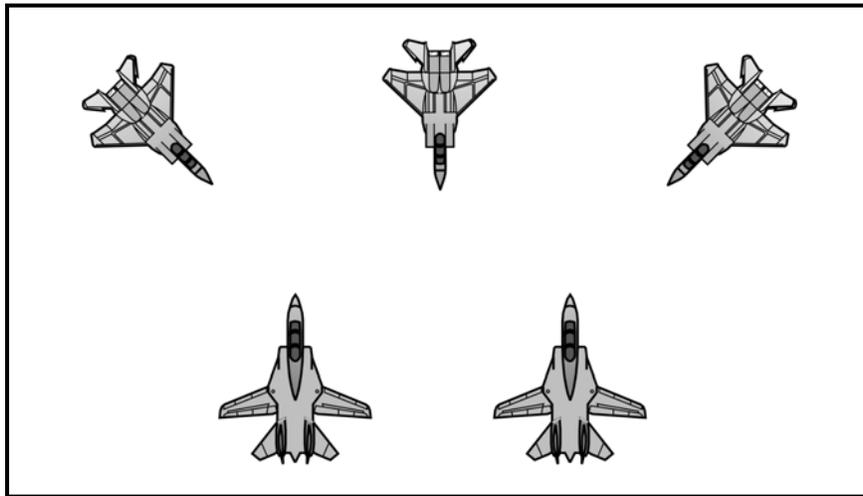


Figure 5-46 Beyond Visual Range (BVR) 12

Execute a check turn or tac turn to set up eyeball--shooter VFQ

BVR for Dick and Jane:

1. Define roles quickly
2. Engaged fighter must aggressively force bandit to be predictable
3. Free fighter work out of plane and phase for a quick kill
4. Keep sight
5. Repeat 1-4

513. REVIEW

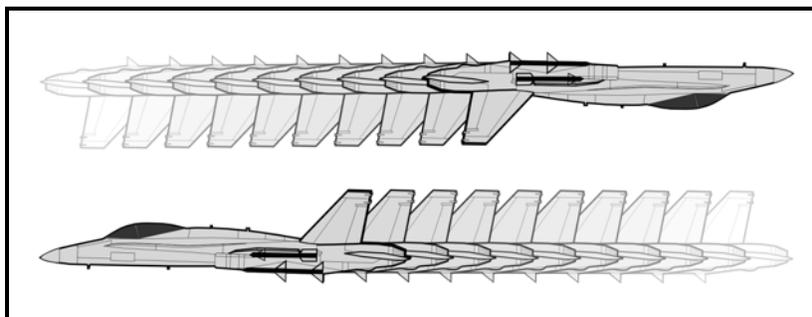


Figure 5-47 Review

Three-Plane ACM Review Options

1. Review the entire lesson
2. Conduct of Hop
3. Engaged/Free Fighter Doctrine
4. Formations
5. Communication
6. Additional Considerations
7. Engagements
8. End this lesson

Please select>

THE END

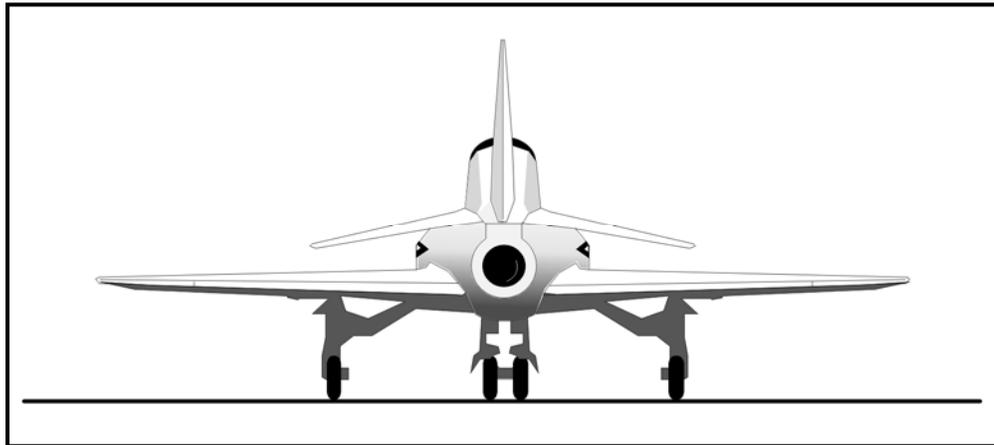


Figure 5-48 The End

PRETEST

Circle the letter of the correct answer.

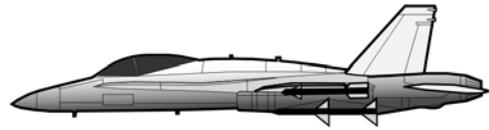
1. You may take off and penetrate an overcast with a three-plane formation in the ACM stage.

