



Civil Air Patrol

National Flight Academy Powered
Training Course Outline/Syllabus

NATIONAL FLIGHT ACADEMY POWER TRACK

FLIGHT RULES

- 1) National Flight Academy training flights shall not begin prior to sunrise.
- 2) NFA training aircraft (any aircraft being flown with cadets on board for the purpose of instruction) shall be on the ground no later than 30 minutes before sunset.
- 3) Student solo flights outside-the airport traffic pattern are not authorized.
- 4) All Crews will begin each day by filling out an ORM sheet. (1 per plane per day)
- 5) NFA Weather Minimums

a) Dual Instruction Flights

No dual flight instruction will be given at a NFA unless the weather (current and forecast for time of return) meets the following criteria:

- i) For flights outside the airport traffic pattern:
 - (1) Ceilings no less than 2500' AGL.
 - (2) Flight visibility, no less than 3 nautical miles.
 - (3) Winds no greater than 20' kts (sustained or gust) and not exceeding the aircraft's maximum demonstrated crosswind on the runway(s) to be used.
- ii) Dual instruction flights 'may depart IFR (to VFR conditions) if all conditions below are met:
 - (1) Each flight is individually approved by the chief flight instructor.
 - (2) An IFR flight plan is filled prior to departure.
 - (3) The training portion of the flight is conducted under the weather conditions mentioned above.
 - (4) The weather is forecasted to be VFR for the time of return, the instructor holds an instrument instructor rating.
 - (5) The instructor has current CAP Form approving instrument flight
 - (6) The instructor meets FAR instrument currency requirements.
- iii) For flights restricted to the airport traffic pattern:
 - (1) Ceilings no less than 1500' AGL.
 - (2) Flight visibility no less than 3 nautical miles.
 - (3) Winds no greater than 15 kts (sustained or gust) and not exceeding a crosswind component of 10 kts on the runway(s) to be used.

b) Solo Flights

No student solo flight will be conducted at a NFA unless the weather (current and forecast for time of return) meets the following criteria:

- i) Ceiling no less than 2000' AGL.
- ii) Flight visibility no less than 5 nautical miles.
- iii) Winds no greater than 10 knots (sustained or gust) and not exceeding the aircraft's maximum demonstrated crosswind on the runway(s) to be used.

6) NFA Minimum Fuel Requirements

- a) NFA training flights shall not depart without sufficient fuel to fly for the scheduled training sortie time at cruise power and continue thereafter for 60 minutes at cruise power.

CADET FLIGHT ACADEMY TRAINING STANDARDIZATION

- 1) Transfer of control of the aircraft must be explained to the student before every flight. The procedure **will** be a challenge/response technique. The instructor will challenge with the phrase, "I have the flight controls" and the student responds "you have the flight control". The instructor then says "I have the flight controls."
- 2) The student must sit high enough to have good visibility over the nose of the aircraft. This is approximately high enough to just see the top of the engine cowling from the normal, seated position. Use a cushion **if** necessary. The student should be sitting forward enough to make full rudder pedal deflections, but not so far forward that full aft movement of the control wheel is inhibited. Be sure that the student's seat is adjusted to the same position for each flight.
- 3) Explain that the rudder control is the bottom of the rudder pedal, and brakes are at the top. Heels should normally rest on the floor unless braking is desired. Ensure that the student understands that the brakes and the rudder are completely separate and independent controls.
- 4) Stress dividing attention from the very first flight -- check wingtip to determine pitch and bank angle, look for traffic, check pitch attitude over the nose of the aircraft, check airspeed, etc. Reiterate dividing attention during all maneuvers.
- 5) Insist on a continuous scan for traffic from the very first flight.
- 6) Perform clearing turns before EVERY practice maneuver -- stalls, steep turns, MCA, and ground reference maneuvers. Clearing turns consist of at least 180 degrees of turn (one 180, or two 90 degree turns in opposite directions) at standard rate, but no steeper than 30 degrees of bank.
- 7) Student should be taught to keep one hand on the throttle during all ground operations, takeoff, climb out, and all operations at low altitude.
- 8) Be sure the student uses a constant reference for determining pitch attitude. Putting a fist, thumb up, on top of the instrument panel works well for determining level flight attitude -- student can count how many fingers the horizon is above the panel. Different methods will work for different students, but the method chosen should be used consistently.
- 9) The student must know and demonstrate the correct pitch, power, and flap settings for all maneuvers without reference to the airspeed indicator.
- 10) During level-off from a climb, leave full power on until the desired cruise speed is reached. Trim should be used to relieve pressure on the control wheel as the aircraft accelerates. This gets the aircraft up to cruise speed quickly and minimizes level-off time, and trim and power adjustments. Teach "Pitch, Power, Trim" for all changes between level flight and climb or descents. ie: set the pitch attitude first, then when desired airspeed is reached, set the power, and finally, trim the airplane for that speed.
- 11) Use 65% power as the cruise power setting for local area practice. This will save fuel, require less area for accomplishing the maneuvers, and allows for quicker transition from one maneuver to another.

- 12) Insist the student use one hand on the control wheel for all maneuvers, including landing. Ensure the student uses a light grip on the wheel. **Do not teach the student to trim the airplane into the landing flare.** Excessive up-elevator trim, combined with lowered flaps can cause a violent pitch up movement during a go-around attempt.
- 13) Monitor the student's control coordination closely, and correct whenever necessary.
- 14) Back elevator pressure must be added in all turns, including descending turns. Errors show up in the traffic pattern as too high an airspeed at the completion of the turns.
- 15) Constantly monitor climbs, MCA, and power-on/off stalls for proper right rudder inputs.
- 16) Use V_y and full power for all climbs, and monitor pitch attitude closely.
- 17) Introduce stalls during minimum controllable airspeed flight by allowing the wing to "nibble" at the stall as a result of excessive pitch. This will result in a gentle stall, with little break, and an easy recovery to MCA flight. That should be followed with a series of gliding stalls that are recovered without power. Then minimum altitude loss techniques are taught through power-on recoveries.
- 18) From power-off stalls, proceed into teaching approach/landing stalls. Teach "Release back pressure, Power up, Pitch up, Flaps up" for recovery. Recoveries from both imminent and fully stalled conditions should be taught for all stalls.
- 19) Student should understand that, for a given airspeed, the pitch attitude must be lower with flaps than without flaps. This is because flaps increase the angle of attack even though pitch remains the same.
- 20) Before beginning serious practice in the traffic pattern, the student should master the rectangular course ground reference maneuver, and be able to maintain a straight track over the ground using both crab and side-slip techniques.
- 21) Teach the student to use an "aim point" to judge the angle of the final approach. If the aim point appears to be moving up in the windshield, you will land short. (If the point appears to move down, you will overshoot. Emphasize that this technique requires accurate pitch control to work with any kind of consistency.
- 22) Teach the student to go-around if the result of the approach is ever in any doubt. This can be reinforced if you, as the instructor, initiate a go-around during a demonstrated landing.
- 23) Ensure that the student considers any crosswind component into the planning of the traffic pattern, especially the turn from base leg to final. Emphasize that increasing the turn's bank angle, or trying to "rudder" the aircraft around the turn to correct for an overshoot of the final approach course is dangerous.
- 24) Teach the landing as a two-step process: 1. The round-out and 2. The flare. Round-out is when the aircraft's pitch is increased and the rate of descent is arrested. Flare is when the aircraft's pitch is further increased to the landing attitude. In a well executed approach and landing, these two steps occur as one continuous motion. Discourage "feeling" for the runway with alternate raising and lowering of the nose. Once the pitch attitude is increased in the round-out or flare it should not be lowered again. If the level-off is made too high, a go-around is usually called for. No attempt should be made to salvage a bad landing with power.

- 25) If a landing cannot be made in the first third of the runway, or in the middle third laterally, a go-around should be initiated.
- 26) After landing, the student should be taught to hold the elevator back pressure, and let the nose wheel lower itself to the runway as the aircraft slows. Student should be sensitive to directional control during the roll-out.
- 27) When practicing touch-and-goes, do not initiate the "go" until the nose wheel is on the runway, and the flaps are retracted to the takeoff position. This will help prevent loss of directional control and full-flap takeoffs. If the runway is too short to do this safely, then the runway is TOO Short.
- 28) Teach the student to avoid excessive braking during the roll-out. **Remember: The only turn-off you HAVE to make is the LAST turn-off.**
- 29) Teach only the side-slip method for crosswind landings. The "crab/kick" method requires the student to make a perfectly-timed, abrupt control movement when their attention is focused on the last few inches of altitude. Should the student "balloon," he/she will be left high in the air, with low speed and drifting away from the runway. The side-slip method establishes the proper drift correction well out on the final approach, and requires little adjustment throughout the landing.
- 30) Students fatigue easily with concentrated takeoff and landing practice. Continued work in the traffic pattern, hour after hour is an indication that the basics of flying the aircraft have not been mastered. It is much better to delay concentrated pattern work until the air work and ground reference maneuvers are acceptable than to rush into takeoffs and landings, hoping that things will smooth out in the pattern. They will usually get worse. Students who have mastered the air work and ground reference maneuvers, and who can fly all the maneuvers using outside attitude references require surprisingly little practice in the pattern to learn proper landing technique.
- 31) The flight instructor will bring to the attention of the Chief Flight Instructor, information regarding students who are having greater than normal difficulties with training, as soon as possible. Typical problems such as students prone to airsickness, or a student requiring evaluation by a different instructor, can be easier to deal with early in the program rather than near the end of the encampment.
- 32) As in all other CAP activities: **SAFETY IS OUR #1 GOAL!!**

COMPLETION LEVEL KEY

- LEVEL 1** Student is able to participate in the maneuver as it is demonstrated by the flight instructor.
- LEVEL 2** Student is able to perform the assigned maneuver with explanation, and minimum assistance from the flight instructor.
- LEVEL 3** Student is able to perform the assigned maneuver with a minimum of explanation, and with no assistance from the flight instructor.
- LEVEL 4** Student is able to perform the assigned maneuver to the level of competence necessary for safe, solo flight, with no explanation or assistance from the flight instructor.

LESSON 1 - DUAL FLIGHT

The first lesson consists of familiarization with the airplane and its operating procedures, the sensations of flight, local flight areas, and the use of flight controls and instruments. A one-hour round-trip flight to the practice area or nearby airport is effective in stimulating a new student's interest.

<u>OPERATION</u>	<u>COMPLETION LEVEL</u>	<u>COMMENTS</u>
1. Airplane Familiarization <ul style="list-style-type: none"> • Pre-flight inspection - use checklist • Cockpit familiarization • A/C flight manual • A/C certificates and documents 	Level 1	Approx .5 hr this lesson
2. Engine Start <ul style="list-style-type: none"> • Use of checklist • Safety precautions • Clearing area 	Level 1	
3. Radio Operation <ul style="list-style-type: none"> • Audio panel & switches • Squelch operation 	Level 1	
4. Taxiing <ul style="list-style-type: none"> • Use of throttles & brakes • Control position for windy conditions 	Level 1	
5. Pre-takeoff Check <ul style="list-style-type: none"> • Use checklist 	Level 1	
6. Takeoff. Traffic Pattern & Climb out <ul style="list-style-type: none"> • Area familiarization 	Level 1	Stress good traffic scan right from the start.
7. Flight Controls - Four Fundamentals <ul style="list-style-type: none"> • Control effects & Usage • Stability • Trim • Straight & Level Pitch & bank control • Turns - medium bank (approx. 30 degrees) • Effects of power (turning tendencies) • Leveling off from climbs & descents • Climbs & descents (straight & turning) • Use of flaps 	Level 1	Do by visual reference (VR) & instrument reference (IR). Do not use hood, but show all instrument reactions. Demonstrate adverse yaw. Correct way first, and then un-coordinated.
8. Traffic Pattern, Approach. Landing & Parking	Level 1	Stress correct landing attitude on each landing.
9. Post-Flight Discussion		"Good flight" - ALWAYS!
10. Preview Next Lesson <ul style="list-style-type: none"> • Review straight & level, turns, climbs & descents. Introduce steep turns. slow-flight & power-off stalls 		Most students can climb, descend & turn at end of lesson 1.

LESSON 2 - DUAL FLIGHT

At the end of the second lesson, the student should be able to perform the four basic maneuvers (straight & level, turns, climbs, and descents) with minimum assistance and slow-flight and power-off stalls under the direction of the instructor.

<u>OPERATION</u>	<u>COMPLETION LEVEL</u>	<u>COMMENTS</u>
1. Pre-Flight Discussion		Limit all IR training to a time permitting basis.
2. Pre-Flight Inspection	Level 2	
3. Engine Start	Level 2	
4. Radio Operation	Level 2	
5. Taxiing	Level 2	
6. Pre- Takeoff Check	Level 2	
7. Takeoff and Departure <ul style="list-style-type: none"> • Departure & level off procedures 	Level 2	
8. Climbing Turns	Level 2	VR & IR to predetermined altitude
9. Straight & Level	Level 2	VR&IR
10. Medium Turns	Level 2	VR&IR
11 Steep Turns	Level 1	Warm-up with 45 degree of bank, then 50 - 60 degrees.
12. Airspeed & Configuration Changes	Level 1	Use this to lead into MCA & stalls.
13 Slow Flight/Minimum Controllable Airspeed (MCA)	Level 1	Without flaps at first, then with different flap settings up to full flaps.
14. Power-Off Stalls	Level 1	Start with recoveries without power, and then show how power reduces the altitude lost.
15. Descents & Gliding Turns	Level 2	
16. Traffic Pattern, Approach, Landing & Parking	Level 2	Stress the correct landing attitude on every landing.
17. Post-Flight Discussion		
18. Preview Next Lesson <ul style="list-style-type: none"> • Review previous maneuvers. • Introduce approach/landing stalls. 		

LESSON 3 - DUAL FLIGHT

At the completion of this lesson, the student should perform the four basic flight maneuvers with a reasonable degree of proficiency, and should accomplish slow-flight and power-off stalls with minimum assistance from the instructor. The student should be responsible for pre-flight inspection, starting procedures, radio communication, taxiing, and parking without direction from the instructor, except in unusual or unfamiliar situations.

<u>OPERATION</u>	<u>COMPLETION LEVEL</u>	<u>COMMENTS</u>
1. Preflight Discussion		Limit all IR training to a time permitting basis.
2. Preflight, Starting Engine, & Taxiing	Level 3	
3. Takeoff & Departure	Level 2	
4. Climbs & Climbing Turns	Level 2	
5. Level-off from Climbs and Descents	Level 3	
6. Straight & Level, Medium-bank Turns	Level 3	
7. Airspeed & Configuration Changes	Level 2	Re-emphasize good traffic scan techniques.
8. Minimum Controllable Airspeed	Level 2	VR & IR to predetermined altitude.
9. Power-off Stalls	Level 2	VR&IR
10. Approach/Landing Stalls	Level 1	VR&IR
11. Descents & Descending Turns	Level 3	Warm-up with 45 degree of bank. then 50 - 60 degrees.
12. Traffic Pattern, Approach, Landing & Parking	Level 2	Use this to lead into MCA & stalls.
13. Post-flight Discussion		Without flaps at first, then with different flap settings up to full flaps.
14. Preview Next Lesson Power-on Stalls		Start with recoveries without power, and then show how power reduces the altitude lost.
<ul style="list-style-type: none"> • Ground Reference Maneuvers • Landing Approaches • Forced Landings & Emergencies 		

LESSON 4 - DUAL FLIGHT

Upon completion of this lesson the student should have the ability to recognize and recover from stalls with little or no assistance from the instructor, fly prescribed patterns by ground references, and execute a traffic pattern and landing approach with the instructor's direction.

<u>OPERATION</u>	<u>COMPLETION LEVEL</u>	<u>COMMENTS</u>
1. Pre-flight Discussion		Emphasize the need for good altitude, heading & airspeed control during all maneuvers.
2. Preflight Inspection, Starting Engine, & Taxiing	Level 3	
3. Takeoff (Normal & X-wind) & Departure	Level 2	
4. Straight & Level, Med. Turns, Climbs, & Descents	Level 3	VR&IR
5. Steep Turns	Level 2	Use 45 degrees of bank.
6. Minimum Controllable Airspeed	Level 3	
7. Approach/Landing Stalls	Level 2	
8. Power-on Stalls	Level 2	Use power-on stalls to intro, takeoff//departure stalls.
9. Takeoff/Departure Stalls	Level 1	Emphasize minimum altitude loss during recovery.
10. Emergency Procedures <ul style="list-style-type: none"> • Forced Landings • System Emergencies 	Level 1	Use memorized, "immediate action" checklist, and printed checklists.
11. Ground Reference Maneuvers <ul style="list-style-type: none"> • Parallel Track (road or section line) • Rectangular Course • S-turns Across a Road 	Level 2	Instructor demo if needed. Show effects of wind on ground track and turn radius.
12. Traffic Pattern, Approach, Landing, Parking	Level 2	
13. Post-flight Discussion		
14. Preview Next Lesson <ul style="list-style-type: none"> • Traffic Pattern • Takeoffs & Landings • Emergency Procedures 		

LESSON 5 - DUAL FLIGHT

This lesson is a review of the flight maneuvers and procedures already covered in preparation for concentrated work on traffic patterns, takeoffs, and landings. Reasonable proficiency in coordination, airspeed control, and ground reference maneuvers should be achieved prior to the completion of this lesson.

<u>OPERATION</u>	<u>COMPLETION LEVEL</u>	<u>COMMENTS</u>
1. Pre-flight Discussion		
2. Pre-flight Inspection, Starting Engine	Level 4	
3. Takeoff (Normal & X-wind) & Departure	Level 3	
4. Straight & Level, Med. Turns, Climbs, Descents	Level 4	VR& IR
5. Steep Turns	Level 3	
6. Minimum Controllable Airspeed	Level 3	VR & IR Relate recovery technique to go-around
7. Approach/Landing Stalls	Level 3	Imminent and full stalls
8. Ground Reference Maneuvers <ul style="list-style-type: none"> • Crabs and Slips 	Level 3	Demonstrate crab then slip. Explain differences, and uses.
9. Takeoff/Departure Stalls	Level 2	
10. Emergency Procedures <ul style="list-style-type: none"> • Forced Landings • System Emergencies 	Level 2	Re-emphasize pitch vs. airspeed. Do at various flap and approach power settings.
11. Glides & Descents	Level 4	
12. Traffic Pattern, Approach, & Landing	Level 2	1 or 2 times as time permits.
13. Parking and Shutdown	Level 4	
14. Post-flight Discussion		
15. Preview Next Lesson <ul style="list-style-type: none"> • Takeoffs & Landings (Normal & X-wind) • Accelerated Stalls • Go-Arounds • Wake Turbulence Avoidance 		

LESSON 6 - DUAL FLIGHT

- The first half of this lesson is a review of previous flight maneuvers, and accelerated stalls are introduced. Concentrated takeoffs and landings should begin in the second half of this lesson.
- At the completion of this lesson the student should demonstrate a high degree of proficiency in all flight maneuvers, and be able to make takeoffs and landings with minimal assistance from the instructor.

<u>OPERATION</u>	<u>COMPLETION LEVEL</u>	<u>COMMENTS</u>
1. Pre-flight Discussion		Emphasize precision in airspeed & altitude control.
2. Takeoff (Normal & X-wind) & Departure	Level 4	
3. Steep Turns	Level 4	
4. Minimum Controllable Airspeed & Approach/Landing Stalls	Level 4	Do Approach/Landing. Stalls out of MCA.
5. Ground Reference Maneuvers <ul style="list-style-type: none"> • Rectangular Course 	Level 4	Relate rectangular course to the traffic pattern.
6. Takeoff/Departure Stalls	Level 3	Imminent and full stalls.
7. Accelerated Stalls	Level 2	
8. Emergency Procedures <ul style="list-style-type: none"> • Forced Landings 	Level 3	Simulated in the traffic pattern.
9. Traffic Pattern	Level 3	Emphasize communications and traffic vigilance.
10. Wake Turbulence Avoidance	Level 3	
11. Approach & Landing (Normal & X- wind)	Level 3	
12. Go-Arounds & Balked Landing	Level 4	
13. Post-flight Discussion		
14. Preview Next Lesson <ul style="list-style-type: none"> • Slips to landings • Emergency Procedures 		

LESSON 7 - DUAL FLIGHT

At the completion of this lesson the student should be able to make unassisted takeoffs and landings (even in light crosswinds), and accurately fly the traffic pattern. A short review of previous flight maneuvers is introduced to break up the monotony of traffic pattern flying.

<u>OPERATION</u>	<u>COMPLETION LEVEL</u>	<u>COMMENTS</u>
1. Pre-flight Discussion		
2. Takeoffs (Normal & X-wind)	Level 4	
3. Approach/Landing Stalls	Level 4	
4. Accelerated Stalls	Level 3	
5. Emergency Procedures	Level 4	
<ul style="list-style-type: none"> • Partial Power Loss • Complete Power Loss • Electrical Failure • Aborted Takeoffs 		
6. Forward Slips to Landing	Level 3	During no-flap landings simulating electrical failure. Beware of student fatigue.
7. Takeoffs & Landings	Level 4	
8. Wake Turbulence Avoidance	Level 4	
9. Post-flight Discussion		Critique this flight with first solo in mind for next lesson.
10. Preview Next Lesson		
<ul style="list-style-type: none"> • Accelerated Stalls • Forward Slips to Landing • Emergency Procedures 		

LESSON 8 - DUAL AND SOLO FLIGHT

At the conclusion of the dual portion of this lesson, the student should have achieved a reasonably high degree of proficiency in all flight training maneuvers, and be able to make consistent, safe takeoffs and landings without instructor assistance or direction. Student should also be capable of recovering from poor approaches and bad bounces during landing. He/she should have demonstrated the ability to solve all ordinary problems encountered during local flights.

<u>OPERATION</u>	<u>COMPLETION LEVEL</u>	<u>COMMENTS</u>
1. Pre-flight Discussion		
2. Takeoffs (Normal & X-wind)	Level 4	
3. Accelerated Stalls	Level 4	
4. Emergency Procedures	Level 4	
• Forced Landings		
5. Takeoffs & Landings	Level 4	
6. Forward Slips to Landing	Level 4	During no-flap landings only.
7. SOLO FLIGHT		CONGRATULATIONS!
8. Post-Flight Discussion		Student rests. Instructor critiques student's performance, encouraging continued flight instruction towards private certificate.

FLIGHT INSTRUCTION LOG

STUDENT:	INSTRUCTOR:													
Flight #	1	2	3	4	5	6	7	8	9	10	11	12	13	14
LESSON #														
Pre-flight Inspection														
Engine start, Taxi and Run-up														
Radio Operations and Communications														
Takeoff (Normal)														
Crosswind Takeoff														
Climbs and Level-off														
Straight and Level														
Turns (Shallow and Medium)														
Steep Turns (50-60 degrees of bank)														
Descents (Glides) and Level-off														
Slow Flight and Minimum Controllable Airspeed														
Power-off Stalls and Approach/Landing Stalls														
Power-on Stalls and Takeoff/Departure Stalls														
Accelerated Stalls														
Emergency Procedures and Forced Landings														
Ground Reference Maneuvers														
Landings (Normal)														
Crosswind Landings														
Go-Arounds and Balked Landing Recovery														
Slips (side-slips and Forward slips) to Landing														
Use of Flaps														
Basic Instrument Flight														
Parking, Shutdown and Securing Aircraft														
Vigilance, collision & wake turbulence avoidance														
Judgment														
Use of Checklists														
Flight Time (This Flight)														
Total Flight Time														

Fill in the completion level the student has attained for each maneuver. A lesson is not completed until the required completion level for each maneuver in that lesson has been attained.

Flight #	INSTRUCTORS COMMENTS	OBJECTIVES FOR NEXT FLIGHT *	Instructor's Signature
			Student's Signature
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			

* Include the number of the lesson to be flown and/or specific maneuvers to be accomplished in continuation of the same lesson.



CIVIL AIR PATROL
United States Air Force Auxiliary
Cadet Program Directorate

Cadet Flight Training Study Guide

NOTE

This study guide is designed for the National Flight Academy Ground School. The information contained is based on the C-172-180 horsepower engine. On the flightline, you will be assigned to a Cessna 172, but the model may vary. The differences between the aircraft information taught in ground school and that given in your assigned aircraft's pilot operations handbook will be briefed by your instructor. Your flight instructor is the final authority on the information you will need to know.

Edited June 2002 by
Chaplain LtCol. Bernard Johnson

Revised and expanded June 2007 by
LtCol. Brian D. Childs

PART 1

Primary Flying

C -172

PREFACE

This study guide is divided into two parts: Part 1: Primary Flying C-172 and Part 2: Aircraft Flight Manual C-172. The format of the guide resembles, as closely as possible, academic flight instruction manuals and USAF aircraft flight manuals (commonly called the "Dash One") to help familiarize the student with publications to be used during Undergraduate Pilot Training. It contains specific information required in the course of instruction, specific to the Cadet Flight Training Program and the necessary information for study compiled from other available sources, as appropriate.

PART 1

This part contains the basic principles, procedures and restrictions which apply to all personnel operating C-172 aircraft under operational control of the Civil Air Patrol Cadet Flight Training Program.

PART 2

This part contains information regarding systems, flight characteristics, and operating procedures for C-172 aircraft under operational control of the Civil Air Patrol Cadet Flight Training Program.

CHECKLISTS

The Flight Manual contains only amplified checklists. Abbreviated checklists have been issued as supplemental publication. Line items in the Flight Manual and checklists are identical with respect to arrangement and item numbers.

