FLIGHT TRAINING
INSTRUCTION

PRIMARY FORMATION

T-6B

2020
CNATRA P-766 (Rev. 04-20)

Subj: FLIGHT TRAINING INSTRUCTION, PRIMARY FORMATION, T-6B

1. CNATRA P-766 (Rev. 04-20) PAT, "Flight Training Instruction, Primary Formation, T-6B" is issued for information, standardization of instruction, and guidance to all flight instructors and student military aviators in the Naval Air Training Command.

2. This publication is an explanatory aid to the T-6B Joint Primary Pilot Training curriculum and shall be the authority for the execution of all flight procedures and maneuvers herein contained.

3. Recommendations for changes shall be submitted via the electronic TCR form located on the CNATRA website.

4. CNATRA P-766 (Rev. 05-11) PAT is hereby cancelled and superseded.

[S. E. HNATT]
By direction

Distribution:
CNATRA Website
FLIGHT TRAINING INSTRUCTION

FOR

PRIMARY FORMATION

T-6B

P-766
LIST OF EFFECTIVE PAGES

Dates of issue for original and changed pages are:
Original...0...12 Mar 10
Revision...1...25 May 11
Revision...2...06 April 20

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 94 CONSISTING OF THE FOLLOWING:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>COVER</td>
<td>0</td>
<td>5-1 – 5-6</td>
<td>0</td>
</tr>
<tr>
<td>LETTER</td>
<td>0</td>
<td>6-1 – 6-9</td>
<td>0</td>
</tr>
<tr>
<td>iii – ix</td>
<td>0</td>
<td>6-10 (blank)</td>
<td>0</td>
</tr>
<tr>
<td>x (blank)</td>
<td>0</td>
<td>A-1 – A-4</td>
<td>0</td>
</tr>
<tr>
<td>1-1 – 1-11</td>
<td>0</td>
<td>B-1 – B-9</td>
<td>0</td>
</tr>
<tr>
<td>1-12 (blank)</td>
<td>0</td>
<td>B-10 (blank)</td>
<td>0</td>
</tr>
<tr>
<td>2-1 – 2-3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-4 (blank)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-1 – 3-13</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-14 (blank)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-1 – 4-24</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
INTERIM CHANGE SUMMARY

The following Changes have been previously incorporated in this manual:

<table>
<thead>
<tr>
<th>CHANGE NUMBER</th>
<th>REMARKS/PURPOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The following interim Changes have been incorporated in this Change/Revision:

<table>
<thead>
<tr>
<th>INTERIM CHANGE NUMBER</th>
<th>REMARKS/PURPOSE</th>
<th>ENTERED BY</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SAFETY/HAZARD AWARENESS NOTICE

This course does not require any special safety precautions other than those normally practiced on the flight line.

TERMINAL OBJECTIVE

Upon completion of this course, the student shall be able to direct specified two-plane formation maneuvers in the T-6B aircraft.

INSTRUCTIONAL PROCEDURES

1. This is a flight training course and will be conducted in the Operational Flight Trainer (OFT) and the T-6B aircraft.

2. The student will demonstrate a functional knowledge of the material presented in this Flight Training Instruction (FTI) manual and other various instructional references.

INSTRUCTIONAL REFERENCES

1. T-6B NATOPS Flight Manual

2. Local Standard Operating Procedures (SOP) Instruction
# TABLE OF CONTENTS

LIST OF EFFECTIVE PAGES ........................................................................ iv  
INTERIM CHANGE SUMMARY ..................................................................... v 
SAFETY/HAZARD AWARENESS NOTICE ................................................ vi 
TABLE OF CONTENTS ................................................................................... vii 
TABLE OF FIGURES .................................................................................... ix 

## CHAPTER ONE - INTRODUCTION TO FORMATION ........................................ 1-1 
100. INTRODUCTION ...................................................................................... 1-1  
101. FORMATION DEFINED ........................................................................... 1-1  
102. FLIGHT DISCIPLINE ............................................................................... 1-1  
103. RELATIVE MOTION ................................................................................ 1-2  
104. RADIUS OF TURN .................................................................................. 1-4  
105. PURSUIT GEOMETRY ............................................................................ 1-5  
106. FORMATION COMMUNICATIONS ........................................................... 1-8  
107. FUEL AWARENESS ............................................................................. 1-10 

## CHAPTER TWO - GROUND PROCEDURES ............................................... 2-1 
200. INTRODUCTION ...................................................................................... 2-1  
201. OUTBOUND ........................................................................................... 2-1  
202. TAXI ...................................................................................................... 2-1 

## CHAPTER THREE - DEPARTURES .............................................................. 3-1 
300. LINE-UP ................................................................................................ 3-1  
301. INTERVAL TAKEOFF ............................................................................. 3-2  
302. INTERVAL ABORT .................................................................................. 3-3  
303. INITIAL RENDEZVOUS/DEPARTURE/CLIMBOUT .............................. 3-3  
304. RUNNING RENDEZVOUS ...................................................................... 3-4  
305. RENDEZVOUS UNDERRUN .................................................................. 3-5  
306. SECTION TAKEOFF .............................................................................. 3-8  
307. SECTION ABORT ................................................................................... 3-10  
308. INSTRUMENT DEPARTURES ................................................................. 3-10  
309. CLIMB AND LEVEL-OFF ...................................................................... 3-12  
310. OPERATIONS CHECKS ......................................................................... 3-13 

## CHAPTER FOUR - SECTION PARADE ...................................................... 4-1 
400. INTRODUCTION ...................................................................................... 4-1  
401. THE PARADE SEQUENCE ................................................................... 4-1  
402. PARADE POSITION ............................................................................... 4-2  
403. PARADE TURNS .................................................................................... 4-3  
404. CROSSUNDER ...................................................................................... 4-7  
405. BREAKUP AND RENDEZVOUS .............................................................. 4-9  
406. CRUISE FORMATION ........................................................................... 4-14  
407. CRUISE MANEUVERING ...................................................................... 4-15
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>SECTION RECOVERY</td>
<td>5-1</td>
</tr>
<tr>
<td>500</td>
<td>INTRODUCTION</td>
<td>5-1</td>
</tr>
<tr>
<td>501</td>
<td>RECOVERY OVERVIEW</td>
<td>5-1</td>
</tr>
<tr>
<td>502</td>
<td>THE BREAK</td>
<td>5-2</td>
</tr>
<tr>
<td>503</td>
<td>SECTION APPROACHES</td>
<td>5-3</td>
</tr>
<tr>
<td>504</td>
<td>TAKING SPACING ON FINAL</td>
<td>5-5</td>
</tr>
<tr>
<td>505</td>
<td>NORDO APPROACH</td>
<td>5-5</td>
</tr>
<tr>
<td>506</td>
<td>SECTION MISSED APPROACH</td>
<td>5-6</td>
</tr>
<tr>
<td>507</td>
<td>RECOVERY TAXI</td>
<td>5-6</td>
</tr>
<tr>
<td>6</td>
<td>EMERGENCIES</td>
<td>6-1</td>
</tr>
<tr>
<td>600</td>
<td>INTRODUCTION</td>
<td>6-1</td>
</tr>
<tr>
<td>601</td>
<td>AIRCRAFT MAINTENANCE PROBLEMS ON DECK</td>
<td>6-2</td>
</tr>
<tr>
<td>602</td>
<td>RADIO FAILURES (NORDO)</td>
<td>6-2</td>
</tr>
<tr>
<td>603</td>
<td>INADVERTENT IMC</td>
<td>6-3</td>
</tr>
<tr>
<td>604</td>
<td>WINGMAN LOST SIGHT</td>
<td>6-3</td>
</tr>
<tr>
<td>605</td>
<td>BLIND PROCEDURES</td>
<td>6-4</td>
</tr>
<tr>
<td>606</td>
<td>SECTION PRECAUTIONARY EMERGENCY LANDING (PEL)</td>
<td>6-6</td>
</tr>
<tr>
<td>607</td>
<td>UNSAFE LANDING GEAR INDICATIONS</td>
<td>6-7</td>
</tr>
<tr>
<td>608</td>
<td>AIRBORNE LANDING GEAR INSPECTION</td>
<td>6-8</td>
</tr>
<tr>
<td>609</td>
<td>MID-AIR/AIRBORNE DAMAGED AIRCRAFT/BIRDSTRIKE</td>
<td>6-8</td>
</tr>
<tr>
<td>610</td>
<td>DOWN AIRCRAFT PROCEDURES</td>
<td>6-9</td>
</tr>
</tbody>
</table>

APPENDIX A - GLOSSARY

APPENDIX B - VISUAL SIGNALS
<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1-1</td>
<td>Vertical Movement</td>
<td>1-3</td>
</tr>
<tr>
<td>Figure 1-2</td>
<td>Horizontal Movement with Power</td>
<td>1-3</td>
</tr>
<tr>
<td>Figure 1-3</td>
<td>Horizontal Movement with Aileron</td>
<td>1-4</td>
</tr>
<tr>
<td>Figure 1-4</td>
<td>Radius of Turn</td>
<td>1-4</td>
</tr>
<tr>
<td>Figure 1-5</td>
<td>Lead Pursuit</td>
<td>1-5</td>
</tr>
<tr>
<td>Figure 1-6</td>
<td>Pure Pursuit</td>
<td>1-6</td>
</tr>
<tr>
<td>Figure 1-7</td>
<td>Lag Pursuit</td>
<td>1-7</td>
</tr>
<tr>
<td>Figure 2-1</td>
<td>Trail Taxi</td>
<td>2-2</td>
</tr>
<tr>
<td>Figure 2-2</td>
<td>Stagger Taxi</td>
<td>2-2</td>
</tr>
<tr>
<td>Figure 3-1</td>
<td>Runway Positioning for Takeoff</td>
<td>3-1</td>
</tr>
<tr>
<td>Figure 3-2</td>
<td>Run-Up and Takeoff</td>
<td>3-2</td>
</tr>
<tr>
<td>Figure 3-3</td>
<td>Rendezvous Underrun</td>
<td>3-6</td>
</tr>
<tr>
<td>Figure 3-4</td>
<td>Underrun – Lead is in a turn</td>
<td>3-7</td>
</tr>
<tr>
<td>Figure 3-5</td>
<td>Blind Rendezvous</td>
<td>3-11</td>
</tr>
<tr>
<td>Figure 4-1</td>
<td>Parade Position</td>
<td>4-2</td>
</tr>
<tr>
<td>Figure 4-2</td>
<td>Excessive Step-up</td>
<td>4-3</td>
</tr>
<tr>
<td>Figure 4-3</td>
<td>VMC Turn Away from Wingman</td>
<td>4-4</td>
</tr>
<tr>
<td>Figure 4-4</td>
<td>Turn into Wingman</td>
<td>4-6</td>
</tr>
<tr>
<td>Figure 4-5</td>
<td>Crossunder</td>
<td>4-8</td>
</tr>
<tr>
<td>Figure 4-6</td>
<td>Breakup</td>
<td>4-10</td>
</tr>
<tr>
<td>Figure 4-7</td>
<td>60° Bearing Line (Left Orbit)</td>
<td>4-11</td>
</tr>
<tr>
<td>Figure 4-8</td>
<td>Sucked Position (Left Orbit)</td>
<td>4-12</td>
</tr>
<tr>
<td>Figure 4-9</td>
<td>Acute Position (Left Orbit)</td>
<td>4-12</td>
</tr>
<tr>
<td>Figure 4-10</td>
<td>Cruise Position (60° Cone)</td>
<td>4-15</td>
</tr>
<tr>
<td>Figure 5-1</td>
<td>Instrument Approach Position</td>
<td>5-4</td>
</tr>
<tr>
<td>Figure 6-1</td>
<td>Blind Rendezvous</td>
<td>6-5</td>
</tr>
<tr>
<td>Figure 6-2</td>
<td>Section PEL Profile</td>
<td>6-7</td>
</tr>
<tr>
<td>Figure B-1</td>
<td>General Signals</td>
<td>B-1</td>
</tr>
<tr>
<td>Figure B-2</td>
<td>Takeoff Signals</td>
<td>B-2</td>
</tr>
<tr>
<td>Figure B-3</td>
<td>General Airborne Signals (1)</td>
<td>B-3</td>
</tr>
<tr>
<td>Figure B-4</td>
<td>General Airborne Signals (2)</td>
<td>B-4</td>
</tr>
<tr>
<td>Figure B-5</td>
<td>General Airborne Signals (3)</td>
<td>B-5</td>
</tr>
<tr>
<td>Figure B-6</td>
<td>General Airborne Signals (4)</td>
<td>B-5</td>
</tr>
<tr>
<td>Figure B-7</td>
<td>General Airborne Signals (5)</td>
<td>B-6</td>
</tr>
<tr>
<td>Figure B-8</td>
<td>General Airborne Signals (6)</td>
<td>B-7</td>
</tr>
<tr>
<td>Figure B-9</td>
<td>General Airborne Signals (7)</td>
<td>B-8</td>
</tr>
<tr>
<td>Figure B-10</td>
<td>Approach Signals</td>
<td>B-9</td>
</tr>
</tbody>
</table>
CHAPTER ONE
INTRODUCTION TO FORMATION

100. INTRODUCTION

The formation syllabus is one of the most challenging and exciting stages in Primary Flight Training. The purpose of this syllabus is to teach students the concepts of mutual support and to understand, recognize, and control relative motion as it applies to formation flying.

From the early days of Naval Aviation, formation flying has been instrumental in the tactical application of aircraft. Whether you are the wingman on a cross-country flight or the flight lead on a multi-plane combat strike mission, flying safe and efficient formation is critical to the success of the mission. Because flying formation is a team effort, the success of the flight depends upon individual efforts coordinated with other flight members.

In addition to the ability to concentrate firepower, formation flying also offers the inherent advantages of mutual support, improved command and control, and the ability to mass combat forces in a concentrated area. Military aircraft of all types are routinely called upon to perform missions where formation proficiency is an applied task.

101. FORMATION DEFINED

A formation consists of two or more aircraft flying in relatively close proximity to each other, providing pre-briefed mutual support for each other. The smallest formation unit is a section, which consists of two aircraft: a Section Leader and a Wingman. Next in size is a division, which consists of three or more aircraft. Adding sections or divisions, as required, makes larger formations. The Formation Lead is commonly referred to as “Lead,” while the Wingman is often referred to as “Wing” or “Dash 2” (sometimes written as -2, -3, -4, etc. in larger formations).

102. FLIGHT DISCIPLINE

The Designated Flight Lead is an administrative position, that in Primary is the instructor pilot designated on the flight schedule by the commanding officer. The Designated Flight Lead is the pilot who is ultimately responsible for the mission objectives and the safe and orderly conduct of the flight. The Flight Lead may fly in either position (Lead or Wing) during the conduct of the flight.

The Formation Lead is a physical position that may change throughout the flight. The Formation Lead is the pilot at the controls who is flying the lead position and is responsible for immediate conduct of the flight. These responsibilities include:

1. Performing smooth/consistent, stable, and predictable changes in power, heading, and altitude.

2. Keep the flight within the proper operating area and comply with local course rules.
3. Keep the flight clear of clouds (unless on an IFR clearance) and other aircraft.

4. Always know where Wing is.

5. Execute the briefed formation sequence utilizing proper visual and radio communications.

Formation flying requires “thinking ahead of the aircraft” and proactive planning. Everything takes a little longer to accomplish in a formation. Common tasks like changing radio frequencies or maneuvering require more time in formation; therefore, Lead will have to plan accordingly. In order to maneuver the flight safely and effectively within the confines of the designated formation area, Lead must first possess a clear understanding of the area boundaries. Additionally, Lead must be able to visualize how a combination of maneuvers can be utilized to guide the flight within those boundaries. Wind speed and direction will affect the flight’s ground track and should be considered. Finally, Lead should be conscious of the sun's position relative to Wing and should limit the Wingman’s exposure to looking into the sun as much as possible.