- a. True
- b. False



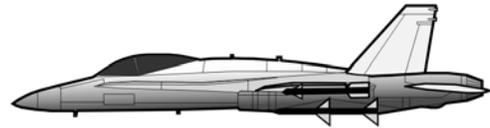
2. During single switch maneuvering, what should the free fighter call?

- a. G's and fuel state
- b. Speed and angels
- c. Number of aircraft in sight
- d. "Two's in hot."



3. During the call the bogey exercise, the fighters are nonmaneuvering.

- a. True
- b. False



4. For training purposes and safety, all gun tracking will be broken off at 1000 ft.

- a. True
- b. False



5. The student will normally initiate the knock-it-off call for training objectives.

- a. True
- b. False

6. Anyone can call a knock-it-off for safety reasons.

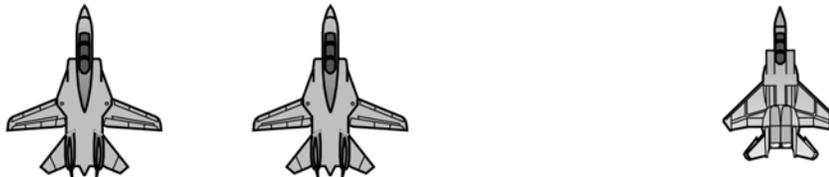
- a. True
- b. False



7. Both fighters must have the bandit in sight prior to the start of any engagement.

- a. True
- b. False

"VISUAL, NO JOY" "TALLY, VISUAL"



8. If one fighter is engaged, the other should be:

- a. engaged
- b. bugging out
- c. free
- d. defensive



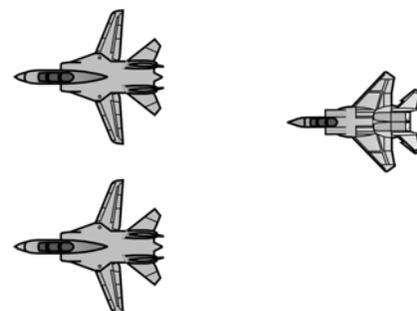
9. If deck allows, what AOA should the free fighter use to extend with?

- a. 16.5
- b. 18-20
- c. 5-10
- d. 10-12



10. Which fighter should assume the tac lead?

- a. The wingman
- b. The lead
- c. Whoever has the most situational awareness
- d. Whichever was prebriefed



