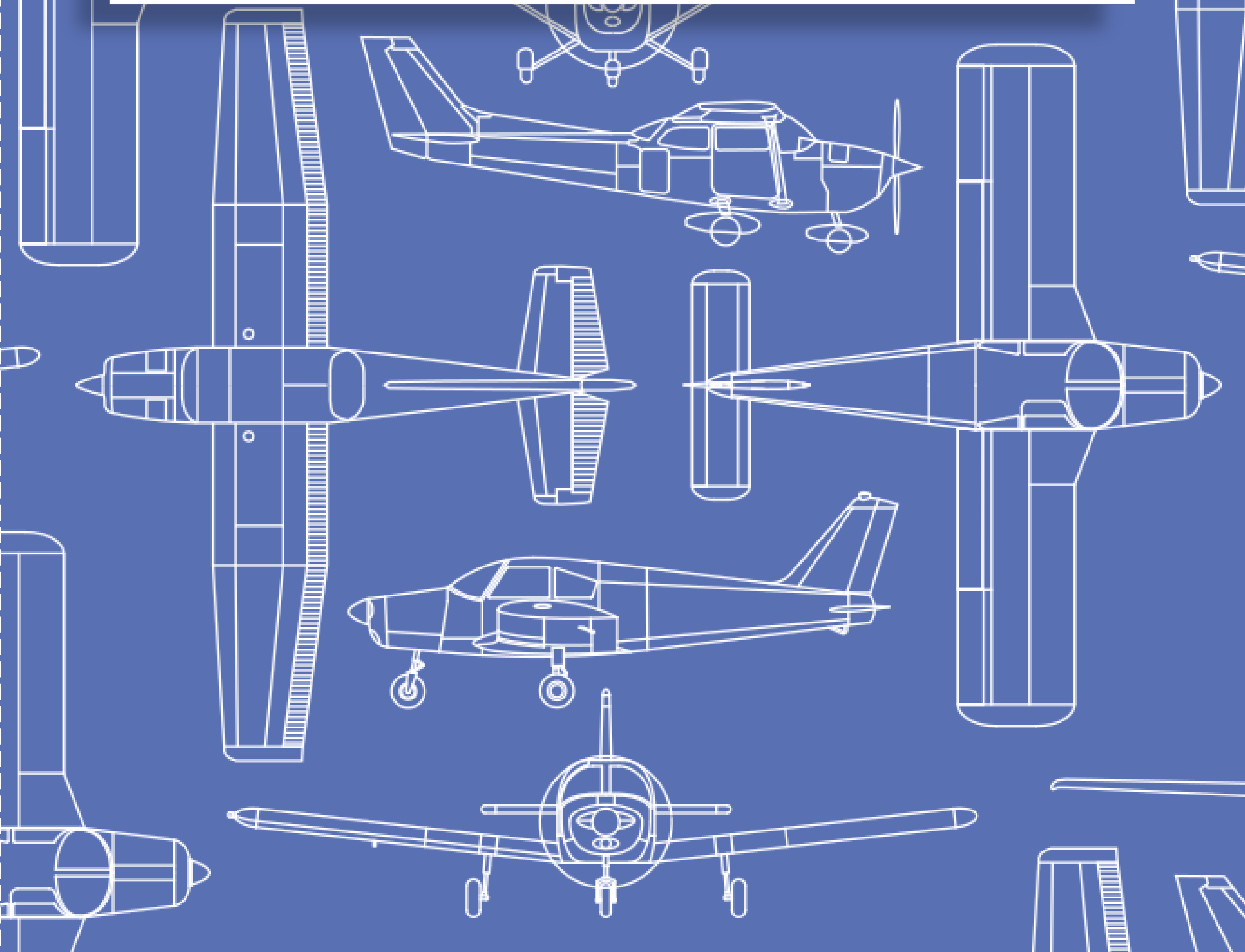
United Flight Systems

UFS

Single Engine
Tasks and Maneuvers Guide



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Change Log

Version	Date	Description of Changes
2.3	August 5, 2024	Added power-off 180 maneuver, emergency landing. Updated aircraft information for UFS fleet and trim stall.
2.2	November 5, 2023	Draft edits complete, first publicly available version.

Introduction

This guide is designed for single engine pilot candidates.

Look for these codes throughout this guide to determine if they apply to the training you are undertaking:

- Private: PVT
- Commercial: COM
- Instrument: IR
- Flight Instructor: CFI, CFII

Your instructor will provide much further development of these maneuvers and tasks. This guide is simply to help give your training structure and standardization. The desire of United Flight Systems is to have a system that you can use from instructor to instructor. UFS realizes that each instructor is unique in personality. However, standardization of procedures allows a flight candidate to use any/all instructors on staff and still have consistency in the training received.

This Tasks and Maneuvers Guide is designed to be utilized in any of the United Flight Systems training aircraft. It is a necessary process of the student and their flight instructor to apply specific make/model aircraft data and limitations to the specific procedures. The published aircraft limitations and procedures apply in all scenarios.

Flight maneuvers are all preceded by a process to maintain situational awareness. A before landing checklist is performed as it is in clear view of the pilot on the instrument panel. Some maneuvers are performed in the cruise configuration. In complex aircraft, accordingly, use some common sense regarding the desired position of the landing gear and the propellor control relative to the specific maneuver itself. The maneuvers performed in the cruise configuration are: Steep Turns, Lazy 8's, Power on Stall Recognition/Recovery.

Version 2.3
August 5, 2024

Ground Operations

Preflight Action PVT, IR, COM

Preflight action is the process in which the pilot prepares for a flight. The process consists of tasks that assess the possible areas of risks to the safety of the flight. These tasks develop the pilot's situational awareness and develop a go, no-go perspective. Nothing is risk free. The pilot must make decisions and implement mitigation tactics to accept risks at an appropriate level.

PAVE

The FAA recommends the PAVE checklist to identify and mitigate sources of risk.

Pilot

- Personal certificates & documents (pilot certificates, FAA medical certificate, gov't identification, logbook and endorsements if required).
- Charts or EFB (current navigation data? EFB battery level? Back-up battery?)
- Competency & currency (Are your pilot skills at a sufficient safe level? Are you legally current to fly?)
- I.M.S.A.F.E checklist (illness, medication, stress, alcohol, fatigue, eating) Am I mentally, emotionally, physically healthy to fly?