The Wingman is the pilot in the aircraft in the wing position. Wingman responsibilities include:

1. Keep Lead in sight and maintain flight path deconfliction.

2. Maintain proper position.

3. Comply with Lead’s signals and give timely response.

4. Provide mutual support: Be prepared to assume the lead at any time – back up lead with navigation, communication, etc.

103. RELATIVE MOTION

Essentially, formation flying is nothing more than controlling the relative motion between aircraft. Lead is considered to be fixed, and any movement between aircraft is considered movement of the Wingman in relation to the Lead. In the Contact stage, the horizon is used as the primary attitude reference. In Formation, Lead’s aircraft becomes the primary reference for attitude control for their wingman. Relative motion can be resolved into movement about any one or combination of all three axes. Vertical movement (Figure 1-1) is primarily controlled by elevator inputs to climb/descend relative to Lead. Horizontal movement can be controlled by using power to move fore/aft (Figure 1-2) and by using aileron to move left/right (Figure 1-3) relative to Lead. Strive to maintain perfect positioning, but understand that Wing will only be there for a fleeting moment. The best formation pilots in the world rarely maintain position for an extended period of time. What makes a good formation pilot is the ability to recognize and limit deviations and make timely and efficient corrections.

When Wing is forward of bearing line, they are Acute. When Wing is aft of bearing line, they are Sucked. Closure is the relative rate at which Wing is approaching Lead, and Opening is the relative rate at which Wing is receding from Lead. The farther Wing is away from Lead, the more challenging it is to detect/correct position changes. Good formation flying is the result of
anticipation and the use of small, timely corrections about all three axes. While learning to fly formation, always correct for Altitude, Bearing, and then Closure/Separation (referred to as “the A-B-C’s”). There are four possible errors in regards to the bearing line, they are broken down to “Acute with power,” “Sucked with power,” “Acute with aileron,” and “Sucked with aileron.” These common errors are shown in the figures below:

![Figure 1-1 Vertical Movement](image1)

![Figure 1-2 Horizontal Movement with Power](image2)
104. RADIUS OF TURN

Another key to good formation flying is to clearly understand radius of turn and how it relates to controlling position. Because the Lead aircraft acts as the source of all position information, Wing needs to anticipate position corrections in relation to Lead’s radius of turn. If Lead turns into Wing’s position, Wing will require less power to complete the turn because he is flying a smaller radius of turn. Failing to reduce power will cause Wing to become Acute. When the Lead turns away from Wing’s position, Wing will require more power because he is flying a larger radius of turn. Failing to increase power will cause Wing to become Sucked. Radius of turn concepts will be utilized for initial Rendezvous, Parade Turns, Breakup and Rendezvous, Cruise Maneuvering, and Tail Chase. Leading all turns with a power change in wing is required to maintain position. Think of radius of turn like running on a track: the runner on the outside lane has to work harder to keep up with the runner on the inside lane and vice versa.
105. PURSUIT GEOMETRY

The concept of pursuit geometry between aircraft is fundamental to formation maneuvering. This geometry relates specifically to flight paths and planes of motion which can get very complex and convoluted. For the purposes of this FTI, we will assume both aircraft are moving forward at the same speed and in the same plane of motion. With that assumption, aircraft nose position relative to the other aircraft will determine the type of pursuit. There are three basic types of pursuit:

1. **Lead Pursuit** (Figure 1-5) is used to decrease nose-to-tail separation. For lead pursuit, the nose is positioned in front of the other aircraft’s flight path. Eventually, lead pursuit will develop into an aft Line-of-Sight (LOS) movement of Lead’s aircraft in Wing’s windscreen.

![Figure 1-5 Lead Pursuit](image-url)
2. **Pure Pursuit** (Figure 1-6) is achieved by putting Wing’s nose on Lead’s aircraft. In pure pursuit there is no LOS movement; the other aircraft remains fixed at 12 o’clock in the canopy. A co-airspeed pure pursuit picture initially creates closure that diminishes over time until the fuselages are aligned and there is no closure.

3. **Lag Pursuit** (Figure 1-7) is used to maintain or increase nose-to-tail separation. Lag pursuit starts with nose position behind the other aircraft and results in a forward LOS movement of Lead’s aircraft in Wing’s windscreen. A small amount of lag pursuit (lead aircraft inside of the canopy bow) with slight fuselage misalignment can result in a constant nose-to-tail separation. Greater amounts of lag pursuit will result in increased nose-to-tail separation.
Keys to Successful Formation Flying:

1. **Relax**: using a light touch on the aircraft controls.

2. **Keep the aircraft trimmed**. It is very difficult to make fine corrections if the aircraft is not trimmed.

3. **Scan** Lead’s entire aircraft and do not fixate on any one checkpoint.

4. **Use three part corrections**. Every initial correction needs to have a corresponding 2 point re-correction. For example, if aft of the bearing line: (1) add power to begin moving forward, (2) reduce power approaching bearing line to stop the forward movement, and (3) re-set power somewhere in the middle to stabilize on the bearing line.
106. FORMATION COMMUNICATIONS

Your visual or radio communications within the flight must be clear and timely to avoid confusion. The Wingman should have time to acknowledge the signal before Lead executes the maneuver.

Communications in formation are the same as in previous stages with some minor differences. The flight will essentially use two call signs: An ATC call sign to communicate with outside agencies (e.g., ATC, Base, etc.) and a tactical (TAC) call sign selected by the flight for inter-flight communications. Students are encouraged to select a tactical call sign with no more than one or two syllables (e.g., “ANGRY,” “RAIDER,” “HAMMER”). Flight Lead’s TAC call sign “Angry One One” will not change even if flying “Dash 2.” The other aircraft in the flight will keep their appropriate TAC call signs (“Angry One Two,” “Angry One Three”).

Tactical Frequency: Each formation flight will utilize designated and pre-briefed tactical frequencies. Each flight will pre-brief both a primary and secondary UHF and a primary and secondary VHF frequency. These tactical frequencies will be utilized for the sole purpose of inter flight communications allowing all aircraft in the flight a discrete frequency to communicate on as needed. Lead will conduct a radio check-in while on the ground on the tactical frequency and each aircraft will remain on that frequency at all times. In the event of the need to change to a secondary tactical frequency or the requirement for the flight to change from VHF to UHF or UHF to VHF tactical frequencies, Lead will direct the change with a positive check in following the tactical frequency change.

Example

Lead: “Angry, switch VHF TAC.”

Both aircraft change to pre-briefed VHF tactical frequency.

Lead: “(TAC call sign)”

Wing: “(TAC call sign)”

Lead then directs additional radio changes as needed.

NOTE

Lead and Wing must always have direct communication with each other via the pre-briefed tactical frequency which is confirmed with a positive check-in each time the tactical frequency is changed.

There is no need for Lead to conduct a check in on ATC, area common, CTAF or other frequencies because the flight is already on, and has already conducted a positive check in, on the briefed tactical frequency. Wing will monitor all other assigned frequencies and conducted
radio changes with Lead as needed. If at any time you are in doubt of the correct frequency for the PRI radio use the tactical frequency to “get-well.”

There are three methods for the flight to change radio frequencies. Pre-briefed automatic frequency changes (“Auto Switches”), ATC directed radio changes, and Lead directed frequency changes using the pre-briefed tactical frequency.

**Radio switches with check-ins should never be conducted over ATC or other controlling frequencies in an effort to limit communications on saturated communication frequencies. It is the responsibility of Wing to ensure they are on the appropriate frequency or to query Lead to “get-well.”**

The Formation Lead will conduct all communications with outside controlling agencies, and Wing will monitor and back Lead up as necessary. Lead should give sufficient time for Wing to change frequencies prior to communicating with the controlling agency.

**Radio Usage:** Use the radio instead of hand signals under Instrument Meteorological Conditions (IMC) conditions and/or anytime there is confusion in order to change position or configuration or otherwise communicate between formation aircraft. It is imperative that Wing listen to the radios and change frequencies with Lead.

**Visual Signal:** Lead can initiate the frequency change through the use of a visual signal, but the flight must be in a “stable” condition and the Wingman should be in a position to see the signal. The visual signal can be used both on the ground and airborne. If Lead taps their helmet and then passes one or two digits, they are referring to a preset button or frequency. If a manual frequency is to be passed, Lead will pass the frequency change by tapping the side of their helmet, followed by sequentially holding up the number of fingers equal to the digits of the frequency being passed. Numbers 6 through 9 are passed with fingers horizontal by indicating the number which, when added to 5, gives the desired number from 6-9. The number zero is indicated by a closed fist. The Wingman will indicate they have received the signal with a head nod. Visual signals will generally be given to Wing when in parade.

The Wingman will be expected to make frequency changes while maintaining the proper formation position; mid-air deconfliction is Wing’s primary responsibility. Some situations may require Wing to slightly increase lateral separation, if visibility permits, but resume position once the switch is complete. For preset frequency changes, input the new frequency, glance quickly to verify the correct preset frequency, continue with transmissions as appropriate. For manual frequency changes, Wing should enter one frequency digit at a time, while keeping their eyes on Lead. Take quick glances to verify the correct manual frequency.

**NOTE**

Execute visual signals high on the canopy, away from the face, in clear view of the Wingman. Some signals may have to be exaggerated for clearer interpretation.
The Formation stage emphasizes proper communication procedures, communication brevity, and teamwork throughout the flight.

Common Errors:

1. Lead does not give Wing enough time to set a new frequency (i.e., starts transmitting immediately after frequency change).

2. Lead “steps” on other transmissions on the new frequency.

3. Lead does not provide a stable formation platform for Wing during a frequency change (e.g., poor Wingman consideration).

107. FUEL AWARENESS

Knowing the fuel state of both aircraft at all times is essential. Lead must know the aircraft with the lowest fuel state in the flight for planning purposes. The same information is critical if Wing has to assume the Lead. To determine the flight’s fuel state, Lead will direct Operations Checks commonly referred to as “Ops Checks” at various points during the flight. Lead will then use the lowest fuel state in the flight for planning purposes. Understanding the definitions of Joker, Bingo, and Divert Fuel is required:

**JOKER:** A predetermined fuel state (above Bingo fuel) that signifies when the allotted fuel for a particular phase of the profile has been exhausted. Upon reaching Joker, the current maneuvers need to be terminated so that there is sufficient fuel for the next portion of the planned profile. In the Primary formation syllabus, Joker will normally be used in order to split time for each student to conduct formation maneuvers as Wing. Joker may also be used in order to save fuel for pattern work or other reasons determined by the Flight Lead.

**BINGO:** A predetermined fuel state at which time the flight needs to commence recovery in order to land with minimum fuel requirements. When either aircraft in the flight reaches BINGO fuel, terminate the area profile and commence the recovery phase.

**DIVERT FUEL:** A predetermined fuel state which allows all aircraft in the flight to divert to their briefed alternate. This fuel state will normally be higher than it would be as a single ship due to the added fuel needed in separating the flight as weather may dictate.

**NOTE**

Mission priorities and flight conditions may change while airborne (e.g., working area, weather conditions, alternate airfield requirements, etc.). The Flight Lead may adjust JOKER and (or) BINGO/DIVERT fuels during flight to accommodate mission conditions. When a new JOKER or BINGO is set, Wingman shall acknowledge with the new JOKER / BINGO.
Example

Lead: “Angry, set JOKER 870 (eight-seven-zero).”

Wing: “(TAC call sign), 870 (eight-seven-zero).”

When either member of the flight reaches JOKER or BINGO, they will call “(TAC call sign), Joker” or “(Tac call sign), Bingo” over the tactical frequency. Lead will then direct the flight to set a new assigned fuel state.

NOTE

It is not necessary to wait until the flight actually reaches JOKER or BINGO to set a new assigned fuel state. JOKER and BINGO correspond to a particular phase of flight, so Lead should direct the flight to set the new assigned fuel state once that phase of flight is commenced.
CHAPTER ONE

INTRODUCTION TO FORMATION

1-12

INTRODUCTION TO FORMATION
CHAPTER TWO
GROUND PROCEDURES

200. INTRODUCTION

Teamwork is an essential element to good formation. Studying, setting up a briefing space, briefing, pre-flight, post-flight, and debrief should all be a team effort. The following ground procedures will be common to all formation flights.

201. OUTBOUND

Aircraft issue and preflight will be conducted in the same manner as any syllabus flight. Students should note and record the assigned spot for both aircraft on the flight line. Maintenance will attempt to assign aircraft next to each other on formation sorties. If the aircraft are not parked next to each other, it is imperative to immediately set the briefed VHF TAC frequency once the battery is turned on to facilitate communication. If delays are encountered on the ground, relay the applicable information to other aircraft via TAC frequency. Both Lead and Wing should then follow Lead’s briefed communication sequence.

Set up the communications in accordance with (IAW) local SOP, Course Rules and flight brief.

1. Conduct radio check-in IAW local SOP or Course Rules.

2. All aircraft in the flight will monitor and copy ATIS and ATC clearances and set the appropriate transponder code and altimeter setting. Wing will set the appropriate squawk and leave the transponder in “standby.”

3. TCAS will be used at Flight Lead/IP discretion; usually the aircraft in lead position will maintain TCAS for the flight. If the flight separates for any reason (for training such as PEL, or for deteriorating weather), Wing shall immediately set their transponder to ALT and TCAS to ON.

202. TAXI

Taxi to the run-up area will normally be in the Trail Taxi position IAW local SOP or Course Rules. Trail is set by Wing taxiing directly behind Lead's aircraft, while maintaining no closer than 1 plane length from Lead. This distance is best estimated by making Lead’s wingspan fill the HUD field of view. Wing will taxi with enough spacing to avoid a collision in the event of a brake failure.

Following the run-up, Wing can assume the Stagger Taxi position if the taxiway width and local SOP or Course Rules allows. The stagger position for Lead is to establish their aircraft in the center of the appropriate side of the taxiway. Wing should taxi approximately one to two plane lengths behind Lead centered on their own side of the taxiway.
Lead should taxi at a speed that does not force Wing to exceed published Taxi speeds to remain in position. Lead should monitor Wing during taxi and adjust taxi speed as necessary.

![Figure 2-1 Trail Taxi](image)

Figure 2-1 Trail Taxi

Lead shall position themselves in the run-up area with sufficient spacing to allow for hand signals and a visual inspection for both aircraft. Wing should park abeam Lead, with nose wheel centered. Wing *SHALL NOT OVERLAP* wings. Each aircraft will individually complete the
Overspeed Governor and Before Takeoff Checklists. When both checklists and integrity checks are complete, the Wingman will initiate a “thumbs-up” to the Lead aircraft indicating that Lead’s aircraft passed its integrity check. Wing will hold this hand signal until receiving a thumbs-up from Lead indicating that Wing’s aircraft has passed its integrity check. If any of the inspection items are not correct, the inspecting aircraft shall make an appropriate radio transmission to identify the problem.

INTEGRITY CHECK

1. Fuselage: (cowlings, panels, and antennas secure. No visible leaks)

2. Wing: (flap position, lights set)

3. Gear: (proper strut extension, tire inflation)

Lead will conduct radio calls IAW SOP or Course Rules, then taxi the flight to the hold-short line of the active runway where the flight will conduct a radio switch to tower in accordance with the brief.
CHAPTER THREE
DEPARTURES

300. LINE-UP

Once the flight has been given clearance for takeoff, Lead will note the wind sock if available, and position himself on the downwind side of the runway. Each aircraft will conduct the Line-up Checklist while crossing the hold short line positioning themselves on center of their respective side of the runway. Lead will place their aircraft on the downwind side of the runway, which allows Lead’s wake turbulence and propeller wash to blow away from Wing during the takeoff roll. If the winds are reported calm, Lead may take either side of the runway based on departure heading, sun angle, etc. Lead will allow enough room for Wing to turn and taxi forward for alignment. Once Wing is certain which side Lead is taking, Wing will taxi to the center of their side of the runway and move forward until the leading edge of their wing is in line with the trailing edge of Lead's horizontal stabilizer.