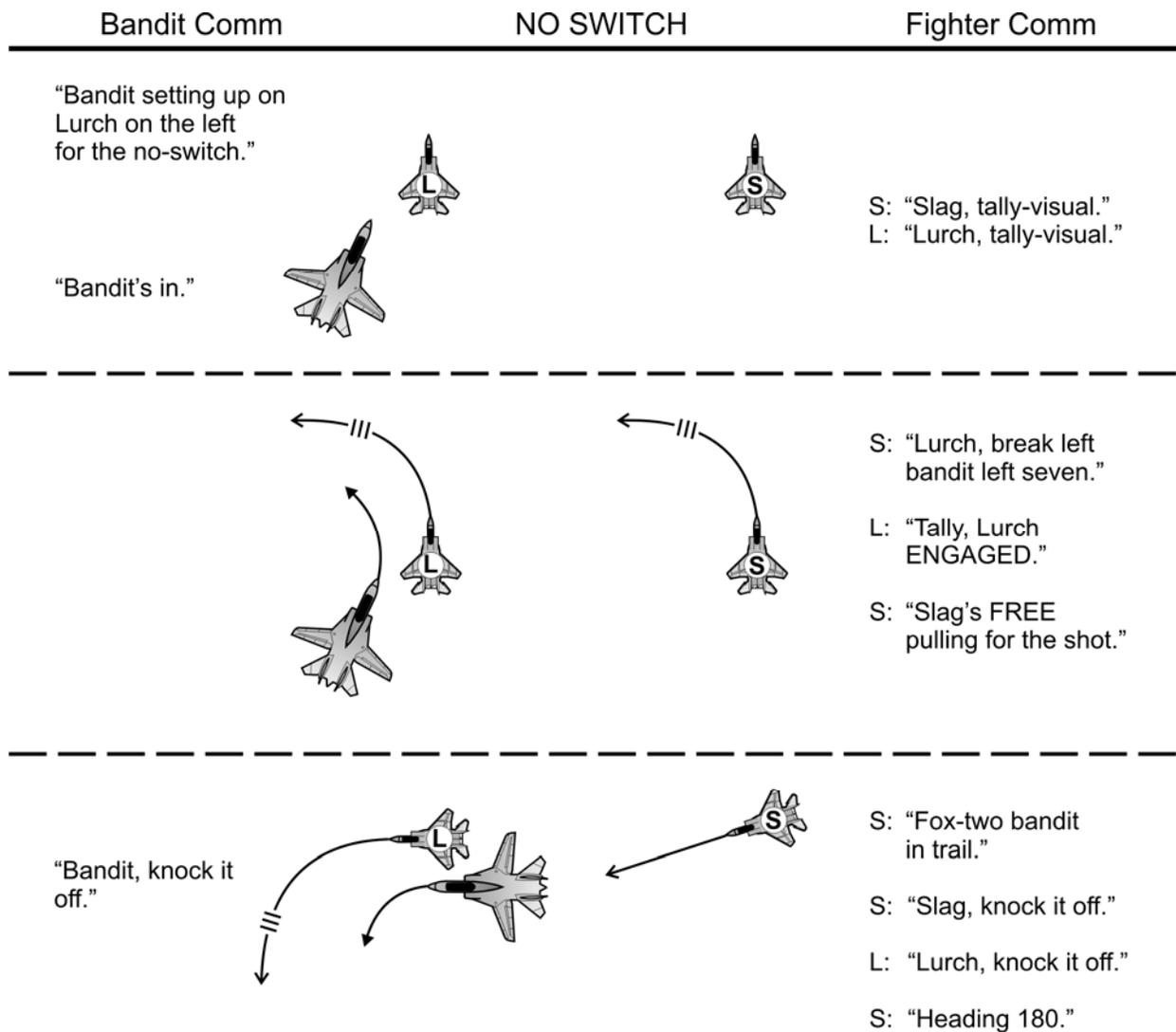
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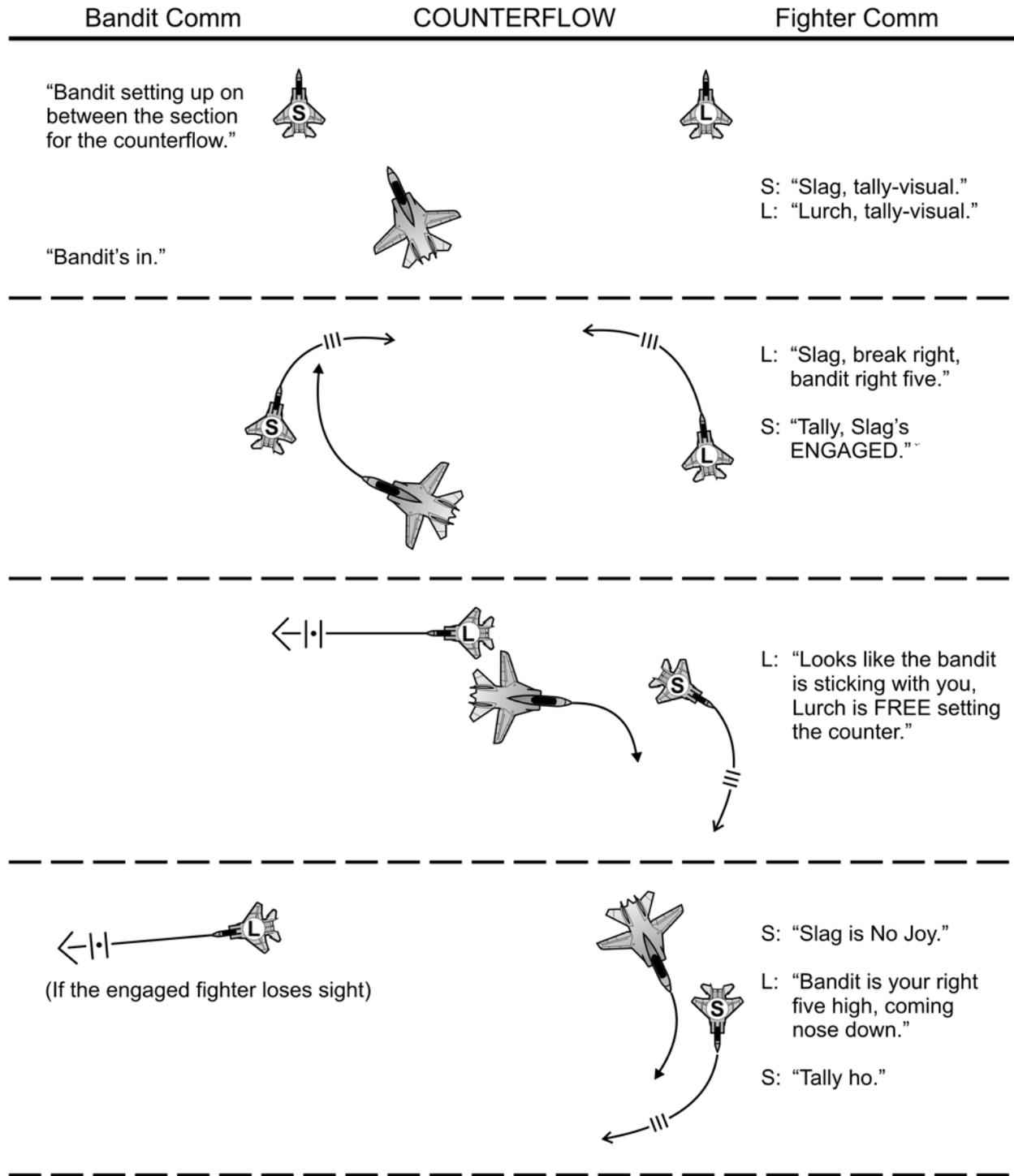
**APPENDIX A
GLOSSARY**