STANDARDIZATION AND ARRANGEMENT

Standardization assures that the scope and arrangement of all Orientation Guides are identical. The manual is divided into independent sections to simplify reading it straight through or using it as a reference manual.

SOUND JUDGMENT

This study guide provides the best possible operating instructions under most circumstances, but it is not a substitute for sound judgment. Multiple emergencies, adverse weather, terrain, etc., may require modification of the procedures.

DEFINITIONS

The following definitions apply to the use of the words "shall," "will," "should," and "may."

Shall: Construed to mean that the requirements are binding or mandatory.

Will: Used to express a declaration of purpose. This term is used in descriptive material only, not in procedural information.

Should: Used to express a non mandatory desire or preferred method of accomplishment and shall be construed as a non-mandatory provision.

May: Used to express an acceptable or suggested means of accomplishment and shall be construed as a non-mandatory provision.

Additionally, when the pronoun "he" is used, suffice it to mean "he" or "she". It is not meant to specify gender, but to simplify printing formats.

WARNINGS, CAUTIONS, AND NOTES

The following definitions apply:

WARNING

Warning: Operating procedures, techniques, etc., which could result in personal injury or loss of life if not carefully followed.

CAUTION

Caution: Operating procedures, techniques, etc., which could result in damage to equipment if not carefully followed.

NOTE

Note: *Operating procedures, techniques, etc., which are considered essential to emphasize.*

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CHAPTER 1

INTRODUCTION TO PILOT TRAINING

GENERAL

The objective of this manual is to help you develop into a pilot skilled in the basic fundamentals of flight. To accomplish this goal, you must attain the highest degree of proficiency possible. This requires initiative, good judgment, trained reflexes, and skillful flying techniques that come only as a result of study, practice and determination. The information you learn here must not be forgotten or casually learned. Every detail is important if you expect to be a safe, professional pilot.

Some important information has been extracted from other manuals and regulations and included within this manual. However, in no way is this manual to be considered all inclusive.

The information in this manual is intended to form a basic foundation upon which you and your instructor can build. The majority of the skills and techniques that you develop in pilot training will come from your assigned instructor, other instructors you fly with, and from things you simply gain through experience. As you gain experience and confidence as a pilot, you will also be developing and expanding your ability to exercise sound judgment. The procedures in this manual and other manuals and regulations are vital to flying operations and you must study them carefully. However, because of the many different situations that you will experience as a USAF pilot, these procedures can only provide a basis for judgment, they do not replace it.

FLYING SAFETY

Flying safety is more than a mere set of practices or a particular safety record; it is an attitude. You should continually evaluate your performance in the light of "Did I perform that activity in a professional, disciplined, safe manner?" This extends from the time you start planning a flight until you finish debriefing.

One item you should be particularly concerned with is the potential for a midair collision. Your best defense is to see the other aircraft first. This entails aggressively clearing the airspace around you using the techniques your instructor will show you.

GROUND SAFETY

The flight line is a hub of activity. Consequently, while on the flight line, be continually alert.

You must use your eyes continuously. Never trust your ears alone to warn you of an approaching truck or taxiing aircraft.

As you go out to your assigned aircraft watch out for taxiing aircraft, fuel trucks, maintenance vehicles, and **STAY CLEAR OF ALL PROPELLERS.**

When performing your aircraft preflight do not limit your inspection to the aircraft, but be observant for objects that may cause damage to the aircraft or anything that might obstruct your taxi route. Also ensure that a fire extinguisher is available when you start the engine.

When leaving your aircraft after flight, use the same precautions you used when you first came on the ramp. You may be tired from the flight, but this is not the time or the place to relax.

PREFLIGHT BRIEFING

Operational missions throughout the Air Force are normally preceded by a mission preflight briefing. Your instructor will place special attention on crew coordination concepts and transfer of aircraft control during emergency situations. Aircrew members and passengers will be briefed on their specific duties and responsibilities related to safe mission accomplishment. Aircrews will refer to the following briefing guide and brief applicable items prior to each mission.

C-172 CONTACT BRIEFING GUIDE

1. Ground Operations.
 - a. Mission.
 - b. Mission Length.
 - c. Call Sign.
 - d. Takeoff Time.
2. Takeoff (Abort Procedures).
3. Departure.
4. Area Work (review gradebook/syllabus requirements).
5. Arrival.
 - a. Entry.
 - b. Type Pattern and Landings.
 - c. Landing Time.
6. Additional Information (as applicable).
 - a. Clearing (areas of possible conflict).
 - b. Checks.
 - c. Wake Turbulence.
7. Emergency Procedures.
8. Questions.

POSTFIGHT DEBRIEFING

After each daily flight, your instructor will review the day's lesson. This is your chance to clear up any mistakes and to learn the correct procedure. Your instructor's review should clarify these points, but ask questions if you fail to understand all the steps in a maneuver being discussed.

Make sure that you understand each lesson fully, since each new lesson builds on the preceding lesson. You must completely understand your mistakes and the actions you must take to correct them. The time to ask questions is immediately after the flight, when your problems are still fresh in your mind. Your instructor will outline what is expected on the next mission and will assign specific materials to be studied.

TRANSFER OF AIRCRAFT CONTROL

An important requirement during your flying training is a positive and clear understanding of who has control of the aircraft. When you are flying stay on the controls (aileron, elevator, and rudder), until told otherwise. To transfer control, the instructor will tell you over the intercom "I have the aircraft", or "You have the aircraft." Under normal conditions the pilot assuming control will say, "Roger. I have the aircraft" and shake the control wheel noticeably. During critical phases of flight, however, it is imperative you relinquish the controls immediately upon your instructor's verbal command, so as not to obstruct any flight control or throttle movement. Remember, if you are flying, remain on the controls until your instructor signals he or she has control of the aircraft.

Your instructor may give you verbal assistance any time it is warranted, provided sufficient time and conditions permit you to execute the instructions without compromising safety. This verbal assistance does not constitute taking control of the aircraft.

USE OF THE CHECKLIST

The checklist is a condensed version of the aircraft flight manual and contains only the basic steps and sequences for aircraft operation. Reading and understanding the information in the flight manual is imperative if the checklist is to be of any use in flight. Use the checklist as necessary to ensure accomplishment of prescribed actions during all phases of aircraft operation

STUDENT RESPONSIBILITIES

This program is designed to lay a sound basis for further pilot training. A major key to fulfillment of this objective is organization and planning. Your part of this process is to assure proper flightline preparation, diet, and adequate rest.

Each day when you report to the flight line you should be prepared for your scheduled mission. This entails a great deal more than simply reading about the maneuvers in this manual. You should know from memory all the procedures to be followed in the execution of a given maneuver and be able to state the sequence of required actions.

Many students find that “armchair” flying is a helpful technique in preparing for a mission. Basically, this means that you organize a simulated mission profile for the sortie to be flown, and then you simulate the flight mentally, reviewing each item you must accomplish.

Another method that is helpful in preparing for a mission is known as Cockpit Time. Cockpit Time is time spent in the cockpit of an aircraft on the ground. Your instructor will outline the procedures and policies for this training time.

NOTE

Do not move any engine controls or switches while becoming familiar with the cockpit.

Remember - flight time is limited. If you prepare yourself properly on the ground, you will be able to spend your airborne time more profitably.

CHAPTER 2

BASIC PRINCIPLES OF FLIGHT

EFFECTS OF CONTROLS

Each phase of flying is based upon one or more fundamental maneuvers of flight. A thorough knowledge of these fundamentals will greatly speed your progress in mastering the more advanced maneuvers in flight training.

Your instructor will demonstrate the use and effects of the controls first in straight and level flight at cruising airspeed and then in other flight attitudes of progressively increasing complexity. The same predictable responses to control movements will result, regardless of the attitude of the aircraft. You should think of yourself as the pivot point about which all changes of attitude occur.

THREE AXES OF FLIGHT

There are three axes about which an aircraft rotates and the three flight controls which may be used to control this rotation. The axes are the lateral, longitudinal and vertical. The external flight controls are the elevator, ailerons, and rudder. The control wheel actuates the first two, the latter by use of the rudder pedals. The axes and their corresponding flight controls are explained below. (See Figure 1)

The lateral axis is an imaginary line, which runs from wingtip to wingtip through the center of gravity perpendicular to the fuselage centerline. Rotation about this axis is called pitch and is controlled by the elevators.

In straight and level flight, when forward pressure is applied to the control wheel, the nose moves down; when back pressure is applied to the wheel, the nose moves up. Control of the aircraft pitch attitude about the lateral axis (wingtip-to-wingtip) to achieve level, climbing, or descending flight can be accomplished by maintaining the nose of the aircraft in a fixed position in relation to the earth's horizon. There are many other outside references, such as the wingtips and the glare shield, that can also be used. These references are used in combination with each other in relation to the horizon to determine pitch attitudes. The vertical axis is an imaginary line, which runs through the center of gravity perpendicular to both the lateral axis and the fuselage centerline. Rotation about this axis is called yaw and is controlled by the rudder.

When pressure is applied to the right rudder pedal in flight, the nose yaws to the right; when pressure is applied to the left rudder pedal, the nose yaws to the left.

AIRCRAFT AXES

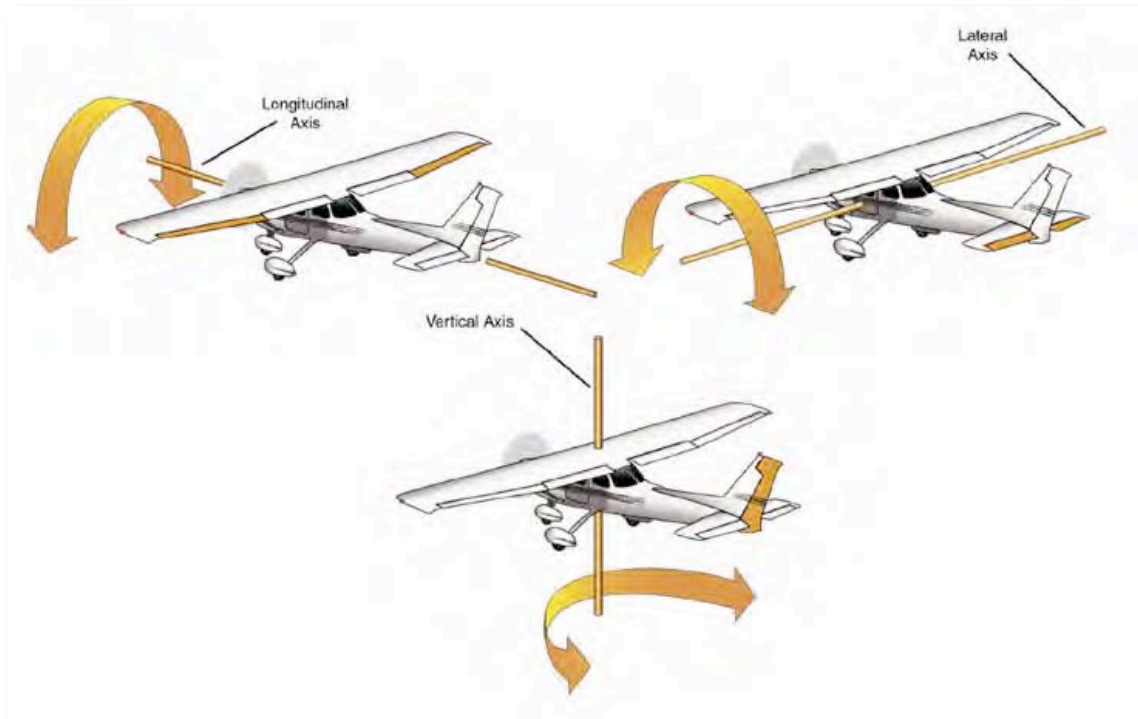


Figure 1 - The Three Axes of Flight

Level-flight control of aircraft yaw can be accomplished by selecting an outside reference over the nose of the aircraft and controlling the pivotal movement of the nose in relation to this reference, by use of the rudder.

Drift may be mistaken for yaw, but when yaw exists the ball in the turn-and-slip indicator is displaced from center. Also, you will find that yaw causes your body to lean toward one side of the cockpit as when rounding a corner in a car. Coordinated flight should be free of yaw. Even in a steep bank, when properly executed, your body retains a comfortable, upright position.

The longitudinal axis is an imaginary line, which runs through the center of gravity parallel to the fuselage centerline. It is perpendicular to the lateral and vertical axes. Rotation about this axis is called roll and is controlled by the ailerons.

Rotation about the longitudinal axis is caused by the difference in lift created as aileron surfaces are moved out of the streamlined position in the wing. The wing with the raised aileron goes down because of decreased lift, and the wing with the lowered aileron goes up because of increased lift.

Rotating the control wheel toward a wing raises the wing's aileron, causing the wing to go down. At the same time, the other wing's aileron goes down causing that wing to go up. Rotation about the longitudinal axis is in the same direction as control wheel movement.

Center of Gravity

An aircraft's center of gravity is a point within the aircraft, where its entire weight might theoretically be concentrated. Only a shift in load will change the center of gravity. The center of gravity of the C-172 is located at a point forward of the main landing gear. All three axes intersect at the center of gravity of the airplane. All changes of attitude of the airplane involve its rotation about one or more of these axes.

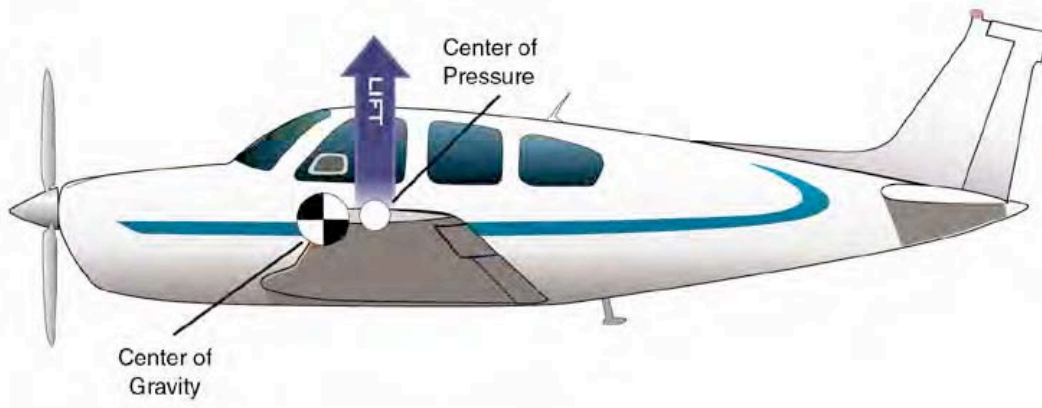


Figure 2 - Center of Gravity / Center of Pressure

Bank

Controlling the bank attitude of the aircraft to achieve straight-and-level flight can be accomplished by positioning the wingtips relative to the horizon. Other combinations of inside and outside references may also be used to determine this attitude.

The instrument most referred to for control of bank attitude is the attitude indicator; but, indirectly, the heading indicator and the turn-coordinator indicator may also be used.

The attitude indicator gives a direct indication of bank attitude. A bank is indicated when any deviation from a wings-level attitude is shown. By using the outside references and the attitude indicator in controlling the bank, you can place the aircraft in an approximate attitude and keep it there.

Any change in the heading indicator gives an immediate indication that the wings have moved from the level position and the aircraft is turning. Remember that any time the aircraft is in a coordinated bank it will automatically turn in the banked direction. A small angle of bank will result in a slow change in heading and a large angle of bank will result in a rapid change in heading. Heading changes will be apparent through outside references, the heading indicator and the turn-coordinator indicator.

The turn-coordinator indicator gives an indirect indication of the bank attitude of the aircraft when the ball is centered. When the turn needle is exactly centered, the aircraft is in straight flight.

When the turn needle is deflected, the aircraft is turning in the direction of the deflection, which indicates a bank in that direction.

USE OF CONTROLS

When a control surface is moved out of its streamlined position, the air flowing past it will exert pressure against it and try to return it to the streamlined position. It is this pressure that you feel on the control wheel and rudders.



Figure 3 - Aileron and Flap Controls

The amount of pressure exerted is governed by the airspeed and the degree that the control surface is deflected. At higher airspeeds more pressure is felt for any given deflection.



Figure 4 - Vertical Stabilizer (Rudder) and Horizontal Stabilizer (Elevator)

How to Use the Rudder

The position of the feet should be comfortable with all the weight on the heels. Let your heels rest on the floor, with the balls of your feet on the lower parts of the rudder pedals. When you use the rudder, apply pressure smoothly and evenly by pressing with the ball of one foot, as if you were using the brakes of an automobile. Do not let your legs and feet become tense, but stay relaxed so that you can feel rudder pressures.

How to Use the Control Wheel

Generally, you should hold the wheel lightly, the same way you would hold the steering wheel of an automobile - relaxed and comfortable. Always remember that to get the desired results from the controls, you should think of using pressures rather than movements. Some maneuvers, however, require more positive pressures. It is important that your arm and hand be relaxed so you can feel the pressure from the wheel. Nevertheless, you must never relax to the extent that you fail to maintain positive control of the aircraft.

How to Use the Throttle

Throttle movement should be slow at low RPM with the rate of movement increased as engine response is obtained. You will find that the throttle can be advanced more rapidly at higher RPM settings. As a guide to correct power control, the throttle should be moved at a rate such that if movement were stopped, an increase in indicated RPM would stop simultaneously. Learn to set the approximate desired power setting without staring at the tachometer. This can be done by engine sound and relative throttle position while crosschecking the tachometer to refine the power setting. Abrupt throttle movements may cause engine failure or slower than normal engine response.

Coordination

The effect of each control has been discussed individually, but you should realize that no single control movement provides all the control for a maneuver. To fly your aircraft efficiently you must use the controls together. This is known as coordination of controls and is vital to smooth flying.

After you know how the aircraft will react when the controls are used, you must learn how to use them properly. Rough, erratic usage of all or any one of the controls will cause the aircraft to react accordingly, so it is important that you be able to apply the pressures smoothly and evenly.

Torque

Torque is a factor that varies with almost everything we do in a single-engine, propeller-driven aircraft. Torque induced by the propeller of a single-engine aircraft tends to lower the left wing and pull the nose of the aircraft to the left.

There are several factors of torque that affect the aircraft during takeoff and flight. The most prominent factors are asymmetrical loading of the propeller and torque reaction. Actually, only the reaction force is torque in the strict sense of the word, but it has become common practice to group these forces together and call them the factors of torque.

During flight, these torque factors will occur in varying degrees, depending on the conditions and are interrelated to some extent. During different flight conditions, one torque factor may have a more prominent effect than the other.

The factors of torque will be explained individually so that you may understand them and be able to make appropriate corrections. These effects are partially compensated for in the rigging of the aircraft. Aircraft rigging will be explained later in this chapter.

Asymmetrical Loading of the Propeller

When an aircraft is flying, it is traveling into the relative wind. As the speed of the aircraft is changed, the angle of the relative wind also changes. When an aircraft is flying at cruising speed, the relative wind is approximately parallel to the longitudinal axis of the aircraft, but when an aircraft is flying at climb speed, the relative wind is at an angle to the longitudinal axis. The angle of the relative wind increases as the pitch attitude increases and as the airspeed decreases. It is the angle of the relative wind to the longitudinal axis that causes the asymmetrical loading of the propeller. (See Figure 5.)

Asymmetrical loading of the propeller occurs because the bite of the downward-moving propeller blade is greater than the bite of the upward-moving blade, in relation to the forward motion of the aircraft. This causes a greater thrust on the downward-moving blade (right side) which yaws the aircraft to the left. When the relative wind is parallel to the longitudinal axis of the aircraft, both the upward- and downward-moving blades have an equal loading. The effect of the asymmetrical loading of the propeller becomes more prominent as the angle of attack of the aircraft increases and/or as the airspeed decreases.

Torque Reaction

For every action, there is an equal and opposite reaction. The rotation of the propeller, a clockwise movement as viewed from the cockpit, tends to roll the aircraft counterclockwise, or to the left.

You can understand this by visualizing a rubber band-powered aircraft. Wind the rubber band for right-hand propeller rotation, hold the propeller, and release the fuselage. The fuselage will spin around to the left. This effect is present in any propeller-driven aircraft except that the propeller, instead of being held still, is resisted by the air. This resistance tends to rotate the aircraft in the opposite direction.

ASYMMETRICAL LOADING OF THE PROPELLER

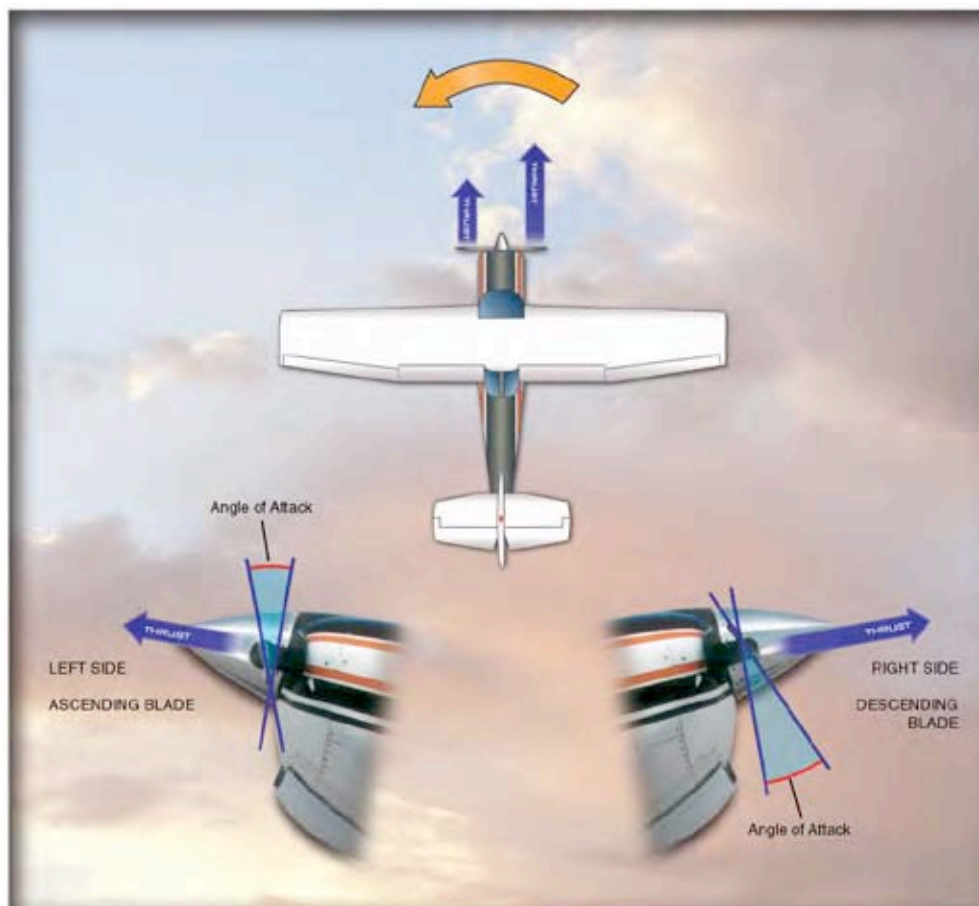


Figure 5 - Asymmetrical Thrust

Asymmetrical thrust occurs when an airplane is flown at a high angle of attack. This causes uneven angles of attack between the ascending and descending propeller blades. Consequently, less thrust is produced from the ascending blade on the left than from the descending blade on the right. This produces a tendency for the airplane to yaw to the left.

SPIRALING SLIPSTREAM

The propellers on most single-engine airplanes built in the United States rotate in a clockwise direction as viewed from the cockpit. This rotation causes the air moved backward by the propeller to spiral around the fuselage and strike the bottom of the left horizontal stabilizer and the left side of the vertical fin. The spiraling slipstream increases the angle of attack and lift of the left horizontal stabilizer, which tends to rotate the airplane to the right about its longitudinal axis. It also increases the angle of attack of the vertical fin so that it causes the airplane to rotate to the left about its vertical axis. (See Figure 6.)

SPIRALING SLIPSTREAM

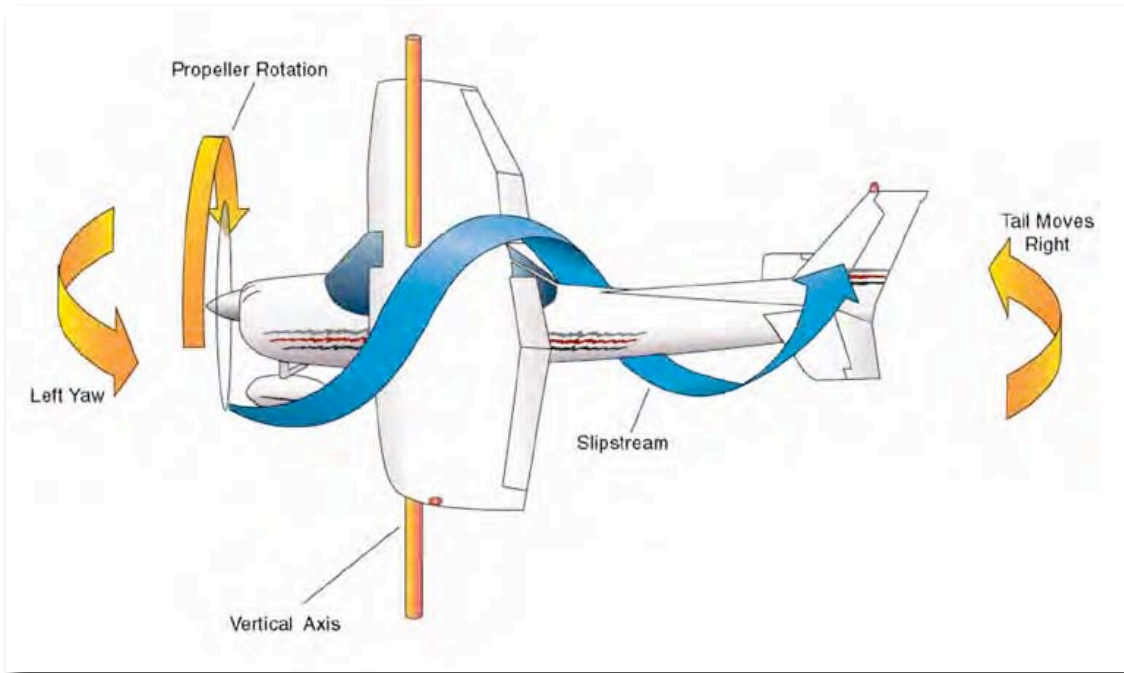


Figure 6 - The effects of the spiraling slipstream

As the slipstream produced by the propeller rotation wraps around the fuselage, it strikes the left side of the vertical fin causing the tail of the airplane to move to the right and the nose to yaw to the left about its vertical axis.