Aircraft

- Is the aircraft airworthy per part 91 operational regulations (**AV1ATE**).
  - Annual/ADs, VOR check, 100-hour inspection, altimeter & pitot static inspection, transponder inspection, ELT operation inspection and battery.
  - Normally handled by dispatch.
  - Must be done by student for check ride.
- All required Aircraft Documents aboard **(ARROW).**
  - Airworthiness, registration, radio operation, operating limitations (manuals, markings, and placards), weight & balance data.
- Physical inspection of the aircraft.
- Inoperative equipment must be handled appropriately.
  - Checked if required by any of the following.
    - The §91.205 type of operation equipment requirements (Day VFR, night VFR, IFR).
    - The manufacturer's type certificate data sheet (https://drs.faa.gov/browse)
    - The kind of operation equipment list (KOEL) in the AFM.
    - Anything required by an airworthiness directive (AD)?
  - If not required, must be:
    - Deactivated (turned off, covered, or breaker pulled)
    - Placarded as inoperative (tape, post-it note, sticker)
    - Squawked
- Weight & Balance must be computed for the flight.
- Takeoff & landing performance must be computed for the current/forecast atmospheric conditions.

en**V**ironment

- Weather briefing from an approved source
  - 1-800-WXBRIEF, 1800wxbrief.com, aviationweather.gov, EFB like ForeFlight.
  - Assess the weather for hazards and risks.
  - Assess the weather against your personal weather minimums.
  - Mitigate the weather hazards-risks with conservative decisions.

- NOTAMs affecting your route and desired airports.
- Temporary flight restrictions (TFRs) affecting your route and desired airports.
- Assess your route of flight and intended airports for hazards and risks.

External Pressures

- Get-there-itis.
- Passenger or job pressures.
- Pressure to finish a check ride.

ADWARF

This acronym is used to comply with §91.103 – required preflight action.

All Pertinent Information

- The FAA uses the word "ALL" enforcing the idea not to take preflight action casually.
- Preflight action when done appropriately greatly improves mitigation of flying's risks.
- The pilot's primary job is to be aware of "all" information related to a flight.

Delays

- NOTAMs & TFRs provide information leading to potential delays at departure, enroute and destination airports.
- Delays require the pilot to have contingency fuel plans (sufficient fuel on board).

Weather

- Pilot must obtain a weather briefing from an FAA Approved Weather Provider.
- Pilot must assess and mitigate weather hazards and risks.

Alternatives / Alternate Airports

- "Plan A" must commonly be modified enroute. Good pilots always have a "Plan B" and "Plan C" in mind.
- IFR pilots must determine if an alternate airport is required to be computed / included in the ATC flight plan.
- Being a flexible pilot impacts fuel management decisions.
- IFR rule: Published IAP at destination? If so, 1-2-3 Rule with 600/2, 800/2, or non-standard alternate minimums may allow flight without a filed alternate. Otherwise, an alternate is always required.

Runway Lengths Including Takeoff & Landing Performance Calculations

- Determine runway lengths from chart supplement or ForeFlight.
- Apply atmospheric conditions and runway conditions to compute takeoff and landing distances from the AFM.
- Compare computed distances to the runway lengths. What is your margin?

Fuel Requirements

- The pilot must know the actual fuel on board, typically visually confirmed.
- Fuel ***Safe Endurance Time (SET)*** must be computed.
- Pilot must verify fuel endurance exceeds regulation requirements:
    - Day VFR: Departure to destination + 30 minutes.
    - Night VFR: Departure to destination + 45 minutes.
    - IFR: Departure to destination then alternate (if req) + 45 minutes.

Time in Tanks Philosophy

Know your aircraft's Safe Endurance Time (SET)!

Statistically speaking, general aviation pilots do a poor job managing fuel and a poor job of executing safe decisions regarding fuel. Fuel exhaustion is still a primary cause of accidents and deaths in general aviation in the United States. Fuel exhaustion is the result of pilots making poor decisions about knowing their aircraft and what limitations apply to safe flying endurance.

There is a difference between fuel exhaustion and fuel starvation. Fuel exhaustion is flying an aircraft until all fuel is consumed by the powerplant and it quits. There is no more fuel on board. Fuel exhaustion is always a human induced mistake, the result of poor planning. Fuel starvation is the result of mechanical issues or mismanagement that prevent the powerplant from getting fuel that is in the onboard fuel tanks. There is still fuel on board, but it isn't getting to the engine. Fuel starvation may be a purely mechanical problem, such as a stuck valve or a failed transfer pump but may also be the result of a pilot's mismanagement of the fuel system.

United Flight Systems' goal is to train pilots to better respect and manage fuel decisions in the aircraft. A common pitfall of fuel planning is to think of endurance in terms of distance: if the airplane needed 25 gallons of fuel to fly from Houston to New Orleans, then it should need 25 gallons to fly back. This misconception is a primary reason pilots continue to run their aircraft out of fuel resulting in accidents and deaths.

In reality, aircraft consume fuel at a constant rate per TIME (not distance) at a given power setting. Since aircraft operate in moving bodies of air flowing over the Earth's surface, we don't always cover the same distance in a given amount of time—wind matters.

The best approach, then, is to think of fuel in terms of the flight time it provides, not distance. The time in our tanks should be based on conservative application of fuel computations presented in the FAA approved flight manuals for the aircraft you fly.

The process for computing ***Safe Endurance Time (SET)*** is not complicated. The following two methods should be used to compute your aircraft's SET based on the amount of fuel on board prior to every flight.

1. **Calculate a worst-case climb fuel consumption based on the AFM/POH charts for your aircraft.**
    a. Use the AFM chart to determine the fuel and time needed to climb to the aircraft's service ceiling.
    b. Add the taxi/takeoff fuel to the climb fuel.
    c. Divide the new fuel quantity by climb time in hours to get the climb fuel burn in gallons/hour.

C172N Example

TIME, FUEL, AND DISTANCE TO CLIMB

MAXIMUM RATE OF CLIMB

CONDITIONS:
Flaps Up
Full Throttle
Standard Temperature

NOTES:
1. Add 1.1 gallons of fuel for engine start, taxi and takeoff allowance.
2. Mixture leaned above 3000 feet for maximum RPM.
3. Increase time, fuel and distance by 10% for each 10°C above standard temperature.
4. Distances shown are based on zero wind.