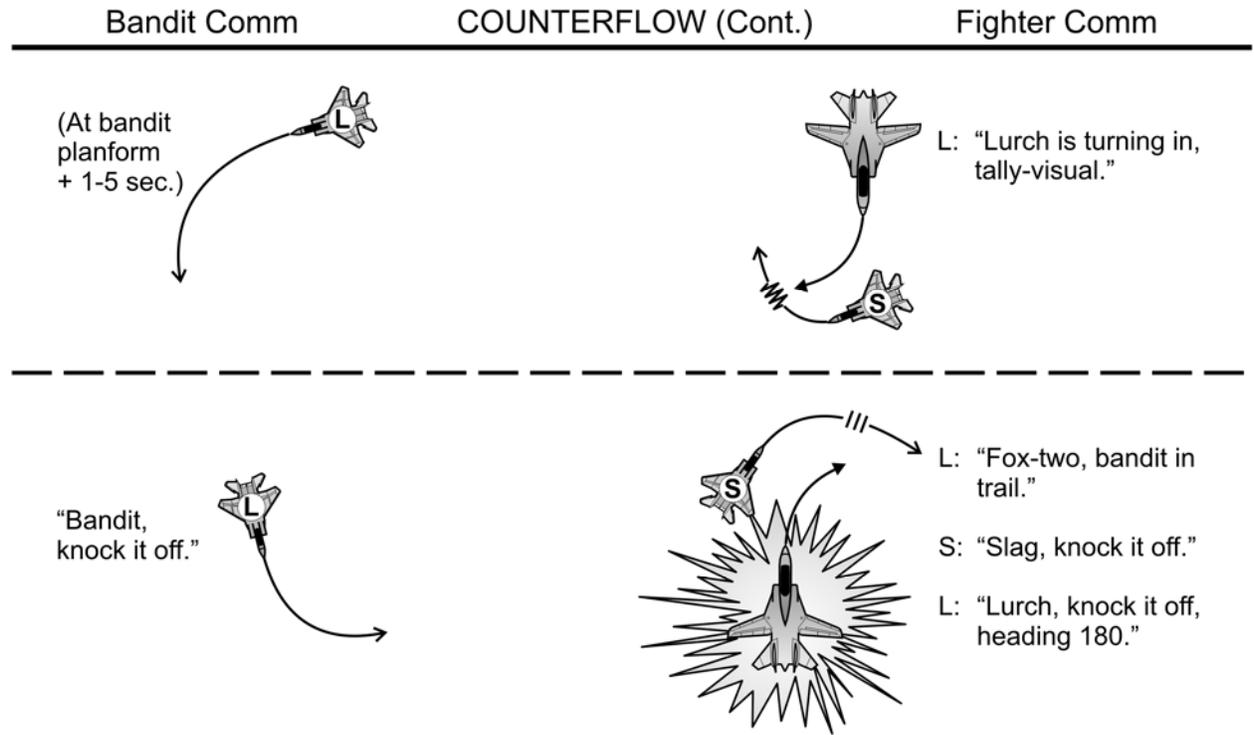
A100. N/A

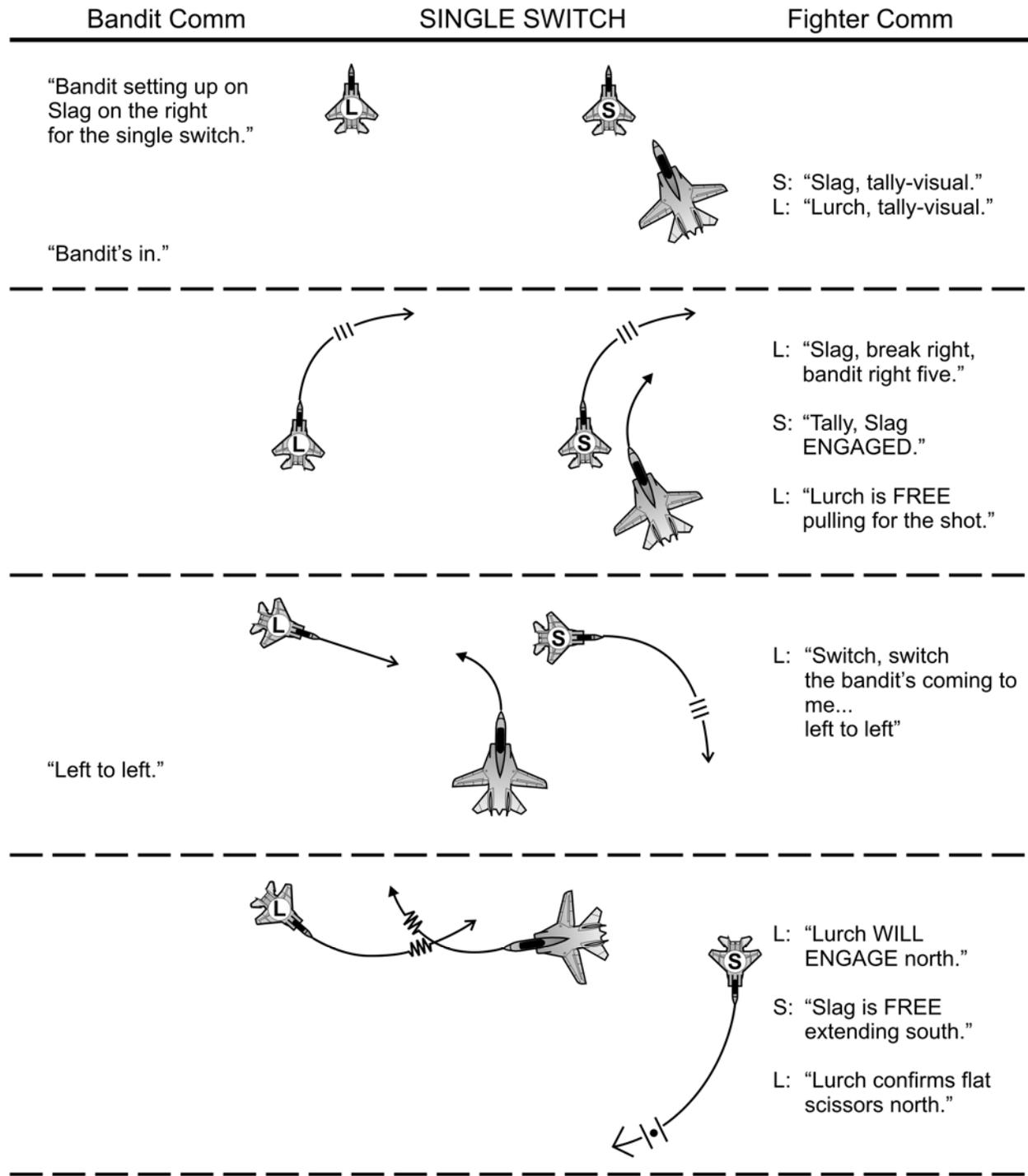
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**APPENDIX B
ADVANCED STRIKE 2 V 1 COMM PROCEDURES**







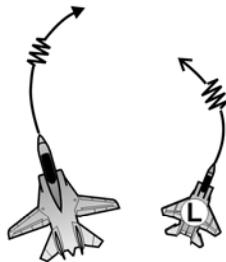


Bandit Comm SINGLE SWITCH (Cont.) Fighter Comm

If "Two in sight," engaged fighter describe bandit's position, i.e., "Bandit's on the left in a right turn."

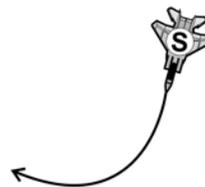
If "1" in sight, engaged fighter transmits, "Stand by for merge."

If "0" in sight, engaged fighter describe type of fight, heading, and altitude, "Lurch, engaged horizontal scissors, 360, 19,000."

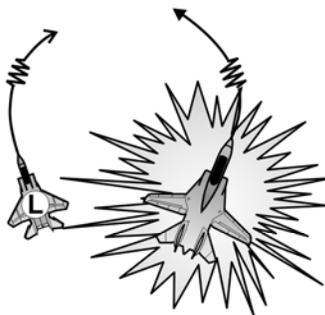


S: "Slag turning in,..."

"Zero in sight" or
"One in sight" or
"Two in sight"



"Bandit, knock it off."