RIGGING

The forces induced by the propeller are partially compensated for in the rigging of the aircraft. The aircraft is rigged for balance in straight-and-level cruising flight. This rigging is accomplished by increasing the angle of incidence of the left wing and offsetting the vertical stabilizer and/or rudder to counteract the tendency to roll or turn to the left. During takeoff, climb, or any high power, low airspeed maneuver, you must use right rudder to compensate for the decreased effect of rigging. During glides or any low power maneuver, left rudder may be needed to compensate for the increased effect of rigging. The amount of rudder pressure needed will increase as airspeed is increased.

AIRSPEED AND RPM

The C-172 has a fixed pitch propeller. With a constant throttle setting, RPM increases as airspeed increases and decreases as airspeed decreases. Therefore, it is not practical to maintain exact power settings during maneuvering flight.

COMPOSITE FLIGHT

Composite flight means using outside references supported by flight instruments to establish and maintain desired flight attitudes. This method of aircraft control will be practiced throughout your flight training.

All maneuvers are accomplished by establishing attitudes and/or changing attitudes as necessary to obtain the desired results. An attitude should be established and maintained by positioning the nose and wings of the aircraft in relation to the horizon.

Very small changes in attitude may not be quickly noticed by outside reference to the earth's horizon but will be indicated by the flight instruments; therefore, occasional reference to the flight instruments is necessary to ensure that the desired performance is being maintained. The practice and use of correct composite flight procedures will result in accurate and precise flying. Increased reference to the instruments will be necessary when the horizon is difficult to see. However, reference solely to instruments imposes several disadvantages. The most serious of these is the inability to see other aircraft and other flight hazards.

Reference to any instrument or group of instruments must be rapid so that all necessary information is obtained at a glance. Always be alert to avoid midair collision and to remain position oriented.

NOTE

Do not concentrate on any one reference as it is imperative that you maintain a constant vigilance for other aircraft. Check your reference, make a correction, look around, cross-check other references and then use all of the references to confirm the accuracy of your control pressures or the need to make further corrections. This process is continually repeated in composite flying.

TRIM

When you consider all the factors that affect the aircraft in various conditions of flight, the need for trimming the aircraft becomes apparent. Considerable force is required to hold the correct elevator control pressure for level flight at low airspeed. Flying would become exceedingly fatiguing if some means were not available to relieve the pilot of these pressures. By trimming the aircraft, you may relieve yourself of extra physical exertion.

The C-172 has an elevator trim tab (See Figure 7). The control for this trim is located on the center pedestal below the instrument panel. The only trim position indication is a white line marked TAKEOFF. Aligning the trim pointer with the TAKEOFF mark trims the elevator so that only minimum control pressures are required as the aircraft leaves the ground during takeoff.

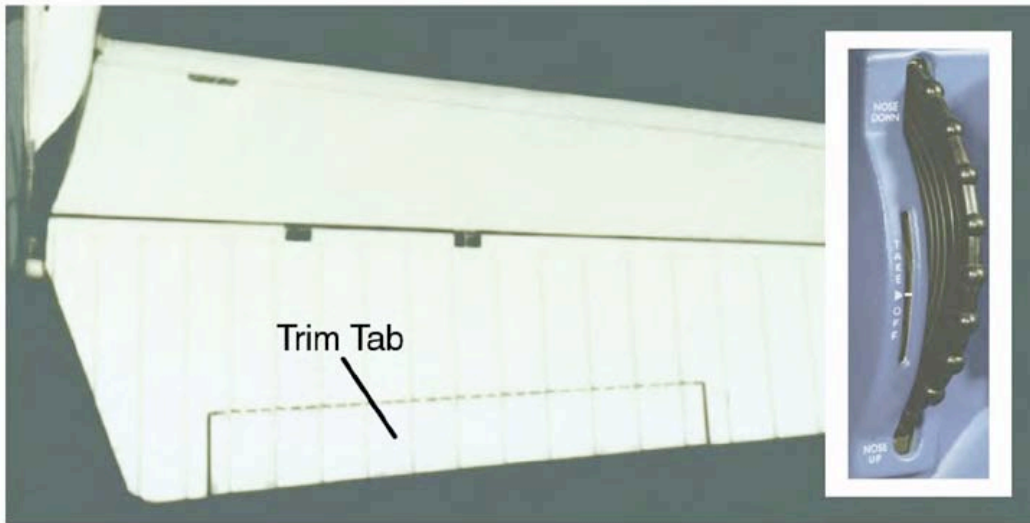


Figure 7 - Elevator trim tab and trim wheel

The correct procedure for trimming an aircraft is to hold the desired attitude with control pressure and then trim to relieve this pressure. If you are holding forward pressure on the control wheel roll the trim wheel up until all pressure is relieved. Conversely, if you are holding back pressure roll the trim wheel down.

STRAIGHT-AND-LEVEL FLIGHT

Your objective in this training exercise is to learn the use of the controls, to combine the use of outside and instrument references for maintaining aircraft attitude and to learn to divide your attention by constantly checking all available references without concentrating too long on any one.

Before practicing straight-and-level flight, you must be familiar with the flight instruments to be used. You must understand the effect and the use of the controls and be relaxed and properly seated in the aircraft. When your body is free of tension, you can more easily feel the amount of pressure you are applying to a control as well as pressures of centrifugal force.

Attaining level flight, at first, is a matter of fixing reference points on the aircraft in relation to the earth's horizon and comparing or cross-checking this relationship with the indications of the flight instruments.

You will fly straight-and-level by becoming familiar with the outside references. The apparent position of the outside references will depend on your seat adjustment and your eye level.

By using outside references to establish pitch attitudes, you can place the nose of the aircraft in the desired pitch attitude and hold it there. Refer to the altimeter, vertical velocity indicator, and the airspeed indicator to verify aircraft performance.

The altimeter will be a guide to determining whether the attitude established is correct. If it is correct, the altitude should remain constant; any change from the desired altitude shows the need

for a change in pitch. If you are losing altitude, raise the nose (increase the pitch attitude); if you are gaining altitude, lower the nose (decrease the pitch attitude). Notice the rate of change of the altimeter indications. A slow change indicates a small deviation and a fast change indicates a large deviation.



Figure 8 - In straight-and-level flight, all four forces are equal to each other

The airspeed indicator in steady level flight at a constant power setting will indicate a constant reading. An increase in airspeed would indicate a nose-low attitude and a decrease in airspeed would indicate a nose-high attitude.

The vertical velocity indicator is a sensitive instrument and in composite flight is best used as a trend instrument. In straight-and-level flight any continued displacement of the needle from the zero position indicates a need for a pitch change.

Your instructor will demonstrate each instrument in conjunction with the outside references. Do not concentrate too much on one reference or stare at a particular instrument seeking information. This not only will slow your progress, but will cause a dangerous situation because you are not ensuring that your intended flight path is clear of other aircraft or clouds. Check each outside and inside reference in turn and interpret each as a guide to minor control adjustments.

Familiarity with these instruments will help you to determine the control pressures necessary to control the attitudes and the direction of the aircraft. Control pressures should be smooth and

should be applied with confidence. The beginning student over controls due to lack of experience; but this tendency can be minimized through practice of smooth application. Good control is a continuous succession of small corrections to keep the aircraft in the desired flight path.

Power

If you hold the altitude constant with elevator control, a higher power setting results in a higher airspeed. Any reduction of power results in a reduction of airspeed and a requirement to increase pitch attitude to maintain a constant altitude.

There are no outside references to control power other than sound. The instruments used for power control are the tachometer and the airspeed indicator. You will soon become familiar with the power settings for different airspeeds.

General

After you have had a little practice in straight-and-level flight and have learned to crosscheck all your references properly, you can establish the correct level flight attitude in a few seconds. You must learn to look around quickly and to establish pitch, bank, and direction simultaneously. Power changes and trim technique will become easier for you. A trim change is necessary when you find you have to hold continuous pressure on the control wheel, but with practice you will learn to trim instinctively.

The flat glare shield in the C-172 provides a horizontal surface above the instrument panel and may be used as a horizontal reference to the horizon.

Let your eyes sweep along the horizon, picking up the wingtips as you do, and make a mental note of required corrections. In the process, look for other aircraft that might be flying in your area while you check your outside references and make your corrections. Return then to inside references to confirm your corrections, then outside again in a continuous process. Soon it will become second nature and effortless.

Straight-and-Level flight requires almost no pressure on the controls, provided the aircraft is properly trimmed and the air is smooth. When you are flying through rough air, the flight attitude may change abruptly. Do not fight the controls to prevent these changes from occurring. Ride the turbulence out like a boat on a rough sea and make smooth but firm corrections as needed.

MONITORING INSTRUMENTS

Although the flight crew checklist contains specific instances when instruments and indicators will be checked, the instruments and indicators need to be continuously monitored. Continued checking of the instruments and indicators can provide early identification of an impending malfunction; therefore, check the instruments and indicators at sufficient intervals to ensure adequate monitoring.

TURNS

A turn is a basic maneuver used to change the direction of the aircraft. It involves the close coordination of all three flight controls, aileron, rudder, and elevator. Since turns are incorporated in almost all of the other maneuvers, it is important that you learn to perform them well.

Shallow, Medium, and Steep Bank Turns

A shallow bank turn is a turn with 15 degree or less bank. A medium bank turn is a turn with approximately 30 degree bank. A steep bank turn is a turn with approximately 45 degree bank.

Before beginning any turn, look in the direction of the turn to clear above, below, behind and at your flight level. You do this to make sure that the area is clear of other aircraft or clouds that may interfere with safety in executing the maneuver.

When the area has been cleared, simultaneously apply pressure to both the aileron and rudder in the direction of the turn. This pressure will move the control surfaces out of their streamlined position and cause the aircraft to bank and turn. The rate at which the aircraft rolls is determined by the amount of pressure applied. Hold the pressures constant until you obtain the desired angle of bank, then neutralize the aileron and rudder pressure. In establishing this bank attitude, mostly outside references should be used, supported by instrument references.

As the bank is initially established to enter a turn, the nose should remain in the same relative position to the horizon that it was in level flight. As the bank increases, the pitch attitude will have to be increased in order to keep the vertical component of lift equal to the weight of the aircraft (See Figure 9). In shallow and medium banked turns the increase in pitch attitude is relatively slight. As bank increases from medium to steep, the required increase in pitch attitude becomes more pronounced.

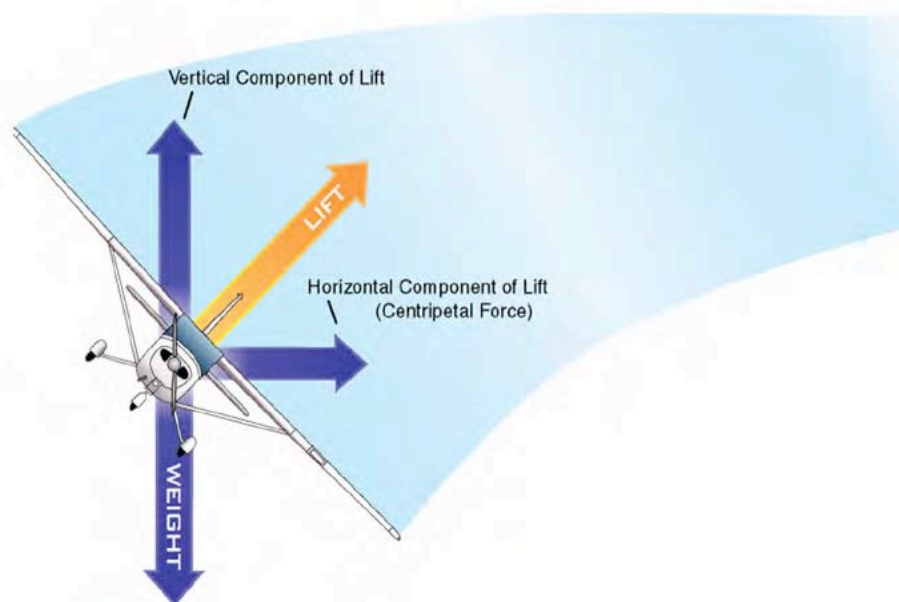


Figure 9 - The Vertical and Horizontal Components of Lift

Just as in straight-and-level flight, use outside references to initially establish the bank angle. The best outside reference for the degree of bank is the angle of the earth's horizon across the windscreen. The instrument reference for angle of bank is the attitude indicator.

As the desired angle of bank is approached, relax the aileron and rudder pressures at the same rate they were applied. This will stop the bank from increasing as the aileron control surfaces are returned to their neutral or streamlined positions.

The elevator pressure is held constant to maintain a constant pitch attitude. Throughout the established turn, the angle of bank should be held constant with adjustments of the ailerons, in the same manner as the wings were kept level in straight-and-level flight.

The rollout from a turn is much the same as the entry except that control pressures are used in the opposite direction. Apply aileron and rudder pressure in the direction of the rollout or towards the high wing. As the angle of bank decreases, relax the elevator pressure smoothly to maintain altitude. With decreasing angle of bank the requirement for additional lift decreases.

Since the aircraft normally will turn as long as there is any bank, start the rollout before reaching your desired heading. The aircraft will turn some during the time it takes to roll wings level from a banked attitude. Steeper banks require more lead to rollout on a desired heading. Relax the pressures smoothly until the controls are neutralized as the wings become level.

NOTE

Your posture while seated in the aircraft is very important in all maneuvers. Don't lean from side to side. Instead, sit straight up and move your head around freely. During turns, maintain this position. Don't lean away from the turn or attempt to keep your body vertical with the horizon. Relax and ride with the turn. If you don't maintain a constant position in the cockpit your outside references will continually change. A relaxed pilot is usually a good pilot because he is free to think and can feel the pressures on the controls.

Turning exercises are accomplished by making precision turns; that is, with a constant angle of bank and a definite amount of turn. For example to make a precision 90° turn, you could align the aircraft with a road or a section line on the ground and turn perpendicular. In the absence of any ground reference, pick a point on the horizon that is directly off a wingtip, look around to clear, then turn to the point.

SKIDS AND SLIPS

Skids

A skid occurs when the aircraft slides sideways away from the center of a turn. Too much rudder pressure in relation to the aileron pressure used in establishing a turn causes the skid. If you increase the rate of turn by use of the rudder without increasing the angle of bank, the aircraft will skid sideways away from the center of the turn.

After a turn is established, the rudder must be streamlined with the flight path of the aircraft. If you hold rudder pressure in the direction of the turn, a skid will result. A skid will also occur in level flight if the nose of the aircraft is rotated sideways about the vertical axis. This occurs when rudder pressure is inadvertently held or when the aircraft is flying at an airspeed and power setting other than the ones rigged for.

Slips

A slip occurs when the aircraft slides sideways and downward towards the center of a turn. It is caused by an insufficient amount of rudder in relation to the amount of aileron used when establishing a turn. That is, if you roll into a turn by applying more aileron than rudder, or if a turn has been established and rudder is held again, the direction of turn, the aircraft will slip sideways and downward towards the center of the turn, thus losing altitude.

NOTE

In a skid, centrifugal force will incline your body away from the direction of turn, and in a slip, gravity will incline your body towards the center of the turn. If you sit at ease in the aircraft, you can feel the pressures that are exerted on your body.

ADVERSE YAW

The movement of the ailerons out of the streamlined position creates drag. With this movement, both ailerons create more form drag, but the aileron on the upward moving wing also creates more induced drag (drag due to lift); thus, the total drag on the upward moving wing is greater than the total drag on the downward moving wing. This difference in total drag causes the aircraft to initially yaw away from the direction of turn (See Figure 10).

You overcome adverse yaw by using the rudder. As you apply aileron pressure, simultaneously apply rudder in the same direction. Use the rudder as long as the ailerons are deflected. The correct amount of rudder pressure depends on the aircraft speed and the amount of aileron used. Checking that the ball is centered in the turn-and-slip indicator will confirm that you are using the correct amount of rudder.

Remember, adverse yaw is present during both roll in and roll out of turns and is most noticeable at low airspeeds and at extreme aileron deflections.

ADVERSE YAW

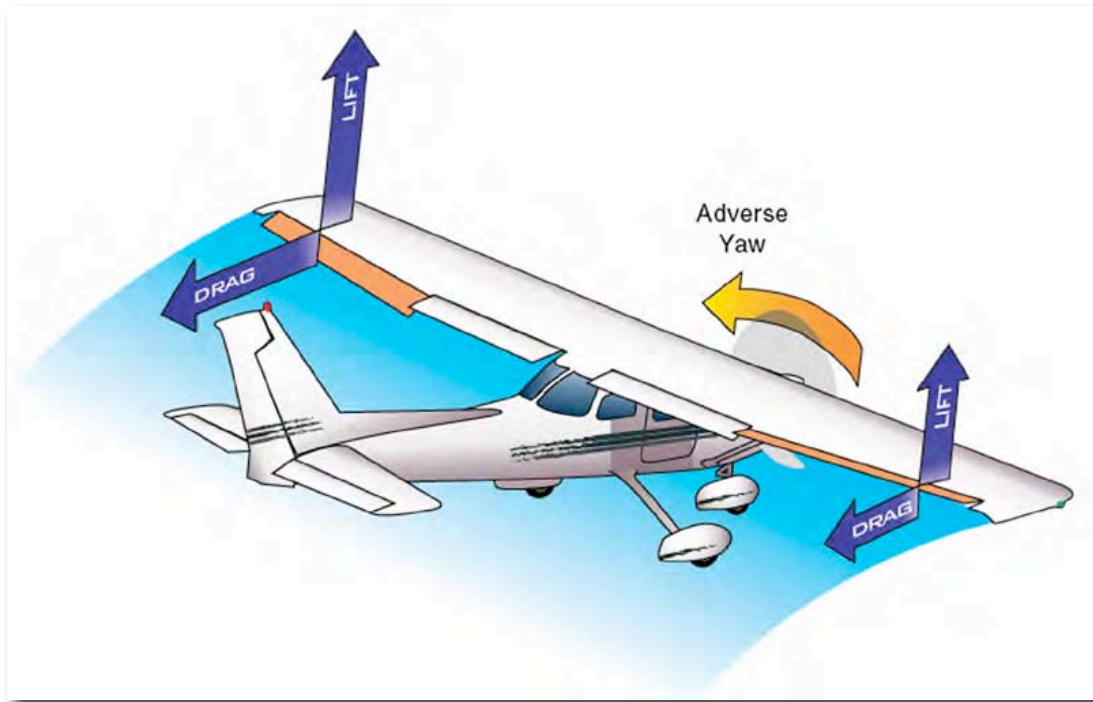


Figure 10 - Adverse Yaw

Adverse yaw is caused by higher induced drag on the outside wing, producing more lift. The need for rudder to control adverse yaw will be greatest at high angles of attack and with large aileron deflection.

CLEARING THE AREA

When clearing the area, the primary concern is to ensure that the intended flightpath is well clear of other aircraft; however, remember to clear behind the aircraft as well. The type of clearing will depend upon the planned maneuver, the configuration of the aircraft and other flight planning factors. Focus your eyes on a distant point and use various search patterns – vertical, horizontal, etc. - with the choice depending on individual preference. Visual search now becomes a definite pattern instead of random looking. Move your head around to ensure a door post or other aircraft structure is not obstructing your vision. Use of the radio will also aid in clearing. Radio transmissions from other aircraft or controlling agencies can alert you to possible traffic conflicts. In addition, turning may facilitate clearing.

WAKE TURBULENCE

As an aircraft produces lift, it generates wingtip vortices or wake turbulence. These vortices rotate counter to each other and present a danger to other aircraft. The C-172 is very susceptible to wake turbulence because of the short wingspan, low flying speeds, and limited aileron authority. When wake turbulence is anticipated, proceed with extreme caution.

It is important that pilots do not depend solely on controllers to advise them of the possibility of wake turbulence. Remember, the controller issues advisories but, in some cases, may not be aware of the wake turbulence hazards associated with less than heavy or very heavy aircraft and is not responsible for ensuring adequate wake turbulence separation. (See Figure 11)

WINGTIP VORTICES AND INDUCED DRAG



Figure 11 - Wingtip Vortices and Induced Drag

(1) High pressure air joins low pressure air at the trailing edge of the wing and wingtips. (2) Wingtip vortices develop. (3) The downwash increases behind the wing. (4) The average relative wind is inclined downward and rearward and lift is inclined aft. The rearward component of lift is induced drag.

VOR HOMING

Before proceeding with any VOR work, first refer to the lost procedures for your local area and then check the heading indicator against the standby magnetic compass. If any difference of heading is noted, reset the heading indicator to agree with the magnetic compass. If excessive precession is noted in the heading indicator disregard it and refer only to the magnetic compass for heading information.

The navigation radio and VOR indicator can be used to orient the aircraft to any desired VOR station. The following procedures should be used when using the navigation radio to proceed to a selected VOR station:

1. **Tune and Identify the Station.**

This is accomplished by first checking that the desired frequency is dialed in the receiver frequency selector. Adjust the volume control for the navigation receiver to ensure that you are able to hear an oral or Morse Code station identifier.

2. **Center the Needle with a TO Indication.**

Rotate the VOR course deviation indicator (CDI), until the needle centers and the word TO appears. (See Figure 12). Observe the course under the vertical index line. This is the magnetic bearing from the aircraft to the VOR station.

CAUTION
VOR bearing selector is unreliable when
microphone button is depressed.

3. **Turn to this course on the Heading Indicator.**

Fly this heading until the bearing indicator needle moves off center.

4. **Repeat the Centering Procedure.**

Repeat the procedure of centering the needle as necessary to fly the aircraft to the VOR station. This procedure is termed homing to the station. Since homing does not incorporate wind drift correction, in a crosswind the aircraft follows a curved path to the station. As the aircraft approaches the VOR station, the bearing indicator needle may move from side to side and the TO-FROM indicator fluctuates between TO and FROM. You have definitely flown past the station when you receive the first steady change from TO to FROM. Once past the station, you should turn to a heading which will take you to the airport by reference to the lost procedures for your local area.

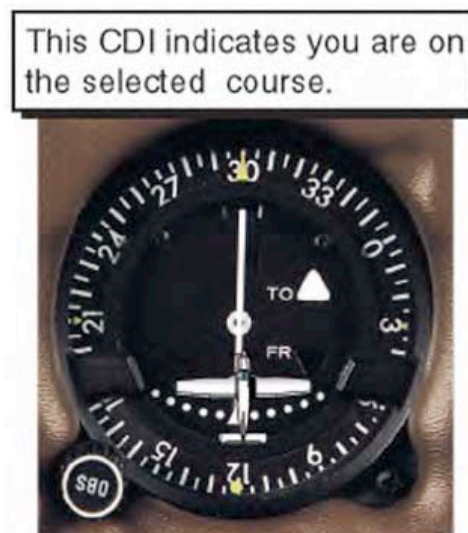


Figure 12 - CDI Indicator

CHAPTER 3

GROUND OPERATIONS

VISUAL INSPECTION

The preflight check starts before you reach the aircraft. Survey the proposed taxi routes for any possible obstructions, such as ground repair work on or near the ramp, stray equipment, or personnel who might be harmed by the prop wash. A complete visual inspection of the aircraft is a very important part of each mission.

Check all forms pertaining to aircraft operation, refueling, and maintenance. Therefore, the importance of checking this form cannot be overemphasized. Report discrepancies. Do not accept the aircraft until you are satisfied with the aircraft status that the aircraft is ready to fly. Student pilots will not perform operational checks of systems or verify adequacy of maintenance performed. Operational checks may be performed in conjunction with dual student sorties as long as they do not interfere with training objectives.

Check the general condition of the trim tab, hinges and control surfaces. Binding of the controls and cracked hinges on control surfaces are reasons for rejecting the aircraft. Do not manhandle control surfaces.

POSITION IN THE AIRCRAFT

Each time you fly, your position in the aircraft should be the same. Determine the correct position of the seat. Your instructor will help you make the appropriate adjustments until you become accustomed to making the changes yourself.

INTERIOR CHECK AND STARTING PROCEDURES

The items in your checklist are listed in such order as to begin from the left of the cockpit and move to the right. This system makes it easy to learn and reduces the margin for error. As in the visual inspection consider each item as important as the next, if an item is overlooked, it is possible for certain systems to become inoperative or damaged.

Before starting the engine, clear the area around the aircraft 360 degrees and call, "Clear", prior to engaging the starter. Make certain you have the brakes set properly.