WEIGHT LBS	PRESSURE ALTITUDE FT	TEMP °C	CLIMB SPEED KIAS	RATE OF CLIMB FPM	FROM SEA LEVEL		
					TIME MIN	FUEL USED GALLONS	DISTANCE NM
2300	S.L.	15	73	770	0	0.0	0
	1000	13	73	725	1	0.3	2
	2000	11	72	675	3	0.6	3
	3000	9	72	630	4	0.9	5
	4000	7	71	580	6	1.2	8
	5000	5	71	535	8	1.6	10
	6000	3	70	485	10	1.9	12
	7000	1	69	440	12	2.3	15
	8000	-1	69	390	15	2.7	19
	9000	-3	68	345	17	3.2	22
	10,000	-5	68	295	21	3.7	27
	11,000	-7	67	250	24	4.2	32
	12,000	-9	67	200	29	4.9	38

Total Fuel to 12,000' = 1.1 (taxi/takeoff) + 4.9 = 6.0 gal

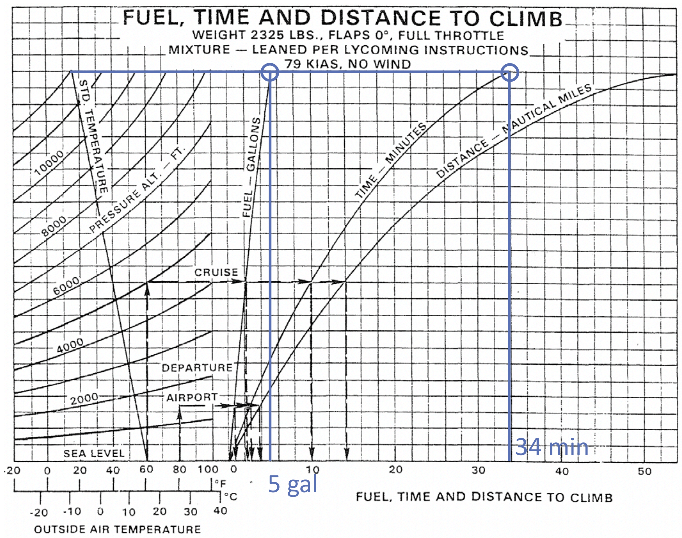
Time to 12,000' = 29 min = 0.483 hours (29/60)

Climb fuel rate = 6.0 gal / 0.483 hours = ***12.4 gph (round to 13 gph)***

PA28-161 Example

WEIGHT LIMITS

Maximum Ramp (Dock) Weight: 2227 lbs.
Maximum Takeoff Weight: 2220 lbs.



Taxi/Takeoff fuel = 2227 – 2220 = 7lbs = 1.17 gal

Total fuel to 12,000' = 1.17 (taxi/takeoff) + 5 = 6.17 gal

Time to 12,000' = 34 min = 0.567 hours (34/60)

Climb fuel rate = 6.17 gal / 0.567 hours = ***10.8 gph (round to 11 gph)***

2. **Calculate a worst-case cruise fuel consumption based on the AFM/POH charts for your aircraft.**

C172N Example

CRUISE PERFORMANCE

STAND LAPSE - 2°C/1000'

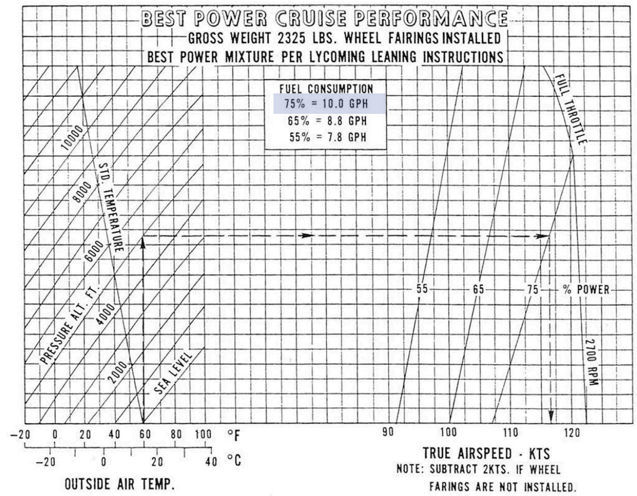
CONDITIONS:
2400 Pounds
Recommended Lean Mixture (See Section 4, Cruise)

-5°C | 15°C/59°F | 35°C

PRESSURE ALTITUDE FT	RPM	20°C BELOW STANDARD TEMP			STANDARD TEMPERATURE			20°C ABOVE STANDARD TEMP		
		% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2000	2500	- - -	- - -	- - -	76	114	8.5	72	114	8.1
	2400	72	110	8.1	69	109	7.7	65	108	7.3
	2300	65	104	7.3	62	103	6.9	59	102	6.6
	2200	58	99	6.6	55	97	6.3	53	96	6.1
	2100	52	92	6.0	50	91	5.8	48	89	5.7
4000	2550	- - -	- - -	- - -	76	117	8.5	72	116	8.1
	2500	77	115	8.6	73	114	8.1	69	113	7.7
	2400	69	109	7.8	65	108	7.3	62	107	7.0
	2300	62	104	7.0	59	102	6.6	57	101	6.4
	2200	56	98	6.3	54	96	6.1	51	94	5.9
	2100	51	91	5.8	48	89	5.7	47	88	5.5
6000	2600	- - -	- - -	- - -	77	119	8.6	72	118	8.1
	2500	73	114	8.2	69	113	7.8	66	112	7.4
	2400	66	108	7.4	63	107	7.0	60	106	6.7
	2300	60	103	6.7	57	101	6.4	55	99	6.2
	2200	54	96	6.1	52	95	5.9	50	92	5.8
	2100	49	90	5.7	47	88	5.5	46	86	5.5
8000	2650	- - -	- - -	- - -	77	121	8.6	73	120	8.1
	2600	77	119	8.7	73	118	8.2	69	117	7.8
	2500	70	113	7.8	66	112	7.4	63	111	7.1
	2400	63	108	7.1	60	106	6.7	58	104	6.5
	2300	57	101	6.4	55	100	6.2	53	97	6.0
	2200	52	95	6.0	50	93	5.8	49	91	5.7
10,000	2600	74	118	8.3	70	117	7.8	66	115	7.4
	2500	67	112	7.5	64	111	7.1	61	109	6.8
	2400	61	106	6.8	58	105	6.5	56	102	6.3
	2300	55	100	6.3	53	98	6.0	51	96	5.9
	2200	50	93	5.8	49	91	5.7	47	89	5.6
12,000	2550	67	114	7.5	64	112	7.1	61	111	6.9
	2500	64	111	7.2	61	109	6.8	59	107	6.6
	2400	59	105	6.6	56	103	6.3	54	100	6.1
	2300	53	98	6.1	51	96	5.9	50	94	5.8

Worst-case cruise consumption = ***8.7 gph, round to 9***

PA28-161 Example



Worst-case cruise consumption = ***10 gph***

3. **Calculate your desired fuel reserve in time. It must at a minimum comply with §91.151 (VFR) or §91.167 (IFR).**

   The safe operational paradigm says this reserve fuel should NOT BE USED except for in an emergency or abnormal scenario. For all normal operations, we must be on the ground with this reserve fuel still in our tanks.