WARNING

Wake turbulence or Lead aircraft propeller wash may result in severe degradation of Wing aircraft controllability during takeoff.

Figure 3-1 Runway Positioning for Takeoff
301. INTERVAL TAKEOFF

**WARNING**

The runway shall be at least 100' wide to accomplish an interval takeoff.

Once the flight is in position (Figure 3-2) and cleared for takeoff, Lead will pass the run-up signal. Wing will acknowledge with a head nod. Both aircraft will set 30% torque and check for safety of flight items and proper instrument indications (essentially the same checks required for an individual takeoff). When Wing is ready for takeoff, they will do a quick visual inspection of Lead's aircraft and pass a thumbs-up or use the radio to point out any discrepancies. Lead will return the thumbs-up (or thumbs-down as appropriate), look forward, pass the "kiss-off" signal, and proceed with a maximum power takeoff while maintaining their side of the runway. When Lead starts the takeoff roll, the Wingman will begin their takeoff roll five seconds later, allowing for approximately 1000' separation between aircraft. Both aircraft will execute a normal takeoff with the Wing aircraft devoting a portion of their scan on Lead to ensure safe separation is maintained.

![Figure 3-2 Run-Up and Takeoff](image-url)
302. INTERVAL ABORT

Many aviators have found themselves in the dirt by second guessing their decision to abort or continue. Make a decision and stick with it! Every abort situation cannot be addressed, but it is critical that abort contingencies be part of the formation pre-flight brief. When an abort is necessary, simultaneously initiate aborted takeoff procedures (IAW NATOPS) and transmit intentions to the flight. Remember to aviate (maintain control of the aircraft), navigate (remain on your side of the runway tracking down the runway), then communicate (wingman, tower).

**Simultaneous Abort:** If Lead aborts, they shall remain on their side of the runway and transmit intentions as soon as possible; Wing shall abort behind Lead while maintaining their side of the runway. Wing’s five second interval should allow sufficient spacing to abort behind Lead.

**NOTE**

If Lead loses directional control during the aborted takeoff, Wing will make every effort to avoid Lead which may include changing runway sides or departing the prepared surface if the situation dictates.

If Wing aborts, they will execute abort procedures, remain on their side of the runway, and once Lead is safely airborne (and Wing’s aircraft is safely under control), transmit the abort over the radio. Wing’s radio transmission is not as essential in this case because they will be the only one remaining on the runway in a section interval takeoff.

303. INITIAL RENDEZVOUS/DEPARTURE/CLIMBOUT

**Lead:** Once safely airborne, perform the After Takeoff Checklist, level off to clear the pattern complying with local course rules departure procedures. Once clear of the pattern, Lead will set 80% Torque and continue to climb at 160 KIAS (approximately 8-10° nose up on the PFD until Wing is in position. If a turn is required prior to Wing joining in the Parade Position, it will be made at no more than 30° AOB unless directed otherwise. After the rendezvous is complete, Lead has the option of directing Wing to the Cruise Position.

**NOTE**

If Lead is flying an airspeed other than 160 KIAS, be careful not to make a drastic correction due to the increase in Wing’s closure rate.

**Wing:** Once safely airborne perform the After Takeoff Checklist, climb to place Lead on or slightly above the horizon, and move to the inside of any departure turn to expedite the join. All maneuvering must still comply with local SOP or Course Rules. If attempting to rendezvous in a turn, Wing will apply the same checkpoints used in the standard breakup and rendezvous (section 405). It is imperative that Wing be conscious of their airspeed and closure rate. When
Lead rolls wings level, commence a running rendezvous. Wing will maintain no more than 40 KIAS of closure until joined.

**304. RUNNING RENDEZVOUS**

The Running Rendezvous is used to join a flight while proceeding on course. The Running Rendezvous is primarily a “Power Rendezvous” used after a departure.

Once Lead has rolled out of a turn, Wing will maintain the side they are established on and continue with the Rendezvous using power. Placing Lead just above the horizon will give the appropriate step-down initially until the exhaust stack becomes discernable. Wing will then transition to placing the exhaust stack tangent to the leading edge of Lead’s wing to maintain proper step-down for the remainder of the join-up. Wing must also maintain appropriate lateral separation to ensure safe separation and arrive on the bearing line. Once Altitude and Bearing is established, Wing will then maneuver into Parade Position.

**WARNING**

Wing shall never approach Lead from the 6 o’clock position because closure is very difficult to discern and may become excessive while in close. It is important for Wing to establish proper step-down to ensure vertical separation and then establish proper lateral separation while working towards the bearing line and parade checkpoints.

Airspeed should be monitored throughout closure so that no more than 40 KIAS excess of Leads airspeed is maintained. Inside 1000’ of nose-to-tail distance, Wing should observe Lead’s aircraft displace from the 11/1 o’clock position and begin to drift aft on the canopy as Wing approaches the bearing line. At this time, power should begin to be gradually reduced as Lead will appear to track aft with an increasing rate along the canopy as the Wingman approaches the bearing line. Wing should keep Lead’s speed in mind and crosscheck their own speed to judge closure rate. Wing should continue to track on a parallel course to the targeted position abeam the Lead and arrive on the bearing line while stabilizing and matching Leads airspeed. Wing will complete the join by collapsing the distance while maintaining bearing line until in Parade Position, this final portion of the join will require power and aileron toward Lead to move into position.

**Running Rendezvous Keys to Success:**

**Lead**

1. Be a stable platform while complying with Course Rules departure.

2. Monitor Wing during the critical last stages of the rendezvous.
Wing

1. Use proper takeoff interval.
2. Avoid excessive closure rates.
3. Maintain proper step-down at all times.
4. If uncomfortable with the closure rate or bearing, execute the underrun procedures.
5. Trim for the increasing airspeed and re-trim after stabilizing in position.

Running Rendezvous Common Errors:

Lead

1. Allows airspeed to wander, setting Wing up for an underrun or delaying the rejoined.
2. Improper departure procedures resulting in poor Wingman considerations.
3. Erratic or abrupt power changes, abrupt roll rate or level off.

Wing

1. Fails to trim for increasing airspeed.
2. Exceeds recommended closure speed.
3. Misjudges relative motion and closure causing stagnation or an underrun.
4. Not maintaining sufficient lateral separation until arriving on bearing. This makes closure difficult to judge, often resulting in common error #3.

305. RENDEZVOUS UNDERRUN

The underrun procedure allows Wing to get out of an unsafe situation during the rendezvous phase, stabilize clear of Lead, and then safely rejoin. Wing should always approach the rendezvous with a conservative mindset. Wing will initiate an underrun when any of the following situations occur:

1. Wing develops an excessive closure rate.
2. Wing becomes excessively Acute.
3. Wing gets Acute in close to Lead and is too close to make angle of bank corrections.
4. Anytime Wing feels uncomfortable and in their judgment an unsafe situation has developed.

5. Anytime directed to by the Formation Lead.

The underrun procedure shall be executed as follows:

**Lead is wings level:**

1. **LOWER** the nose to maintain step-down.
2. Retard PCL to **IDLE** (speed brake as required) to avoid passing ahead of Lead.
3. Increase **LATERAL** separation using aileron and avoid crossing flight paths.
4. When able, call underrun (**"(TAC call sign), underrun"**).
5. Maneuver as necessary to rejoin in Parade Position.

**Figure 3-3 Rendezvous Underrun**

**Lead is in a turn:**

1. **LOWER** the nose to obtain step-down.
2. **LEVEL** the wings and move to a position outside the Lead’s radius of turn.
3. Retard PCL to **IDLE** to avoid passing ahead of Lead (extend the speed brake if required for excessive closure).
4. **PASS BELOW AND BEHIND** Lead.
5. When stable, and outside of the turn, call underrun ("(TAC call sign), underrun").

6. Maneuver as necessary to rejoin to VMC Turn Away Parade Position.

After performing the underrun procedure, with de-confliction established (passing safely below and aft), expeditiously begin to match Lead's angle of bank and add power (retract the speed brake if it is extended). Avoid getting too long in trail or too far outside Lead’s radius of turn. Wing will call underrun when able. Lead will acknowledge this call with "(TAC call sign)," and will monitor the underrun and be proactive to ensure safe separation is maintained.

![Diagram of Underrun – Lead is in a turn](image)

**Figure 3-4 Underrun – Lead is in a turn**

During the underrun, Wing moves to a stable position by matching Lead’s angle of bank and airspeed, with closure under control, while keeping Lead on or above the horizon. Once stable, Wing will execute the join-up using airspeed differential to a VFR turn away position, remaining outside of Lead’s radius of turn. The Instructor Pilot (IP) may request “back in” to return to the inside of Lead’s turn to attempt the join-up phase again, if desired.

**Example**

Wing (when able): “(TAC call sign), underrun.”

Wing (IP): “(TAC call sign), request back in.”

Lead (IP): “(Wingman TAC call sign), cleared back in.”
Underrun Common Errors:

Wing

1. Wing fails to initiate underrun soon enough, causing insufficient nose-to-tail separation, excessive negative “Gs,” or IP intervention.

2. Wing fails to maintain appropriate step-down during the underrun maneuver. Becoming stepped up before the rejoin will require a descent and may result in excessive closure due to airspeed gained in altitude correction.

3. Leaves PCL at idle after passing beneath and aft of Lead, resulting in excessive separation.

Underrun Keys to Success:

1. Recognize an unsafe/unsalvageable situation early.

2. Taking a conservative approach and not pressing a bad situation.

Just like a waveoff, the key to an underrun is recognizing the unsafe situation early so you can execute the procedure with enough time to ensure safe separation.

306. SECTION TAKEOFF

The section takeoff has many practical advantages. It is frequently used to expedite departures and alleviates the necessity for a rendezvous in poor weather conditions. Wing will fly formation from brake release to rotation and into the airborne phase.

Restrictions. The following conditions will be met to accomplish a section takeoff:

1. Minimum runway width is 150’.

2. The maximum crosswind component is 10 knots for a dry runway and 5 knots for a wet runway.

3. The flight must have non-precision circling minimums or no lower than 1000’ ceiling and 3 miles visibility (basic VFR) if a non-precision approach is not available.

4. No standing water on the runway.

Once cleared onto the runway, each aircraft will complete their Line-up Checklist individually and maneuver to the center of their respective side of the runway.

Lead will position on the downwind side of the runway. If winds are calm or straight down the runway, Lead may choose either side.
Once in position, Lead will pass the run-up signal and each aircraft will set 30% torque. When the run-up and visual inspection are complete and a thumbs-up is received from Wing, Lead will acknowledge with a thumbs-up then straighten their hand with the arm vertical while looking forward. Lead will then drop their arm smoothly in a chopping motion until their arm is parallel to the canopy rail. The rate of arm “chop” should match the rate of PCL advance to follow. After the hand reaches the canopy rail, Lead will release the brakes and smoothly set 90% torque (approximately 5 seconds). When Lead’s arm reaches the canopy rail, Wing will also release brakes and smoothly add power.

Wing will maintain the takeoff bearing with PCL adjustments and rudder inputs. If Wing goes Acute immediately after brake release, he may lightly tap the brakes one time to maintain position but should attempt to correct with power as much as possible. Wing shall not tap or ride the brakes in an effort to maintain bearing.

As the flight approaches 5-10 knots prior to Vr, Lead will smoothly rotate to the takeoff attitude. Lead’s goal is to allow 3-4 seconds for complete nose strut extension. This slow rotation rate will allow Wing to observe nose strut extension and match Lead’s rate of rotation. The Wingman should attempt to match Lead’s attitude. As both aircraft reach flying speed, they will become airborne at the same time. Initially, Wing will be in a level or slightly stepped up position relative to Lead. This position will be momentary and Wing should allow for Lead to continue their climb in order to gain proper step-down. Wing shall not lower their nose to correct step-down while still close to runway.

**NOTE**

Early detection and correction for changes in relative motion are the keys to performing a good section takeoff.

When safely airborne, Lead will survey Wing to ensure the flight is climbing away from the ground and Wing is in a position to see the gear retraction signal. Lead will then distinctly nod their head forward and sharply back to raise the landing gear and flaps when above 110 KIAS minimum. No preparatory gear retraction signal is required because it is implied that the gear will be retracted following takeoff. Alternately, Lead may direct gear retraction via the TAC frequency. Both pilots will then raise the gear and flaps simultaneously. The Wingman will pass the thumbs-up to inform Lead that Wing’s gear and flaps are up and locked and Lead’s gear and flaps appear up and locked. Lead will return the thumbs-up, acknowledging the same.

**NOTE**

Wing should always strive to be “dirtier” than Lead in reference to configuration. Wing should only retract gear and flaps once Leads is in transit, otherwise a closure could develop due to the differential in drag. The first action Wing will notice is the inboard gear doors opening during the gear retraction sequence.
Early lift-off by the Wingman creates a less than ideal situation due to:

1. Close proximity to the ground.
2. Wing’s step-up on Lead.
3. Difficulty in keeping Lead in sight.

In order to keep Lead in sight, Wing should avoid abrupt corrections, gain or maintain lateral separation once safely airborne, and relax back stick pressure slightly to reduce the climb rate. As Lead climbs, Wing will match Lead’s climb attitude, configuration, reestablish bearing line, and join in Parade Position. Do not develop a rate of descent at any time following liftoff.

**Section Takeoff Common Errors:**

1. Either pilot forgetting to accomplish the Line-up Checklist.
2. Lead putting Wing on the wrong side of the runway.
3. Lead forgetting brake release signal (Hand chop).
4. Early and abrupt rotation by Lead.
5. Wing allowing aircraft to fall too far aft.
6. Early rotation by Wing.

**307. SECTION ABORT**

If either aircraft aborts the Section Takeoff after brake release, maintain lateral control of the aircraft and do not cross the centerline of the runway. The abort is easily recognizable because a rapid line of sight rate/large relative motion will develop between the aborting and non-aborting aircraft. The non-aborting aircraft will gain immediate separation by applying PCL to MAX, maintaining their side of the runway, and executing an individual takeoff. For this reason, Wing must maintain wingtip clearance when lining up on the runway and throughout the takeoff. The aborting aircraft will execute the NATOPS abort procedure while maintaining their side of the runway. The good aircraft should only abort if safe separation cannot be maintained or if they subsequently have their own emergency.

**308. INSTRUMENT DEPARTURES**

When weather or runway conditions preclude accomplishing a section takeoff, the flight has two options:

1. Lead aircraft will level off below IMC and adjust power to maintain 160 KIAS until the Wing has joined, then adjust power to approximately 90% torque, and start a 180 KIAS climb to
VFR on top. It is imperative that Wing maintain section integrity by safely maintaining visual contact. If Wing loses sight of Lead, perform the Lost Sight procedure discussed in the Emergency Procedures section of this FTI.

2. Obtain separate takeoff clearances to get above the weather and execute the Blind Rendezvous Procedures, referred to TACAN rendezvous in fleet aircraft. Lead will check into the area and await the Wingman. When the Wingman checks in, Lead will be directive and descriptive as to where the rendezvous will take place. A Blind Rendezvous is a visual circular rendezvous employed to rendezvous a flight above the weather after takeoff or during the mission if the flight is separated. The Blind Rendezvous is normally executed in a left-hand turn tangent to the briefed fix at a specified airspeed, altitude, and direction (inbound or outbound). As shown in Figure 3-5, points around the rendezvous circle are numbered from one to four, with point one located at the fix and sequential positions located at 90-degree intervals around the circle. The fix will be a VFR ground reference, FMS reference point, or a radial/DME fix.