NOTE

Even though the parking brake is set guard the brakes during and after engine start in case the parking brake is not sufficient to hold the aircraft stationary After starting the engine, divide your attention between the instruments and the area outside the aircraft.

RADIO PROCEDURES

Make certain that the radio is on and the proper frequency(s) is selected. It is imperative that your message be both clear and concise. Organize your thoughts, depress the mike button, say what you intend to say, and get off the air.

Remember that when the mike button is depressed, the entire channel is blocked for other aircraft. Do not depress the mike button during another pilot's transmission.

Keep radio voice communication to a minimum at all times. The call to the ground control serves as the radio check. A typical call would be, "(CALL SIGN), taxi", i.e. "CAP FLIGHT 4225, taxi".

TAXIING

After completion of the before taxi checks, visually clear the area to the front and rear. Increase power, if necessary and release the brakes. Pick up momentum straight ahead, then smoothly check brakes for proper operation. Use the rudder pedals to control nose wheel steering. You can steer the nose wheel up to maximum pedal deflection; beyond this you can use brakes to gain a greater deflection of the nose wheel.

When using brakes to sharpen turns in the taxi, increase the power slightly to give the aircraft momentum in the new direction and to overcome the resistance of the braking. When on the ramp or other congested area taxi at a walking speed. When leaving a parking area, be especially alert for aircraft taxiing past your position; also watch for personnel, ground equipment, etc.

When you are clear of the parking area, use power as needed to keep the aircraft rolling at a moderate speed. Use the brakes as sparingly as possible to prevent excessive wear and overheating. Normally, do not use both brakes and power at the same time. If you need power, you normally do not need the brakes, and vice versa.

Checks that are accomplished while taxiing should not be done until the aircraft is in an unobstructed area. Do not concentrate all your attention inside the cockpit while doing these checks.

Aircraft will not be taxied with less than 10 feet clearance from an obstacle. When an obstacle is between 10 and 25 feet from the aircraft, taxiing will not be accomplished without the assistance of a wing walker. Locally based aircraft may taxi closer than 25 feet without wing walkers provided established taxi lines are marked and obstructions are either permanent or are aircraft parked in established parking spots. If at any time you have a doubt about the clearance of the wingtips, stop the aircraft and have someone guide you past the obstruction. Spacing between taxiing aircraft must be a minimum of two-ship lengths.

After you stop the aircraft during ground operations, set the throttle at 1,000 RPM minimum to aid in engine cooling, lubrication and to prevent spark plug fouling.

NOSEWHEEL STEERING AND BRAKES

The C-172 is equipped with nosewheel steering to facilitate better ground control. It is operated by steering with the rudder pedals.

NOTE

Do not attempt to steer the aircraft with the control wheel. A common student error is to try to “drive” the aircraft with the control wheel as would be done in an automobile.

You will probably encounter some difficulty in adjusting yourself to steering the aircraft with your feet. You may have a tendency to neutralize the rudder just as the aircraft starts turning. This will merely straighten the nosewheel, necessitating the application of rudder to again put the aircraft in the turn.

The rate of turn when using nosewheel steering is determined by the amount of rudder applied. After applying enough rudder to start the aircraft turning, hold the rudder in this position. If the rate of the turn becomes greater than desired, ease off the rudder. Learn to anticipate the movements of the aircraft and apply nosewheel steering (rudder) accordingly. Since the aircraft will continue to turn slightly as the rudder pressure is released, you must anticipate the turn completion and neutralize the rudder before reaching your new heading.

If a sharper turn is desired than can be made with the rudder pedal steering mechanism, use the brakes to establish the rate of turn desired. While making a turn in this manner, keep the inside wheel rolling. Any attempt to pivot the aircraft on a locked inside wheel damages the wheel, tire, and strut. This is particularly dangerous because the damage may not be apparent. To make sure that the inside wheel rolls, release the inside brake intermittently. Apply the brakes smoothly, evenly, and cautiously at all times.

CROSSWIND CONTROLS

Moderate to strong winds can cause loss of control and can overturn the airplane. Always be alert for the presence of moderate winds and be cautious while taxiing into propeller wash or jet blast. Proper use of the ailerons and elevator helps you control the aircraft while taxiing. This becomes clear when you consider the lifting action that may be created by the wind flowing over the wings and tail.

When taxiing into a quartering headwind or crosswind from the right, the right wing tends to rise unless you hold the control wheel in that direction (right aileron up). Moving the right aileron up reduces the impact of wind striking underneath the wing. This control movement also causes the left aileron surface to go down, increasing lift on the wing and further reducing the tendency of the right wing to rise. Hold the elevator control in the neutral position. Use the opposite of this technique for crosswind from the left. (See Figure 13).

When taxiing with a quartering tailwind, keep the control wheel forward and the upwind aileron down. Since the wind is striking from behind, this reduces the force of wind under the aileron and wing, and keeps the tail down.

CROSSWIND CONTROLS

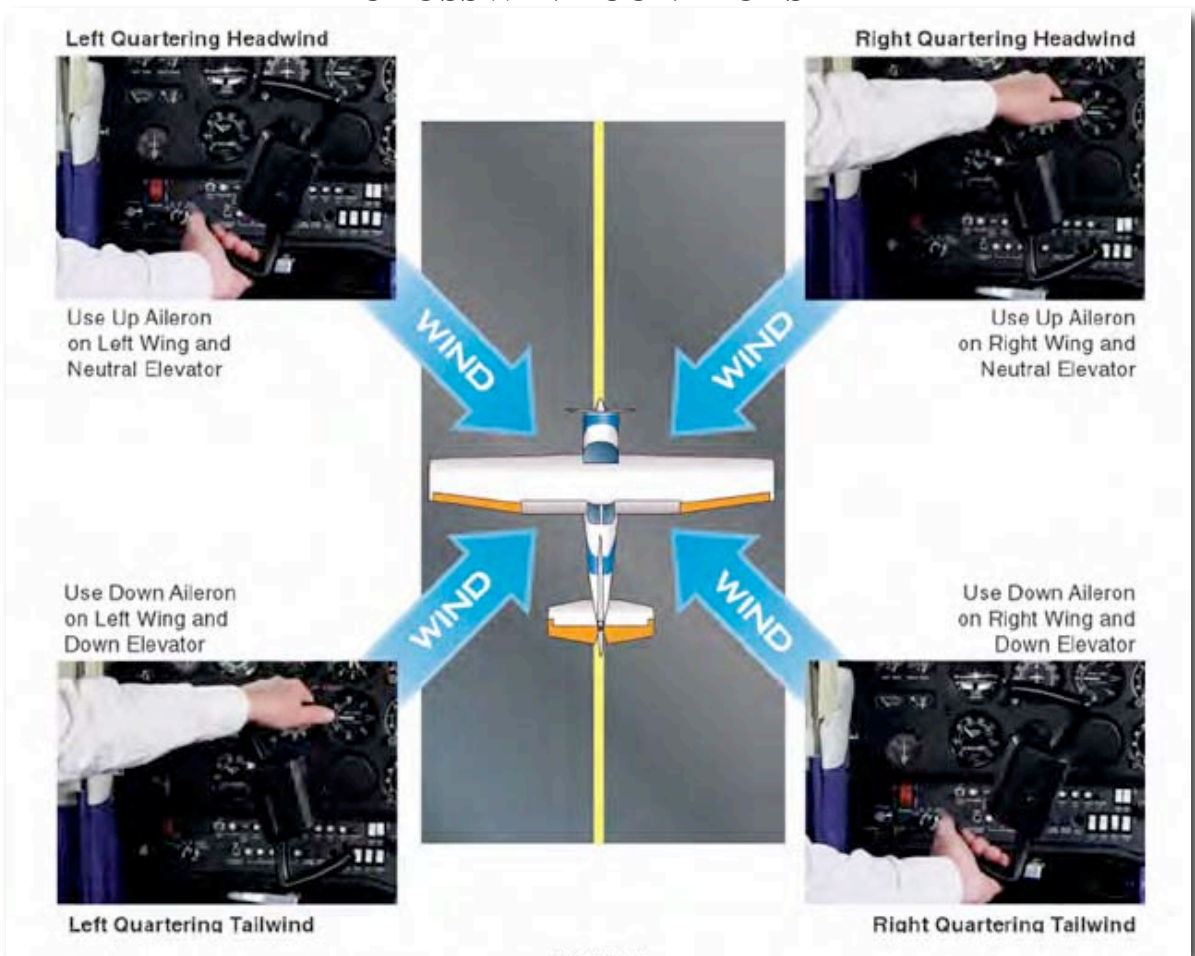


Figure 13 - Crosswind Control Positions

Proper use of crosswind taxi procedures help minimize the effect of wind and make the aircraft easier to taxi.

NOTE

Strong quartering tailwinds require extreme caution. Avoid sudden bursts of the throttle or sharp braking. Use full control deflection when positioning the controls.

NOTE

The most common errors in taxiing are using the brakes with the throttle above the idle position, taxiing too fast, attempting to turn too sharp, and failure to use the flight controls properly in windy conditions.

GROUND ASSIST

Proper use of the flight controls will counteract the effects of winds within the normal operating limits. Your flight training will be accomplished within the wind limits specified by your instructor, however, instances may arise when special ground handling will be required. At these times all available personnel must assist in the recovery of aircraft.

The C-172 is highly susceptible to overturning when high winds strike the aircraft from a direct-cross or quartering tail position. The aircraft overturns with a spiraling motion between the nose gear and a main gear. It therefore follows that efforts must be made to maintain a normal ground attitude of the aircraft to keep an equal weight distribution on the landing gear. The easiest way to help hold the aircraft in a normal attitude is to use personnel to hold the aircraft in the proper ground attitude.

NOTE

When taxiing in high winds, pilots must taxi extremely slowly, using proper wind controls, while avoiding the use of brakes to prevent compression of the nose gear strut, which will expose the underside of the tail section to the winds.

Ground handling will be accomplished using the following procedures: Position the first available person at the rear of the fuselage, upwind side; attempt to maintain a normal ground attitude of the tail section. Position the next available person behind the upwind wing strut, maintaining downward pressure on the strut as far removed from the fuselage as possible. Additional personnel, as available, will provide assistance on the downwind tail section and downwind wing, in that order. The optimum condition is to use all four personnel as described above.

WARNING

Ground assist personnel should avoid risk of personal injury from the propeller and the aircraft should it become unmanageable and overturning appears imminent.

BEFORE TAKEOFF CHECK

For engine runup in strong and gusty crosswinds, align the aircraft as nearly as practical into the wind with the nosewheel straight.

Hold the brakes and proceed with the engine runup and before takeoff procedures in the flight crew checklist.

NOTE

During the engine runup, check outside frequently to detect any movements. If the brakes are weak or you are not holding them tight enough, the aircraft may inadvertently move.

Before takeoff, you should adjust the friction lock so that the throttle is held firmly in the position you place it, but not so tight that you cannot move it.

When all checks are complete, taxi to the number one position. You must be cleared for takeoff by the controlling agency. The radio call for this clearance will be as directed locally.

CHAPTER 4

TAKEOFF, TRAFFIC EXIT, CLIMB AND LEVEL OFF

Up to this point, you have checked the aircraft thoroughly and have assured yourself you are ready for takeoff. Your primary concern now is making the takeoff.

Although one continuous maneuver, the takeoff will be discussed in five separate steps for purposes of simplicity and explanation:

1. Taking the runway.
2. Application of power.
3. The takeoff roll.
4. Leaving the ground.
5. After becoming airborne.

TAKING THE RUNWAY

When cleared for takeoff, acknowledge your clearance and visually clear final approach and the runway before taxiing onto the runway.

NOTE

Under certain conditions you may be cleared to "Taxi into position and hold." This means you may taxi onto the runway, but are not cleared for takeoff. Be sure to acknowledge this restricted clearance, i.e. "CAP FLIGHT 4225, position and hold", then line up in the center of the runway; stop; and wait for clearance to takeoff before you begin the takeoff roll.

Align the aircraft with the centerline of the runway while ensuring the nosewheel is straight. Prior to the controls becoming effective, position the control wheel slightly aft of neutral, the ailerons as necessary for any crosswind, and check your feet are on the bottom of the rudder pedals, not on the brakes.

NOTE

Positioning the control wheel aft of neutral will prevent wheelbarrowing by keeping the weight of the aircraft off the nosewheel.

APPLICATION OF POWER

When you are ready to begin the takeoff roll, smoothly advance the throttle to the full in position.

NOTE

You should be ready to begin the takeoff roll as soon as you have the aircraft aligned with the runway centerline. You normally need not bring the aircraft to standstill prior to applying full power. Maintain directional control by smooth positive rudder application. Because of the forces induced by the propeller, application of power will cause the aircraft to yaw to the left.

NOTE

Check engine instruments early during the takeoff run to confirm that the engine is developing full power and that no malfunction exists.

THE TAKE OFF ROLL

You will feel the elevator become gradually effective as the airspeed builds. Since the tail surfaces receive the full effect of propeller blast, they become effective first. At this point in the taxi-flight transition, the aircraft is being flown more than taxied. As this occurs, you need to make smaller rudder corrections to maintain smooth directional control. At approximately 44-52 Kts, smoothly apply backpressure to establish the takeoff attitude. Your instructor will demonstrate the proper attitude. Since a good takeoff depends on takeoff attitude, it is essential that you know the proper attitude.

The ideal takeoff requires minimum pitch adjustment after the aircraft becomes airborne. Use whatever backpressure is necessary to hold this attitude. Keep the wings level by applying aileron pressure as needed. At the takeoff point, all flight controls become effective in maneuvering the aircraft.

NOTE

*At anytime during the takeoff, a situation may arise that requires an abort. The decision to abort rests with the pilot and depends on the nature of the problem, speed, and runway remaining. When faced with this situation, you must make decisions accurately and quickly. When experiencing certain types of malfunctions, you may find it advisable to continue the takeoff and then land as soon as practicable. In any event, use the flight manual procedures and limitations to assist you in making your decision to abort or continue the takeoff. Your instructor will help you develop the judgment to make accurate, timely decisions. **THERE IS NO SUBSTITUTE FOR GOOD JUDGMENT.***

LEAVING THE GROUND

Maintain the takeoff attitude. As the airspeed approaches 56-65 Kts, the aircraft will fly off the ground. As the aircraft leaves the ground, you will be concerned primarily with maintaining the correct flight attitude and direction. If insufficient backpressure is held, the aircraft may settle back to the runway. Be careful not to force the aircraft into the air by applying too much backpressure before adequate flying speed is gained. If this happens, the nose may rise so high that a stall develops. Forcing the aircraft into the air prematurely is an unsafe practice and must be avoided.

AFTER BECOMING AIRBORNE

The aircraft gains speed rapidly after becoming airborne. Maintain a shallow climb and allow the aircraft to accelerate to the proper climbing speed of 78-82 Kts. Adjust the elevator trim to relieve pressure on the elevator control. Use the airspeed indicator as a check to determine whether the attitude you are holding is correct.

When an aircraft has taken off immediately ahead of you, anticipate the possibility of wake turbulence, especially if the wind condition is calm or straight down the runway. Although sudden deviations in flight attitudes may occur, do not become alarmed. Use firm control pressures to make a turn in either direction to fly out of the wake turbulence, then realign the aircraft with the original flightpath. If a crosswind is present, make the turn upwind, since the wake turbulence will be blown downwind or away from your flightpath.

Early on the takeoff leg, select a distant reference point aligned with the runway and use it to make certain you are not drifting. If you are drifting, turn your aircraft into the wind. In addition, check your runway alignment by looking behind you. If your drift correction is proper, the aircraft maintains a straight path over the ground away from the runway.

NOTE

During phases of operation where loss of power is critical, such as takeoffs, the need for monitoring engine instruments assumes even greater importance. Therefore, you should learn to cross check engine instruments during during takeoffs. Early recognition of power failure cannot be overemphasized. In this aircraft, loss of power is usually detected by engine sound or by referring to the engine instruments. Failure to attain or maintain airspeed may also be a clue.

TAKEOFF ROLL (CROSSWIND)

As you taxi to takeoff position, it is essential that you check the wind sock or other wind directional indicators, or get wind data over the radio so that you may recognize and anticipate the presence of a crosswind.

The technique for an initial takeoff with a crosswind is the same as a normal takeoff except that aileron is held into the wind as the takeoff roll is started.

Rotation is delayed until 52 Kts to retain nosewheel steering as long as possible. As the aircraft approaches flying speed the ailerons become more effective. You must therefore reduce aileron deflection to keep the wings level, but you have to maintain some aileron deflection throughout the takeoff roll. This aileron deflection is necessary because the upwind wing develops more lift, causing it to fly (begin rising) before the downwind wing.

If the upwind wing rises (thus exposing more impact surface), a skipping action may result. This is a series of very small bounces caused by the aircraft attempting to fly on one wing and then settling back onto the runway.

During these bounces, the crosswind will move the aircraft sideways, and the bounces will develop into side skipping. This skipping imposes stresses on the landing gear and tires, which could result in a mechanical failure. In addition, the tendency of the aircraft to weathervane (streamline itself into the wind) is increased.

LEAVING THE GROUND (CROSSWIND)

As the wheels leave the runway, the aircraft will start drifting with the wind. Allow the aircraft to turn into the wind (weathervane) until an adequate crab is established. Continue to climb in the crab to maintain runway alignment on the takeoff leg. The remainder of the takeoff climb is the same as previously explained under the heading, After Becoming Airborne.

WHEELBARROW EFFECT

Wheelbarrowing is an attitude or condition in a tricycle gear aircraft when more weight is on the nosewheel than is on the main wheels. It can occur during landing or takeoff roll and becomes more critical in a crosswind. An airplane in this situation will tend to pivot rapidly about the nosewheel similar to a ground loop in a tail wheel aircraft. Indications of wheelbarrowing are unstable directional control, wheel skipping, and/or extreme loss of braking effect when the brakes are applied.

Wheelbarrowing most often occurs when (on landing) a pilot attempts to spike (touchdown) an aircraft on the runway at a higher than normal airspeed, and then tries to hold the aircraft on the ground with forward pressure on the control wheel. Wheelbarrowing will most likely result in a loss of braking and steering capability.

During takeoff, the use of excessive forward elevator pressure to hold the airplane on the ground to speeds above normal takeoff speed may result in wheelbarrowing.

The wheelbarrow effect can occur at lower speeds on takeoff than during landing due to the prop wash increasing the lifting power of the horizontal stabilizer.

To avoid wheelbarrowing, pilots must understand the need for proper attitude and airspeed control during takeoff approach and landing, particularly in crosswind conditions.

If wheelbarrowing does occur, corrective action must be based on a number of factors: degree of development of the wheelbarrowing, pilot proficiency, remaining runway length and aircraft performance versus aircraft configuration. Only after considering these factors should the pilot initiate one of the following corrective measures:

- a. If the aircraft is not pivoting, check elevator control slightly aft of neutral and aileron into the wind. If adequate aircraft performance is available, enough runway is available and obstructions are not a factor, execute a go-around or continue the takeoff, whichever applies.
- b. If the aircraft is pivoting, check the throttle in idle, position the elevator control to aft of the neutral position, and reduce braking to lighten the load on the nose gear. Check aileron into wind, and return steering and braking to normal.

WEATHERVANING

Wind acting on the aircraft will produce the same effect that it has on windsocks, wind tees, and weathervanes; hence the terminology, weathervaning. The aircraft will attempt to turn into the wind. This effect is most dangerous during the takeoff and landing roll if not countered. Proper use of the rudder and aileron will prevent weathervaning. During the takeoff and landing roll use any straight line reference (white stripe on the runway, concrete joints, etc.) and rudder to keep the aircraft rolling straight. During the initial takeoff and during touch-and-go landings, a crosswind from the left along with the forces induced by the propeller presents the most serious condition for loss of control. Thorough knowledge of weathervaning and corrective actions is necessary for proper control of the aircraft. Correct for weathervaning by use of cross control technique.

TRAFFIC EXIT

After takeoff, climb straight ahead to a minimum altitude of 400 feet above the terrain, or to the altitude specified for traffic exit at your airport. When beyond the departure end of the runway and clear of all other aircraft, turn 45 degrees in the direction of the traffic pattern using bank as required. This turn constitutes the exit from the traffic pattern unless the local airport pattern dictates otherwise.

CLIMBS

A climb is a maneuver executed to gain altitude in a safe orderly manner. The flight procedures for straight climbs and climbing turns are the same except that, for the climbing turn, you use a shallow bank and make small additions to your cross-check.

General Climb Procedures

To establish a climb from level flight, raise the nose and advance the throttle. Adjust the pitch attitude and trim so that the airspeed stabilizes at 82 Kts with the full throttle. The rate of throttle movement will depend on the rate of pitch change; however, do not overspeed the engine by advancing the throttle too quickly.

Straight Climbs

The straight climb is practiced first, to familiarize you with the correct climbing attitude. Although you can attain the best rate of climb with the straight climb, it is not the best clearing procedure from a safety standpoint, because it is difficult to see ahead of the aircraft.

Climbing Turns

During most of your training, you use the climbing turn when you desire to gain altitude. This maneuver increases your proficiency in aircraft control and planning. Use a shallow bank turn and roll out of the turn as necessary to adequately clear.

LEVEL OFF FROM CLIMBS

To return to level flight from a climb, start the level off approximately 50 feet below the desired altitude. Smoothly lower the nose to the level flight attitude using outside references, and set the throttle as desired.

From a climbing turn, you may level the wings simultaneously with a level-off or continue the turn to the desired heading. Refer to the altimeter and vertical velocity indicator to help you maintain the desired altitude. After leveling at cruise/maneuvering altitude, perform the level-off check. This check is not required for intermediate level offs. The climb check should be accomplished departing an airport traffic area.

CHAPTER 5

STALL MANEUVERS AND SLOW FLIGHT

Stall maneuvers and slow flight enable you to recognize attitudes, seat pressures, and the control feel that signal unsafe flight conditions. A thorough knowledge of these maneuvers will allow you to fly an airplane safely at maximum performance. Stalls and slow flight are completed at least 2,500 feet or more above AGL.

The stall is best defined as a condition where the airflow over the top of the wing becomes separated from the surface. When this occurs, the aircraft suffers a drastic reduction in lift. (See Figure 14.)

Our main interest in this phenomenon, as pilots, is that when the stall occurs continued flight in the normal sense is no longer possible. If the stall condition is severe, loss of control effectiveness is experienced and sudden pitching and rolling motions occur. As a stall progresses, control effectiveness is lost in the following order - aileron, then the elevator, and finally the rudder. During stall recovery, control effectiveness is regained in the reverse order - rudder, elevator, and aileron. Obviously a stall at low altitude is dangerous since considerable altitude may be lost during recovery. Careful study of the following material will teach you the conditions leading to a stall, how to detect an impending stall, and the stall recovery.

CONDITIONS LEADING TO A STALL

Basically, there is one cause for a stall – exceeding the critical angle of attack. Remember that the angle of attack is the angle between the chord line and the flightpath. The turbulent air causes the aircraft to buffet or shake. Separation begins to occur at a certain critical angle of attack and further increase in the angle of attack will cause separation on most of the top surface of the wing.

It is important to realize that an airplane can stall at any airspeed, attitude, or power setting if you demand, with the elevators, an angle of attack above the critical value. If the airspeed is low, the stall will occur with light seat pressure and low Gs. If the airspeed is high, you will feel considerable Gs and seat pressure when the angle of attack is sufficient to cause a stall. Stalls occurring with more than one G are often referred to as high-speed stalls or accelerated stalls.

The factors that affect the stalling characteristics of your aircraft are weight, load factor (G), airspeed, configuration (use of flaps), thrust, and coordination (skids or slips).

HOW TO DETECT AN IMPENDING STALL

To become a proficient pilot, you must recognize the flight conditions that are conducive to stalls and know how to apply the necessary corrective action. You will be taught to recognize an approaching stall by both sight and feel.

STALL ANGLE OF ATTACK

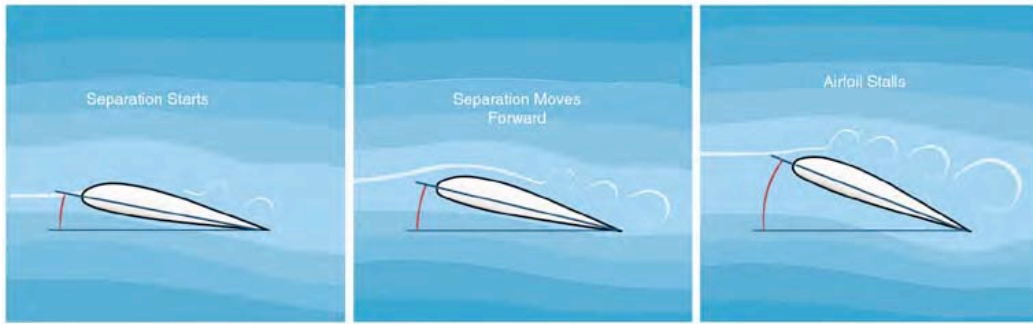


Figure 14 - Effects of Exceeding the Critical Angle of Attack

Increasing the angle of attack beyond the critical angle of attack causes a progressive disruption of airflow over the upper surface of the wing. The airflow first begins to separate at the trailing edge. As the angle of attack is further increased, the airflow separation progresses forward until the wing is fully stalled.

You can see abnormal nose-high attitudes and decreasing airspeed, which may lead to a stall. During turns and when pulling Gs, you can see the rapid motion of the nose as excessive back pressure is applied.