   Example: 60 minutes for a day VFR flight (30 min legal minimum + an extra 30 min of personal minimums)

4. **Use the worst-case cruise fuel consumption to convert the reserve time to a reserve fuel volume:**

   Reserve Volume (gallons) = Reserve Time (minutes) * Worst-Case Cruise Rate (gallons per hour) / 60

   C172N Example

   *Reserve Volume = 60 minutes * 9 gph / 60 =* ***9 gallons***

   PA28-161 Example

   *Reserve Volume = 60 minutes * 10 gph / 60 =* ***10 gallons***

5. **Subtract the reserve volume from the total fuel quantity to get a Safe Fuel Quantity (SFQ):**

   Safe Fuel Quantity = Total Fuel Quantity – Reserve Volume

   The total fuel quantity must be visually verified prior to flight. Don't trust the fuel gauges alone. This can either be done by using a known reference in the AFM (full, tabs, collar, etc.) or with a dipstick calibrated for your specific aircraft.

C172N Example	*PA28-161 Example*
Visually confirmed full tanks = 40 gal usable	*Visually confirmed at tabs = 34 gal usable*
SFQ = 40 – 9 = 31 gal	*Reserve Volume = 34 – 10 = 24 gal*

6. **Convert the Safe Fuel Quantity (SFQ) to a Safe Endurance Time (SET):**

   Method 1: appropriate for local and for shorter cross-country flights

   If you're going on a local flight or a shorter cross country where you're not climbing to high altitudes. You can get a good-enough estimate of SET by neglecting the climb fuel consumption. This works if you were conservative with the worst-case cruise fuel burn and have a conservative personal minimum.

   SET (hours) = SFQ / Worst-Case Cruise Rate (gallons/hour):

C172N Example	*PA28-161 Example*
SET = 31 gal / 9 gph = 3.44 hours	*SET = 24 gal / 10 gph = 2.4 hours*
SET = 3 hours 26 minutes	*SET =* ***2 hours 24 minutes***

   Method 2: more complicated but more accurate and risk sensitive

   As aircraft get larger and more complicated, fuel burn during takeoff and climb to the cruising altitude is much more dramatic in its effect on ***SET.*** Fuel flow/burn to get to a larger aircraft to its efficient cruising altitude is very high versus the cruise fuel/burn. Jet operations are simplified by thinking about fuel computations by the hour #1, hour #2, hour #3 and so on fuel burns. Hour #1 spends a large percentage of that hour at high power, high fuel flow to get to its efficient cruising altitude. Hour #2 is spent at efficient cruising altitude. Subsequent Hours are cruise and power idle descents.

   You can apply this philosophy to training aircraft by assuming the first hour consumes fuel at the worst-case climb rate, and each subsequent hour consumes fuel at the worst-case cruise rate.

   First hour fuel = climb fuel rate:

   SET (hours) = (SFQ – First Hour Fuel) / Worst-Case Cruise Rate + 1 hour

C172N Example	*PA28-161 Example*
SET = (31 gal - 13 gal) / 9 gph + 1 hour	*SET = (24 gal – 11 gal) / 10 gph + 1 hour*
SET = 3.0 or 3 hours 0 minutes	*SET =* ***2.3 or 2 hours 18 minutes***

Pilots need to learn quick but accurate and safe methods to convert the verified fuel quantity to ***SET Safe Endurance Time.*** Preflight action, risk assessment/mitigation, and ADM require pilots to be aware of what the aircraft can and cannot do.

Realize this is all done on the ground in the preflight performance calculations. The more important process will be the pilot's in-flight decision making and situational awareness. The pilot must land prior the exceeding the ***SET***! The pilot must continually evaluate a flight's progress in comparison to remaining available time.

Using a dedicated fuel timer can ease a pilot's awareness of available fuel status. The countdown timer tells you the safe remaining available time. **Always treat the reserve as emergency only fuel** (not available for use except in an emergency). Land prior to or at the expiration of the computed ***SET*** and the aircraft will have 1 hour of emergency reserve remaining.

Preflight Walkaround — PVT, IR, COM

The Preflight Walkaround is the process of visually evaluating the condition of the aircraft before flight.

1. Preliminary arrival at the aircraft:
    a. Be aware of big picture items.
    b. Remove tie downs and "remove before flight" tags/flags.
    c. Check fuel and oil early so fuelers/rampers can be called while you continue the preflight.
2. Cockpit preliminary check: battery on, lights on, pitot heat on, flaps to short field extension. Exit the aircraft for light check. Return to cockpit, battery off.
    a. For preflight inspection not at DWH, extend the flaps only maximum allowed for a takeoff.
    b. This allows a ferry flight if flaps fail in the extended position.
3. A.R.R.O.W Documents:
    a. Airworthiness Certificate, Unexpired Registration, Radio Station Operating License (required for international flights only), Operating Limitations (AFM, Markings, & Placards), Weight & Balance Info (for the unique N numbered aircraft).
4. Memorized flows are completed appropriate to make & model of aircraft, verified by the checklist.
    a. Checklist must be in hand and completed during the walkaround.
5. Check tires for tread condition (no visible chord allowed) and proper inflation.
6. All flight control actuators checked for allowable play (fused/binding actuators are not airworthy).
7. Check for all control surface counterweights.
8. Sumped fuel that is clean is to be returned to the fuel tanks—don't pour on the ground.
9. Verify the fuel caps are vented.
10. Verify pneumatic type stall warning indicators work (apply suction).
11. Verify vane type stall warning indicators work with battery DC power on.

Before Engine Start — PVT, IR, COM

Prior to starting the aircraft's powerplant, a systematic process of cockpit checks is performed.