Upon reaching the fix, Lead simultaneously calls over the TAC frequency “(TAC call sign), point one” and commences a 30-degree AOB turn in the briefed direction on altitude and at 200 KIAS. Passing each 90-degree position, the Lead transmits their position number until Wing acquires a “visual”; Wing responds to each position call with their position relative to the fix (Wing’s DME in whole numbers, e.g., "Two Eight" if using a radial/DME). Lead must adjust the rendezvous turn to compensate for wind, ensuring that point one is always at the briefed fix. Wing will fly toward the point one fix at 500' below the briefed rendezvous altitude and remain 500' below the briefed rendezvous altitude until established on Lead’s bearing line with relative fuselage alignment. Upon arrival at a known point on the circle, typically point one, Wing will initiate a turn in the briefed direction of the rendezvous using AOB as required. Initiate the turn, even if you don’t see Lead, so that you stay inside the rendezvous circle. Lead should continue...
to call their arrival at the points along the circle to help Wing establish an idea of Lead’s relative position from them. From these cues, Wing will be able to narrow their search for Lead. Once Wing sees Lead, they will call "visual" and continue to maneuver their aircraft toward Lead’s bearing line and align the fuselages. Lead will stop calling points when they hear "visual" from Wing. Once on the bearing line with fuselages aligned, Wing will climb to Lead’s altitude by placing Lead’s aircraft upon the horizon and proceed with a standard join-up IAW Section 405. Initially, if Lead’s aircraft is behind Wing’s wing line when a visual sighting is achieved or when Lead’s position call has provided the necessary situational awareness, Wing should proceed to the center of the circle. The center of the circle is known as the "Post" and serves as a control zone from which Wing should be able to expeditiously maneuver their aircraft to visually acquire Lead and begin the lead/lag procedure for rendezvous. The lead/lag procedure is best conceptualized as maneuvering to place Lead at Wing’s "10 or 2" position. For example: in a normal left hand rendezvous, Wing should use AOB and lead pursuit as required to place the lead aircraft at the 2 o’clock position relative to the wing aircraft’s nose. Wing is now using a lead pursuit maneuver inside Lead’s radius of turn. Wing is closing the distance to Lead but must still resolve fuselage alignment. Wing should immediately reduce their AOB and allow the lead aircraft to drift left across their windscreen towards the 10 o’clock position. Wing is now using the lag maneuver. Wing should then increase AOB as required to place Lead back at the 2 o’clock position and evaluate. By repeating this process, Wing is closing the distance to Lead while working off "angles" to align the fuselages. Once Wing has achieved bearing line and fuselage alignment, they should step-up and proceed with the join-up IAW Section 405. The goal of this procedure is to use lead/lag principles for rendezvous while maintaining a constant airspeed. If Lead obtains visual contact first, they may call "visual" and describe their relative position from Wing over the radio to help Wing gain sight of Lead.

309. CLIMB AND LEVEL-OFF

Following a Section Departure through the weather, and once joined up and confident that IMC will not be a factor, Wing may be directed to Cruise Position for transit to the working area. Several factors should be considered when choosing a base altitude and course, to include: remaining in Visual Meteorological Conditions (VMC), airspace restrictions, and traffic avoidance. If on an IFR clearance, comply with all ATC departure instructions.

Climb and Level-Off Common Errors:

Lead

1. Lead being too abrupt with controls and power.

2. Excessive Wingman consideration. Lead allowing Wingman consideration to cause mistakes on the departure (headings, altitudes, radio calls, etc.).

Wing

1. Wing taking too long to get into position after takeoff.
2. Wing failing to recognize deviations from Parade Position, and therefore failing to make timely/appropriate corrections.

3. Wing over controlling the aircraft, causing an unstable Parade Position.

310. OPERATIONS CHECKS

An Operations Check is initiated by Lead stating “Angry, Ops Check,” and will be conducted IAW NATOPS (with the addition of checking accelerometer). Wing will acknowledge the call and when complete with their Operations Check, will respond with current fuel state and good G. Lead will then respond with current fuel state and good G. The three mandatory Ops Checks are:

1. Prior to beginning the area profile.
2. After the Lead Change.
3. Prior to departing the area.

Additional Ops Checks may be accomplished during the sortie as needed. Fuel state will be called, rounded down to the nearest 10 lbs and “good G” will be used unless maximum indicated G indication is exceeded.

Example

Lead: “Angry, Ops Check.”

Wing: “(TAC call sign, standby).” If not ready to pass Ops Check.

Wing: “(TAC call sign), 870 (eight-seven-zero), good G.”

Lead: “(TAC call sign), 860 (eight-six-zero), good G.”

As the Wing pilot, it is important to accomplish the Operations Check one item at a time, checking your position relative to Lead between each item. Prioritize tasks: Fly formation first, and accomplish checklist items as workload permits. During turns, it is recommended to fly the aircraft and resume the check after the turn is complete.

After the initial Operations Check, if Wing is in a Cruise Position, they will be directed back to a Parade Position by Lead prior to executing the parade sequence. Wing may only rejoin when directed by Lead via radio call, or shoulder pat aboard.

After leveling-off, Lead will establish a base airspeed of 200 KIAS. This will be the base airspeed for the remainder of the flight unless otherwise briefed.
CHAPTER FOUR  
SECTION PARADE

400. INTRODUCTION

Some examples of when parade flight might be used are overhead patterns (break), instrument approaches in IMC, flight in congested areas, and exhibition flights.

Parade formation advantages:

1. Provides good visibility between aircraft (e.g., communications and in poor weather).
2. Presents a professional military appearance.

Parade formation disadvantages:

1. Formation is less maneuverable than a single aircraft or cruise/tactical formation.
2. Wingman must constantly adjust power, resulting in fatigue and higher fuel consumption.
3. Restricts the Wingman’s lookout doctrine for mutual support.

401. THE PARADE SEQUENCE

Once the flight is established in the area and Ops Checks are complete, begin the parade sequence. The parade sequence is a series of tasks which allow both students the opportunity to practice flying basic formation positions and maneuvers. The following sequence is the suggested parade sequence of events, but may be modified based on mission requirements:

1. (4) Parade Turns with approximately 180° per turn
2. Crossunder
3. (4) Parade Turns with approximately 180° per turn
4. Crossunder
5. Breakup and Rendezvous
6. Cruise Maneuvering (typically not flown on basic formation flights)
7. Tail Chase (typically not flown on basic formation flights)
8. Lead Change
9. Repeat Sequence
402. PARADE POSITION

Parade Position is the basis for all maneuvers in this chapter. It is a fixed position on the left/right 45º bearing from Lead with sufficient wingtip clearance and step-down utilizing the checkpoints described below. To maintain Parade Position, Wing must remain relaxed and scan Lead’s entire aircraft. By keeping the aircraft trimmed, Wing will need to only apply slight stick pressures and minor power changes to maintain position. Anticipate and make corrections immediately to minimize the magnitude of errors. The perfect Parade Position is transitory, and every correction has a corresponding re-correction to ensure Altitude (step-down), Bearing line, and Closure/Separation (the A-B-Cs) are correct.

![Figure 4-1 Parade Position](image)

Parade Checkpoints:

1. **Altitude**: The most important of the three checkpoints because it ensures altitude separation should an excessive closure develop. Proper step-down is achieved when Lead’s inboard exhaust stack is fully visible and touching the bottom (tangent) wing. If there is excessive step-down, a space between the exhaust stack and the wing will exist. Conversely, if there is excessive step-up, the stack will be either masked by the wing or will be visible above the wing. *Step-down/up is corrected by forward/aft stick and a corresponding power correction to offset the decrease or increase in speed as needed.*
2. **Bearing Line**: The second most important of the three checkpoints. The bearing line is recognized by placing the lower UHF antenna over the inboard aileron cutout on the opposite wing. *Bearing line corrections can be made with both aileron (lateral) and power (forward/aft)*. The result is that the Wingman should attempt to allow all relative motion to occur diagonally along a bearing line relative to the Lead.

3. **Closure/Separation**: Proper distance from Lead is achieved by being on bearing line with Leads pitot tube on the prop arc.

*Corrections shall only be made in the A-B-C order*. Once all these requirements are met, Wing will be in proper Parade Position. However, as stated earlier, the Parade Position is transitory and a vigilant scan and small deliberate corrections are required to minimize deviations.

Reference Chapter One of this FTI to ensure understanding of “Acute” and “Sucked” as it relates to Parade Position Corrections.

403. **PARADE turns**

Once the flight has arrived in the working area, and Wing is in Parade Position, Lead will take the Wingman through a series of parade turns. Parade turns are generally defined as 30° angle of bank (AOB) turns for approximately 180° heading change, which may be adjusted for area constraints or environment (e.g., sun angle, clouds, etc.). *All turns will require Wing to make a power adjustment.*
Turns Away From the Wingman:

There are two Parade Positions for the Wingman on turns away from the Lead. The first is the VMC position, in which Wing will match the Lead's AOB and roll about their own longitudinal axis. The second is the IMC position, in which Wing rolls about the Lead's longitudinal axis and maintains the standard parade sight picture.

**VMC:** As Lead rolls into the turn, Wing will match Lead's roll rate, adding power to avoid going Sucked due to a greater turn radius. Wing will rotate about their own longitudinal axis in the VMC Turn Away. The proper Altitude Checkpoint for the VMC turn away position is the underside of Lead’s fuselage on the horizon. The proper Bearing Checkpoint will still be the lower UHF antenna in line vertically with the inboard (opposite wing) aileron cutout; however, there will be a gap between the two in the VMC Turn Away position. Separation is accomplished by placing Lead’s CFS door tangent to the trailing edge of the wing. Bearing line shifts will still be recognized by fore and aft movement of the UHF antenna relative to the aileron cutout. Once the turn is established, Wing is now on a longer radius of turn than Lead thus requiring a slight increase in power and back stick to maintain position. To make corrections, use a combination of aileron and back stick pressure to maintain relative separation, while always holding Lead's fuselage on the horizon. Power should be used to move forward or aft from the bearing line. As Lead initiates the rollout, Wing must match Lead’s roll rate and turn about Wing’s own longitudinal axis while maintaining proper lateral spacing. Wing will need to reduce the power during the rollout because of the decreasing radius of turn difference until Wings level matching Lead’s speed and power. Wing will make small corrections to reestablish position after the rollout is complete.

![Figure 4-3 VMC Turn Away from Wingman](image-url)
IMC: During IMC turns away, the Wingman rotates about Lead's longitudinal axis, matching Lead's rate of roll, while maintaining the same Parade Position checkpoints. The IMC turn away initially requires more power than the VMC turns away and more aft stick because Wing needs to climb above Lead to establish the proper position in addition to being outside Lead's radius of turn. If power is not added when entering the turn, Wing will go Sucked immediately. Conversely, when the Wingman rolls out of the IMC turn away, they will initially require a larger power reduction than the roll-out for the VMC turn away.

Turns Away From the Wingman Common Errors:

Lead
1. Fails to clear the area visually prior to commencing a turn.
2. Fails to maintain altitude and constant AOB in the turn.
3. Rolls into or out of turn abruptly or ratchets into or out of turn (e.g., stops roll at 10-20° AOB on the way to 30°).
4. Overshoots the rollout heading or exceeds parade rate of roll.
5. Ballooning during reversals

Wing
1. Wing fails to match Lead's bank angle and maintain proper altitude.
2. Wing is slow to or fails to add power resulting in being Sucked with power.
3. Wing fails to maintain relative separation and drifts away from Lead.
4. Wing fails to reduce power on rollout sufficiently to prevent becoming Acute.
5. Wing fails to pick up the parade references and rolls out with excessive step-down.

Turns into Wing:

As Lead rolls into an angle of bank, Wing will roll about the Lead's longitudinal axis, match Lead's angle of bank, lower the nose slightly while reducing power, matching Lead's roll rate, and maintaining the same parade check points. Once established, Wing will maintain the same parade references as straight and level flight. The difference between turns into Wing is that the Wingman is on a slightly shorter turn radius than Lead and will always fly the same Parade checkpoints. If Wing is flying the same airspeed as Lead, but with a shorter turn radius, they are going to turn through space slightly faster than Lead and will tend to get ahead of the bearing line (Acute). Wing must initially reduce power a small amount to maintain position and then adjust power to hold position. When Lead rolls out, Wing will need to add a small amount of
power while pulling the nose up slightly to maintain the parade checkpoints. This procedure is used for all “turns into.”

![Figure 4-4 Turn into Wingman](image)

**Turns into Wing Common Errors:**

**Lead**

1. Fails to clear the area visually prior to commencing a turn.

2. Fails to maintain altitude and constant AOB in the turn.

3. Rolls into or out of turn abruptly or ratchet into or out of turn (e.g., stops roll at 10-20° AOB on the way to 30°).

4. Overshoots the rollout heading or exceeds parade rate of roll.

5. Ballooning during reversals.

6. Causing Wing to go extremely “Blind Sun” by poor area management.

**Wing**

1. Fails to rotate about Lead's longitudinal axis to maintain proper step-down.

2. Fails to reduce power slightly to take into account the shorter turn radius during turns into and becoming Acute.

4-6 **SECTION PARADE**
3. Wing fails to maintain relative separation and drifts away from Lead.

4. Fails to add sufficient power upon roll out to prevent becoming Sucked.

404. CROSSUNDER

A formation must be flexible; therefore, the Lead must be able to change the position of the Wingman within the formation while in the Parade Position. The Crossunder is a maneuver where the Wingman moves from parade on one side of Lead to parade on the other while maintaining proper step-down and nose-to-tail clearance.

**Lead:** Lead will check the Wingman in position and clear the area keeping the formation clear of obstructions and ensure the maneuver can be completed within the area limits. The Lead will then give the Crossunder signal while maintaining a steady platform as Wing is executing the maneuver.

**Wing:** Wing will acknowledge the Crossunder signal with a head-nod, and stabilize in the Parade Position prior to commencing the maneuver. Wing should execute the maneuver using only straight lines. First down and aft, stabilizing for a moment and then “sliding” straight across to the other side and finally forward and up to Parade Position. This movement is intended to create two distinct corners at which Wing will momentarily stabilize. Wing will keep relative motion slow and controlled throughout the maneuver.

1. Wing will observe the signal Lead passes and acknowledge with a quick head-nod.

2. Stabilize in the Parade Position.

3. Simultaneously adjust power and pitch to begin drifting aft while slightly increasing step-down. The step-down checkpoint continues to be exhaust stack tangent to the leading edge of the wing. Proper nose-to-tail separation has been achieved when the UHF antenna is over the dihedral bend of the wing. It will be necessary to increase power prior to reaching the appropriate nose-to-tail separation in order to stabilize in position.

4. Once stabilized with proper step-down and nose-to-tail separation, make a slight wing dip towards Lead and then reset the wings level attitude. This will create a minor heading change and allow for Wing to cross behind and lower than Lead. Observe Lead tracking slowly (rate should be no faster than a walking pace) to the other side while keeping the exhaust stacks tangent to the forward wing line to ensure proper step-down.

5. A slight power increase will be required to maintain the established nose-to-tail distance in order to account for the slight heading differential. Continue to adjust power as necessary to move straight across to the other side without a change in nose-to-tail separation.

**WARNING**

At no time should Wing's nose be under any part of Lead's aircraft.
6. When reaching the correct position on the other side (UHF antenna on the dihedral bend of the wing), arrest lateral motion with a slight wing dip toward Lead approaching the opposite bearing line, then stabilize. Wait until the UHF antenna is over the bend before arresting your lateral movement. If you are using an appropriate crossing speed, you should not need to lead the stabilization. As your head position changes during the Crossunder, you will naturally move your hand which may cause you to stagnate prior to reaching the proper position. Fight this temptation by maintaining stick position and proper pace.

7. Use slight back stick pressure while adding power as required, move the aircraft up and forward into the Parade Position on the new side of Lead. Maintain exhaust stack tangent to the leading edge of the wing at all times in order to maintain step-down and reestablish the proper bearing checkpoint and then separation.