You can feel the control pressures become light and less effective at low airspeeds. During rapid or steep turns, you can feel the excessive pressure forcing you into the seat as well as the excessive pressure you are applying to the controls.

STALL WARNING

The stall characteristics of the C-172, as with all types of aircraft, will differ slightly in the power-on and power-off conditions of flight. The technique of recognizing an approaching stall by the sight and feel method requires more concentration in the power-on maneuvers because there is a lack of noticeable aircraft buffeting (trembling, shaking, or vibrating sensation).

Buffeting is a positive indication of an impending stall. However, since this pronounced stall warning does not always occur, you cannot depend solely on it, but must rely on other indications, especially in power-on maneuvers.

There are many attitudes and conditions of flight in which you will not experience buffeting prior to the stall. However, it is very unlikely that you could place the C-172 aircraft into an attitude or condition of flight where at least one of the two senses would not warn you of an impending stall. Knowing this, you should understand the necessity for developing the technique of sight and feel rather than depending only on mechanical means, such as the airspeed indicator or stall warning system, to warn you of an approaching stall.

STALL RECOVERY

The C-172 has excellent stall recovery characteristics. The elevator is effective enough to reduce the angle of attack during the most severe stalls. Aileron controls are marginal during a full stall; rudder control is adequate to provide directional control except in the most severe stalls.

To recover from a stall, the following steps apply (Steps 1 and 2 are accomplished simultaneously):

Step 1: Use control wheel forces as necessary to decrease the angle of attack while simultaneously decreasing the angle of bank. These two actions will have the desired effect of restoring flight. Thus, the aircraft is immediately brought out of a stalled condition and returned to a flying condition although you may still be in a descent with the wings are severely stalled, the use of aileron will be ineffective and will aggravate the stalled condition regardless of the finesse with which the aileron is applied. The correct recovery technique is to initiate the proper control wheel action to break the stall and maintain directional control with the rudder until the aircraft begins flying, then use the ailerons to level the wings.

Step 2: Advance the throttle smoothly full in. Since the throttle is your only direct control over thrust, it is important that you have maximum thrust, which will expedite the return to level flight by increasing airspeed.

NOTE

There is no situation, which will be improved by abrupt throttle movements.

Step 3: When you feel the aircraft regain flying airspeed, return to level flight. The stall recovery is not complete until the aircraft is returned to level flight. Avoid attempting too rapid a recovery, which will lead to a secondary stall. Your instructor will require you to develop a feel for flying the aircraft out of a stalled condition with a minimum loss of altitude.

POWER-ON STALLS

Power-on stall maneuvers are designed to teach you to recognize and recover from a nose-high, full stall, with minimum altitude loss.

NOTE

Though normally practiced while maneuvering in the area, power-on stall situations can occur in the traffic pattern, such as if you over-rotate during takeoff, become distracted during the turn to crosswind/downwind, etc. You will normally be required to recover from practice stalls when control effectiveness is lost. Control effectiveness is considered lost when the nose abruptly drops or an unplanned rolling motion takes place. Full aft control wheel need not be obtained prior to initiating recovery, and the exact point where the full stall is reached is not considered a point of emphasis. It is important, however, for you to see how an aircraft behaves if recovery from a stall is not made at the first indication of the approach to the stall.

Prior to practicing power-on stalls, clear the area, and adjust the throttle. Pay particular attention to the area above and in front of your aircraft. It will be necessary to clear constantly throughout the maneuver.

Straight-Ahead Stall

To execute the straight-ahead power-on stall, raise the nose to approximately a 15 to 25 degree pitch attitude. Your instructor will point out the outside references to use. Slowly and smoothly increase backpressure to hold a constant attitude until the stall occurs. Keep the wings level with the ailerons and counter yaw with the appropriate rudder input.

Recover by using control wheel forces as necessary to decrease the angle of attack while smoothly advancing the throttle full in. Apply aileron pressure after the stall is broken to keep the wings level. Notice the pitch change necessary to recover. The pitch change will depend on pilot proficiency. Allow the nose to lower until you feel positive pressures on the controls, which indicates that the aircraft is regaining flying airspeed. Reapply backpressure to recover with minimum altitude loss and without encountering a secondary stall. The maneuver is complete when you have returned to level flight.

Turning Stall

The pitch attitude for entry is the same range as for the straight-ahead stall. The bank in the turning stall may be in either direction and should be held at approximately 20 to 30 degrees. From straight-and-level flight establish the entry pitch and bank attitude.

When this attitude is reached, hold it until the stall occurs, then recover straight ahead as you did in the straight-ahead stall. Due to the effect of torque, the aircraft will attempt to roll out of a right turning stall entry and overbank on left turning stall entries. Counter yaw with the appropriate rudder input.

NOTE

Emphasis should not be on a precision entry, but rather on recognition and recovery from fully stalled conditions. The order in which the stalls are accomplished is not important.

Maneuver Review:

1. Clear the area.
2. Throttle - adjust.
3. Do one straight-ahead and two turning stalls/recoveries.
4. Return to cruise flight.

CHARACTERISTIC STALL

The characteristic stall is designed to build your confidence in the aircraft by demonstrating the aircraft's inherent stability. Your instructor will demonstrate the characteristic stall.

Perform a normal straight-ahead power on stall entry, but trim the elevator full nose up as the entry pitch attitude is established.

NOTE

The use of full nose-up trim limits the altitude loss during the demonstration and prevents overspeeding the engine.

When the stall is recognized, the controls are released. The nose of the aircraft will lower to a descending attitude, and as the airspeed increases, the nose will begin to rise.

A wing may drop as the nose lowers; however, due to the stability of the aircraft, the wings will normally attempt to return to level as the airspeed increases.

NOTE

The characteristic stall may be performed as a separate maneuver or during a power-on stall series.

SECONDARY STALLS

Secondary stalls are designed to show you what will happen if you become too anxious to return to level flight during a stall recovery. It also teaches you the value of smooth back pressure at critical airspeeds and the importance of allowing the aircraft to begin flying before completing a stall recovery. It is called a secondary stall since it occurs after a partial recovery from a preceding stall and is a type of accelerated stall.

The secondary stall is usually demonstrated after a partial recovery from a power-on stall; however, a secondary stall may be encountered during any stall recovery. Note that the throttle is full-in when the secondary stall is actually encountered.

Clear the area and perform a normal power-on stall. When the stall occurs, initiate recovery. Steadily bring the control wheel back as if you were trying to rush the return to level flight. Continue to increase back pressure until the aircraft buffets and the nose stops tracking. When this occurs, recover using control wheel forces as in a normal stall recovery. When sufficient airspeed has been gained, return the aircraft to level flight.

TRAFFIC PATTERN STALLS

You will practice traffic pattern stalls to become proficient in recognizing and recovering from stall conditions that could occur in the traffic pattern. These stalls simulate traffic pattern and

landing situations where you are rapidly cross-checking all available outside and instrument references. Recovery must be initiated at the first indication of a stall.

Turning Stall

Clear the area and establish yourself on a simulated downwind. Reduce power, turn to a simulated base leg, and lower the flaps to 20 degrees when below 85Kts. After establishing simulated base, ensure the throttle is at idle. Begin a turn to a simulated full approach with the nose higher than normal. Continue the turn, steadily increasing bank and back pressure, until you recognize a stall indication.

Recover by using control wheel forces as required to decrease the angle of attack, and level the wings. Simultaneously advance the throttle to full power. Reapply back pressure to return to level flight with minimum altitude loss.

NOTE

Subsequent turning stall maneuvers may be flown from a simulated base leg. Two turning stalls are normally accomplished, one to the left and one to the right. On one turning stall, recover on the artificial stall indication and on the other, recover on the aerodynamic stall indication. The sequence of the turning stalls is unimportant.

Landing Attitude Stall

Establish an 65 Kts simulated final approach, check throttle at idle, and execute a normal round out for landing. Hold the landing attitude until you recognize an aerodynamic stall indication. At that point, execute a normal stall recovery.

No-Flap Stalls

No-flap traffic pattern stalls are also practiced. In performing the stalls without flaps, the same airspeeds are used as in the no-flap landing pattern. While performing these stalls be aware of the differences in aircraft buffet, pitch attitudes, and stalling airspeeds.

Maneuver Review:

1. Clear the area.
2. Establish a simulated downwind leg.
3. Throttle - reduce.
4. Turn to a simulated base leg.
5. Throttle - check at idle after establishing a base.
6. Do two turning stalls recoveries and one landing attitude stall/recovery.
7. Return to cruise flight

SLOW FLIGHT

You will practice slow flight to develop your feel for the aircraft and your ability to use the controls correctly. Slow flight will acquaint you with the characteristics of the aircraft at minimum flying speeds and will demonstrate the importance of smooth control application. Slow flight also simulates the control pressures and flight conditions usually encountered during the early part of a go-around maneuver. Slow flight will improve your proficiency in performing other maneuvers in which low airspeeds are encountered.

You may enter slow flight after completion of traffic pattern stalls, power-on stalls, or by reducing airspeed and configuring for the maneuver. When the airspeed is below 85Kts, lower the flaps to 20 degrees (may also be done no-flap configuration).

Continue to maintain altitude while the airspeed decreases. When the airspeed has decreased to approximately 52-60 Kts, adjust the power to maintain altitude and airspeed. Trim the aircraft throughout these changing flight conditions.

NOTE

No-flap slow flight should normally be flown at the higher airspeed range due to the higher stalling speed without flaps. Do not assume that the airspeed range allows large pitch/power changes. You should attempt to hold a constant airspeed throughout the maneuver. Your instructor will show you how to use the throttle to maintain a constant airspeed.

Since the aircraft is intentionally being flown near stalling speed, it is not unusual for the stall warning horn to sound during slow flight, especially in turbulent air. If you have no reason to doubt the accuracy of the airspeed indicator, you may continue with slow flight, taking care to ensure that the airspeed is 52 Kts or greater. Be alert for any other indications of an approaching stall. If you recognize any of the other indications, immediately execute a stall recovery.

Your instructor may demonstrate the following handling characteristics of the C-172 at minimum flying speed. Techniques employed in the demonstration may vary with instructor. You are not required to be able to duplicate these demonstrations except for straight-and-level and the coordination exercise.

LOW SPEED HANDLING CHARACTERISTICS

Straight-and-Level Flight

At slow flight airspeed, notice the nose-high pitch attitude required to maintain level flight and the amount of right rudder pressure required to control yaw. Keep in mind that should a go-around become necessary at low airspeeds, the nose-high attitude must be established to preclude sinking towards the ground. Notice the large angle between the chord line of the wing and the horizon, the amount of trim necessary and the amount of power necessary to overcome induced drag.

Control Effectiveness

Notice that with normal control deflections aircraft response is much slower. This same sluggish response will be present during a go-around at low airspeeds.

Adverse Yaw

This demonstration will emphasize the need for rudder coordination. As the aircraft is rolled into a bank while keeping the rudder neutral the aircraft will yaw in the opposite direction of the turn due to the increased induced drag on the upward moving wing and the decreased drag on the downward moving wing. A roll out without the use of rudder will produce yaw in the direction of the turn. Use of coordinated rudder during the turn entry and exit will counteract adverse yaw and will keep the ball centered in the turn-coordinator indicator.

Torque

This demonstration will emphasize the necessity of controlling torque, especially in the traffic pattern. When the throttle is advanced to full power at low airspeeds, the aircraft will immediately yaw and roll to the left. Application of right rudder and aileron will control these aircraft tendencies.

Rate of Turn

A shallow banking turn in slow flight will produce a high rate of turn. Compare this rate of turn with the rate of turn produced by a shallow bank turn during normal cruise. Remember that during final turns and turns to clear the runway it is easy to overshoot the desired headings due to the high turn rate.

Steep Turns

Increasing the angle of bank during a level turn at low airspeed will cause the aircraft to approach a stall. An aircraft does not stall in a turn because lift is lost. The reason an aircraft stalls is because the stall speed is increased due to the increased wing loading and "G" forces needed to maintain level flight.

Abrupt Control Movements

At minimum flying airspeed, abrupt control movements will cause the aircraft to approach a stall. Handling an aircraft in this manner at low airspeed and altitude could be disastrous; therefore, smooth use of the controls is mandatory during landings and go-around.

Raising the Flaps

Retracting the flaps at minimum flying speed creates a dangerous situation. If the pitch attitude is increased to maintain altitude, the aircraft may stall. Lowering the nose of the aircraft to prevent a stall will cause the aircraft to descend. You must have a minimum of 73Kts when raising the flaps during a go-around.

Coordination Exercise

Coordination exercises during slow flight require proper application of aileron, elevator, rudder, and power. Turning left may require only a reduction of right rudder; whereas, in turns to the right, considerable right rudder pressure is required. After the bank is established, right rudder will have to be used to counteract the effect of torque. Use a shallow bank for turns during coordination exercises in slow flight.

Maneuver Review:

1. Clear the area.
2. Throttle - reduce.
3. Below 85 Kts., lower the flaps to 20 degrees, if desired.
4. Throttle - as required to maintain altitude and airspeed
5. Return to cruise flight.

CHAPTER 6

TRAFFIC PATTERNS AND LANDING

When several aircraft are operating from the same airfield, it is necessary that each pilot conforms to a standardized traffic pattern and procedure. It is essential that the runway be your primary reference in the traffic pattern. Anytime your instructor gives you a visual reference, the reference is appropriate for the existing conditions and will not be applicable for all landing situations. You should use these references as aids in developing the judgment required to accurately estimate distances and glidepaths.

THE STANDARD RECTANGULAR PATTERN

The standard rectangular pattern is used to ensure a safe and uniform traffic flow while handling the maximum number of aircraft with minimum congestion. The pattern should be adjusted for the existing wind conditions.

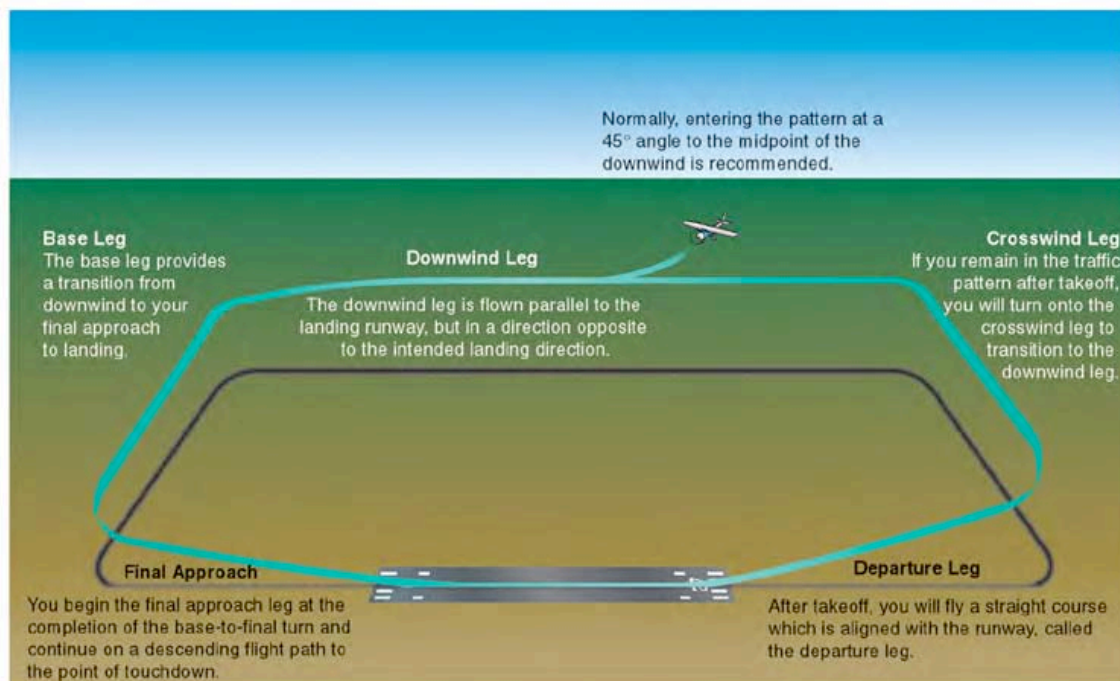


Figure 6-1 – The standard traffic pattern has five named legs; downwind, base, final, departure and crosswind.

BEFORE TRAFFIC ENTRY

Call the tower/unicom for landing instructions/information prior to entering the pattern. You can usually determine the landing direction by watching other aircraft and observing the wind direction.

Accomplish any necessary checks and be at traffic pattern altitude and airspeed before entering the pattern. Fly the traffic pattern altitude as directed or depicted.

All legs in the traffic pattern are made by referencing the runway. Turns in the traffic pattern are made using bank as required, usually no greater than a medium bank.

45 DEGREE ENTRY LEG

This leg is designed to permit an orderly flow of traffic into the rectangular pattern. Fly the 45° entry leg so that you intersect the downwind leg approximately abeam the midpoint of the runway at an angle of 45°.

DOWNWIND LEG

The downwind leg ground track is parallel to the landing runway. Plan your turn to the downwind leg so that your aircraft is approximately 3/4 mile from the runway. Accomplish the before landing check when convenient on the downwind leg. Maintain 90 Kts on this leg until you reach the point to begin the turn to base leg. At this point, reduce the throttle, begin the turn to base leg, and lower the flaps to 20°, if desired, when below 85 Kts. Adjust the pitch attitude to maintain 75 Kts. Complete the turn to base-leg with the necessary drift correction to maintain a groundtrack perpendicular to the landing runway.

BASE LEG

The throttle is used as required on base leg to maintain 70 Kts. Initiate the turn to final so as to roll out on the extended runway centerline, maintaining a minimum of final approach speed during the turn.

FINAL APPROACH

The final approach begins when the wings are level after the final turn. On final, maintain final approach airspeed and trim. Final approach speeds are 70 Kts (no-flaps), 65 Kts (20° flap) and 60 Kts (full flap). You should have at least 2,000 feet spacing on the aircraft ahead of you on final approach.

CROSSWIND CONTROL

After rolling out on final, you must maintain runway alignment and a smooth, constant glidepath to fly-taxi attitude and touchdown.

The final approach flight path must be aligned with the runway centerline. Since there is almost always some crosswind, special techniques must be used to maintain runway alignment. (See Figure 15.)

CROSSWIND CONTROLS ON FINAL APPROACH

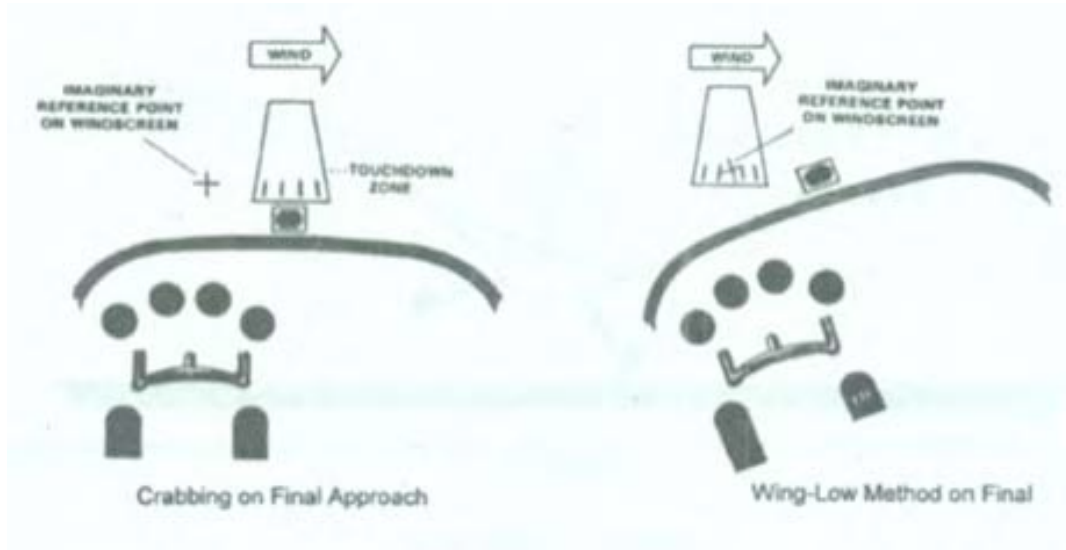


Figure 15 - Crabbing and Wing-Low methods of crosswind corrections

There are two ways to accomplish this, the wing-low method and the crab method. (See Figure 16.) In the C-172, the crab method will be used initially as you roll out on final with a transition to the wing-low method. You should plan to roll out of the final turn with a crab into the wind. This gives you a reference of how much control deflection is needed for the transition to the wing low method. As early as possible, set up for the wing-low crosswind approach. Use of the wing-low method increases drag and decreases lift. You should anticipate the need to add power to maintain airspeed and possibly raise the nose to maintain the glidepath.

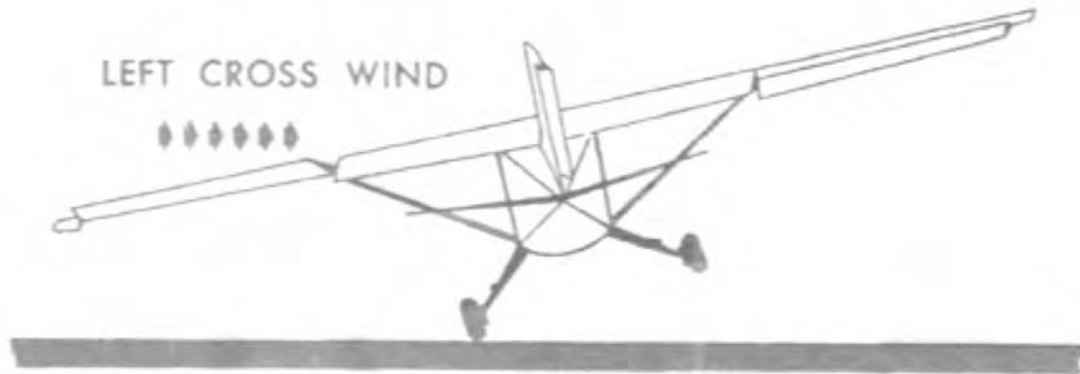


Figure 16 - Left Cross Wind, wing-low method

The proper procedure is:

1. *Apply sufficient rudder deflection to align the longitudinal axis of the aircraft with the runway.*
2. *Use aileron as necessary to keep the aligned with the runway flightpath centerline*

The second and most difficult objective is to see and fly a proper glidepath to the roundout and touchdown position. In the normal landing configuration, the C-172 flight attitude is such that the aircraft may be aimed at a position short of the intended touchdown point.

Plan to touchdown within the first 1,000 feet of the runway. The reason for aiming short is that touchdown is delayed during the round out to bleed off airspeed since final approach speed is above the touchdown speed and must be reduced before touchdown can occur. Ground effect also tends to delay touchdown. For strong headwinds on final, the aim point should be closer to the intended touchdown point. *The airspeed should be checked frequently while on final approach.*

One of the more common errors is having insufficient power on final and trying to maintain airspeed by dropping below the proper glidepath. If this occurs, add power and decrease the rate of descent while maintaining final approach speed.

Seeing the proper glidepath takes practice and experience; however, you can improve the learning situation by proper eye movement. Just as in driving an automobile, move your eyes from side to side with occasional glances at the cockpit references. Include the horizon as a reference as well as the runway.

NORMAL LANDINGS (Flaps as desired)

So that you may better understand the factors that affect your judgment and pilot technique, the landing is divided into three phases - the roundout, the touchdown, and the landing roll.

The Roundout

As you approach the aimpoint and the landing is assured, begin the roundout by checking the throttle in idle while increasing back pressure on the yoke. The roundout consists of decreasing the rate of descent as the runway is approached. Smoothly apply back pressure to hold the aircraft just off the runway as the proper landing attitude (pitch attitude) is reached. The pitch attitude at touchdown should be slightly higher than the pitch attitude used for takeoff. When making a roundout, you are slowing to touchdown speed while decreasing the rate of descent so the aircraft will settle gently onto the runway. Different rates of descent will cause the height at which the roundout must be initiated to vary. A roundout initiated at a greater height must be executed more slowly than one from a lower height to allow for a greater loss of altitude. Execute your roundout proportionate to the apparent rate of descent. When the rate of descent is very slow and you are still well above the runway, make little or no increase in the pitch attitude until you are close enough to the runway to establish the final landing attitude. Your instructor will show you, by the use of references, the height at which a roundout should be started.

Throughout the roundout do not forget the effects of the crosswind, if one exists. You must maintain the cross-control configuration throughout the roundout and the touchdown. This usually will result in touching down on one main tire before the other. As the airspeed decreases to just above the stall, additional aileron and rudder deflection may be needed. Remember that the control surfaces are deflected out of their normal streamlined position and will add drag; airspeed will decrease much faster and stall speed will increase.

Anytime the control pressmes feel mushy and it is apparent that you are losing control of the aircraft, or the pitch attitude becomes significantly higher than the normal landing attitude, execute a go-around.

NOTE

Anytime the approach or roundout does not look safe to you, go-around. Do not attempt to make a landing from a bad approach. If it appears you are going to land long, do not hesitate to go-around.

The Touchdown

The touchdown is the gentle settling of the aircraft onto the runway in the landing attitude. You must continue to hold any crosswind control deflection used during the roundout. If you do not, the aircraft will weathervane and touchdown in a crab, resulting in directional control difficulties on the ground.

The Landing Roll

After touchdown continue to hold sufficient back pressure to keep the nosewheel off the runway. Maintain directional control with use of rudder. After the nosewheel lowers to the runway, continue to hold the control wheel slightly aft of neutral to keep the weight of the aircraft off the nose gear. This will counter wheelbarrow effect. Do not attempt to steer the aircraft with the control wheel. Check the brakes, then use as necessary to slow to a safe taxi speed before turning off the runway. Avoid use of brakes immediately after touchdown to avoid blowing a tire. After turning off the runway, complete the after landing check outlined in the flight crew checklist. Continue using the same caution as when airborne since the flight is not finished until the aircraft is safely parked.