1. Organize cockpit tools/equipment for ease of use and efficiency.
2. Obtain ATIS and any required airspace/ATC clearances ***prior to engine start.***
3. Brief the expected taxi route to the active runway, noting all hotspots along the taxi route.
4. Brief the passengers using the S.A.F.E.T.Y Briefing.
    - Seatbelts (operation and when to use).
    - Airflow, comfort systems, potential for airsickness (air vents and sick sacks).
    - Fire extinguisher (location and use).
    - Exits (demonstration of opening the exits).
    - Talking rules, look for traffic (sterile cockpit in traffic pattern, seeing traffic).
    - Your questions.
5. Memorized before engine start flows are verified by checklist.
6. Parking Area and Surrounding Area will be advised and cleared with a verbal announcement.

Aircraft Light Usage — PVT, IR, COM

UFS desires lights to be used in accordance with professional habits and the "Operation Lights On" FAA safety program.

1. Anytime the master switch (DC power) is on, or aircraft is on external electrical power – nav lights illuminated.
2. Prior to engine start and while engine running – flashing red beacon illuminated (flashing red = danger risk).
3. Prior to taxi (low light conditions) – taxi light illuminated.
4. Taking the active runway – landing lights and wing tip strobe lights illuminated.
5. Exiting the active runway – landing lights and wing tip strobe lights extinguished.
6. Crossing any runway during taxi – all lights illuminated.
7. Cruise Climb / Practice Area- All lights illuminated per the desire of the pilot.

Engine Start — PVT, IR, COM

Starting the aircraft's powerplant requires the pilot to be familiar with systems and methods for starting the engine. Improper starting procedures can damage the engine.

1. Prior to start, verbalize what type of start is required (normal, hot, flooded).
2. All three types of starts should be committed to understanding for correct application when necessary.
3. Do not allow the starter to rotate for more than **5 rotations** without any sense of engine ignition occurring.
    a. Over-exertion of the starter damages it.
4. Acceptable pumping of the throttle during engine start (carbureted engines ONLY).
    a. Only pump the throttle if the propeller is rotating.
    b. If necessary, the proper procedure for pumping the throttle is a quick push to the fully open position, then quickly return it to idle position.
    c. ONLY up to 2 pumps while the engine is turning.
    d. As engine ignites, throttle to idle position.
    e. Set throttle at 800-1000 RPM for warm up.
5. Immediately following ignition, scan the tachometer for less than 1000 RPM, oil pressure for positive indication and ammeter for charging indication. (***TOE***: **T**achometer<1000, **O**il pressure green, **E**lectrical system producing amps).
6. **Immediate shut down** is required:
    a. If no oil pressure is indicated.
    b. I full scale ammeter (pos or neg) indication is indicated (possible cause is "hung starter," the starter remaining engaged to the flywheel).
7. In the first 5 minutes after start, DO NOT IDLE > 1000 RPM.
8. To minimize sparkplug contamination, lean the mixture aggressively for taxi.
9. Leaning for taxi procedure – lean mixture to the point of initial engine hesitation and then slightly enrichen.

Pre-Taxi — PVT, IR, COM

Prior to aircraft movement for taxiing to the active runway, appropriate tasks must be completed.

1. Familiarize yourself with the ATIS & airport information.
2. Six Pack flow check or glass cockpit. Check the PFD, AHRS, and ADC information:
   a. Airspeed = 0 kts.
   b. Attitude indicator is erect within 5 minutes.
   c. Altimeter set (setting or field elevation) and within 75' of correct field elevation.
   d. VSI shows zero or referenced for zero climb.
   e. Heading indicator set to magnetic compass showing known headings.
   f. Turn coordinator shows no inoperative flag.
3. Visually scan all areas forward, left, center and right of the aircraft. Verbalize “clear left, center, right.”
4. Pre-taxi radio and avionics panel check:
   a. Set and certify communication & navigation radios for operation (using nearest nav aids).
   b. Flow the avionics from the top to the bottom, systematically check coms/navs/GPS.
   c. Check for coms audio clarity & transmission strength.
   d. Check nav’s for audio ID of signal & proper CDI movement.
   e. Verify GPS database is current and that GPS self-tests are satisfactorily complete.
5. Announce taxi movements (non-towered airports) or receive taxi clearance from ATC.
6. On initial taxi movement, with appropriate transfer of aircraft controls, perform brake checks for each side.

Taxi — PVT, IR, COM

While the aircraft is in taxi motion, appropriate tasks must be performed.

1. Continuously note wind conditions & apply the correct aileron & elevator corrections.
   a. Memory aid: climb into headwinds, dive away from tailwinds.
2. Never taxi faster than a quick walking speed
3. Verbally announce “clear left, center, right” (clear of hazards) at all intersections.
4. Have the airport diagram available during all taxi movements and maintain situational awareness.
   a. If you lose track of your position, STOP (unless you’re on a runway)
5. Systematically check & verbalize the gyroscopic flight instruments (or the AHRS presentation) and mag compass.
   a. Attitude indicator shows ≤5° bank in turns and is erect ≤5 minutes.
   b. Heading indicator synched to the magnetic compass showing known headings & turns appropriately as aircraft turns.
   c. Turn coordinator: miniature aircraft shows turns in the same direction of airplane; the ball goes opposite.
6. Sterile cockpit: during taxi, NO unnecessary talking or activities.
7. If time and position allow, perform the **CIGARR** check (flight **C**ontrol check, **I**nstrument check, **G**as systems check, **A**ttitude (trims) set. Don’t perform the **R**un Up and **R**adios until stopped.

Pre-Takeoff — PVT, IR, COM

Final Checks to the aircraft are performed to verify the safe mechanical condition to systems necessary for flight. Preparation for normal or specialty takeoffs includes preparation for potential emergencies.