Figure 4-5 Crossunder

Crossunder Common Errors:

Lead
1. Fails to maintain a steady platform due to poor basic aircraft control.
2. Fails to give Wing enough straight-away to accomplish the maneuver.

Wing
1. Fails to stabilize momentarily in each position prior to moving on to the next position.
2. Fails to adjust power, allowing aircraft to drift aft or under Lead.
3. Uses excessive bank angle during Crossunder, causing excessive crossing rate.

4-8 SECTION PARADE
4. Fails to maintain proper step-down during Crossunder maneuver.

5. Stops Crossunder early, prior to reaching checkpoints on the opposite side.

405. BREAKUP AND RENDEZVOUS

The Breakup and Rendezvous (B&R) is used to practice a co-altitude, co-airspeed re-join. The breakup establishes the interval for the rendezvous. The Rendezvous is an exercise using pursuit curves to align fuselages, maintain a desired bearing line, and affect a rendezvous without an airspeed advantage. This maneuver will serve as the basis for nearly all join-ups throughout your Naval Aviation career regardless of platform.

Lead: Prior to initiating the maneuver, Lead must ensure the maneuver can be accomplished within the given airspace. The standard breakup turn is normally a 180° turn. Lead always has the option of adjusting the break turn based on weather or area constraints. B&R’s may be initiated with Wing on either the left or right side. Lead is responsible for maintaining situational awareness and ensuring break turns are performed away from Wing.

Lead will:

1. Ensure proper flight parameters are set (200 KIAS on altitude).

2. Check that Wingman is in position.

3. Check the break direction is clear.

4. Give the Breakup and Rendezvous signal.

5. Ensure the Wingman acknowledges the signal.

6. Give the Kiss Off signal and break away from Wing.

Lead will perform a level break away from Wing for approximately 180° using PCL to MAX and G’s to maintain 200 KIAS. This maneuver will require about 3-4 Gs in order to maintain altitude and airspeed. Once releasing the back stick pressure (Gs) and beginning to rollout on the new heading, power must be reset to maintain 200 KIAS. After rollout, Lead will wait for Wing’s call, “(TAC call sign), ready, ” signifying that Wing is established in trail on parameters and ready to begin the rendezvous. Lead will acknowledge Wing’s “ready” call and continue on course for area management or perform a 45° AOB “wing flash” in the desired direction of turn, and then establish a 30° AOB turn on altitude at 200 KIAS. Lead will continue to maintain altitude, airspeed, and clear the area while monitoring Wing for a safe rendezvous. It is imperative that Lead maintain the contract airspeed of 200 KIAS, otherwise an unsafe closure or lack of closure may develop. Once Wing is stabilized in a VMC Turn Away Parade Position, Lead will roll out and repeat the sequence (as needed).
**Wing:** As Lead approaches the 3/9 line abeam the leading edge of the wing (approximately 3 seconds), Wing will break in the same direction by using PCL to MAX, keeping Lead in sight and on the horizon, and using pursuit curve principles to maintain 800-1000' in trail. Once Lead is established straight and level, Wing will expeditiously position the aircraft in trail (with a slight step-up to avoid prop wash), stabilize at 200 KIAS, and call “(TAC call sign), ready.” Once stabilized at 200 KIAS, Wing should avoid any further PCL adjustments and use only pursuit curve principles until approaching the join-up phase. When Lead begins their turn and moves outside the HUD Field of View (FOV), immediately maneuver to the inside of Lead’s radius of turn (lead pursuit) using 30-45° AOB, keeping Lead on the horizon. Wing will maintain this turn until the top of Lead’s vertical stabilizer bisects the midpoint of the opposite wing (this is the visual reference for the 60° bearing line). Wing should anticipate intercepting the 60° bearing line by reducing their AOB slightly prior to reaching the bearing line to avoid going Acute. When Wing arrives on the 60° bearing line, match Lead’s AOB and align fuselages. The A-B-C’s still apply here. Keep Lead on the Horizon (Altitude), vertical stabilizer midpoint on opposite wing (Bearing) and control your closure. Maintain the 200 KIAS contract airspeed throughout the rendezvous.
Figure 4-7  60° Bearing Line (Left Orbit)

Wing must now use the concepts of radius of turn, fuselage alignment, and pursuit curves in relation to bearing line to affect closure and to complete the rendezvous. Wing should hold Lead on the horizon while making small changes in AOB to maneuver along the 60° bearing line. When Wing is within one to two wingspans of Lead, execute the join-up phase.

ALTITUDE: Wing must hold Lead’s aircraft on the horizon throughout the rendezvous. If Lead is below the horizon, Wing is high and should descend to put Lead on the horizon. If Lead is above the horizon (a large amount of sky between Lead's aircraft and the horizon), Wing is low and should climb to put Lead on the horizon. Remember that increases or decreases in altitude will affect airspeed and thus affect position relative to the bearing line. Correct altitude in relation to Lead is maintained by keeping Lead on the horizon.

BEARING: When Wing is on the proper bearing line, Lead’s vertical stabilizer will bisect Lead’s outboard wing. If Wing is ahead of the bearing line or “Acute,” Lead’s vertical stabilizer will be outboard of the center of the wing, or, if further Acute, there will be space between Lead's wingtip and vertical stabilizer. Being “Acute” is caused by Wing using too much AOB and leading Lead’s turn excessively. In this case, Wing should correct back to the 60º bearing line by decreasing bank angle; adjusting the pursuit geometry. Be aware that this will result in a temporary increase in closure until reestablishing on a stable bearing. If excessively Acute, or Acute in close, correcting may result in excessive closure which will require an underrun. If Wing is behind the bearing line or “Sucked,” Lead's vertical stabilizer will be inboard of the center of the wing. Being “Sucked” is caused by Wing holding too shallow of an AOB thus not leading Lead’s turn enough, and will result in insufficient or no closure. In this case, Wing should correct back to the 60º bearing line by increasing bank angle and positioning the aircraft inside Lead’s turn using proper lead pursuit.
A good rule of thumb for corrections to bearing is the “STICK TO STAB” method. If the vertical stabilizer moves to the right of bisecting Lead’s outboard wing, the stick goes right to correct back to the bearing line. Conversely, if the vertical stabilizer moves left of bisecting Lead’s outboard wing, the stick needs to move left to correct back to the desired bearing line.

Figure 4-8 Sucked Position (Left Orbit)

Figure 4-9 Acute Position (Left Orbit)
CLOSURE: Wing will ensure 200 KIAS is expeditiously set prior to calling “ready.” Wing will concentrate on maintaining the 60º bearing line and a safe closure rate relative to Lead's aircraft. Wing will maintain 200 KIAS until:

1. The join-up phase begins.
2. An underrun is required.
3. Stagnating on the bearing line as a result of airspeed.

As Wing approaches Lead on the 60º bearing line, Wing will see more detail on Lead's aircraft (rivets, aileron hinges, etc.) which will help judge closure. Wing needs to monitor closure, because as Wing approaches Lead, any corrections with angle of bank will take effect quickly. If Wing stagnates on the bearing line, and airspeed is 200 KIAS, add a small amount of power as necessary to regain closure.

NOTE

If an underrun is needed, execute the procedure IAW section 304 (Rendezvous Underrun).

JOIN-UP:

The join-up phase of the rendezvous begins at the point where one to two T-6B wingspans will no longer fit between Wing and Lead. The join-up phase should be executed at a slow and controlled rate of motion (e.g., Wing should close at a walking pace and be able to stop and freeze the aircraft at any point). If closure is slightly fast (running pace), Wing may need to begin the join-up phase early (two wingspans out).

At this point, Wing’s angle of bank should very closely match Lead’s. Assuming the airspeeds are also closely matched, very little needs to be done with bank angle to complete the join-up.

Begin the join-up phase by simultaneously:

1. Lowering the nose to establish step-down (exhaust stack tangent to the leading edge of the near wing).
2. Adjust power to maintain nose-to-tail separation (Wing’s nose should at no time be under Lead’s aircraft). Usually, this will require a power reduction due to the required descent.

This is essentially a Crossunder while in a turn. The first half can be described as “in like a V”, as the Wing aircraft moves in a diagonal line from the level position inside Lead’s turn, to the stepped-down, 6 o’clock position. Wing should stabilize in this position, matching Lead’s AOB while maintaining step-down by keeping both of Lead’s exhaust stacks visible and below the wing.
After stabilizing in the 6 o’clock position:

1. Smoothly increase power to account for the larger turn radius, climb slightly and move forward to the VMC turn away position. This is often described as “out like a J,” as you establish *lateral separation*, before moving up into the VMC turn away position.

2. Adjust bank, pitch, and power to maintain the VMC turn away position.

**Breakup and Rendezvous Common Errors:**

**Lead**

1. Fails to monitor Wing during the rendezvous.

2. Fails to clear for the formation during the Breakup and Rendezvous.

3. Fails to maintain airspeed, bank angle, and altitude during the rendezvous.

**Wing**

1. Fails to establish and maintain proper airspeed.

2. Fails to hold Lead on the horizon during the rendezvous.

3. Flies through bearing lines and becomes Acute.

4. Confuses the proper bank angle corrections.

5. Uses large corrections to the bearing line and never stabilizes.

6. Fails to anticipate corrections and overshoots the bearing line without stabilizing.

7. **ACCEPTS AN UNSAFE SITUATION AND DOES NOT INITIATE AN UNDERRUN!**

**406. CRUISE FORMATION**

Cruise is a fluid position which allows Wing to maneuver freely on either side of Lead taking advantage of turn radius while allowing Lead maximum flexibility to maneuver the flight as required. The Cruise Position also reduces Wingman workload, provides better lookout capabilities, and is more fuel efficient for the Wingman due to a reduced requirement to make power adjustments. For these reasons, it is commonly used during the enroute phases of flight. When used as an administrative formation (enroute phase), Lead will initiate the appropriate signal, and Wing will comply. Wing will use power and pursuit curves to move from Parade to Cruise and vice versa. During this administrative cruise, Wing has full use of power, pursuit curves, and speed brake to maintain the desired position. Some turns may only require a slight power change with no associated pursuit curve change to maintain position. More aggressive
turns may require the use of pursuit curves and power to maintain appropriate position. When conducting the cruise maneuvering exercise, Wing will maintain Cruise Position by using pursuit curves (lead, lag, and pure) and lift vector placement while maintaining a constant power setting.

**Cruise Position:** The Cruise Position is a position on the 60° bearing line, with approximately 20' of step-down, and 3-6 plane widths between aircraft (Figure 4-10). Wing may move freely between the left and right Cruise Positions without direction or permission from Lead.

**Visual references for the Cruise Position:** Altitude is maintained by keeping the exhaust stack below and tangent to the leading edge of the wing, Bearing is maintained by keeping the forward tip of the ventral fin over the inboard aileron cutout on the opposite wing, and Separation is the edge of the prop arc on the pitot tube (as in Parade Position). The Cruise Position will be utilized to the maximum extent possible, based on the advantages listed above (i.e., enroute transit to and from the established working area, etc.).

![Figure 4-10 Cruise Position (60° Cone)](image)

407. CRUISE MANEUVERING

Cruise maneuvering will build on the two dimensional fundamentals learned while adding the challenge of maneuvering in the vertical plane as well. During VMC parade turns into and away, Wing was limited to one side or the other from Lead while conducting level turns. Power was either increased (parade turn away) or decreased (parade turn into) to prevent Wing from going Sucked or Acute relative to Lead’s bearing line. In contrast, cruise maneuvering will use a fixed power setting, but Wing will now have the ability to change sides as required, using radius of turn principles (lead, lag, or pure pursuits) to maintain the 60° cruise bearing line.
During the cruise maneuvering exercise, Lead is restricted to no more than 120° AOB and no less than 1G. Wing will need to maneuver within the Cruise Position cone to maintain proper cruise spacing, but should strive to work toward the 60° bearing line (Lead’s 5 or 7 o’clock position). Nose-to-tail separation is primarily maintained by varying radius of turn through the use of pursuit curves. If Wing uses lead pursuit (by putting their nose in front of Lead’s aircraft), nose-to-tail separation will decrease. Conversely, if Wing uses lag pursuit (by putting their nose behind Lead’s aircraft), nose-to-tail separation will be maintained or increase. Pure pursuit can be recognized by zero LOS movement of Lead across Wing’s windscreen. Corrections to fix separation are temporary, Wing rarely needs to lead or lag for more than a few seconds before the desired spacing is achieved.

**NOTE**

Wing must avoid lingering at Lead’s 6 o’clock position due to the reduced ability to judge closure.

**NOTE**

Cruise maneuvering wingovers are different from Contact FTI wingovers, in that Lead must maintain positive G throughout the maneuver to give Wing sufficient G authority to maneuver in the cone. Lead will have to use a bank angle past 90° AOB in order to maintain a 1G. Lead shall not “float” the turn in an attempt to roll out on an exact heading or altitude.

**Parade to Cruise Maneuvering**

**Lead**

1. Pass the cruise signal with an alternating pointing thumb over each shoulder.

2. Once the signal is acknowledged, smoothly adjust power to 80% torque (above 10K), 70% torque (below 10K).

3. Maintain a stable platform until Wing is established in the Cruise Position.

4. Once Wing calls, “(TAC call sign), ready,” Lead may begin maneuvering.

**Wing**

1. Acknowledge Lead's cruise signal with a head nod.

2. Use initial airspeed differential and small heading changes to slide to the 60° bearing line into the Cruise Position. This may require a small power reduction, coordinated with a small aileron input away from Lead.
3. Approaching the Cruise Position, reset power to 80% torque (above 10K), 70% torque (below 10K) upon Lead’s direction.

4. Call, “(TAC call sign), ready,” to begin maneuvering.

**NOTE**

80% torque (above 10K), 70% torque (below 10K) will be set by both aircraft prior to beginning cruise maneuvering. Although torque will change with altitude, the PCL will not be adjusted from this initial setting.

**LEVEL CRUISE TURN INTO WING**

With power fixed in both aircraft, a turn into Wing will immediately shift the 60° bearing line aft, forcing Wing into an Acute position. Wing’s position, coupled with Lead’s rate of maneuver, will determine how aggressively Wing will have to correct to regain or maintain the bearing line. Wing will adjust AOB to establish a lag pursuit and correct back to proper bearing and distance from Lead. Approaching the 60° bearing line, Wing must now overbank and increase G (as required) to align fuselages. A turn into may require Wing to cross under Lead momentarily in order to reestablish proper position.

**LEVEL CRUISE TURN AWAY FROM WING**

Just the opposite is true with fixed power and a turn away. The bearing line on the side of Wing will shift forward, placing Wing into a Sucked position. Wing’s position at the time of the turn (already Sucked, in position, Acute), and Lead’s bank angle and turn rate, will determine how much and how fast Wing will have to correct to regain or maintain the bearing line. If Wing is Sucked during Lead’s turn, Wing will have to aggressively maneuver to the inside of the turn using lead pursuit to close the distance. If Acute, maintaining a lag position is required until the bearing line on the inside of Lead’s turn catches up, at which time Wing will overbank to the inside of Lead’s turn while increasing G (as required) to align fuselages.

**VERTICAL TURNS/REVERSALS**

During a nose high turning away maneuver, Wing will use lead pursuit and likely have to maneuver to the inside of Lead’s turn. This will create the closure needed to regain the bearing line. Once the bearing line is achieved, Wing will increase AOB and G (as required) to align fuselages. This may require Wing to bank well past 90° AOB.

During a nose high turning into maneuver, Wing will need to use lag pursuit, maneuvering outside of Lead’s turn if required, until the proper distance is achieved and then overbank with Gs (as required) to the inside of Lead’s turn and align fuselages. This may require Wing to bank well past 90° AOB.
During nose low maneuvers, realize that the aircraft with the greater nose low will accelerate faster and away from the other aircraft. As Wing, this could cause an uncomfortable Acute position forcing an aggressive lag maneuver or a knock-it-off (KIO).