No-Flap Landing

Traffic pattern procedures are similar to the normal landing except that flaps are not used. It may be necessary to extend the downwind to move the base leg slightly farther from the runway to allow time to establish airspeed on final. This will result in a slightly shallower final approach with a somewhat higher than normal pitch attitude. Final approach airspeed is 70 Kts.

Full Flap Landings

The full flap landing permits a slightly steeper final approach and a slower final approach airspeed and could be used when landing over trees, on short fields, or during forced landings, especially unprepared surfaces. The base turn of the full flap pattern is normally placed slightly closer to the runway when compared with a normal pattern. The base turn for a full flap pattern is flown using normal pattern procedures. When on final approach, full flaps are lowered and airspeed is reduced to 65 Kts.

The airspeed must be monitored closely as it decreases toward final approach airspeed. Maintain airspeed and glidepath by use of the throttle and flight controls. The round out will require a greater pitch change and greater control forces than for a normal landing, since you are starting it from a steeper glidepath and with a lower pitch attitude. Care, must be taken not to roundout

high, since the airspeed decreases rapidly with flaps lowered. If a high round out is not recognized and corrected, a dropped-in landing will result.

Touch-And-Go Landings

After the aircraft touches down on the main gear, first bring your flaps up full, establish takeoff attitude and smoothly advance the throttle full in. Use normal takeoff techniques until airborne. Establish 80 Kts climb and retrim the aircraft. Check engine instruments as soon as practical after applying power for takeoff to confirm that the engine is developing full power and no malfunctions exist. In strong crosswinds, you may have to execute the touch-and-go on only one main gear due to the use of the wing-low method of landing.

NOTE

During touch and go landing, retract flaps before adding power for go around.

GO-AROUNDS

Sometimes during traffic pattern and landing practice, you will find yourself poorly positioned and will have to discontinue an approach for reasons of Safety and execute a go-around. You can imagine how dangerous a traffic pattern would be if all aircraft were allowed to land and depart from a field at will. In the interest of safety, precise traffic patterns must be flown under the supervision of tower control. In these patterns, you are able to see and anticipate the movement of other aircraft and stay clear of them.

Although an approach may be aborted at any point, a go-around is usually executed from the final approach or roundout. The sooner a poor landing condition is recognized and the go-around is started, the safer it will be. You should not wait until the last second to make a decision and you should not try to salvage a bad approach.

Ideally, there should be little need for the tower to direct go-arounds. The pilot of the aircraft is responsible for executing the go-around when a dangerous condition is encountered. Examples include low final turns, overshot final turns, wake turbulence, distracted attention, inadequate spacing, and many other dangerous conditions.

The proper method for executing a go-around is as follows:

From Final or Landing Phase (Straight-Ahead Go-Around)

1. Throttle- Full IN

NOTE

If full flaps were used, retract the flaps to 20 degrees as soon as practical after advancing the power.

2. At a safe altitude and above 70 kts, check the flaps up
3. Establish a 80 kts climb.
4. You should normally not have to clear the runway, however, do not overfly an aircraft in take off position, takeoff roll, or takeoff leg. If you must clear the runway, be at a safe altitude

and use the minimum bank angle practical. Displace yourself so you can adequately clear the runway and takeoff leg. Climb to the locally directed altitude.

From Base Leg (Inside Go-Around)

1. If at or below locally directed go-around altitude, advance the throttle full in and check the flaps up above 70 kts. Climb, if necessary, to the go-around altitude.

NOTE

If above locally directed altitude. Maintain a minimum of delay advancing throttle until at go-around altitude. Maintain a minimum of 75 kts during the descent.

2. Turn inside the normal final approach so you can adequately clear final approach, the runway) and takeoff leg.
3. When at go-around attitude, use throttle as necessary to maintain 80 to 90 kts

Breakout

If it is necessary to discontinue the landing pattern, follow the local procedures for leaving the pattern. Do not wait to be directed to breakout if you see a dangerous situation developing; use your initiative and judgment and exit traffic immediately. If you are directed to breakout, follow instructions without hesitation. Breakout situations will most likely occur on crosswind, downwind and entry legs.

CHAPTER 7

LANDING IRREGULARITIES

LOW FINAL APPROACH

When you place the base leg too far from the runway, or dive the aircraft through the turn to final, excessive altitude may be lost and cause the final approach to be far below the desired approach path. Such a situation would require additional power to fly the aircraft up to the runway.

This is called dragging-in your final approach and should be avoided. The roundout from a dragged-in final approach is more difficult to judge, and a slight misjudgment may result in a short landing.

Add power as soon as you start getting low on final approach; then retard power when you are back on the proper glide slope. (See Figure 17.) If you have any doubt about the approach, if it looks wrong or feels wrong, execute a go-around.

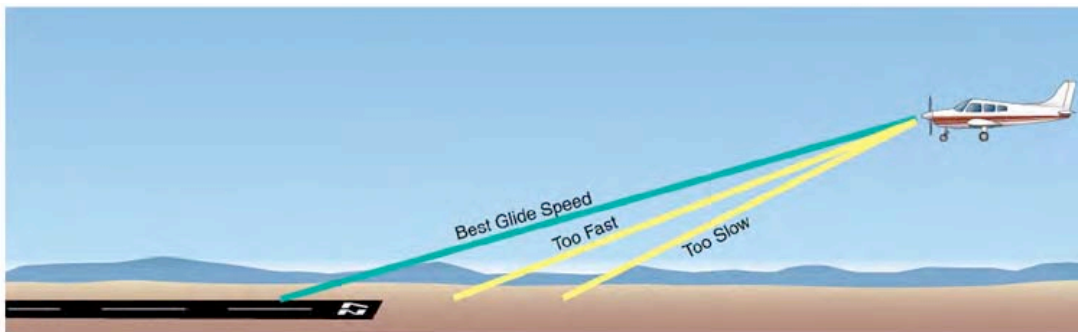


Figure 17 - Effects of airspeed control on the final approach leg

TOO SLOW ON APPROACH

When your airspeed is too slow on final approach, your judgment of the glide ratio and the proper roundout height may not be accurate because the proper point to begin roundout is lower with low airspeed and requires more precise judgment. Also, the aircraft may stall, depending on the pitch attitude and control use, especially if the wind is gusty.

When you recognize a slow approach, make the same recovery as for a low final approach. Apply power early - at an altitude high enough to reestablish the correct airspeed and attitude - or go-around.

ROUNDOUT TOO HIGH

Sometimes when it appears that the ground stops moving toward you, and your roundout has been too rapid, you will be too high above the runway. To compensate for this you can maintain a

constant pitch attitude until the airspeed diminishes slightly and the aircraft again starts descending; then continue the roundout.

This technique should be used only when you have adequate airspeed and runway. If you have reached a landing attitude and are still well above the ground, don't wait for the aircraft to start descending again. Execute a go-around and plan another approach.

Remember that when a landing attitude is attained, the aircraft is rapidly approaching a stall; the airspeed is decreasing and the critical angle of attack is being approached, even though you are no longer increasing the pitch attitude.

In your study of descents you learned that, as the nose is lowered to a descending attitude, the pitch change causes the lift of the aircraft to decrease momentarily. This is also true during a roundout. Do not lower the nose of your aircraft to increase the rate of descent when very close to the runway. The momentary decrease in lift may be so great that the aircraft may land on the nosewheel which could collapse.

You should go-around anytime that you feel the nose should be lowered excessively to prevent a stall during the roundout. The need for substantial lowering of the nose is an indication that you may be too high above the ground and approaching a stall.

Anytime you approach a stalling condition apply full power, adjust your pitch attitude, and go-around. It is unsafe to continue the landing. However, if you have applied power to go-around and the aircraft continues to settle, do not try to hold it off by raising the nose above the landing attitude. Hold the landing attitude. Let it touchdown if it wants to. The contact will be moderate if you have added power, and you will be safely airborne again shortly.

ROUNDING OUT TOO LATE OR TOO RAPIDLY

If you are too late in starting the roundout and pull the control wheel back too rapidly in an effort to prevent the aircraft from touching down, you can cause a high-speed stall. This is a dangerous situation and may cause the aircraft to land (Depending on air speed) extremely hard on the main landing gear. This may not be a controllable situation, depending airspeed. If it occurs, immediate power will increase thrust, lift, and controllability, and will enable you to recover and go-around.

The important things to remember in this situation are: (1) don't panic; (2) recognize the problem; and (3) do something immediately - that is, add power and control the aircraft. In your recovery, hold the landing attitude. Your main gear may contact the ground a second time, but if you have properly initiated recovery, your second contact will not be as hard.

FLOATING

When you misjudge the final approach (reduce the power too late, use too much power on final or fail to use flaps properly) your tendency will be to dive the aircraft toward the end of the runway in an attempt to land. When you dive the aircraft there will be an increase in airspeed. This will cause you to float and possibly balloon. You will be well down the runway before a landing can be made.

Good judgment must be used anytime the aircraft floats. You must gradually raise the nose as airspeed decreases and landing speed is approached. A small error in judgment may result in bouncing or ballooning. If you see that you cannot make a safe landing, add power and go-around.

The recovery from floating will depend on the amount of floating. Since prolonged floating uses considerable runway length, it should be avoided especially in strong crosswinds. If floating takes you beyond the desired touchdown zone, add power and go-around.

BALLOONING

There are several factors that may cause an aircraft to balloon. All are results of poor judgment or over-controlling. Starting the roundout too rapidly or raising the nose to a landing attitude before the airspeed has decreased sufficiently will cause you to balloon. The altitude gained in each instance will depend on the airspeed or the rate at which the pitch attitude is increased.

When ballooning is not severe, a landing may be made. Maintain direction, hold a constant landing attitude, and let the aircraft settle onto the runway.

When ballooning is severe, go-around. Simultaneously apply power, maintain direction, and lower the nose to the takeoff attitude. Do not attempt to salvage the landing.

Be extremely cautious of ballooning when there is a crosswind. If the proper wing-low crosswind correction is not maintained until touchdown, the aircraft will probably balloon because of the added lift as you level the wings. This puts you in more trouble because you will also be drifting again. Once you level the wings, make certain that the appropriate wing is down in a crosswind and that direction is maintained with opposite rudder. If you balloon slightly, the wing will have to be lowered even further to compensate for the relative increase of drift component at the lower airspeed.

If you have any doubt, go-around.

BOUNCING

A bounce is very similar to ballooning. The difference is the initial cause factor. If the aircraft strikes the runway hard, it will bounce into the air just as a ball will bounce. The height it reaches depends on the force with which it strikes the runway and the amount of back pressure held. This height also depends on the speed at the point of touchdown.

A bounce occurs if the aircraft makes contact with the ground before the landing attitude is attained. A common student error is to use too much backpressure when it is realized too late that the aircraft is sinking too fast because it is not yet in the landing attitude. In attempting to correct the first mistake an increase in pitch attitude may come too late - just as the bounce occurs. Both factors tend to force the aircraft into the air again.

The corrective action for a bounce is similar to that for ballooning and depends on the severity of the bounce. When it is slight and there is no great change in pitch attitude, continue with the landing. Maintaining direction and smoothly adjusting the pitch to a landing attitude just prior to touchdown can accomplish this.

When a bounce is severe (you feel the aircraft rising rapidly) make a go-around immediately. Do not attempt to make the landing. Simultaneously apply power, maintain direction, and lower the nose to a safe pitch attitude. Follow through with the go around even though another bounce may be encountered.

WARNING

Do not attempt a landing from a bad bounce.

Extreme caution and alertness must be used anytime a bounce is encountered when there is a crosswind. When one wheel strikes the runway, the other wheel will touchdown immediately afterwards, and the wings will be leveled. The crosswind correction is lost if you bounce and release crosswind controls. In this case you should reestablish the drift correction if the landing is continued, and hold the wing low until first one wheel and then the other stays on the ground. If directional control cannot be maintained or if the bounce is hard, add full power and go-around.

PORPOISING

Porpoising is a condition encountered during landing wherein the aircraft bounces back and forth between the nosewheel and the main gear after the initial ground contact. Porpoising is caused by an incorrect landing attitude upon touchdown, which brings the nosewheel in contact with the runway before the main gear touches down.

This condition most likely will occur when landing is attempted with an incorrect landing attitude and at an excessive airspeed. If immediate corrective action is not initiated, the porpoising will progress to a violent, unstable oscillation of the aircraft about the lateral axis. These repeated heavy impacts of the aircraft on the runway ultimately may result in structural damage to the landing gear and airframe. Therefore, a proper landing attitude immediately prior to touchdown is imperative to preclude the occurrence of the porpoise.

If porpoising should be encountered, immediately reposition the controls (control wheel neutral or slightly back) to establish the normal landing attitude. Maintain this attitude and simultaneously advance the throttle to full in and go-around.

CAUTION

Do not attempt to counteract each bounce with opposite yoke movement, because the combined reaction time of pilot and aircraft is such that the control movement will aggravate the porpoising action. Repositioning and holding the controls at neutral or slightly aft will dampen out the oscillation as soon as it occurs.

LANDING IN A DRIFT OR CRAB

At times you may find yourself correcting for drift by crabbing on the final approach.

If you round out and touchdown while the aircraft is drifting or in a crab, it will contact the runway while moving sideways. This will impose extreme side loads on the landing gear and may cause material failure.

The method of correcting for drift on the final approach is the wing-low method. This allows you to keep the longitudinal axis aligned with the runway throughout the final approach and landing. Proper drift correction during landing will prevent skipping.

During final approach, roundout, and touchdown in a crosswind, there are two factors which should be well understood: 1) that the path or track of the aircraft over the ground should be a straight line in the same direction as the runway; and 2) that the fuselage of the aircraft should remain lined up with the runway throughout the approach. Do not fly at an angle to the runway. If the nose of the aircraft is not straight, and the fuselage is not in line with the runway centerline, the cause is probably one of the following: drifting caused by insufficient or no wing-low crosswind correction; crabbing, caused by weathervaning to correct for crosswind instead of approved wing-low method; or a combination of both.

WING RISING AFTER TOUCHDOWN

During crosswind landings there may be sometimes when a wing will rise during the landing roll. Depending on the amount of crosswind and the degree of corrective action, a loss of directional control may occur.

When an aircraft is rolling along the ground in a crosswind condition, the upwind wing is receiving a greater air pressure than the downwind wing, because of the fuselage's interference with the relative wind over the downwind wing. This causes a lift differential. The wind is also striking the aircraft's fuselage on the upwind side, which may further assist the raising of a wing by tending to tip or roll the fuselage. If no correction is applied, it is possible that one wing will rise sufficiently to cause the other one to strike the ground.

Ailerons are used to keep the wings level. If a wing starts to rise during the landing roll, you should immediately apply more aileron toward the high wing. The sooner aileron is applied, the more effective it will be. The further you allow a wing to rise before taking any corrective action, the more aircraft surface is exposed to the impact pressure of the crosswind.

If the wing comes up and there is also a loss of directional control, the wind is attempting to raise a wing and the crosswind is also acting on the fuselage surface behind the main wheels and is weathervaning the aircraft into the wind. Again, you should apply aileron to lower the high wing and maintain directional control with rudder, nosewheel steering, and/or brakes. Correct wing low techniques will preclude loss of control during landing.

CHAPTER 8

BASIC AIRWORK MANEUVERS

GLIDES AND GLIDING TURNS

You practice glides and gliding turns to enable you to establish and maintain the proper glide airspeed and attitude and to develop your ability to judge gliding distance. The forced landing pattern and portions of the normal landing approach make use of the glide.

To enter a glide from straight-and-level flight, clear the area, then reduce the throttle to idle. Maintain level flight as the airspeed decreases and trim. Below 85 Kts, lower the flaps, if desired. As the airspeed approaches glide speed, lower the nose to maintain the glide speed and begin a turn if desired. Glide speed depends on the position of the flaps: flaps up 70 Kts; flaps extended up to 20 degrees - 65 Kts; and over 20 degrees flaps - 60 Kts. Normally, you should use shallow bank turns during the descent; however, a glide may be accomplished at other bank angles or even straight-ahead. Be sure to CLEAR. Advance the throttle smoothly to approximately 1500 rpm every 30-40 seconds to clear the engine.

To level off from a glide, begin raising the nose to a level flight attitude approximately 50 feet before reaching the desired attitude. Simultaneously advance the throttle as necessary and check the flaps up above 70 Kts.

NOTE

A glide with flaps allows you to descend at a steeper angle and a faster rate without increasing airspeed.

Maneuver Review:

1. Clear the area.
2. Throttle - IDLE.
3. Flaps - as desired below 85 Kts.
4. Maintain level flight until the airspeed approaches glide speed.
5. Adjust the pitch to maintain glide speed.
6. Clear the throttle every 30-40 seconds.

ENROUTE DESCENT

You use the enroute descent primarily to descend at cruise airspeed from your enroute altitude to traffic pattern altitude.

Accomplish the Before Descent Check. Lower the nose and begin a turn while reducing the throttle to a setting that gives you the desired rate of descent. Use turns throughout the descent to provide better clearing.

Use an airspeed between 90 and 112 Kts; however, do not interpret this wide range in airspeed to permit large airspeed changes.

If the throttle is in idle, adequately clear engine every 30 to 40 seconds.

To level off from the enroute descent, smoothly raise the nose to a level flight attitude approximately 50 feet before reaching the desired altitude and simultaneously advance the throttle to the desired setting.

Maneuver Review:

1. Accomplish the Before Descent Check.
2. Reduce the throttle and begin a series of descending turns and clear the engine.

STEEP TURNS

Steep turns are designed to help you develop a quick and efficient cross-check and experience the exaggerated aerodynamic forces resulting from the increased bank.

Basically, the only difference in steep turns and other turns is the angle of bank and the amount of back pressure and power needed. Steep turns are normally practiced as 360-degree precision turns, but may be used to turn any amount.

Clear the area. You should begin your roll in as you would a shallow or medium bank turn. As your bank increases to a medium bank, there is a need for increased backpressure to maintain altitude. As the bank is increased, there may be a need to increase power to maintain a minimum of 80 Kts.

A common student error is the misuse of controls when entering a steep turn. The natural tendency of the pilot's hand to move backwards as a right turn is initiated, causes a premature increase in pitch (climb). Conversely, the student's hand tends to move forward as a left turn is initiated, causing a decrease in pitch (descent). These tendencies can only be counteracted by mental awareness and positive control inputs.

To maintain altitude and bank, both inside and outside references must be used. Your instructor will show you the outside references for right and left steep turns. You should maintain altitude and make corrections using outside references and use your inside references to monitor your progress. Use aileron and rudder pressures as required to maintain approximately 45 degree bank. Altitude is controlled by varying backpressure.

A nose-high attitude can be corrected by relaxing a small amount of back pressure while maintaining bank. A slight nose-low attitude can be corrected by increasing backpressure. More extreme nose-low attitudes may require reducing the angle of bank a few degrees with coordinated aileron and rudder pressure and simultaneously using back pressure to raise the nose to the desired pitch attitude and then reestablishing bank. Use the angle of the earth's horizon across the windscreen as the outside reference for the degree of bank. The instrument reference for angle of bank is the attitude indicator.

The rollout is much the same as the entry except that control pressures are used in the opposite direction. Keep in mind that at lower airspeeds larger rudder and aileron control deflections are needed to make the aircraft roll. As the bank decreases, relax the backpressure smoothly, until the controls are neutralized. Set the throttle as desired. Steep turns require more lead to roll out on a desired heading.

Maneuver Review:

1. Clear the area.
2. Throttle - as required.
3. Do a steep turn in either direction

COORDINATION EXERCISE

(8- Turns, Turns around a point, etc.)

The coordination exercise is designed to improve your ability to coordinate the flight controls while making turns with reference to the ground. Rudder application will be of primary emphasis.

The exercise is flown within a cone approximately 20° either side of a central reference. All turns during the exercise are normally made using a medium bank except the entry and termination turns, which are normally made using a shallow bank.

Clear the area and begin the maneuver from straight-and-level flight with the throttle set at normal cruise. Pick a central point directly in front of the aircraft. Turns will be made to approximately 20° either side of the central point. Begin a turn in either direction, planning to roll out of the turn so that as the wings become level when the nose of the aircraft is approximately 20° from the central reference. Do not hesitate at this point but immediately begin a turn toward the point approximately 20° the other side of the central reference. Keep in mind that after the initial turn, the number of degrees to turn is approximately 40° and will remain so until the recovery from the coordination exercise. Continue the maneuver for several turns. Remember to clear the area while performing this exercise. Recover by returning to the central reference point. This will normally be a shallow bank turn. Your instructor may have you practice this exercise using different angles of bank and heading changes.

Maneuver Review:

1. Clear the area.
2. Throttle - normal cruise.
3. Do a series of coordinated, level turns

RECTANGULAR COURSE

Flying the rectangular course does two things for you. First, you develop the ability to fly your aircraft while planning ahead, staying oriented with the ground, and maintaining a specific groundtrack. Second, you increase your ability to recognize the effect of wind drift and make necessary corrections to fly a good traffic pattern.

The rectangular course is a maneuver in which the groundtrack of the aircraft remains over a selected rectangular area on the ground. (See Figure 18.)

Select a field, or group of fields, having a rectangular outline. Perform a descent, planning to arrive on a 45° entry leg at 800 feet above the terrain. Adjust the throttle as necessary to maintain 90 kts. Lead the turn to arrive over the reference line you have selected for your rectangular course. Your instructor demonstrates the planning involved to stay on the rectangular perimeter of your course. Remember that you must crab into the wind to make a straight reference line track along your ground reference line.

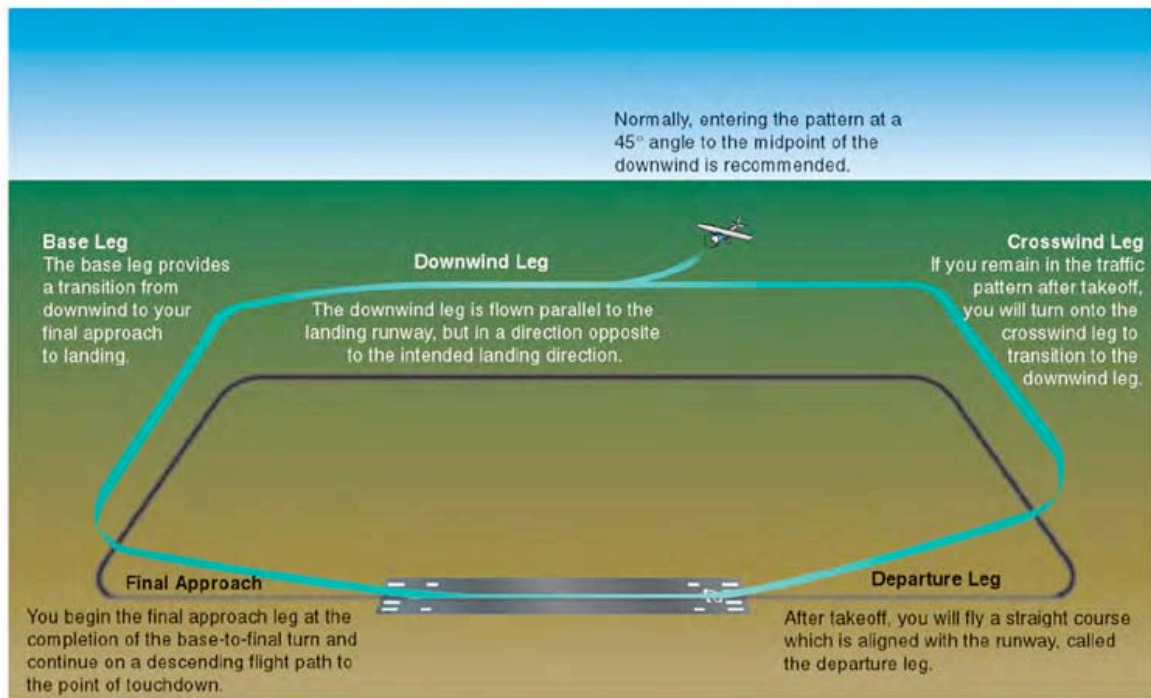


Figure 18 - Rectangular Course

After you attain proficiency, your instructor may also require you to fly a ground track at a specified distance away from the rectangle.

He may also require you to accomplish traffic pattern procedures such as descents on a simulated base leg and final approach and climbs on simulated takeoff leg using an appropriate airspeed configuration.

Make all turns using bank as required, normally shallow to medium turns.

CHAPTER 9

SIMULATED FORCED LANDINGS

Simulated forced landings are designed to teach you a safe, efficient way to land the aircraft in the event of partial or complete engine failure and will improve your judgment, ability to plan, and increase your confidence in your own flying ability.

THE LANDING PATTERN

Practice the 360-degree forced landing pattern as well as other types of forced landing patterns. We use the 360-degree pattern, when possible, because it is easily adjustable for varying wind conditions, provides a large margin for errors in judgment, and is easily related to the rectangular traffic pattern with which you are already familiar.

The forced landing pattern begins at approximately 1,500 feet above the intended touchdown zone, headed into the wind. This point is called high key. Your instructor will show you how to maneuver the aircraft so as to arrive at high key.