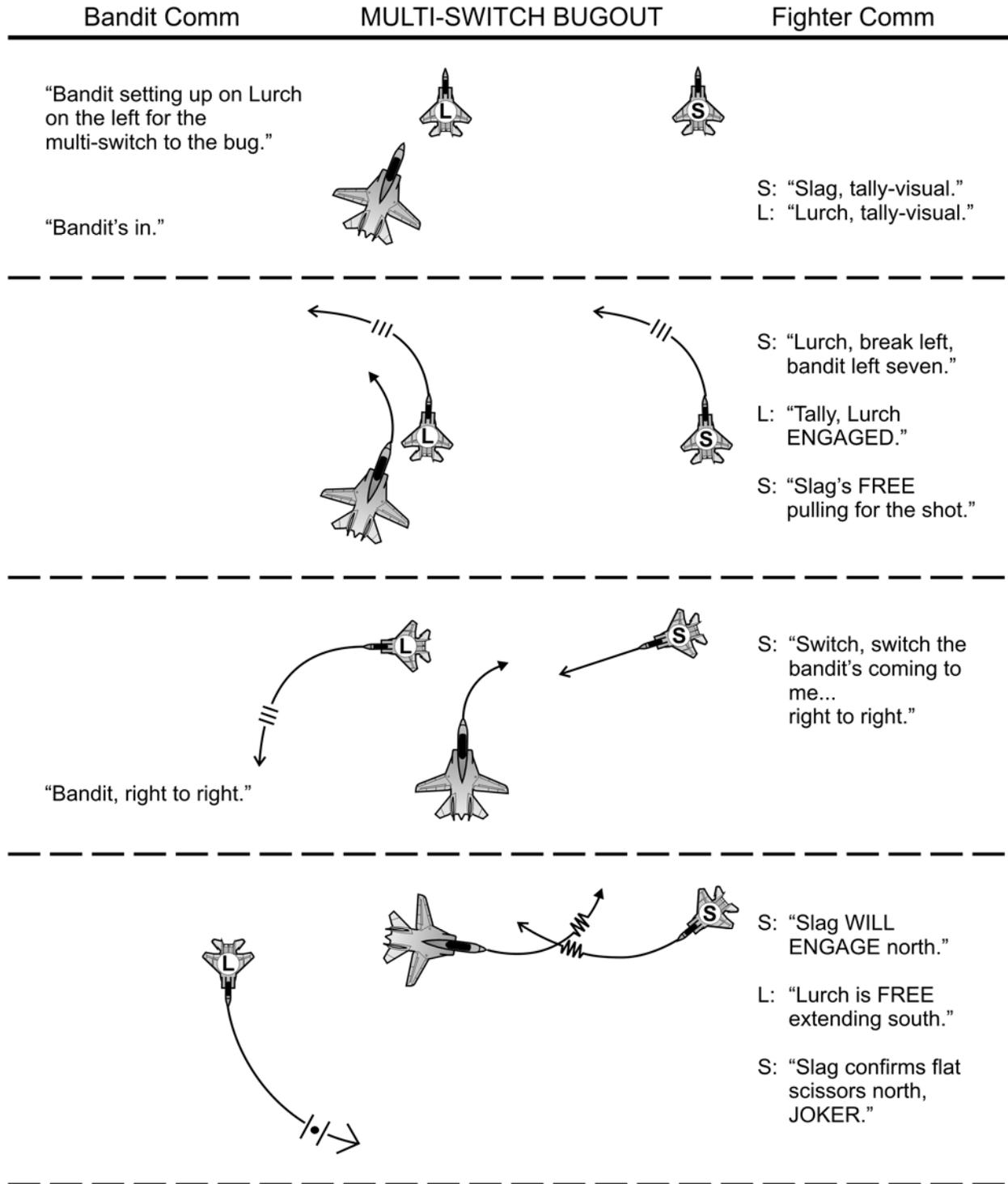


S: "Tally-visual, Fox-two, bandit on the right, in a left-hand turn."

S: "Slag, knock it off."