Cruise back to Parade

Lead

1. Lead calls (or Wing requests), “(TAC call sign), terminate.”

2. Remain predictable, roll wings level as energy state permits, adjust power to attain normal cruise airspeed (200 KIAS), and attain a level flight attitude. (Lead may roll into a turn in order to expedite the rejoin as required).

3. Direct Wing to move into Parade Position by calling “(Wingman TAC call sign), cleared to parade.” If a turning rendezvous is desired, Lead will enter a 30° AOB turn in the desired direction and maintain a constant altitude while working toward 200 KIAS.

4. Provide a stable platform while Wing returns to the Parade Position.

Wing

1. Observe Lead's roll out and maintain the Cruise Position.

2. Note airspeed and anticipate an acceleration or deceleration to 200 KIAS. Acknowledge and join on Lead when directed.

3. For a running rendezvous, join in the Parade Position on the current side. If a turning rendezvous is directed, maneuver to a Parade Position IAW Section 405.

Example

Wing: “(TAC call sign), request terminate.”

Lead: “Angry terminate. (TAC call sign), terminate.”

Wing: “(TAC call sign), terminate.”

Lead: “(Wingman TAC call sign), cleared to parade.”

Wing: “(TAC call sign).”
Common Errors:

Lead

1. Fails to give Wing enough time to stabilize in the Cruise Position before commencing maneuvers.
2. Fails to monitor Wing’s position during the turns (visual lookout).
3. Poor airwork (ratcheting the wings).
4. Fails to maintain positive G (unloading).

Wing

1. Allows excessive separation to develop without establishing lead pursuit to correct.
2. Slow to use lag pursuit during turns into and gets Acute or develops high closure rate.
3. Using PCL to maintain position with a power differential rather than pursuit curves.
4. Fails to maintain proper step-down.

Keys to Success:

1. After Wing is established in the Cruise Position, Lead may conduct the first turn into the Wingman to better enable them to firmly establish position.
2. If Wing is in a Sucked position or long on bearing, Lead should conduct a turn into instead of a turn away.
3. Wing needs to anticipate turns and use lead, lag, or pure pursuit to maintain position inside of Lead’s turn.

408. TAIL CHASE

Through the use of lead, lag, and pure pursuit, students will further learn the basics of how flight paths relate to each other in the dynamic maneuvering of the Tail Chase. Tail Chase demonstrates the effects of lead and lag pursuit on nose-to-tail distance through the use aerobatic maneuvering.

The G “warm-up” (G-warm) will be performed in conjunction with the breakup, prior to Tail Chase.
CHAPTER FOUR

Leads

1. Pass signal for Tail Chase. The Tail Chase signal is the forefinger and thumb extended into a “cocked pistol” (Appendix B).

2. Once the signal is acknowledged, Lead advances PCL to MAX, descends slightly (as needed), and accelerates to a minimum of 220 KIAS. At 220 KIAS, Lead will give the kiss-off signal and perform a MAX power break away from Wing, using 4G’s for a minimum of 180° of turn.

3. Upon completion of the G-warm both aircraft leave PCL at MAX (above 10K) or adjust to 90% torque (below 10K).


Wings

1. Acknowledge Lead’s Tail Chase signal with a head nod.

2. Maintain Parade Position as Lead accelerates using power.

3. Wing will break after Lead passes the 3 or 9 o’clock position using PCL to MAX and 4-5G’s to arrive in position for Tail Chase.

4. PCL at MAX (above 10K) or adjust to 90% torque (below 10K) and call, “(TAC call sign), ready,” to begin maneuvering.

5. During Tail Chase, Wing will maintain 800-1000' in trail and should offset to the 5 or 7 o’clock position from Lead to avoid Lead’s prop wash. Wing will maintain position using Lead, Lag, and Pure Pursuit principles similar to cruise maneuvering outlined in section 407.

NOTE

PCL to MAX (above 10K) or 90% torque (below 10K) will be set by both aircraft upon rollout from the G-warm. Although torque will change with altitude, the PCL will not be adjusted from this initial setting.

Tail Chase Maneuvering: The objective of Tail Chase is to demonstrate the effects of pursuit curves on nose-to-tail distance in a more dynamic environment than cruise maneuvering. In the Tail Chase portion of the parade sequence, Lead will start maneuvering with steep turns and turn reversals. The first turn should be a level 2-3G turn to allow the Wingman to demonstrate lead, lag, and pure pursuit in a relatively benign environment of cruise maneuvering was not performed. These will be followed by maneuvers such as Wingovers, Barrel-rolls, Half Cuban Eights, and Loops.

4-20 SECTION PARADE
NOTE

Due to the large airspeed changes that result, Split-S and Immelmann maneuvers shall not be performed during Tail Chase.

Wing will follow Lead through the maneuvers, delaying maneuvering until the approximate position where Lead initiated their turn or pull. This will result in Wing flying through Lead’s “smoke trail” and will assist in maintaining appropriate distance.

To maintain 800-1000’ of separation, Wing should delay each maneuver for approximately 2-3 seconds, and then initiate the maneuver while keeping Lead’s aircraft in a constant position on Wing’s canopy. Like a level turn, lead pursuit is accomplished by pulling inside of Lead’s turn radius thus requiring more Gs. During a vertical maneuver such as a loop, Wing will be required to increase G pull in order to decrease distance from Lead and vice versa. The difference in vertical maneuvering is the airspeed variance and its effect on aircraft performance.

Tail Chase maneuvering shall not be conducted below 6000’ AGL or within 500’ of the bottom of the assigned altitude block, whichever is higher. Throughout Tail Chase maneuvering, aircraft will avoid less than 1G, more than 6G’s, and at no time fly no slower than 110 KIAS. If deviations are outside these limits, they may lead to an unsafe situation, and a “knock-it-off” (KIO) call shall be made.

After the “terminate” call, Lead will remain predictable, smoothly set power for 200 KIAS, and turn as necessary to expedite the join. Lead will clear Wing aboard as stated below. If performing a running rendezvous, Wing will use airspeed differential to join in Parade Position in anticipation of the Lead Change. If performing a turning rendezvous, Wing will establish on the inside of Lead’s radius of turn and conduct the rendezvous IAW Section 405. Because this is an administrative rendezvous, Wing may use airspeed differential/power to affect the join.

409. TERMINATE AND KNOCK-IT-OFF PROCEDURES

There are times during a formation flight when any member of the flight may see a need to terminate maneuvering. Depending on the urgency of the situation, the formation may utilize the term “terminate” or “knock-it-off” (KIO). Typically, “terminate” is used when the desired learning objectives have been met or to cease maneuvering for a non-safety related situation. Wing will request (or Lead will direct) a terminate IAW the example below. KIO is used when safety of flight is an issue, such as an emergency, traffic threat, or a crewmember has G-locked due to poor Anti-G Straining Maneuver (AGSM) execution during Tail Chase. Either aircraft can initiate a KIO. When either of these calls are made, Lead will maneuver in a predictable manner to a safe flying attitude (typically recovering to straight-and-level flight or into a shallow AOB as required). Lead will then be directive with subsequent intentions. As with all communications in the aviation environment, it is critical to use the proper format when making these calls.
Example (Terminate initiated by Lead)

Lead: “Angry terminate, (TAC call sign), terminate.”
Wing: “(TAC call sign), terminate.”

Example (Terminate initiated by Wing)

Wing: “(TAC call sign), terminate.”

Lead: “Angry terminate, (TAC call sign), terminate.”
Wing: “(TAC call sign), terminate.”

Example (KIO)

Lead or Wing: “Angry, knock-it-off.”

Lead: “(TAC call sign), knock-it-off.”

Wing: “(TAC call sign), knock-it-off.”

NOTE

The pilot calling the KIO should state the reason if able, such as range (minimum), area boundary, blind, traffic, etc. Lead may state their altitude and give a reference heading for the flight.

410. LEAD CHANGE PROCEDURE

The Lead Change is a maneuver designed to effect a safe and efficient change of the Formation Lead with the least possible degradation to flight integrity. The Lead Change must be executed smoothly, so there is a crisp, instantaneous exchange of Lead and Wing roles and responsibilities. If at any time there is confusion by either aircrew about who has the Lead, utilize the radios to identify the Lead (use TAC call sign to identify the Formation Lead aircraft).

A Lead Change is required for training but may also be conducted when the Lead aircraft has radio or navigation equipment problems that hamper their ability to lead the flight in a safe and orderly manner. Prior to passing the Lead Change signal to the Wingman, the Lead will ensure that the flight is clear of other aircraft and weather and that the flight will be able to remain in the operating area during the Lead Change. Lead passes the Lead Change signal to the Wingman. If the Wingman accepts the Lead, they pass the acceptance signal and maintains airspeed, altitude, and the present heading. The new Wingman must keep their eyes on the new Lead. Flying Wing from this position is challenging because the new Wing is looking over their shoulder at the other aircraft to maintain proper separation. Each aircraft must be sure not to let head movement affect stick movement throughout the maneuver. The new Wing should be a stable platform for Lead to maneuver around. As the new Lead, you may need to accept being slightly
off airspeed or altitude initially. Maintain your altitude while conducting the Lead Change and make corrections to airspeed and altitude only after Wing has stabilized in the Parade Position. New Lead needs to check their power after assuming Lead and quickly make an adjustment if they have an excessive disparity from what is needed to maintain airspeed. If for any reason the new Lead needs to deviate, wait until Wing is aft of Lead’s wing.

**Lead Change Signal**

1. Lead will establish the flight in a location where the Lead Change has enough room to be executed and Wing has enough time to orient themselves in the area.

2. Lead will check Wing in Parade Position.

3. Lead will initiate the Lead Change signal by patting the side of their helmet closest to Wing three times with their opposite hand while looking forward and then simultaneously turning their head and pointing their hand at Wing.

4. Wing will accept the lead by patting their helmet on the side closest to Lead once, then they will simultaneously give a single chopping motion and look forward. If Wing shakes off the signal or does not acknowledge the signal, Lead will maintain the lead position and repeat the Lead Change signal.

**Lead Change Procedure**

1. The new Wing will increase wingtip clearance to approximately 20’ by using a slight wing dip away from the new Lead.

2. Wing will retard the PCL slightly and descend to obtain proper step-down prior to beginning aft movement relative to Lead. Proper step-down is established when Lead’s pitot tube is in line with the Orange and White paint line on Lead’s aircraft.

3. Once step-down is established, Wing will use power to slide aft towards the parade bearing line while maintaining step-down. Once on the bearing line, establish the parade scan and make power and attitude adjustments to maintain the proper ABCs.

**NOTES**

1. The new Lead will call for the Ops Check, turn on the Transponder and TCAS after the new Wing moves aft of the new Lead’s wing. After Wing is stable in the Parade Position, they will verify new Lead is squawking “ALT” using their TCAS (audible traffic alert), prior to switching the Transponder and TCAS to “STBY.” This will ensure one aircraft has the squawk at all times.

2. Lead Changes may be conducted on either side.
CAUTION

There can be no confusion of who is the new Lead. If in doubt, clarify who has the Lead on the radios using TAC call signs. Lead is always passed and never taken.

Common Errors:

1. Lead does not initiate the Lead Change in a good position in the area (i.e., with sufficient space in the area).

2. Wing misses Lead Change signal.

3. Lead does not maintain stable platform throughout the maneuver.

4. Wing fails to maintain visual of Lead throughout maneuver due to returning to inside scan following hand signal.

5. Wing fails to establish proper lateral separation and step-down prior to sliding aft which results in each aircraft wingtips coming dangerously close.

6. Flight fails to conduct positive change of TCAS/Transponder responsibilities.
CHAPTER FIVE
SECTION RECOVERY

500. INTRODUCTION

Once training in the working area is complete, the flight will transition to the recovery phase. This will generally be a VMC recovery via local course rules for the break entry. Weather permitting, Lead should direct Wing to the Cruise Position. Approaching the initial VFR entry point, Lead will direct Wing to the Parade Position (unless local SOP or Course Rules addresses an automatic rejoin) with enough time to get stabilized prior to the break. Lead will then give Wing the appropriate visual signal (kiss-off or come with me) and conduct the break with clearance from tower.

After landing, Lead will clear the hold-short line and allow enough space for Wing to clear the runway as well. Once clear of the hold-short, both aircraft will conduct the first three steps of the After Landing checklist and automatically switch to ground frequency where Lead will obtain taxi clearance. The formation will taxi back to parking in accordance with local SOP or Course Rules.

501. RECOVERY OVERVIEW

Upon completion of training in the working area, the flight will be ready to initiate the recovery phase. Lead should position Wing in Cruise Position if conditions permit to maximize lookout and maneuverability while maneuvering to intercept recovery course rules or an instrument approach procedure. Lead should then direct an Ops Check for the flight and obtain ATIS (if it wasn't previously obtained) for the recovery airfield. UHF/VHF tactical frequencies will be switched as necessary to facilitate recovering at a civilian field with VHF CTAF/Tower frequencies. Prior to entering tower’s airspace Lead should clear Wing back into Parade Position for the break and ensure Wing joins on the proper side for the direction of the break.

To assist students in the recovery, the acronym CCAS (Cruise, Operations/Descent Checklists, ATIS, Speeds) may be used.

1. Lead will direct Wing to **CRUISE** Position.

2. Each aircraft will conduct Operations and Descent **CHECKLISTS**. Wing will report fuel state, good G over TAC frequency when applicable.

3. The flight will obtain **ATIS**.

   **NOTE**

   Lead may elect to get the ATIS by directing Wing to monitor the area frequency. Lead may also direct Wing to obtain ATIS while they monitor the area frequency. At no time should a student in Wing be retrieving ATIS while in Parade Position.
NOTE

Only pertinent ATIS information should be passed to the other aircraft. The ATIS code, winds, altimeter setting, and runway in use are the minimum information required and can be remembered using the WAR acronym (Winds, Altimeter, Runway).

4. Lead will adjust the SPEED of the flight in accordance with local SOP or Course Rules.

During descents on recovery, Lead should use no less than 15% torque to allow for corrections for Wing. Wing may use PCL to idle and speed brake as required to maintain position. During the recovery phase, Lead may elect to use the speed brake to increase descent rates or decelerate the formation. The following procedures apply anytime Lead desires to use the speed brake. The speed brake is a drag device and is therefore, less effective as the airspeed is reduced. Extending/retracting the speed brake will induce pitch changes that may need to be counteracted. It is imperative that Lead maintains a stable platform and is clear about the intended use of the speed brake to preclude any closure issues between Lead and Wing. The following procedures apply:

**Speed Brake Extension/Retraction** (using the radios)

Lead: “Angry, standby speed brake.”

Lead: “Speed brake, now.”

**Speed Brake Extension/Retraction** (using visual signals)

Lead: Passes speed brake hand signal IAW Appendix B.

Wing: Acknowledge signal with a head nod.

Lead: Simultaneously give a head nod and extend/retract speed brake.

**502. THE BREAK**

There are two methods of executing the break: interval break or fan break.

**Interval Break**

The interval break is the standard break entry used in Primary Flight Training. When clearance is received and with proper interval, Lead will kiss-off Wing and execute the break maneuver described in the Contact FTI. Wing will break IAW the Contact FTI; no earlier than Lead passing Wing’s 3/9 line (approximately 3 seconds).
NOTE

Wing shall keep lead in sight in order to establish and maintain proper separation.

Wing will execute individual break procedures and not lose sight of Lead. If Lead does not use adequate AOB/Gs or maintain altitude during their break, it will affect Wing’s 1500’ of separation. Lead will make the appropriate landing pattern calls for the flight. Wing will report Dash 2 gear down following Lead’s clearance to land call (IAW local SOP or Course Rules). Both aircraft will land on centerline of the landing runway. The flight will rejoin on deck after crossing the hold-short and taxi back as a flight.