When at high key, begin a gliding turn towards low key. This turn may be made in either direction and is similar to the turn to crosswind and downwind in the traffic pattern. Low key is a point approximately 800 - 1000 feet AGL, 3/4 mile from and abeam the intended touchdown zone. Low key is similar to a point in the traffic pattern on downwind just prior to base.

Continue the turn from low key to base key, planning to arrive there at approximately 600-700 feet AGL. Base key is similar to base in the traffic pattern.

From base key, turn to final approach. On final, you should normally set your aimpoint approximately in the center of the landing field. Transition to land in the first third of the field when full flaps are lowered.

NOTE

Though approximate altitudes are specified at the key points, the landing field should be the primary reference for flying the pattern. The altimeter may not give you valid information unless you know the terrain elevation.

Flaps may be lowered at anytime during the pattern. Plan your pattern so you do not have to retract the flaps after lowering them.

In varying wind conditions, you will have to make adjustments to the forced landing pattern. Your instructor will show you various ways of making these adjustments.

SIMULATED FORCED LANDINGS

When your instructor presents a situation requiring a forced landing, look for a landing field and maneuver towards it as you accomplish the checklist procedures.

NOTE

Do not lose excessive altitude while looking for and maneuvering towards a field. It is imperative that you establish and maintain a proper glide.

If altitude permits, fly directly to the field, planning to arrive over the approach end of the field at high key. If unable, try to enter the pattern at one of the other key points.

During forced landing practice, your instructor will clear the throttle. When the pattern is complete, your instructor will either direct you to go-around or will assume control of the aircraft and execute a go-around. Go-around procedures are the same as from final or landing phase in the traffic pattern. Plan to go-around at a safe altitude (at least 500 ft. AGL) depending on terrain and obstructions.

NOTE

If flaps are extended over 20 degrees, retract the flaps to 20 degrees as soon as practical after advancing the throttle full in.

Climb straight-ahead to 800 feet AGL, then turn, if necessary, towards other suitable forced landing fields in case you must make another forced landing.

Low Altitude Simulated Forced Landings

Low altitude forced landings do not appreciably differ from other forced landings except that there is less time available for planning and execution due to the close proximity to the ground. Therefore, it is imperative that you quickly establish a proper glide and select a landing field. Accomplishment of emergency procedures is important; however, **NEVER SACRIFICE AIRCRAFT CONTROL!** Normally, turn only as necessary when below 400 feet AGL and limit turns to approximately 90 degrees when below 800 feet AGL.

Wind Direction

In order to be able to land into the wind, we need some way of determining the ground level wind direction. Blowing smoke is the best indicator, however, blowing dust, blowing snow, ripples on ponds, and windmills may also provide good information. If there are no indicators of wind direction, plan to land in the same direction as you took off.

Field Selection

Be constantly on the lookout for suitable forced Landing fields since you never know when an emergency requiring a forced landing will occur. Naturally, the best forced landing field is an established airfield; smooth fields with no obstructions are the next best substitute.

Besides the quality of the field, additional factors to be weighed are your present altitude and the distance to the proposed field. It makes no sense to select a perfect field you cannot reach. Pick a

good field even for practice since an engine failure during a practice forced landing could require actual use of that field.

Though you want to land into the wind, landing crosswind in a long field is better than landing into the wind in a short rough field.

CAUTION

If you must land in a cultivated field or a field with a standing crop, land with the furrows. Landing across the furrows may cause structural damage to the landing gear.

Forced landing in the Pattern

To practice a simulated forced landing in the traffic pattern, your instructor will simulate an engine failure by reducing power to idle. Begin a turn towards a prepared surface planning to rollout on final so that power is not required to reach the prepared surface. Establish the proper glide airspeed and lower flaps as required. It is not necessary to touchdown within the normal landing zone. If a long landing will result in a traffic conflict execute a go-around.

Actual forced landings in the traffic pattern may not allow landing on a prepared surface. For example, on takeoff leg a forced landing straight ahead with the aircraft under control is much better than attempting to turn back to a prepared surface, or wasting too much time trying to accomplish the checklist, risking loss of aircraft control.

You aim for approximately the center of the field on a simulated forced landing. You use this technique for two reasons. First, during simulated forced landings, the engine of the aircraft continues to idle thus creating trust. No matter how slight, this increases your glide ratio. With complete loss of power, the aircraft will not glide as far as it did with the engine at idle. The second reason for aiming at the center of the field is that this provides you with a greater margin for error to prevent landing short.

Make your landing with full flaps, if possible, especially on unprepared surfaces so that you can touchdown at the lowest possible speed. After touchdown, hold the control wheel aft to keep the weight off the nosewheel as long as possible. Abandon the aircraft immediately after it comes to a stop. Remain well clear until you are reasonably certain it is safe to return to the aircraft. If there is no need to return to the aircraft, do not.

ACTUAL FORCED LANDINGS

Your practice and instruction in simulated forced landings have been for one purpose: to prepare you to make a successful forced landing if you have an actual emergency.

Your chances of making a successful forced landing are greatly improved. If you remain calm, you can make the landing with little or no damage to the aircraft and no injury to the pilot if the aircraft touches down in control. Some important points are:

- Maintain aircraft control; pick a good field for landing; establish a proper glide; and plan your approach.
- Analyze the situation and accomplish any required checklist procedures
- Inform someone of your situation, if possible.

Remember, the type of emergency or engine problem may require you to accomplish your procedures before you have time to select a field. For example, engine fire during flight requires you to shut the engine down while you are flying and trimming the aircraft for a proper glide; then you must select a field and prepare for the forced landing.

CHAPTER 10

GENERAL INSTRUCTIONS AND RESTRICIONS

The following are general instructions and restrictions, which apply to all personnel operating Civil Air Patrol Cadet Orientation Program C-172 aircraft.

1. The minimum crew requirement is one pilot/student pilot in the left seat.
2. Dual Only Maneuvers. Solo students will not practice the following maneuvers at anytime.
 - a. Stalls
 - b. Simulated forced landings.
 - c. Normal landings, with over 20 degrees of flaps.
 - d. Solo students will practice only maneuvers required by the approved syllabus.
3. Prohibited Maneuvers. The following maneuvers will not be performed at anytime:
 - a. Aerobatic maneuvers
 - b. Spins
 - c. Unauthorized formation flight
 - d. Flight into Instrument Meteorological Conditions (IMC).
 - e. Slips with flaps extended is Prohibited.
 - f. Maneuvers requiring zero or negative-G flight.
 - g. Touchdown from SFLs (except on prepared surfaces at authorized airfields).
 - h. Practice engine shutdowns in flight.
 - i. Night flights.
 - j. Whip stalls.
4. Minimum Altitudes:
 - a. Minimum altitude for stalls, steep turns and slow flight is 2,500 feet AGL.
 - b. C-172 aircraft will not be operated below 1000 feet AGL except during:
 - i. Takeoffs and landings.
 - ii. Simulated forced landings (go-around from SFLs to other than prepared surfaces at authorized airfields will be initiated at a safe altitude, depending on terrain and obstructions.)
 - iii. Rectangular course (execute a go-around at a safe altitude, depending on terrain and obstructions, when performing traffic pattern descent procedures)
 - iv. Coordination exercises



CIVIL AIR PATROL
United States Air Force Auxiliary
Cadet Program Directorate

Cessna 172 Maneuvers and Procedures

NOTE

This study guide is designed for the National Flight Academy Ground School. The information contained is based on the C-172-180 horsepower engine. On the flightline, you will be assigned to a Cessna 172, but the model may vary. The differences between the aircraft information taught in ground school and that given in your assigned aircraft's pilot operations handbook will be briefed by your instructor. Your flight instructor is the final authority on the information you will need to know.

Edited June 2007 by
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PART 2

Maneuvers and Procedures

C -172

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PURPOSE

The purpose of this publication is to provide standardized procedures for accomplishing the flight maneuvers required during pre-solo, solo practice, and the private pilot flight test. The procedures in this manual are based on the Cessna 172P aircraft, but may be used in other Cessna 172 models and most other single-engine training aircraft with very few changes.

ALTITUDES

With the exception of the ground reference maneuvers, landings and takeoffs, all maneuvers will be started at such an altitude that recoveries are completed no lower than 1500 feet AGL.

CLEARING TURNS

Clearing turns are shallow to medium banked turns, during which the student and instructor scan the immediate area around their aircraft looking for other air traffic that may conflict with them during the practice maneuver.

Clearing turns must be accomplished before each practice maneuver. A clearing turn will consist of a minimum of 180-degree change in heading. This may be one 180-degree turn in either direction, or two, consecutive 90-degree turns in both directions. The turns should be done at approximately standard rate, but at no more than a 30-degree angle of bank.

During the second 90-degree portion of the turn (last half of a 180-degree turn), the initial power adjustment should be made, and the aircraft should be put into the proper configuration for the practice maneuver. This will allow the maneuver to be accomplished in the shortest possible time after the clearing turn is completed. Remember, however, the primary purpose of a clearing turn is to ensure that your maneuver will not conflict with any other air traffic. The other tasks done during the clearing turns should not compromise vigilance.

LEVEL OFF FROM A CLIMB

While not a practice maneuver (NOTE: no clearing turns are required), the student is required to level-off, from a climb or descent, at a specified altitude, with a reasonable degree of accuracy and proficiency. This procedure will help the student develop this skill quickly, and perform level-offs with minimum altitude deviation, and a minimum of power and trim readjustments.

1. **PITCH:** When aircraft is approximately 10% of the rate of climb (e.g. 10% of 500 ft./min. is 50 feet) below the target altitude, slowly lower the pitch altitude to the level, cruise flight attitude. As the aircraft accelerates, apply more forward elevator pressure to maintain the target altitude.
2. **POWER:** As the airspeed increases near cruise airspeed, reduce throttle to the cruise power setting.

NOTE

Reduce the throttle early if required to keep the engine RPM within limits. Right rudder pressure will have to be decreased to maintain coordinated flight as the airspeed increases, and as power is reduced.

3. **TRIM:** Use elevator trim to reduce the forward elevator pressure.

NOTE

Trim may be used as the aircraft accelerates to relieve heavy, forward elevator pressures, but avoid flying the aircraft with trim. Trimming is the last step, as it is affected by any changes made by the first two.)

LEVEL FLIGHT TO A CLIMB

This procedure follows the same basic steps as the previous maneuver, and provides the student a simple and efficient means of beginning a constant airspeed climb.

1. **PITCH:** Increase pitch to an attitude that should give a full-power climb at V_Y
2. **POWER:** After the airspeed has decreased to approximately 5 knots above V_Y increase throttle to full power.

NOTE

Increase right rudder pressure to maintain coordination at the lower airspeed and increased power.

3. **TRIM:** Use elevator trim to relieve any elevator control pressures and maintain V_Y

LEVEL FLIGHT TO A DESCENT

Similar to the previous maneuvers, this procedure provides the student with a simple method to transition from level flight to a constant airspeed descent.

1. **PITCH:** Reduce pitch to an altitude that will provide 500 – 700 ft/min rate of descent. (NOTE: This will only require a 5 -10 degree pitch change.)
2. **POWER:** After the aircraft has accelerated 5 - 10 knots (approx. 115 KIAS for a C-172), reduce the power by approximately 200 - 300 RPM to maintain this new speed.
3. **TRIM:** Use elevator trim to relieve any elevator control pressure and maintain a constant airspeed.

LEVEL-OFF FROM A DESCENT

This procedure provides the student with a simple and accurate method to level-off from a descent, at a target altitude, with a minimum of latitude deviation, or power and trim readjustment.

1. **PITCH:** When the aircraft is approximately 10% of the descent rate (e.g. 10% of 500 ft/min is 50 feet) above the target altitude, increase the pitch to the level cruise flight attitude.
2. **POWER:** As the airspeed decreases toward cruise airspeed, increase the throttle to cruise power.
3. **TRIM:** Adjust the elevator trim for level flight at cruise airspeed.

NOTE

All of the above maneuvers require a change in rudder control inputs in order to maintain proper coordination, as airspeed and/or power is changed.

STEEP TURNS

The purpose of this practice maneuver is to develop smoothness coordination, orientation, division of attention, and proper altitude and airspeed control while executing high performance turns. Through this maneuver the student will also learn the effect of bank angle on the total lift of the aircraft.

1. CLEARING TURN(S)

At the 90-degree point

(a) Slowly reduce power to approximately 2200 - 2300 RPM.

NOTE

The power reduction should be timed so the desired power setting is achieved as the clearing turn is completed.

(b) Maintain altitude by increasing elevator back pressure and use elevator trim as required

2. Maintain an airspeed at or below maneuvering speed (VA)-
3. Use coordinated aileron and rudder to establish a bank angle of 45. (+ or - 5- degrees)
4. After approximately 30 degrees of heading change, increase elevator back pressure and increase power to approximately 2400 RPM.
5. Continue turn for two full revolutions (360 degrees), left and right
6. Approximately 25 degrees (or one half the angle of bank) before reaching the desired heading, use coordinated aileron and rudder to smoothly roll out of the bank, while simultaneously. Push the nose down and power back to 2200-2300RPM. This will keep the aircraft from entering a climb.

NOTE

The best way to correct for small climbs or descents during this maneuver is to vary the bank angle by small amounts (no more than 5 degrees). If descending, decreasing the bank angle will usually result in an overcorrection. Excessive elevator back pressure while trying to gain altitude during the steep turn increases the loading on the aircraft, and can lead to a high descent rate or possibly an accelerated stall.

POWER-ON STALL

The purpose of the power-on stall is to demonstrate the effect of an excessive angle of attack of the aircraft with the engine developing medium power, to teach stall recognition and avoidance, and to teach proper stall recovery techniques. The power-on stall is used to prepare the student for demonstration and recovery of takeoff/departure stalls.

1. CLEARING TURN(S)

At the 90-degree point:

- a) Apply carburetor heat
- b) Slowly reduce power to approximately 1500 RPM.

NOTE

The power reduction should be timed so the desired power setting is achieved as the clearing turn is completed.

- c) Maintain altitude by increasing elevator back pressure
2. When the airspeed reaches approximately 60 KIAS, increase power to 1900 to 2200 RPM and turn off carburetor heat.
3. Increase the pitch to an attitude that is slightly higher than the normal climb attitude (if this maneuver is to be demonstrated as a turning stall, initiate the turn at this point).
4. Maintain the pitch attitude by increasing elevator back pressure until the first sign that a stall is imminent (imminent stall recovery) or until the stall occurs (full stall recovery).

NOTE

As airspeed decreases, it is necessary to increase right rudder pressure to maintain proper coordination.

RECOVERY

- a) Decrease elevator back pressure. - Level wings with coordinated ailerons and rudder. Apply full power.
- b) When control of the aircraft is reestablished, and airspeed begins to increase, smoothly.

NOTE

Do not try to establish the best rate of climb attitude too abruptly, as a secondary stall may occur.

POWER-OFF STALL

The purpose of this maneuver is to teach the student stall recognition and avoidance, and proper recovery techniques for a stall occurring during the approach and landing phase of the flight. Simulating a traffic pattern and landing approach with excessive elevator back pressure, this maneuver is done at altitude, but practiced as if the stall occurs only several hundred feet above the ground, requiring the recovery to be accomplished without losing more than 200 feet of altitude.

1. CLEARING TURN(S)

At the 90-degree point:

- a) Apply carburetor heat.
- b) Slowly reduce power to approximately 1700 RPM.

NOTE

The power reduction should be timed so the desired power setting is achieved as the clearing turn is completed.

- c) Maintain altitude by increasing elevator back pressure.

2. When V_{FE} minus 5 KIAS is attained, extend 10 degrees of flaps, and establish and maintain 70 KIAS.

NOTE

Do not start a descent from altitude until 70 KIAS is established. Airspeed and altitude control is as important in high-altitude practice as it is in the traffic pattern.

3. After descending 100 feet:

- a) Reduce power to approximately 1300 RPM, simulating the power reduction on the base leg of the traffic pattern.
- b) Extend flaps an additional 10 degrees.
- c) Maintain 65 KIAS

4. After descending another 100 feet:

- a) Reduce power to approximately 1100 RPM, simulating the power reduction on final approach.
- b) Extend full flaps.
- c) Maintain 60 KIAS

2. Reduce power to idle and slowly increase the pitch attitude until the first sign that a stall is imminent (imminent stall recovery) or until the stall occurs (full stall recovery).

3. RECOVERY

- a) Decrease elevator back pressure. - Level wings with coordinated ailerons and rudder. Full power (Carburetor Heat - OFF). - Retract flaps to 20 degrees.
- b) Establish a normal climb attitude and trim.
- c) After attaining a positive rate of climb, 55 KIAS, and gaining 150 feet of altitude, retract flaps to 10 degrees.
- d) After attaining 60KIAS and gaining another 100 feet of altitude, fully retract the flaps.

NOTE

In steps c. and d., either of the altitude/speed requirements have not been met, then delay- flap retraction until both of the elements are attained.

- e) Establish a normal climb at V_Y .

NOTE

Once recovery is affected, the pitch should not vary from the normal climb attitude. As the flaps are retracted, the aircraft will tend to pitch down. This should be counteracted by applying the correct amount of elevator back pressure, and retrimming after each configuration change.)

NOTE

The procedure for a go-around or balked landing recovery is identical to the approach/landing stall recovery, except stall recovery is not required.

MINIMUM CONTROLLABLE AIRSPEED (MCA)

Minimum Controllable Airspeed (MCA) demonstrates the changes in the handling characteristics of the aircraft at its minimum flight speed. Through practice of this maneuver, the student will learn precise airspeed and altitude control, the effect of high power at low airspeeds, and techniques for operating the aircraft in the area of reverse command ("behind the power curve").

1. CLEARING TURN(S)

At the 90-degree point:

- a) Apply carburetor heat.
- b) Slowly reduce power to approximately 1700 RPM.

NOTE

The power reduction should be timed so the desired power setting is achieved as the clearing turn is completed.

- c) Maintain altitude by increasing elevator back pressure.

2. When V_{FE} minus 5 KIAS is attained, extend 10 degrees of flaps, and establish and maintain 60 KIAS.

NOTE

Adjust power as necessary to maintain altitude while holding the desired airspeed.

3. Extend flaps to 20 degrees, and maintain 50 KIAS.
4. Extend flaps to 30 degrees and maintain 40 KIAS.

NOTE

Re-trim the aircraft after every power or configuration change.

NOTE

During low airspeed/high power configurations a large amount of right rudder pressure will be required to maintain proper coordination.

5. RECOVERY

- a) Apply full power (turn carburetor heat off). - Retract flaps to 20 degrees.
- b) Retract flaps in 10-degree increments as airspeed increases. - Maintain altitude and heading.
- c) After cruise airspeed is attained, reduce power to cruise setting.

TRAFFIC PATTERN SEQUENCE

This procedure is provided to standardize the traffic pattern procedures used in primary flight training, and will allow the flight training pattern work to operate well with a wide variety of other air traffic in the airport environment.

DOWNWIND

1. Set power to 2100 RPM (Lower limit of normal RPM range). This will produce approximately 90 KIAS in level flight.
2. At the mid field, apply carburetor heat.
3. Abeam the intended touchdown point, reduce power to approximately 1700 RPM.

NOTE

When power is reduced, it is necessary to increase elevator back pressure to maintain altitude. The descent from pattern altitude should not begin until the initial approach speed is reached.

4. Extend 10 degrees of flaps when airspeed is at the top of the white arc.
5. Maintain 75 KIAS and use elevator trim as necessary.

NOTE

Do not descend from pattern altitude until 75 KIAS is reached.

6. Begin the turn to base leg when the runway threshold is 45 degrees behind the aircraft and the traffic ahead has passed by on final. If it is necessary to extend the downwind leg because of traffic, delay the next power reduction and the addition of flaps.

BASE

7. Reduce power to 1200 - 1400 RPM.
8. Extend flaps to 20 degrees.
9. Maintain 70 KIAS and trim as necessary.

FINAL

10. Reduce power as required.
11. Extend full flaps when landing is assured.
12. Maintain 65 KIAS (Short/soft field landings will require a different approach speed).

13. Reduce power to idle as appropriate. Touchdown should occur approximately 500 feet beyond the runway threshold.

NOTE

Unless turbulence or a strong crosswind dictates the need for touchdown at a slightly higher airspeed, touchdown should occur with the stall horn on, in the classic nose high attitude. This will minimize the possibility of directional control problems occurring after touchdown. Landings should be accomplished with 0-20 degrees of flaps unless special considerations dictate otherwise.

NOTE

For a short-field approach, establish 65 KIAS with 20 degrees of flaps on base. When the field is made, slow to 60 KIAS and full flaps. Slowly directional control is established.

NOTE

For a soft-field approach, the same procedures for the short field approach are used, except 1100 - 1200 RPM are maintained throughout final approach, flare, touchdown, and roll out. This will help ensure a landing with minimum speed and sink rate. The nose wheel should be held up as long as possible, and a minimum of braking should be used.

GO-AROUND/BALKED LANDING

Sometimes during traffic pattern work and landings, you will find yourself poorly positioned and will have to discontinue an approach for reasons of safety and execute a go-around. Although an approach or landing may be aborted at any point, the sooner a poor approach/landing condition is recognized and the go-around started, the safer it will be. You should not wait until the last second to make a decision and you should not try to salvage a bad approach or landing. The pilot of the aircraft is responsible for executing the go-around when a dangerous condition is encountered.

From Final or Landing Phase:

1. Throttle - Full in
2. Carburetor Heat – COLD
3. Flaps - retract to 20 degrees as soon as practical after advancing power
4. Airspeed 78 KIAS
5. Sidestep same direction as traffic pattern
6. At a safe attitude and airspeed, retract flaps - slowly

NOTE

If it is necessary to discontinue the landing pattern, follow the local procedures for leaving the pattern.

SHORT-FIELD TAKEOFF

1. Lower flaps to 10 degrees.
2. Line up on runway centerline and apply brakes. Start takeoff roll from as close to the end of the runway as possible.
3. Put elevator in the neutral position

NOTE

You may find this position by visually assuring that the elevator is in line with the horizontal stabilizer. DO NOT use forward elevator pressure in an attempt to hold the airplane on the runway during the takeoff roll.

4. Apply full power and verify that full power is being developed.
5. Release brakes.

6. Rotate at 55 KIAS and maintain 56 KIAS until obstacle is cleared.
7. After the obstacle is cleared, assume a normal climb attitude.
8. After airspeed reaches 65 KIAS, and altitude is greater than 150 feet AGL, retract the flaps then maintain 76 KIAS (V_Y).

SOFT -FIELD TAKEOFF

1. Lower flaps to 10 degrees and apply full back elevator.
2. After taxiing onto runway, apply full power without stopping on runway.

NOTE

Some elevator backpressure will have to be released to prevent striking the tail on the runway. Keep only enough back elevator to keep the nosewheel just clear of the runway surface. It will take considerable rudder input to maintain a straight takeoff roll without the nosewheel in contact with the runway.

3. Liftoff will occur at or near V_{s1}
4. Immediately after liftoff, begin to gradually lower the pitch to the normal climb attitude.

NOTE

If there is an obstacle, lower the pitch attitude so that 60 KIAS (V_X is maintained until the obstacle is cleared before accelerating to 76 KIAS (V_Y).

5. After airspeed reaches 65 KIAS, and altitude is greater than 150 feet AGL, retract the flaps then maintain 76 KIAS (V_Y).

NOTE

It is important to immediately reduce the pitch attitude after liftoff to prevent a potential takeoff/departure stall as the aircraft climbs out of ground effect. However the pitch should not be reduced so rapidly that the aircraft settles back onto the ground.

GROUND REFERENCE MANEUVERS

Ground reference maneuvers are designed to develop the student's ability to control the airplane, and recognize and correct for the effect of wind while dividing attention among other matters.

1. CLEARING TURN(S)
2. Enter the maneuver at an altitude of 600-1000 feet AGL and an airspeed less than maneuvering speed (V_A)
3. ALL GROUND REFERENCE MANEUVERS SHALL BE ENTERED WHILE FLYING DOWNWIND.
4. Use 45 - 50 degree banked turns, maximum, at the points of highest ground speed.
5. The maneuvers S-Turns and Turns Around a Point

PART 3

Cessna 172 180HP Conversion

C -172P Flight Manual Supplement

Cessna Model 172P

SECTION 1. General

The information contained in this Flight Manual Supplement is FAA Approved material, and is applicable to the operation of the airplane in accordance with STC SA2196CE which increases the maximum certificated takeoff weight to 2550 lbs, when the airplane has previously been modified with STC SA4428SW.

DESCRIPTIVE DATA

PAGE 1-3

ENGINE

Engine Model Number: 0-360-A4A, A4M, A4N, A2F & A3A
Engine Type: Normally aspirated, direct drive, air cooled, horizontally opposed, carburetor equipped, four cylinder engine with 360 cubic inches displacement
Horsepower Rating and Engine Speed: 180 rated BHP at 2700 RPM
Maximum Continuous RPM: 2540 RPM

PAGE 1-5

MAXIMUM CERTIFICATED WEIGHTS

Takeoff, Normal	2550 lbs
Utility	2100 lbs
Landing, Normal	2550 lbs
Utility	2100 lbs

SECTION 2. Limitations

PAGE 2-5 AIRSPEED INDICATOR MARKINGS

Airspeed indicator must be replaced with Cessna P/N C661064-0112 or remarked as follows:

Cessna Model 172P

PAGE 2-5 AIRSPEED INDICATOR MARKINGS, (continued)

MARKING	KIAS VALUE OR RANGE
White Arc	40-85
Green Arc	50-127
Yellow Arc	127-158
Red Line	158

PAGE 2-4 AIRSPEED LIMITATIONS

Va, Maneuvering Speed:

2550 lbs.....	105 KIAS
2150 lbs.....	95 KIAS
1750 lbs.....	85 KIAS

PAGE 2-5 POWER PLANT LIMITATIONS

Engine Model Number: O-360-A4A, A4M, A4N, A2F & A3A
Maximum Power: 180 BHP rating
Maximum Continuous RPM: 2540 RPM

PAGE 2-6 WEIGHT LIMITS

Maximum Takeoff Weight, Normal	2550 lbs
Utility	2100 lbs
Maximum Landing Weight, Normal	2550 lbs
Utility	2100 lbs

PAGE 2-7 CENTER OF GRAVITY LIMITS

NORMAL CATEGORY

Center of Gravity Range:
Forward: 35.0 inches aft of datum at 1950 lbs or less, with straight line variation to 41.0 inches aft of datum at 2550 lbs.
Aft: 47.3 inches aft of datum at all weights.