At the Runup Area

1. Complete the Pre-Takeoff Flow Checks
2. CIGARR
    a. **C**ontrols: check flight controls (top check: "box 4 corners" the controls. Bottom check: rudders)
    b. **I**nstruments: check flight and engine instruments
    c. **G**as: all fuel system items. Quantity / selectors / pumps
    d. **A**ttitude: check all trim indications for safe flight attitudes
    e. **R**unup: perform the pre-takeoff engine runup (magneto check and carburetor heat)
    f. **R**adios: comms, navs, GPS, transponder
3. Magneto check
    a. The pilot will verbally call out clicks of ignition key to identify left and right magneto checks.
    b. "One two, one two, one, one"
    c. Counting clicks will minimize the chance of turning the magneto key to the off position.
    d. If you inadvertently turn the key to off, leave it off to prevent a backfire into the carburetor.
4. Carburetor Heat (if equipped)
    a. The carb heat will be checked for a drop with RPM at recommended run of RPM. The verbal call out will be "drop, no rise, no ice."
    b. The power plant will then be checked at full idle with carb heat on to confirm that the idle setting guarantees engine operation.
5. Radio panel preparation
    a. Prepare for immediate after takeoff communication and navigation requirements.
    b. Prepare for emergency return approach procedures.
    c. Flow: Start at the Top of the radio/navigation panel, systematically set comms, navs, GPS, and transponder for the flight based on ATC clearance and initial navigation expectations
6. Complete before takeoff checklist

Takeoff and Emergency Briefing

Takeoff Briefing

1. Review V-speeds (V_R, V_Y, V_G)
2. Type of takeoff, including verbally review of procedures if specialty takeoff (short or soft field)
3. If VFR, review
    a. Direction of turn and desired course after departure
    b. First visual waypoint you will look for after departure.
    c. Initial altitude after departure
4. If IFR, review ATC clearance for initial heading, departure procedure, and altitude

Emergency Briefing: broken down into three phases:

1. Any abnormality prior to rotation: **Chop**, **Stop** and **Advise:**
    a. Chop the throttle.
    b. Stop the aircraft (or exit runway if appropriate).
    c. Advise ATC or CTAF.
2. Engine failure after rotation with runway remaining: **Chop**, **Land**, **Stop**, **Advise**, **3 Ms:**
    a. Chop the throttle.
    b. Land on the remaining runway.
    c. Stop the aircraft.
    d. Advise ATC or CTAF.
    e. 3 Ms off: mixture, mags, master.
3. Engine failure after rotation with no runway remaining: **Push**, **Look & Turn**, **Advise**, **3 Ms**, **Open**, **Manage:**
    a. Push nose down for V_G (instinctively push to maintain energy and to prevent stalling the wing)
    b. Look & Turn to an open area with minimal obstacles. Return to airport only with adequate altitude.
    c. Advise ATC or CTAF.
    d. 3 Ms off: mixture, mags, master.
    e. Open the doors.
    f. Manage the aircraft and energy until aircraft lands and stops.

Holding Short Check

Prior to taking position on an active runway, verbalize "final approach clear. Runway XX is verified."

Line Up Check

Perform a *line up check* prior to application of power for takeoff. It is as follows: (Flow memory aid: T.H.A.A.T.S.)

- T – Time off — Start clock or note Time Off (Important for Safe Endurance Time (SET) fuel)
- H – Heading — Gyro / compass / Appropriate Runway all agree (No Red X's on AHRS)
- A – Attitude — Gyro erect (no red Xs on AHRS)
- A – Altitude — Altimeter is correct (no red Xs on AHRS)
- T – Transponder — Squawking altitude
- S – Switches — Verify all Electrical Switches are as required Lights, ice protection, radar, boost pumps

Perform a final Cockpit Flow prior to application of power for takeoff (aka GUMPCC) check will be performed:

- G – Gas — Both/fullest tank/pumps as required
- U – Under Carriage — Down/green
- M – Mixture — Set forward for conditions
- P – Props — Forward
- C – Carb heat — Off
- C – Cowl flaps — Open

After Landing — PVT, IR, COM

Do not touch any controls other than the throttle, yoke, and brakes until the aircraft is clear of the runway and stopped. This is to minimize the chance of a gear retraction on the ground.

- Clear runway & stop at correct side of hold short lines.
- Complete the after-landing flow.
  - Do not retract flaps without verbalizing "feels like a flap, must be a flap, flaps up!"
  - Landing lights ..... off
  - Taxi lights .... as desired
  - Strobe lights .... off
  - Transponder .... VFR 1200
  - Mixture .... lean
  - Carb heat .... off
- Back up the flow with the after-landing checklist once at a longer-term stop (like parking space).
- Use normal taxi procedures to ensure collision and runway incursion avoidance.
- Contact ATC for taxi clearance or advise traffic of taxiing intentions on CTAF.

Shutdown & Securing the Aircraft / Post-Flight — PVT, IR, COM

- Position the aircraft into the tie down "T" position or comply with the ramp handler's hand signals.
- Complete the shutdown flow: SLIM mnemonic.
  - **S** All electrical **S**witches, avionics power switch off.
  - **L** **L**ean mixture to idle cut off.
  - **I** **I**gnition to off and remove key.
  - **M** **M**aster switch off.
- Complete the shutdown/securing checklist.
- Trims set to takeoff positions.
- Control lock installed.
- Seat belts organized for next pilot.
- All trash removed for next pilot ***- leave it nicer than you found it!***
- Exterior 3-point tiedowns secured.
- Maintenance problems explicitly notated for UFS Dispatch record keeping.
  - Be specific in the problem's description - what, when, how, did it improve, did it get worse, etc.
- Log hobbs and tach times for billing and maintenance purposes.

Takeoffs

Normal Takeoff — PVT, IR, COM

When runway conditions allow, a normal takeoff can be performed. The AFM for the aircraft defines the configuration(s) for a normal takeoff.

1. Set normal takeoff flaps per AFM (probably 0).
2. Line up on centerline.
3. Smoothly increase throttle to full power and begin rolling.
4. Confirm RPM > static RPM and announce, “takeoff power set.”
5. Check engine gauges and announce, “engine gauges in the green.”
6. When airspeed indicator starts moving announce “airspeed alive.”
7. At V_R, slowly apply back pressure and announce “rotate.”
8. Pitch for V_Y sight picture and accelerate to V_Y.
9. “Positive rate, negative runway, gear up” (if appropriate)
10. If flaps extended for takeoff, retract flaps and announce “flaps up” once at safe altitude and speed.
11. Maintain full power and V_Y until at least 1,000 AGL, or when a power-off return to airport becomes feasible.

My Airplane Parameters
Flaps:
Static RPM:
V_R:
V_Y:

ACS Tolerances	
	Airspeed
PVT	V_Y +10/-5 KIAS
COM	V_Y ±5 KIAS

Notes

- Apply proper control inputs for takeoff wind conditions (ailerons into crosswind).
- Add power smoothly, over the course of a full two-Mississippi.
- Hand stays on throttle until at least 1,000 AGL.
- If remaining in the traffic pattern, no crosswind turns until 300 ft below pattern altitude.
- If departing the pattern, no crosswind turns below 500’ AGL.
- Lower the nose to find 3 inline ground checkpoints on upwind for tracking purposes. Maintain the runway centerline, keep the aircraft on that line.
- Collision avoidance procedures:
  - Prior to all turns, verbally confirm “clear left, center, right.”
  - Dip the nose (pitch down) on regular basis to scan area ahead for traffic hazards.
  - Always maintain situational awareness regarding your position in the traffic pattern with other traffic pattern aircraft.
  - Upwind is always the best leg to extend in order to get appropriate spacing with preceding aircraft.