Fan Break

An alternate entry method is a fan break initiated with interval by Lead giving the “follow me” signal to Wing. After the signal is given, Lead will execute a smooth roll towards 45° AOB at a rate which the Wingman can match. The Lead will leave the power set through 90° of turn before retarding the PCL to Idle. The Wingman will match Lead’s roll rate, but will retard the PCL to Idle and extend the speed brake at the beginning of the maneuver to create separation. Lead will make the appropriate landing pattern calls for the flight. Wing will report Dash 2 gear down following Lead’s clearance to land call (IAW local SOP or Course Rules). The flight will rejoin on deck after crossing the hold-short and taxi back as a flight.

503. SECTION APPROACHES

The Section Approach is used to expedite the recovery or for mutual support during certain emergencies. The key to a good formation approach is for Lead to fly a smooth, accurate instrument or visual approach, and for Wing to be proactive about maintaining position and complying with signals. Wing should also be prepared to assume the responsibilities of Lead at any time.

Prior to conducting a section approach, Lead must accomplish several tasks that require the Lead pilot to plan ahead. Everything takes longer to accomplish in a formation. Consideration should be given to the approach, missed approach, and the procedures for separating the flight on final. In the event of a missed approach, unless specific instructions were given, execute the published procedure using normal hand signals or via the tactical frequency.

The following should be carefully planned and accomplished prior to Final Approach Fix (FAF) or glide path intercept (not necessarily in this exact order):

1. Bring the Wingman into Parade Position.
2. Reduce airspeed.
3. Configure the flight.
Although these tasks appear simple at first glance, they may become task saturating when adding the appropriate visual signals and combining required Instrument Navigation (INAV) briefings and checklists. Proper preparation is essential to success.

NOTES

1. All turns will be made using IMC Parade Position (i.e., keep the same checkpoints as straight-and-level parade). In IMC, it is imperative that the Wingman maintain section integrity by safely maintaining visual contact.

2. To fly a section approach, weather must be at or above circling minimums, or 1000/3, if no circling minimums are published.

3. Wing will always mirror Lead's configuration and be ready to assume the lead.

Usually, the flight will receive radar vectors to the Final Approach Course (FAC). If VMC, configure at an appropriate time, but no later than the FAF. If operating VFR on top, Lead should give consideration to configuring the section prior to penetrating IMC. If in IMC conditions and not already configured, consider using the radios to call for the gear extension. Ideally, the flight should transition to BAC (gear down, flaps TO) within five miles from the Final Approach Fix (FAF). Both crews will check for proper configuration (gear down, flaps TO) and give a thumbs-up, head nod, or use the radios to confirm. Lead should then position the formation on the FAC. Lead should fly a normal final (Figure 5-1) at 120 KIAS, and Wing will fly Parade Position until Lead detaches Wing.

![Figure 5-1 Instrument Approach Position](image_url)
504. TAKING SPACING ON FINAL

Straight-in Approach

Once Lead has the runway in sight, they should confirm that the Wingman is visual by pointing at the runway. Wing should confirm visual with the runway with a head nod. Lead should detach Wing as early as possible by giving the kiss-off signal or transmitting, ‘(Wingman TAC call sign), cleared to detach.’ Lead will fly a TO flap approach and if required, may accelerate slightly to build spacing between aircraft (do not exceed 150 KIAS). Lead will then configure flaps as required on short final. After receiving the kiss-off, Wing should reduce power, set landing flaps, and establish and maintain a minimum of 1500’ of separation between aircraft. Wing should use airspeed differential (no slower than on-speed AOA) and maneuvering geometry (small S turns) to obtain separation along with maintaining a slight step-up glideslope to avoid Lead’s prop wash. Both aircraft must take extreme care to avoid a flap/gear overspeed during the final segment of the approach. Wing should waveoff if they do not have at least 1500’ of spacing from Lead. Both aircraft will maintain runway centerline through the landing rollout.

Circling Approach

Once Lead has the runway environment in sight, they should confirm the Wingman is visual with the runway. Lead detaches Wing once they commence circling by giving the kiss-off signal or transmitting, ‘(Wingman TAC call sign), cleared to detach.’ Lead will fly a TO flap approach, and if required, may accelerate slightly to build spacing between aircraft. Lead will configure flaps as required for landing. After the kiss-off, Wing should reduce power, set Landing flaps, and establish a minimum of 1500’ of separation between aircraft. Wing should use airspeed differential and maneuvering geometry to obtain separation during the circle to land. Enough separation should occur to allow for normal landings on centerline.

NOTE

Wing has the option of using TO flaps for the approach and landing if deemed necessary due to weather/runway conditions or required spacing. Lead has the option of using LDG flaps as required for weather/runway conditions.

505. NORDO APPROACH

During a section NORDO approach, the lost comm aircraft will be placed in the Wing position. Lead will fly a visual straight-in or instrument approach as required. Wing will be kissed-off at 1 mile from the end of the runway during VMC, and prior to the Missed Approach Point (MAP) or Decision Height (DH) during IMC.

At 1 mile, Lead will give the Wingman the land signal, point to the runway, and when acknowledged, kiss-off Wing (this signifies they are cleared to detach and cleared to land). Lead will smartly take a cutaway to the appropriate side of the runway, maintain pattern altitude, and monitor Wing. Lead will remain in the gear down, TO flap configuration at Wing’s 10/2 o’clock
position and monitor Wing’s landing. Once Wing is safely on deck, Lead will request the pattern if able, or execute missed approach and return to land as required. An additional method for Lead to give Wing clearance to land is by passing the kiss-off signal with enough time to gain separation as described above. Lead will then conduct a Touch and Go landing to confirm that the section is cleared to land. Lead will re-enter the pattern or conduct a missed approach as required.

506. SECTION MISSED APPROACH

Any time a missed approach is required prior to detaching Wing, Lead will pass the climb signal, then slowly advance power while rotating to establish two positive rates of climb. With two positive rates of climb established, Lead will execute the gear retraction just like a section takeoff. Once both aircraft are clean, Lead will look to Wing for a head nod, indicating both aircraft are clean and continue with the missed approach/climbout instructions.

507. RECOVERY TAXI

When the flight recovers together, the formation should taxi as a section. Section taxi, however, is not always practical and should never be forced.

If the flight was split up prior to beginning the recovery phase, Lead and Wing will recover and taxi in separately. Remember, waveoffs are always an option. Never force a landing to maintain flight integrity. If one member of the flight has to waveoff, the other aircraft should give consideration to taxiing in single ship to not impede traffic. If ground traffic is not an issue, you may elect to wait for your Wingman.

Wing should not waveoff simply because Lead executes a waveoff. If granted clearance to land, Wing may land unless mutual support for Lead is a concern. Always use the tactical frequency to clear up any confusion about the taxi plan.

If taxiing in as a formation: Each aircraft will perform individual After Landing Checklists once clear of the hold-short line and automatically switch to the Ground Frequency. Once the taxi clearance is received or IAW local SOP or Course Rules, Lead will direct Wing to contact base. Once Wing has checked in with base, they will switch back to ground and report back up to Lead using the tactical frequency.
CHAPTER SIX
EMERGENCIES

600. INTRODUCTION

There are additional considerations when handling emergency situations in formation. As Lead, remember to take into account all actions that will affect the Wing. As Wingman, maintain situational awareness at all times and be ready to assist as requested.

In formation, the greatest immediate threat during an emergency is a mid-air collision within the flight. The threat of a mid-air collision can be alleviated by immediately communicating and taking additional separation (weather permitting) as appropriate. It is imperative that the emergency aircraft communicate with the Wingman at the first available opportunity.

In depth trouble shooting should never be done from the Wing position. Therefore, the rule of thumb for handling formation emergencies is, “the bleeder is the leader”: the emergency aircraft will have the Lead, and the non-emergency aircraft will assume Wing and provide mutual support. There are many exceptions to this rule, i.e., the emergency aircraft experiencing communication or navigation problems. In some extreme cases, such as an engine failure, a Lead Change may not be immediately practical, and the emergency aircraft may simply have to fall out of the formation.

Backup assistance can be extremely helpful and may include communication/coordination, reading checklists, locating nearest suitable divert airfields, exterior aircraft inspection, and/or providing a stable platform for reference. Avoid the tendency of trying to assist too much; this is referred to as, “jumping in the emergency aircraft’s cockpit.” Be prepared to offer assistance when requested by the emergency aircraft. The type of assistance required may vary; however, quick and accurate communication between aircraft is the key to safely handling any emergency.

The Perch Position is a position where Wing can provide support to the emergency aircraft. It is defined as a position slightly stepped-up, between the 30-60° bearing lines, with 500’ of separation. This position may be tailored depending on the emergency, but allows Wing to support the emergency aircraft while still allowing the emergency aircraft the freedom to maneuver, utilize the CFS, or eject if needed. If the emergency aircraft is maneuvering for an airfield, Wing should position themselves such that they can view the emergency aircraft and the airfield at all times to help clear traffic.

At no time should Wing linger at Lead’s 6 o’clock position.

Within this FTI, procedures for some specific emergency situations have been expanded upon. Remember that mid-air collision is the biggest threat. Good communication is paramount. The good aircraft should be ready to assist or take the lead when requested. Remember, no flight manual or set of procedures are a substitute for common sense and sound judgment. Compound emergencies, number of aircraft in the flight, available facilities, and adverse weather may require modifications to the sections below.
NOTE

If one aircraft experiences an in-flight emergency, use the proper individual’s ATC call sign to prevent confusion with ATC.

601. AIRCRAFT MAINTENANCE PROBLEMS ON DECK

If either aircraft in the section needs to ground abort or is delayed by a maintenance problem, attempt to contact the other aircraft via the pre-briefed tactical frequency to notify them of your status and when you expect to be ready to taxi. If you are required to take the spare aircraft, have a maintenance problem, or break the normal routine, be careful and thorough, and do not rush checklists.

602. RADIO FAILURES (NORDO)

Radio failure in a formation is a potentially confusing and hazardous situation. If NORDO (No Radio), all radios have failed. The formation should maintain VMC if able.

Signaling Flight: Gain the attention of the other aircraft (whether Lead or Wing). As Wing, gain Lead’s attention by maneuvering your aircraft to an Acute position with sufficient lateral separation. Pass the appropriate hand signal for a down transmitter/receiver as appropriate. The lead position should be offered to the NORDO aircraft in order to troubleshoot and attempt to re-establish radio communications. If radio contact cannot be re-established, the aircraft with the good radios shall take the Lead position to return to base. The good aircraft will inform approach and tower that Wing is NORDO and coordinate for ALDIS lamp signals. If Lead experiences a radio failure after the VFR entry point for the runway in use, a Lead Change will not be conducted. Lead will pass the appropriate lost communication hand signals to Wing, and Wing will pick up all calls for the flight, informing tower of the situation to clear all traffic. The flight will break with interval per local SOP or Course Rules. Wing will request the ALDIS lamps to clear Lead to land. If ALDIS lamps are not visible, Lead may elect to clear the runway and land with caution, or conduct a waveoff and re-enter the pattern with interval.

Troubleshooting: Before executing NORDO procedures, check all connections (Helmet/Seat), ensure that the appropriate frequency is selected/channelized (UFCP), check volumes (Audio Panel), check switches (Audio Panel), try front and aft cockpits radios (if dual), attempt radio communications on both the UHF and VHF radios to include the back-up VHF radio. Make sure that the troubleshooting aircraft is offered the Lead position initially to ease the workload on the NORDO aircrew. Troubleshooting shall be conducted by the crewmember not at the controls.

In the event aircrew encounter an in-flight emergency while NORDO, they will pass the condition of the aircraft to the other aircraft using HEFOE hand signals. The use of HEFOE signals, therefore, assumes that one or both aircraft are NORDO. The HEFOE signal will be preceded by executing a weeping signal as depicted in Appendix B. Subsequently, the aircrew will indicate which system is affected by passing a corresponding number also depicted in Appendix B.
603. INADVERTENT IMC

If a formation flight inadvertently enters IMC conditions, Lead will transition to an instrument scan. Wing will maintain Parade Position and continue their scan on Lead. Lead should determine the best way to exit IMC. If unable to return to VMC, ensure proper terrain clearance, contact ATC to pick up an IFR clearance for the flight, or separate clearances for each individual aircraft at the Flight Lead’s discretion.

604. WINGMAN LOST SIGHT

If Wing loses sight of Lead in IMC, Wing will:

1. Transition to an instrument scan to maintain aircraft control and determine aircraft attitude.
2. Call, “(TAC call sign), lost sight.”
3. Smoothly reduce power by approximately 10% and execute the following procedures:

**NOTE**

During IMC formation flight, Wing will have very little reference to attitude as their scan should be nearly solely on Lead’s aircraft. If Wing loses sight of Lead, it may take Wing several seconds to transition to an effective instrument scan and transmit the “lost sight” radio call. For this reason, a smooth reduction of power once lost sight conditions are recognized is essential to reduce the likelihood of a mid-air.

**Straight and Level:** Wing will smoothly turn away from Lead for a 30° heading change, time for 30 seconds, then parallel Lead’s heading. Lead will transmit their heading and altitude (“(TAC call sign), heading 270 at 5500 feet”). Lead will direct a rejoin *if able to regain VMC*, or coordinate for a separate squawk for the Wingman as appropriate.

**Turns:** If in a turn, the aircraft on the outside of the turn will roll wings level and transmit their exact heading and altitude. The aircraft on the inside of the turn will maintain bank angle and continue the turn to the assigned heading, but no less than a 30° heading change. After 30 seconds of timing, the aircraft that was on the outside of the turn will turn to the assigned heading. Lead will direct a rejoin *if able to regain VMC*, or coordinate for a separate squawk for the Wingman as appropriate.

**Climbs:** If lost sight occurs while in a climb, Wing will level off, state altitude, and execute applicable lost sight procedures (either straight and level, or in a turn). The Lead will continue climbing to the assigned altitude, but not less than 500’ beyond lost sight altitude, then coordinate with ATC if more altitude is required. Lead will direct a rejoin *if able to regain VMC*, or coordinate for a separate squawk for the Wingman as appropriate.

---

**EMERGENCIES** 6-3
**CHAPTER SIX**

**PRIMARY FORMATION**

**Descents:** Wing will level off, state altitude, and execute applicable lost sight procedures (either straight and level, or in a turn). Lead will continue descent to last assigned altitude, but no less than 500’ beyond lost sight altitude, paying close attention to terrain clearances. Lead will direct a rejoin **if able to regain VMC**, or coordinate for a separate squawk for the Wingman as appropriate.

**Instrument approach inside the Final Approach Fix (FAF):** If Wing goes lost sight inside the FAF, Wing will expeditiously turn away from Lead to ensure separation, while simultaneously transitioning to an instrument scan and calling **“(TAC call sign), lost sight.”** Wing will need to use caution when reducing power at BAC. Lead will inform ATC as soon as possible and continue with the approach. Once separation is ensured, Wing will climb to the FAF altitude (or glideslope intercept altitude), proceed to the MAP, and perform the Missed Approach Procedure, unless a new clearance is received from ATC (declare an emergency if required).

**NOTE**

At all times, Wing will ensure approach course guidance is maintained until reaching a Minimum Safe Altitude (MSA) for the approach flown or as directed by ATC.

**605. BLIND PROCEDURES**

In the event Wing loses sight of Lead in VMC, Wing will immediately call, **“(TAC call sign), blind, (altitude).”** If Lead is visual, they will direct Wing’s eyes toward Lead’s position, referencing a clock position, high/level/low from Wing, while ensuring de-confliction (visual aircraft has de-confliction responsibility). After each successive call by Lead, Wing will continue to call either **“blind,”** if Lead is still not in sight, or **“visual,”** if Lead is in sight. If Wing calls **“visual,”** Lead will be directive to either conduct a rendezvous or continue training.