Cessna Model 172P

PAGE 2-7 CENTER OF GRAVITY LIMITS, (continued)

Center of Gravity Range:

Forward: 35.0 inches aft of datum at 1950 lbs or less, with
straight line variation to 36.5 inches aft of datum at 2100 lbs.

Aft: 40.5 inches aft of datum at all weights

PAGE 2-8 FLIGHT LOAD FACTORS

NORMAL CATEGORY

Flight Load Factors (Maximum Takeoff Weight – 2550 lbs)

Flaps Up +3.8g, -1.52g

Flaps Down +3.0g

PAGE 2-12 PLACARDS

10. Near airspeed indicator: MANEUVER SPEED – 105 KIAS

SECTION 3. Emergency Procedures

Engine Failure after Takeoff:

Wing Flaps Up 70 KIAS

Wing Flaps Down 65 KIAS

Maneuvering Speed:

2550 lbs 105 KIAS

2150 lbs 95 KIAS

1750 lbs 85 KIAS

Maximum Glide:

2550 lbs 68 KIAS

2150 lbs 62 KIAS

1750 lbs 56 KIAS

Precautionary Landing

With Engine Power 65 KIAS

Landing Without Engine Power:

Wing Flaps Up 70 KIAS

Wing Flaps Down 65 KIAS

Cessna Model 172P

PAGE 3-4 ENGINE FAILURES

ENGINE FAILURE IMMEDIATELY AFTER TAKEOFF

1. Airspeed – 70 KIAS (flaps UP)
65 KIAS (flaps DOWN)

PAGE 3-4 ENGINE FAILURE DURING FLIGHT

1. Airspeed – 75 KIAS

PAGE 3-4 FORCED LANDINGS

EMERGENCY LANDING WITHOUT ENGINE POWER

1. Airspeed – 70 KIAS (flaps UP)
65 KIAS (flaps DOWN)
5. Wing Flaps – AS REQUIRED (30 degrees recommended)

PRECAUTIONARY LANDING WITH ENGINE POWER

2. Airspeed – 65 KIAS
6. Airspeed – 65 KIAS

PAGE 3-5 DITCHING

4. Wing Flaps – 20 – 30 degrees

NOTE:

If no power is available, approach at 70 KIAS with flaps up or at 65 KIAS with 10 degrees flaps

PAGE 3-7 ICING

INADVERTENT ICING ENCOUNTER

11. Approach at 80 to 90 KIAS depending upon the amount of the accumulation

Cessna Model 172P

SECTION 4. Normal Procedures

PAGE 4-3 NORMAL PROCEDURES

SPEEDS FOR NORMAL OPERATION

Unless other noted, the following speeds are based on a maximum weight of 2550 pounds and may be used for any lesser weight.

Takeoff

Normal Climb Out	75-85 KIAS
Short Field takeoff, Flaps 10 degrees, Speed at 50 Feet.....	57 KIAS

Enroute Climb, Flaps Up:

Normal, Sea Level	75-85 KIAS
Normal, 10,000 Feet	70-80 KIAS
Best Rate of Climb, Sea Level.....	76 KIAS
Best Rate of Climb, 10,000 Feet.....	72 KIAS
Best Angle of Climb, Sea Level	62 KIAS
Best Angle of Climb, 10,000 Feet	67 KIAS

Landing Approach:

Normal Approach, Flaps Up.....	65-75 KIAS
Normal Approach, Flaps 30 degrees.....	60-70 KIAS
Short Field Approach, Flaps 30 degrees	62 KIAS
Normal, 10,000 Feet	70-80 KIAS

Balked Landing:

Maximum Power, Flaps 20 degrees.....	60 KIAS
Maximum Recommended Turbulent Air Penetration Speed:	
2550 lbs.....	105 KIAS
2150 lbs.....	95 KIAS
1750 lbs.....	85 KIAS

PAGE 4-8 SHORT FIELD TAKEOFF

Climb Speed – 57 KIAS (until all obstacles are cleared).

PAGE 4-9 ENROUTE CLIMB

Airspeed – 75-80 KIAS

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Oct. 2, 1987

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Cessna Model 172P

PAGE 4-9 LANDING

NORMAL LANDING

1. Airspeed – 65-75 KIAS (flaps UP)
2. Wing Flaps – AS DESIRED (0-10 degrees below 110 KIAS, 10-30 degrees below 85 KIAS)
3. Airspeed – 60-70 KIAS (flaps DOWN)

PAGE 4-10

SHORT FIELD LANDING

1. Airspeed – 65-75 KIAS (flaps UP)
3. Airspeed – 62 KIAS (until flare)

BALKED LANDING

5. Wing Flaps – 10 degrees (until obstacles are cleared)
RETRACT SLOWLY after reaching a safe
Altitude and 65 KIAS

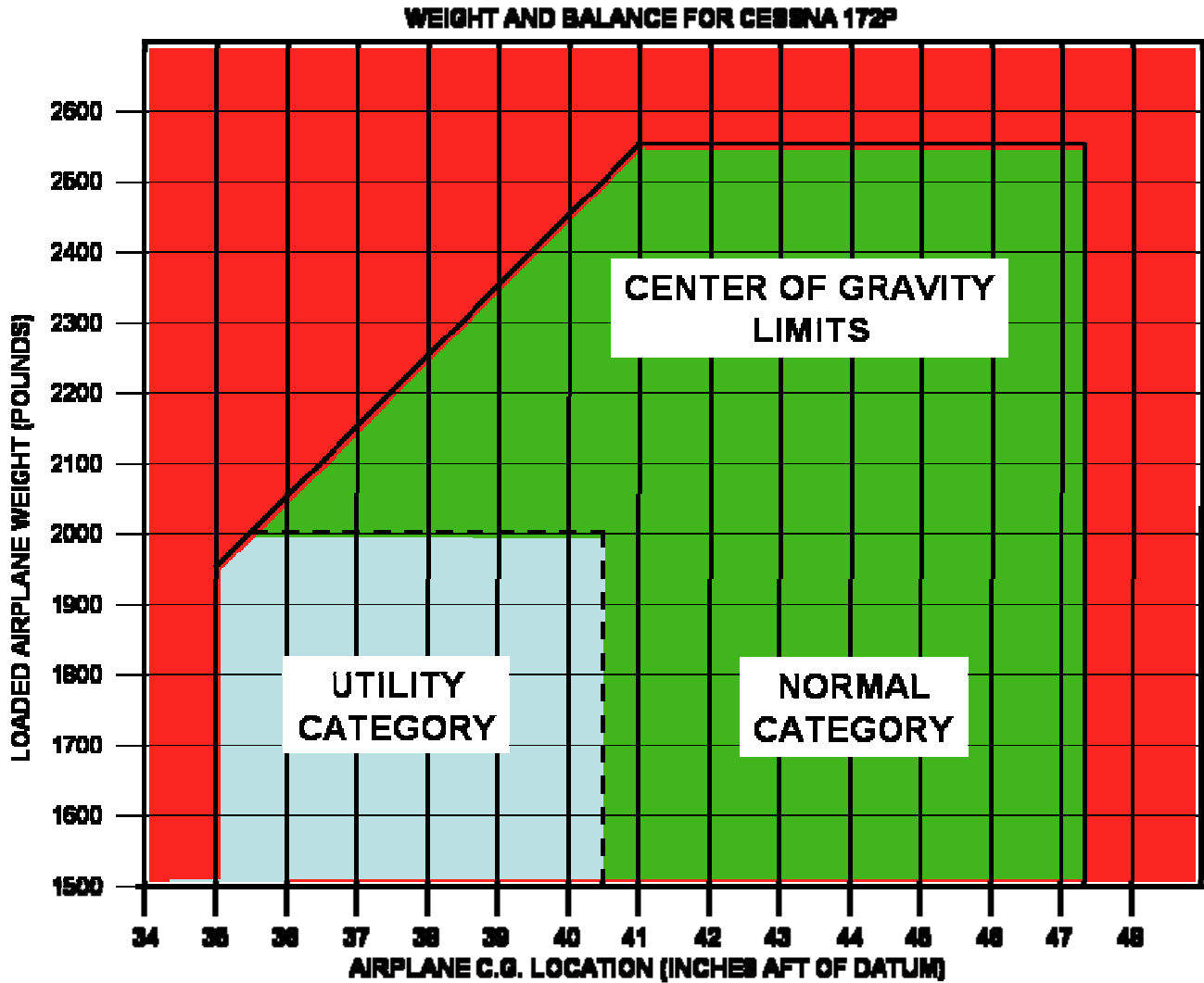
Section 5

PAGE 5-21 LANDING DISTANCE – SHORT FIELD

NOTES:

4. If a landing without flaps is necessary, increase approach speed by 9 KIAS and allow for 35% longer landing distance.

Cessna Model 172P



**180 HP Cessna 172 Skyhawk
Cruise Performance (Standard Temperature)
(All times are estimated)**

Pressure Altitude	RPM	BHP %	GPH	Time @ 40 GAL Useable	Time @ 50 GAL Useable	Time @ 62 GAL Useable
2000	2550	76	10.2	3:55	4:54	6:05
2000	2500	72	9.6	4:10	5:13	6:28
2000	2400	64	8.7	4:36	5:45	7:08
2000	2300	58	7.9	5:04	6:20	7:51
2000	2200	52	7.2	5:33	6:57	8:37
2000	2100	46	6.6	6:04	7:35	9:24
4000	2600	76	10.2	3:55	4:54	6:05
4000	2500	68	9.2	4:21	5:26	6:44
4000	2400	62	8.3	4:49	6:01	7:28
4000	2300	55	7.6	5:16	6:35	8:09
4000	2200	49	6.9	5:48	7:15	8:59
4000	2100	44	6.3	6:21	7:56	9:50
6000	2650	76	10.1	3:58	4:57	6:08
6000	2500	69	9.2	4:21	5:26	6:44
6000	2400	62	8.4	4:46	5:57	7:23
6000	2300	56	7.7	5:12	6:30	8:03
6000	2200	53	7.3	5:29	6:51	8:30
8000	2700	76	10.1	3:58	4:57	6:08
8000	2600	69	9.2	4:21	5:26	6:44
8000	2500	62	8.4	4:46	5:57	7:23
8000	2400	56	7.7	5:12	6:30	8:03
8000	2300	53	7.3	5:29	6:51	8:30
8000	2200	47	6.7	5:58	7:28	9:15
10000	2700	72	9.6	4:10	5:13	6:28
10000	2600	65	8.8	4:33	5:41	7:03
10000	2500	59	8.1	4:56	6:10	7:39
10000	2400	53	7.4	5:24	6:45	8:23
10000	2300	48	6.8	5:53	7:21	9:07
12000	2650	65	8.8	4:33	5:41	7:03
12000	2600	62	8.4	4:46	5:57	7:23
12000	2500	56	7.7	5:12	6:30	8:03
12000	2400	51	7.1	5:38	7:03	8:44



Practice Exercises

Please Read!

The following practice maneuvers are intended to help you better understand the interactions between aerodynamic forces, control inputs, and aircraft behavior. They are also meant to help you learn to recognize (and avoid) situations that can lead to inadvertent stalls and spins.

By necessity, the procedures described are general in nature: Before attempting any of these maneuvers, be familiar with the specific procedures appropriate to the airplane you fly. Also, be aware that some airplanes are not designed or certified to perform certain maneuvers (e.g., spins). Never “push the envelope”—either your own, or that of the airplane!

Finally, we strongly suggest that you bring along a qualified safety pilot (preferably an experienced flight instructor prepared to assume control in the event of a problem) when practicing any maneuvers with which you are not completely familiar or comfortable.

1) AERODYNAMIC DEMONSTRATION

Goal:

- Gain an understanding of the interaction between specific control inputs, aerodynamic forces, and aircraft behavior in various situations

Procedure:

- ✓ Select an entry altitude of at least 2,500 agl
- ✓ Perform clearing turns
- ✓ Configure the aircraft:
 - Mixture rich
 - Fuel on fullest tank
 - Propeller to high rpm (if equipped)
- ✓ Establish trimmed level flight at V_Y

Power

- ✓ Apply full power
 - Note climb at trimmed airspeed, loss of coordination
- ✓ Decrease throttle to idle
 - Note descent at trimmed airspeed, loss of coordination
- ✓ Return to previous configuration

Rudder (Dutch Roll)

- ✓ Apply rudder in one direction, then the other
 - Note roll that occurs as a result of yaw
- ✓ Return to previous configuration

Elevator

- ✓ Establish trimmed, level flight at 100 knots
- ✓ Apply and hold back pressure
 - Note climb with decreasing airspeed, loss of coordination
- ✓ Apply and hold forward pressure
 - Note descent with increasing airspeed, loss of coordination
- ✓ Return to trimmed, level flight at 100 knots

Aileron

- ✓ Apply varying degrees of aileron input without using rudder
 - Note yawing motion opposite the direction of bank (this effect may not be prominent in some aircraft)
- ✓ Return to level flight, then apply aileron and rudder for a coordinated turn
 - Note that the nose "follows" the airplane through the turn (i.e., does not yaw opposite the direction of bank)
- ✓ Return to normal cruise flight

2) MANEUVERING DURING SLOW FLIGHT

Goals:

- Experience the changes in control “feel” and effectiveness as airspeed decreases
- Learn the control inputs required to maneuver the aircraft at low airspeeds without precipitating a stall

Procedure:

- ✓ Select an entry altitude of at least 2,500 agl
- ✓ Perform clearing turns
- ✓ Configure the aircraft:
 - Mixture rich
 - Fuel on fullest tank
 - Propeller to high rpm (if equipped)
- ✓ Reduce power to approximately 1900 rpm or 19” mp (specific power setting will vary with conditions, aircraft type and configuration)
- ✓ Lower flaps to approach setting
- ✓ Maintain straight and level flight as the airplane decelerates
- ✓ Adjust power so that airspeed stabilizes at approximately $1.2 V_{SO}$
- ✓ Use throttle and elevator to maintain this airspeed while:
 - Flying straight and level
 - Gently turning at various bank angles (not to exceed 15 degrees)
 - Climbing and descending
- ✓ Recover to normal cruise flight by:
 - Adding power
 - Decreasing angle of attack
 - Raising flaps

Common Mistakes:

- *Using insufficient rudder to correct for torque and p-factor*
- *Banking excessively during turns, leading to a loss of altitude or a stall*
- *Hesitating to make power changes and other corrections*
- *Failing to trim the airplane appropriately*
- *Unintentionally stalling the airplane*

3) POWER-OFF STALLS

Goals:

- Simulate an inadvertent stall during final approach
- Learn to recognize aircraft “feel,” sounds, and other hints of an incipient stall
- Learn the control inputs required for effective recovery

Procedure:

- ✓ Select an entry altitude of at least 2,500 agl
- ✓ Perform clearing turns
- ✓ Configure the aircraft:
 - Mixture rich
 - Fuel on fullest tank
 - Propeller to high rpm (if equipped)
- ✓ Reduce power to a normal approach setting (approx. 1500 rpm or 15” mp)
- ✓ Lower flaps to approach setting
- ✓ Establish a descent at normal approach speed
- ✓ Pull the nose up to a landing pitch attitude and hold it there
- ✓ Be alert to indications of a stall (warning horn/light, buffeting, loss of control effectiveness)
- ✓ Recover by simultaneously:
 - Decreasing the angle of attack (relaxing back pressure and/or pushing the yoke forward)
 - Using the rudder to maintain coordination and keep the airplane from “falling off” to one side or the other
 - Adding full power
- ✓ Retract the first notch of wing flaps
- ✓ Transition to a shallow climb attitude
- ✓ After positive rate of climb has been established, retract landing gear (if equipped) and begin retracting wing flaps slowly, one notch at a time
- ✓ Resume normal cruise flight

Common Mistakes:

- *Reacting too slowly, allowing the stall to develop further than intended*
- *Attempting to keep the airplane from “falling off” to the left or right by using the ailerons, rather than the rudder*
- *Applying too much back pressure during the initial recovery and causing a secondary stall*
- *Failing to maintain coordinated flight before and during the stall*
- *Losing an excessive amount of altitude during the stall and recovery*

4) POWER-ON STALLS

Goals:

- Simulate an inadvertent stall during takeoff/climb
- Learn to recognize aircraft “feel,” sounds, and other hints of an incipient stall
- Learn the control inputs required for effective recovery
- Demonstrate the fact that a stall can occur at any pitch attitude

Procedure:

- ✓ Select an entry altitude of at least 2,500 agl
- ✓ Perform clearing turns
- ✓ Reduce power to approximately 1500 rpm or 15” mp
- ✓ Configure the aircraft for a normal takeoff/climb:
 - Mixture rich
 - Fuel on fullest tank
 - Propeller to high rpm (if equipped)
- ✓ Pitch for normal takeoff/climb airspeed (V_Y)
- ✓ Set power to at least 65% (in most aircraft, use full throttle)
- ✓ Pitch up to a nose attitude that will induce a stall (normally 15-20 degrees nose-up)
 - Note: If this will result in a pitch angle greater than 30 degrees, use a lower power setting
- ✓ Be alert to indications of a stall (warning horn/light, buffeting, loss of control effectiveness)
- ✓ Recover by simultaneously:
 - Decreasing the angle of attack (relaxing back pressure and/or pushing the yoke forward)
 - Using the rudder to maintain coordination and keep the airplane from “falling off” to one side or the other
 - Adding full power (if not already there)
- ✓ Transition to a normal climb attitude
- ✓ After positive rate of climb has been established, retract landing gear (if equipped)
- ✓ Resume normal cruise flight

Common Mistakes:

- *Reacting too slowly, or failing to apply forward pressure on the yoke as the airplane enters the stall*
- *Attempting to keep the airplane from “falling off” to the left or right by using the ailerons, rather than the rudder*
- *Applying too much back pressure during the initial recovery and causing a secondary stall*
- *Failing to maintain coordinated flight before and during the stall*

5) ACCELERATED STALLS

Goals:

- Simulate an inadvertent stall while maneuvering and “pulling Gs ”
- Learn to recognize aircraft “feel,” sounds, and other hints of an incipient stall
- Learn the control inputs required for effective recovery
- Demonstrate the fact that an airplane can stall at an airspeed above the 1-G stalling speed

Procedure:

- ✓ Select an entry altitude of at least 3,500 agl
- ✓ Perform clearing turns
- ✓ Reduce power to approximately 1500 rpm or 15” mp
- ✓ Configure the aircraft for the maneuver:
 - Mixture rich
 - Fuel on fullest tank
 - Propeller to high rpm (if equipped)
- ✓ Establish an airspeed of roughly $1.3 V_S$ (approximately final approach speed)
- ✓ Establish a bank angle of at least 45 degrees
- ✓ Increase pitch to maintain altitude
- ✓ Be alert to indications of a stall (warning horn/light, buffeting, loss of control effectiveness)
- ✓ At the stall break, recover by simultaneously:
 - Decreasing the angle of attack (relaxing back pressure and/or pushing the yoke forward)
 - Leveling the wings
 - Applying rudder to maintain coordination
 - Adding full power
- ✓ Transition to normal cruise flight
- ✓ Note the indicated airspeed at the time of the stall

Common Mistakes:

- *Abruptly increasing back pressure*
- *Failing to apply enough back pressure*
- *Reacting too slowly, allowing the stall to develop further*
- *Overcompensating during the recovery and putting negative G-loads on the aircraft*

6) CROSS-CONTROLLED STALLS

NOTE: The procedure for demonstrating cross-controlled stalls may result in an unintentional spin. ASF strongly recommends that you bring an instructor who is competent in spins and spin recovery

Goals:

- Simulate an inadvertent stall without proper coordination
- Learn the control inputs required for effective recovery
- Learn what it takes to keep the stall from becoming a spin

Procedure:

- ✓ Select an entry altitude of at least 3,500 agl
- ✓ Perform clearing turns
- ✓ Reduce power to approximately 1500 rpm or 15" mp
- ✓ Configure the aircraft for the maneuver:
 - Mixture rich
 - Fuel on fullest tank
 - Propeller to high rpm (if equipped)
- ✓ Establish a shallow descent at an airspeed of approximately V_Y
- ✓ Apply rudder pressure in one direction and aileron in the other
- ✓ Pitch up to an attitude that will induce a stall
- ✓ Be alert to indications of a stall (warning horn/light, buffeting, loss of control effectiveness)
- ✓ At the first sign of the stall, recover by simultaneously:
 - Decreasing the angle of attack (relaxing back pressure and/or pushing the yoke forward)
 - Leveling the wings with appropriate rudder inputs
 - Regaining coordinated flight
 - Adding full power
- ✓ Transition to normal cruise flight

Common Mistakes:

- *Allowing the stall to develop into a spin*
- *Attempting to stop yawing/rolling movement by using ailerons*
- *Failing to establish a cross-controlled condition*
- *Applying too much back pressure during the initial recovery and causing a secondary stall*

7) NORMAL SPINS

NOTE: Unless you are experienced and proficient in the maneuver, never perform a spin unless accompanied by a qualified safety pilot or instructor. To comply with the regulations, you must wear a properly packed parachute unless you are practicing the spin as part of your training toward an FAA flight instructor certificate

Goals:

- Experience a normal two- to three-turn spin
- Learn the control inputs that cause the airplane to spin
- Learn the control inputs required for proper recovery

Procedure:

- ✓ Select an entry altitude of at least 5,000 agl
- ✓ Perform clearing turns
- ✓ Configure the aircraft for the maneuver:
 - Mixture rich
 - Fuel on fullest tank
 - Propeller to high rpm (if equipped)
- ✓ Reduce power to approximately 1500 rpm or 15" mp
- ✓ Increase pitch until the aircraft is slightly above the normal landing nose attitude
- ✓ Approximately five knots above the normal power-off stall speed, apply full rudder in the direction of the desired spin
- ✓ As the aircraft yaws and rolls in the direction of the rudder input, bring the yoke full back
- ✓ Reduce power to idle
- ✓ Hold rudder and elevator fully deflected for two to three turns
- ✓ Recover from the spin using the method recommended in the pilot's operating handbook. Typical procedures involve:
 - Applying full rudder opposite the direction of the spin rotation
 - Bringing the yoke forward to the neutral position
 - Pitching up firmly (but not abruptly) to stop the dive and regain level flight
 - Adding power and transition to normal cruise flight

Common Mistakes:

- *Leaving too much power in during the spin (this tends to make the airplane spin faster)*
- *During recovery, moving the yoke forward prior to applying opposite rudder (this can increase the rotation speed, and may lead to the spin going "flat")*
- *During recovery, pulling out of the dive too aggressively, stressing the airframe and/or precipitating a stall*



Key Points

Wings and Lift

- ✓ In order to produce lift, a wing has to be “fed” enough air, at the proper angle.
- ✓ The *angle of attack* is the angle of the relative wind to the chord line of the wing.
- ✓ There are two ways to make a wing produce more lift: Increase the airspeed, or increase the angle of attack (up to a point).
- ✓ The wing has a “critical angle of attack” beyond which it will always stall.
- ✓ The critical angle of attack does not necessarily correspond to a particular airspeed.
- ✓ In other words, *the wing can stall at any airspeed.*

Stalls

- ✓ In a one-G situation, the wing will stall at or near the published stalling speed.
- ✓ When the wing is under more than one G, the stall will occur at a higher airspeed
- ✓ Accidental stalls normally happen for one of two reasons:
 - The pilot inadvertently lets the airplane get too slow; or
 - The pilot “pulls Gs” while maneuvering and causes the wing to stall at a higher airspeed.
- ✓ To recover from a stall, you have to decrease the angle of attack: In most cases, this means pushing forward on the yoke and increasing power
- ✓ It’s possible to get “behind the power curve.” This normally happens on final approach. If you notice the airplane getting too slow and try to recover by adding power—but fail to lower the angle of attack at the same time—the airplane can “mush” into the ground, even under full power.

Spins

- ✓ A spin starts when one wing is more deeply stalled than the other, usually as the result of an uncoordinated stall. The differential in drag between the two wings causes a rotational force.
- ✓ In most airplanes, spin recovery involves four steps:
 - Reduce throttle to idle.
 - Neutralize ailerons.
 - Apply full rudder opposite the direction of the spin.
 - Move the yoke forward, past the neutral point.

Safety

- ✓ Remember: A stall can happen at any airspeed or pitch attitude.
- ✓ Altitude is your friend: Below 1,500 agl, maneuvering mistakes are more deadly.
- ✓ Heavily loaded airplanes fly differently. Bring an experienced CFI the first time you fly an airplane at max gross weight, or near the edges of the CG range.
- ✓ Resist the urge to “buzz.” It may seem like harmless fun, but it’s dangerous, and harmful to general aviation’s reputation.