Soft-Field Takeoff — PVT, COM

Runway conditions other than hard surface require a technique to appropriately utilize the unprepared surface. The primary objective is to keep the aircraft's weight primarily on the main landing gear. Ground effect is utilized appropriately to transition from the takeoff technique to the flying condition.

My Airplane Parameters
Flaps:
Static RPM:
V_X:
V_Y:
Safe Retraction Speed:

1. Soft field flaps per AFM.
2. Yoke full aft for taxi and initial takeoff roll.
3. No braking or stopping.
4. Line up on centerline.
5. Smoothly increase throttle to full power and begin rolling.
6. Confirm RPM > static RPM and announce, "takeoff power set."
7. Check engine gauges and announce, "gauges in the green."
8. When airspeed indicator starts moving announce "airspeed alive."
9. Continue holding full aft yoke until nosewheel lifts off ground.
10. Reduce backpressure to maintain nosewheel off ground without striking tail.
11. Once main wheels lift off, push forward to level off and remain in ground effect (within 1 wingspan of runway)
12. Accelerate to V_X in ground effect.
13. If obstacle is present:
    a. Climb out at V_X until clear of obstacle.
    b. Positive rate, negative runway, gear up" (if appropriate)
    c. Once clear of obstacle, accelerate to V_Y and retract flaps once above safe retraction speed (announce "flaps up")
14. If no obstacle:
    a. Climb out of ground effect while accelerating to V_Y.
    b. Positive rate, negative runway, gear up" (if appropriate)
    c. Retract flaps and announce "flaps up" once above safe retraction speed.
15. Maintain full power and V_Y until at least 1,000 AGL.

ACS Tolerances	
	Airspeed
PVT	V_X/V_Y +10/-5 KIAS
COM	V_X/V_Y ±5 KIAS

Short-Field Takeoff — PVT, COM

Runways can have limited length or obstacles in the climb corridor. Some runways have both short length and obstacles. These types of runways require a short-field takeoff technique.

My Airplane Parameters
Flaps:
Static RPM:
$V_{R\ SHORT}$:
V_X:
V_Y:

1. Short field flaps per AFM.
2. When entering runway, angle towards back edge to use all available runway.
3. Come to complete stop and hold brakes.
4. Smoothly increase to full power.
5. Confirm RPM > static rpm and announce, “takeoff power set.”
6. Check engine gauges and announce, “gauges in the green.”
7. Release brakes.
8. When airspeed indicator starts moving announce “airspeed alive.”
9. At $V_{R\ SHORT}$ (slower than normal takeoff V_R), slowly apply backpressure and announce “rotate.”
10. Pitch for V_X sight picture and climb at V_X until clear of obstacle.
11. Announce “clear of obstacle” and decrease pitch to accelerate to V_Y.
12. Retract flaps and announce, “flaps up” once at safe altitude and speed.
13. Maintain full power and V_Y until at least 1,000 AGL.

ACS Tolerances	
	Airspeed
PVT	V_X/V_Y +10/-5 KIAS
COM	V_X/V_Y ±5 KIAS

Enroute

Enroute Climb (Cruise Climb) PVT, IR, COM

During climb from the departure airport to the cruise altitude, configuration clean up, climb power setting, and navigation tasks are performed.

Aircraft Configuration

- Comply with aircraft operating handbook for climb speeds, flap settings, and power settings.
- No power settings changes until clearing 1000 AGL.
- Transition to cruise climb as specified by AFM at appropriate altitude.
- If no climb speeds are specified, use V_Y + 10 KTS.

My Airplane Parameters
Cruise Climb Speed:
Cruise Climb Power:

Climb Checklist

- Complete the climb flow and checklist.
- Extinguish the landing lights outside of the airport area (if desired and not headed to practice area).
- Lean the mixture, when necessary.

Vigilance for Traffic

- Systematically lower nose to search for traffic.
- Clear left or right (raise wing if high-wing aircraft) before initiating any turns.

Orientation & Navigation

- Initiate situational and positional awareness through pilotage and radio navigation.

Communication

- Contact F.S.S. & activate the VFR flight plan if using.
- Establish contact with ATC to participate in radar advisories of traffic (flight following)
- Remember, it is always the pilot's responsibility for seeing and avoiding traffic in VFR conditions.

Cruise PVT, IR, COM

Upon leveling off at the desired cruising altitude, appropriate configurations, power settings, flow checks, communication and navigation tasks are performed.

Altitude Choice

- Level off at appropriate altitudes to comply with FARs for minimum safe altitudes, magnetic course (direction of flight), and weather conditions.
- Use the level off technique of beginning the level off at 10% of the VSI rate.

Checklist

- Complete the cruise flow & checklist.
- Adjusted the mixture properly at all altitudes.
- Always lean at cruise power settings.

Situational Awareness (SA)

- Always know the aircraft's position through pilotage and radio navigation.
- Maintain continuous awareness of weather conditions through contact with ATC, flight service and/or use of ADS-B in data.
- Monitor guard 121.5 emergency frequency in comm 2 during cruise.

Performance Verification

- Continually monitor the flight's performance regarding groundspeed, ground track, time between checkpoints. This performance verifications aids in maintaining a safe vigilance of the flight.

Alternatives & Preparation to Divert

- Always prepare for the possibility of alternative courses of action.
- Never doubt yourself for choosing a diversion to an alternative airport.

The process of non-electronic straight-line navigation solely by external ground checkpoints, magnetic compass and flight time is known as Deduced Reckoning Navigation ("aka Dead Rec Nav"). Pilotage is a type of navigation solely flying from a ground referenced checkpoint to the next checkpoint.

Pilotage and Dead Reckoning — PVT, COM

The process of non-electronic straight-line navigation solely by external ground checkpoints, magnetic compass and flight time is known as dead reckoning navigation. Pilotage is a type of navigation solely flying from a ground referenced checkpoint to the next checkpoint.