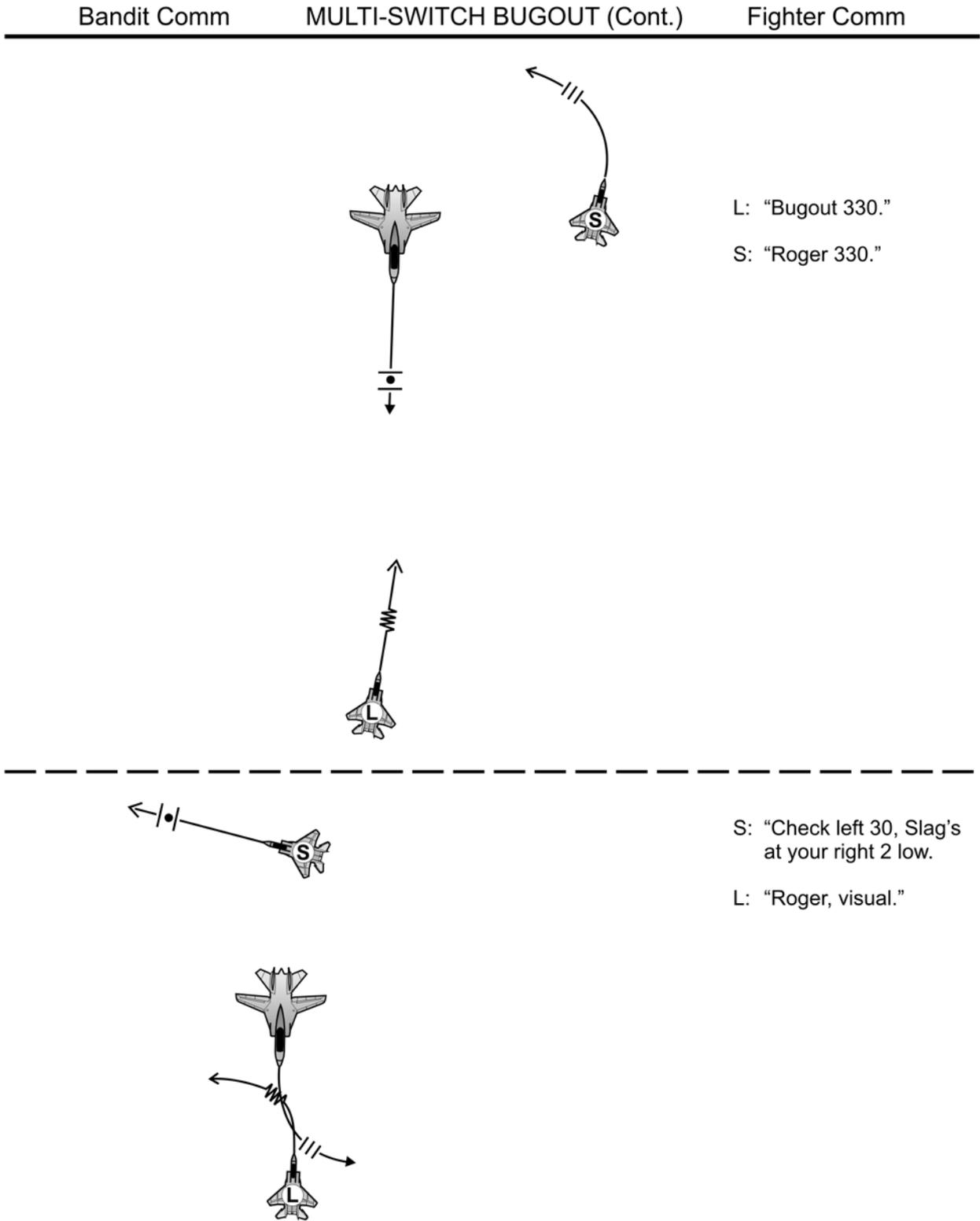
L: "Lurch, knock it off."

S: "Heading 090."

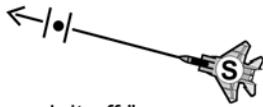


Bandit Comm	MULTI-SWITCH BUGOUT (Cont.)	Fighter Comm	
<p>If "Two in sight," engaged fighter describe bandit's on the right in a left turn.</p> <p>If "1" in sight, engaged fighter transmits, "Stand by for merge."</p> <p>If "0" in sight, engaged fighter describe type of fight, heading, and altitude, "Lurch, engaged horizontal scissors, 360, 19,000."</p>		<p>L: "Roger the joker, let's work the bug... Lurch turning in,"</p> <p>"Zero in sight" or "One in sight" or "Two in sight"</p>	

<p>If free fighter does not have sight, the engaged fighter must stay engaged.</p>		<p>S: "Heads up the bandit's nose is low... Looks like the bandit is coming to you."</p> <p>L: "Left to left."</p>	
<p>"Bandit, left to left."</p>		-----	



Bandit Comm	MULTI-SWITCH BUGOUT (Cont.)	Fighter Comm
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"Bandit, knock it off."

(Bandit will call for an IP or cross turn.)

S: "Bandit 90 to go at 1 mile, looks like a good bug."