**Example**

Wing: **“(TAC call sign), blind, 8000 feet.”**

Lead: **“(TAC call sign), visual at your left 10 o’clock, level.”**

Wing: **“(TAC call sign), visual.”**

If Lead cannot obtain a visual of Wing in VMC, Lead should maneuver predictably and transmit **“(TAC call sign), blind, (altitude).”** If Wing is visual, they will direct Lead’s eyes toward Wing’s position, referencing a clock position, high/level/low from Lead, while maintaining de-confliction. In situations where Lead expects to be blind (e.g. straight ahead running rendezvous), Lead may request Wingman’s position via radio call (**“(Wingman TAC call sign), say position),”**) without calling blind.

---

**6-4  EMERGENCIES**
If both aircraft call “blind,” proceed as follows:

**Lead:** Transmit altitude, maneuver predictably, and be directive to ensure a minimum of 500’ of altitude separation without crossing altitudes (if at a lower altitude than Wing, remain low until visual). Lead will then direct a rejoin at the pre-briefed location or at an alternate location via the tactical frequency. Proceed direct to the rendezvous point, establish a 30° angle-of-bank left orbit at 200 KIAS. Lead will continue to clear and attempt to regain visual with Wing. When Wing calls “visual,” Lead will direct a rejoin.

**Wing:** Lag Lead’s last known position and clear the flight path. Follow all directive instructions from Lead. Once Lead has determined a rendezvous point, proceed direct to that point. When Lead is in sight, transmit “(TAC call sign), visual.” Maintain altitude separation at all times until visual with Lead. Once Wing is “visual,” conduct the rendezvous IAW Section 308 and Section 405.

![Diagram of Blind Rendezvous](image)

**Figure 6-1 Blind Rendezvous**

**NOTE**

TCAS will not be used as a primary means to rejoin the flight, but may be used as a tool to assist in the rejoin.

**Blind Sun:** During maneuvering, Wing may become blind for a short time due to the sun. If this occurs, Wing will call “blind sun” and lag Lead’s last known position. Lead will monitor Wing and call “continue,” if deconfliction can be maintained or “Angry, knock-it-off,” if Wing is not in sight and deconfliction cannot be maintained. Wing will call “visual” as soon as Lead is reacquired.
As Lead, it is important to take the sun into consideration while maneuvering the flight. During early morning flights and late afternoon flights, particularly in the winter months, the sun is lower in the sky and will be more of a factor. The turn into maneuver will take particular attention to the sun due to Wing’s position lower than Lead, thus requiring Wing to look through Lead’s aircraft and possibly into the sun. As Lead, always be aware of the sun position relative to Wing in formation.

606. SECTION PRECAUTIONARY EMERGENCY LANDING (PEL)

If the Lead aircraft experiences an emergency a radio call should be made quickly to allow Wing to get separation in order to allow Lead to maneuver as needed. If Wing experiences an emergency, they must communicate their intent to take the lead, and a verbal lead change should be conducted as soon as possible.

Example

Wing: “(TAC call sign), with an emergency, request lead left or right.”

Lead: Once visual with Wing is established“(Wingman TAC call sign), you have lead on the left or right.”

This verbal exchange of the Lead/Wingman responsibilities will ensure safe separation between aircraft and allow for mutual support. The new Wing will transition to the Perch Position, assist in clearing the flight path, provide divert airfield information, assist the emergency aircraft with the appropriate procedure (if requested), and monitor the PEL aircraft’s performance (e.g., altitude, airspeed, VSI, etc.). The emergency aircraft will maneuver and configure as appropriate prior to High Key while Wing maintains the Perch Position and matches the emergency aircraft’s configuration. Lead may elect to kiss-off Wing at any time. If the PEL aircraft elects to keep Wing in the Perch Position through the ELP, Wing should remain outside Lead’s turn and should waveoff when directed by Lead, but no lower than 300’ AGL. During the waveoff, Wing should keep their eyes out for other aircraft and be careful not to overspeed the gear or flaps. Normally, the Wing aircraft can safely detach and monitor at High Key.
UNSAFE LANDING GEAR INDICATIONS

The following procedures are provided in addition to those outlined in the T-6B NATOPS Flight Manual.

Unsafe Gear on Takeoff

The aircraft with the unsafe indication should notify the other aircraft and ATC and climb to an emergency orbit or delta pattern (IAW local SOP or Course Rules). Coordinate with the Wingman to get an airborne landing gear inspection. Wing will follow the distressed aircraft to the emergency orbit or delta pattern in order to assist. If on a solo flight, the solo without the gear problem will depart the field and reenter as a single aircraft IAW local SOP or Course Rules.

NOTE

At no time shall student solos join-up to inspect landing gear.

Unsafe Gear Prior to Landing

The aircraft with the unsafe indication should climb to the emergency orbit or delta pattern, making the appropriate radio calls to tower and the Wingman. Wing will follow the distressed aircraft to the emergency orbit or delta pattern and assist as necessary. If on a solo flight, the solo without the malfunction will comply with tower instructions.
NOTE

Emergency aircraft may elect to have Wingman/chase aircraft, base, or RDO help read checklists and help troubleshoot.

608. AIRBORNE LANDING GEAR INSPECTION

Consideration should be given to using a discrete radio frequency between aircraft (e.g., Base, Common) to avoid excessive communication chatter and confusion on a controlling agency. The inspection should be conducted at a minimum of 2000' AGL. Cockpit-to-cockpit communication should include, at a minimum, any changes in configuration, airspeed, or altitude of the aircraft being inspected. The inspecting aircraft should keep the other aircraft informed of their current position and intended movements and should not take undue risks while inspecting the landing gear. The inspecting aircraft should use caution if the emergency aircraft shows signs of gear damage that could result in portions of the gear departing the aircraft.

NOTE

Students shall not be in control of the aircraft during the landing gear inspection.

609. MID-AIR/AIRBORNE DAMAGED AIRCRAFT/BIRDSTRIKE

Aircraft will follow procedures established in the current T-6B NATOPS Flight Manual. A mid-air collision is an inherent risk when flying formation. Mid-air collisions can be either minimal or catastrophic and can be within the section or external to the flight.

If severe damage occurs, the aircraft may go into out of control flight (OCF). Delaying ejection in an attempt to recover the aircraft may place the aircrew out of the ejection envelope.

If minimal damage occurs, both aircraft should communicate, separate, and maintain visual contact with each other until de-confliction is assured. The flight will not rejoin. Lead will immediately be directive and start working a de-confliction plan between the two aircraft. Aircraft shall ensure lateral separation using separate working blocks if available, ground references, distance measuring equipment (DME), and/or altitude separation. If possible, Lead should consider coordinating individual chase/inspecting aircraft. After all appropriate emergency checklists are complete, a plan should be developed to get both aircraft on the deck safely. If the possibility exists of damaging the runway or producing a FOD hazard, each aircraft in the flight may choose to land at different airfields.

If a single aircraft in the formation is damaged (e.g., bird strike), the damaged aircraft will communicate (if able), climb to a safe altitude, assume Lead and assess damage. If damage to aircraft or aircrew prevents forward visibility, a controlled ejection may be the only option. The good aircraft will assume the Perch Position and assist as necessary.
610. DOWN AIRCRAFT PROCEDURES

If an aircraft within the flight has to eject, the other aircraft will assume the responsibilities of On Scene Commander and execute the appropriate checklists in accordance with local SOP or Course Rules. If it is an aircraft external to the flight, the Flight Lead will assume On Scene Commander, but may delegate to the Wingman as needed based on position, fuel state, etc.

The aircraft assuming On Scene Commander shall remain on station until relieved by a more capable SAR asset, rescue is complete, aircraft reaches Bingo, or has its own emergency. Although aiding the downed aircrew is important, the safe, orderly conduct of the rescue is equally as important. A thorough handover should be conducted prior transferring On Scene Commander responsibilities to another aircraft.

NOTE

Never give out names over the radio. Limit communication to call sign and number of observed chutes.
APPENDIX A
GLOSSARY

ABC’s: Term used to prioritize corrections while in formation. Altitude, Bearing, then Closure/Separation.

Abeam: A position, either on the left or right side, which is 90° off the longitudinal axis of the aircraft.

Acute: A condition in which the Wingman is positioned forward of a designated bearing line.

Bandit: Term used for a hostile aircraft.

Bearing: Angle off the nose of an aircraft used for position reference.

Bearing Line: An imaginary line drawn aft from Lead's 3/9 line. Measured as angular difference between the Wingman's aircraft and Lead's 3/9 line (i.e., being established on the 60° bearing line means the Wingman is offset 30° from Lead's 6 o'clock position).

Bingo: A predetermined fuel state informing the flight that an aircraft is at a fuel state where they need to recover at the planned destination in order to land with minimum fuel requirements at the planned recovery base.

Blind: A term used to communicate visual contact is lost with a member of the formation while maneuvering in VMC (opposite of “Visual”).

Bogey: Term used for an aircraft with unknown intent. Once identification can be made, these aircraft will normally then be classified as either friendly or bandits.

Break: The portion of the landing pattern where an aircraft executes a decelerating turn to downwind.

Breakup: A maneuver utilized to separate the formation aircraft and establish them in trail or column.

Check Six: A visual lookout to check the aircraft or formation’s 6 o’clock position for other aircraft (e.g., bogeys or bandits).

Checkpoint: A selected point or set of points, on the Lead aircraft, which are utilized by the Wingman to determine relative position.

Closure: The rate at which an aircraft reduces range on another aircraft.

Crossunder: A maneuver utilized to change the position of the Wing aircraft from one side of the Lead to the other.
**Cruise Formation**: A formation which allows the Wingman more flexibility and provides better lookout capabilities and fuel efficiency for the Wingman.

**Cutout**: A visual checkpoint on the T-6B referring to the outermost or innermost corner of that portion of the wing that has been cut out to allow installation of the aileron.

**Dash Two, Dash Three, etc.**: A term used to refer to successive Wingman in a formation.

**Division**: Flight of three or more aircraft.

**Flight Integrity**: The ability of the Wingman to maintain the proper relative position while the formation is performing maneuvers.

**HEFOE**: A method of signaling system failure when NORDO, using hand signals during the day or a flashlight at night.

**Hung on the Bearing**: A condition during the rendezvous where the Wing aircraft ceases to continue closing on the Lead aircraft (a.k.a. stagnating on bearing).

**IFR Parade**: A formation used when a section is penetrating clouds or during an instrument approach.

**Joker**: A predetermined fuel state (above Bingo fuel) informing the formation that a flight member is at a fuel state whence the present maneuver needs to be terminated in order to accomplish the remainder of the planned profile.

**Kiss-Off**: The signal Lead gives prior to detaching Wing from the flight.

**Knock-It-Off**: A radio call used by a flight member to alert the formation to cease maneuvering. This radio call should be preserved as an "unexpected stop and attention getter" and may be initiated by any flight member.

**Lag Pursuit**: A maneuver used by Wing when Lead is in a turn to maintain or increase nose-to-tail separation and range. Wing maneuvers to the outside of Lead's turn by pointing the nose of the aircraft behind Lead's tail.

**Lead Pursuit**: A maneuver used by Wing when Lead is in a turn to decrease nose-to-tail separation and range. Wing maneuvers to the inside of Lead's turn by pointing the nose of the aircraft in front of Lead.

**Lost Sight**: A term used by the Wingman to communicate that they have lost visual contact with the Lead aircraft during IMC conditions.

**Nose-To-Tail**: The distance from the preceding aircraft’s tail to the wingman’s nose.
Parade Position: Fixed position on the 45º bearing on either the left or right side of the Lead aircraft with proper step-down and wingtip separation.

Parade Rate of Roll: Roll rate in which 30º AOB is achieved in 4-5 seconds.

Plane of Motion: An imaginary plane defined by the aircraft's flight path.

Playmate: A term used when referencing aircraft participating in your formation.

Prop Arc: A visual checkpoint on the T-6B referring to the outermost portion of the circle created by the tips of the propeller blades in motion.

Pure Pursuit: Pure pursuit is achieved when there is no LOS movement; the other aircraft remains fixed in position on the canopy.

Relative Motion: Any movement of the Wingman's aircraft in relation to the Lead's.

Running Rendezvous: A rendezvous used to join a flight together while continuing on course after takeoff.

Section: The basic flying unit used in formation consisting of two aircraft.

Section Penetration: Two aircraft executing an instrument approach in formation.

Section Takeoff: Two aircraft taking off simultaneously in formation.

Shake Off: A visual signal (negative head shake) given by the Wingman to indicate they are not prepared to execute the next maneuver or required action.

Stack: A visual checkpoint on the T-6B, referring to the trailing edge of the exhaust stacks.

Stable/Stabilize: Being stable means being in control and able to complete the maneuver safely within the pilot’s capabilities. Stabilize does not mean stop. It means under control.

Step-Down: The vertical distance below Lead's wing.

Step-Up: The vertical distance above Lead's wing.

Sucked: A situation where a Wingman is behind the bearing line.

Tail Chase: Maneuvering designed to demonstrate the concepts of lead, lag, and pure pursuit and its effects on nose-to-tail separation while dynamically maneuvering the section.

Terminate: A radio call (normally initiated by the Flight Lead) to terminate an exercise or maneuvering. This differs from the knock-it-off (KIO) call in that it is anticipated/expected (e.g., after cruise maneuvering).
**Trail**: A formation pattern where the Wing is directly behind the Lead aircraft.

**Turn Circle**: The flight path described by an aircraft in a turn.

**Turn Radius**: The distance between an aircraft's flight path and the center of the turn circle.

**Turn Rate**: Change in heading expressed in degrees per second at which an aircraft is turning.

**Underrun**: A maneuver that allows the Wing aircraft to pass below, behind, and outside the Lead's radius of turn in the event that the rendezvous becomes unsafe.

**Visual**: A term used to communicate positive visual contact with an aircraft in the formation, or any friendly aircraft (opposite of “Blind”).
Figure B-1  General Signals
<table>
<thead>
<tr>
<th>Signal</th>
<th>Meaning</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raises two fingers in back/forth motion</td>
<td>Perform normal engine runup</td>
<td>Wingman acknowledges signal and executes runup and responds with a thumbs-up</td>
</tr>
<tr>
<td>Section leader raises arm vertically</td>
<td>Preparatory: takeoff path clear</td>
<td>N/A</td>
</tr>
<tr>
<td>Section leader drops arm smartly below canopy rail</td>
<td>I am commencing section takeoff</td>
<td>Wingman executes section takeoff</td>
</tr>
</tbody>
</table>

Figure B-2 Takeoff Signals
Figure B-3 General Airborne Signals (1)
Figure B-4 General Airborne Signals (2)
Figure B-5  General Airborne Signals (3)

Figure B-6  General Airborne Signals (4)
Figure B-7 General Airborne Signals (5)
<table>
<thead>
<tr>
<th>Signal</th>
<th>Meaning</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raised fist with thumb extended in drinking position</td>
<td>How much fuel do you have?</td>
<td>Indicate remaining fuel in tens of lbs by finger numbering</td>
</tr>
<tr>
<td>Weeping signal and then finger(s) held vertically to signify following meanings</td>
<td>I'm in trouble</td>
<td>Nod or thumbs-up. Pass lead to disabled aircraft or assume lead, as required</td>
</tr>
</tbody>
</table>

**HEFOE Code**

- Hydraulic system: 1 finger
- Electrical system: 2 fingers
- Fuel system: 3 fingers
- Oxygen system: 4 fingers
- Engine: 5 fingers

Figure B-8 General Airborne Signals (6)
Figure B-9  General Airborne Signals (7)
Figure B-10  Approach Signals
THIS PAGE INTENTIONALLY LEFT BLANK