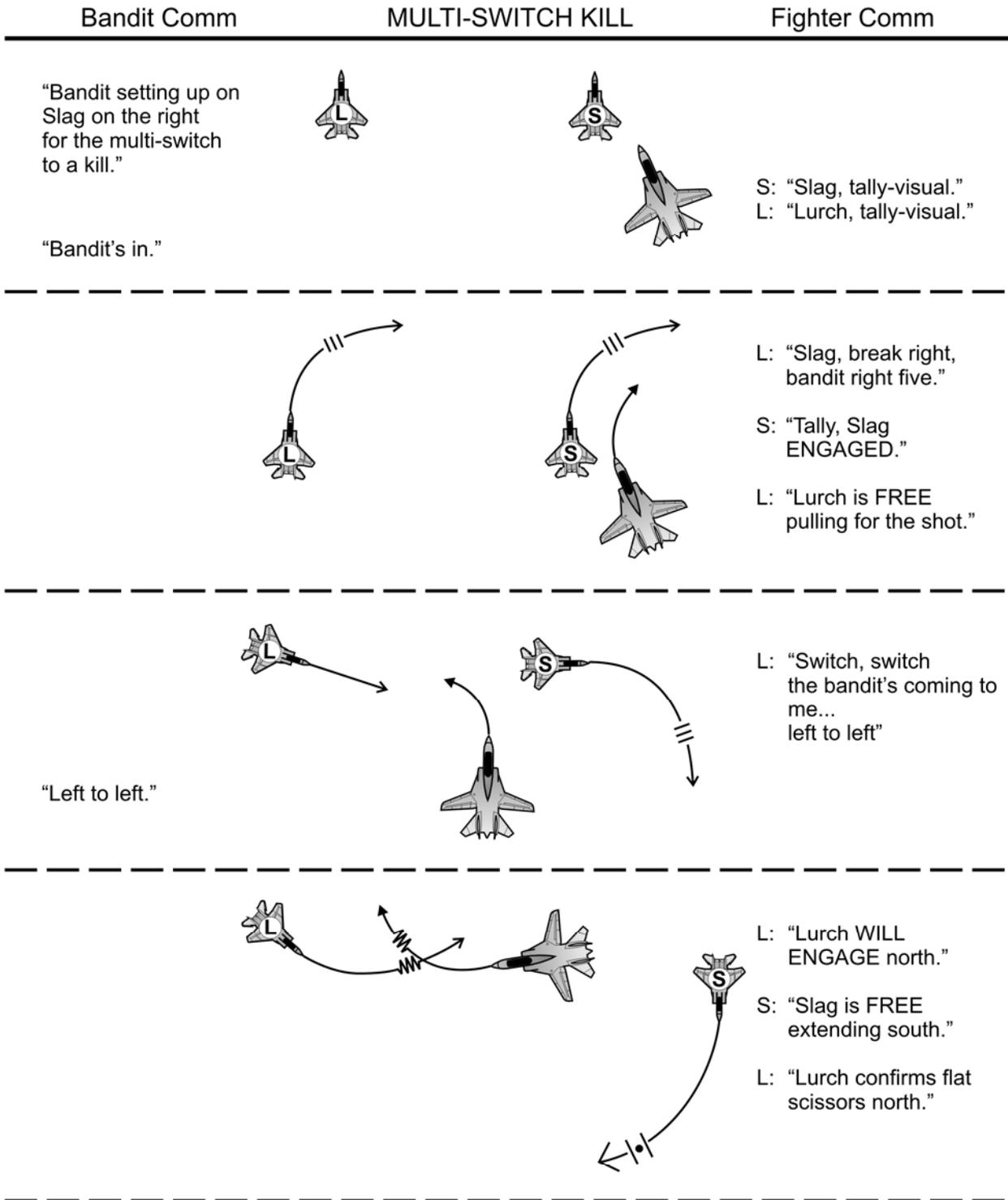


If the bugout appears to be unsuccessful, call for wing to break into the bandit. Utilize counterflow or multi-switch tactics as necessary. The first fighter to the bandit SHOULD become the FREE fighter.



S: "Slag, knock it off."

L: "Lurch, knock it off."



Bandit Comm	MULTI-SWITCH KILL (Cont.)	Fighter Comm
<p>If "Two in sight," engaged fighter describe bandit's position, i.e., "Bandit's on the left in a right turn."</p>		<p>S: "Slag turning in,..."</p> <p>"Zero in sight" or "One in sight" or "Two in sight"</p>
<p>If "1" in sight, engaged fighter transmits, "Stand by for merge."</p>		
<p>If "0" in sight, engaged fighter describe type of fight, heading, and altitude, "Lurch, engaged horizontal scissors, 360, 19,000."</p>		
<p>If free fighter does not have sight, the engaged fighter must stay engaged.</p>		<p>L: "Heads up the bandit's nose is low... Looks like the bandit is coming to you."</p> <p>S: "Right to right."</p>
<p>"Bandit, right to right."</p>		