Ground Track

- Maintain the planned track across ground.
- "Plan the flight. Fly the plan".
- "Fly your body" on the drawn line (the planned track).

Identifying Navigation Points

- Be very specific when identifying checkpoints (to the instructor or examiner).
- Look out forward to the horizon, scan from wingtip to wingtip, to locate surface cues as early as possible. Don't just scan the areas nearest the aircraft.

Data to Collect & Process

- Note each checkpoint's time of arrival on the flight planning form.
- Compute actual ground speeds and record on the flight form.
- The E6B manual flight computer will be used proficiently by all student pilots.
- Continually monitor actual time enroute (the clock was started on takeoff) and compare to the safe endurance time (SET)
- Compare the actual time enroute to the estimated time enroute (ETE). Update to the FSS is required if the flight time will exceed the planned ETE if you filed a VFR flight plan.

ATC Communication

- Use ATC for flight following on all cross-country flights.
- Consider filing, activating, a VFR flight plan with FSS on cross-country flights.
    - DON'T forget to close the VFR flight plan if using.

Diversion to an Alternate — PVT, IR, COM

A decision to divert to any other airport other than the original destination is influenced by many factors, but not limited to:

- Deteriorating weather conditions,
- Enroute weather hazards (thunderstorms, IFR conditions),
- Unexpected airport closure,
- Remaining within safe endurance time (SET), or
- Any emergency or abnormal situation.

To make good diversion decisions, you need to maintain positional awareness.

- Always know your current position.
- Be aware of the Local weather & enroute weather via regular updates from FSS, ATC and ADS-B.
- Practice making conservative decisions regarding weather hazards and risks.

Your philosophy for deciding when and where to divert should be consistent and conservative.

- Divert to a safe airport due to hazardous weather within 20 NM of route or destination and/or weather at or below minimums.
- Pilot will divert to safe airport due to the flight time nearing the SET.
- Any time that you feel uneasy with the current flight situation, divert to a safer situation.

Diversion Checklist (without GPS)

1. Mark your last known position on chart.
2. Note the current time (write it down)!
3. Determine the airport to divert to.
4. Determine magnetic course to the alternate airport.
    a. Use a pen or pencil to connect last known position to the alternate airport.
    b. Slide the pencil or pen in parallel manner to a VOR compass rose.
    c. Read the new magnetic course on the compass rose.
5. Turn the aircraft to the new course.
6. Quickly sketch the new course to alternate.
7. Determine the distance to the alternate.
    a. Use your pen/pencil, connect last position to the alternate.
    b. Use latitude tick marks for distance – 1 minute of latitude = 1 nm.
8. Determine a ballpark estimated time to the alternate.
    a. Use TAS initially as ground speed (ignore wind).
    b. Pilot must be proficient at using the E6B to determine ETE.
    c. Ground speed ratios used to make quick ETE calculations:
    60 kts = 1 mile / min, 90 kts = 1.5 miles / min, 120 kts = 2 miles / min
9. Evaluate divert time to remaining SET. Is fuel sufficient for diversion?
10. Contact the nearest FSS to report the change in destination & ETE (if using flight plan).

Diversion Checklist using ForeFlight EFB

1. Mark your last known position on chart.
2. Note the current time (write it down!)
3. Determine the airport to divert to.
4. Determine magnetic course to the alternate airport.
    a. Use two fingers to bring up ruler between last known position and diversion airport.
5. Determine the distance to the alternate.
    a. Use two fingers to bring up ruler between last known position and diversion airport.
6. Turn the aircraft to the new course.
7. Determine a ballpark estimated time to the alternate.
    a. "Use two fingers to bring up ruler between last known position and diversion airport.
8. Ground Speed Ratios used to make quick ETE calculations:
    a. 60 kts = 1 mile / min, 90 kts = 1.5 miles / min, 120 kts = 2 miles / min
9. Evaluate divert time to remaining SET. Is fuel sufficient for diversion?
10. Contact the nearest FSS to report the change in destination & ETE (if using flight plan).

Lost Procedures — PVT, COM

Flying cross country is a complex operation into unfamiliar territory. It is possible to get disoriented and lost. A systematic process will reorient the pilot when they are lost.

- Remain calm.
- Reset heading indicator to magnetic compass.
- Return to the planned heading.
- Search for large, obvious landmarks and compare them to the sectional chart.
- Locate yourself using VOR cross radials.
    - Locate the 2 nearest VORs.
    - Determine what radial the aircraft is on from each VOR.
    - Where two radials intersect = your location.
- Locate yourself using GPS data.
- Locate yourself utilizing ATC radar location.
    - Contact ATC to locate you on radar.
    - When all else fails, hail help on frequency 121.5, the guard emergency frequency.
- 5 Cs
    - Climb .... Improved radio and nav aid reception, radar coverage, and safer obstacle avoidance.
    - Confess .... Admit to yourself you are lost.
    - Communicate .. Call ATC or FSS for help. 121.5 will always work.
    - Comply .... Do what ATC or FSS says.
    - Conserve........... Set power & mixture for best endurance cruise.

VFR Destination Arrival Preparation — PVT, COM

Use a **standardized briefing, consistent procedure** for organizing and setting up the aircraft for the arrival at an airport. This briefing must be accomplished correctly greater than 10 miles from the destination airport's traffic pattern.

W.I.R.E.S.

Weather
- obtain local weather, appropriate altimeter setting, the runway in use, NOTAMs

Instruments
- Set heading indicator to compass, attitude indicator altimeter setting.
- Verify no red Xs on the PFD and MFD.

Radios
- Use an organized flow check setting the avionics, comms, navs, and GPS based on the airport facilities found in the chart supplement.
- Flow from top to bottom of Avionics:
  Comm1 … Nav1 … Comm2 … Nav2 … GPS … DME … Transponder

Environment
- What Runway is in use?
- Orient yourself. How are you arriving into the traffic area?
- Have airport diagram available for orientation.
- Brief possible runway exits and probably taxi route.

Speed
- Slow the aircraft and set aircraft configuration for the airport and landing.
- Know and apply specific aircraft traffic pattern profiles.

Descent, arrival, before landing flows and checklists will be completed.

Landings

Traffic Pattern / Normal Approach and Landing — PVT, IR, COM

9. Turning Final
- Clear left/right (raise wing if Cessna)
- Time turn to rollout on final
- Do not overshoot, especially if parallel runway

10. On Final
- Flaps full
- Pitch for V_{REF}
- Maintain centerline
- Adjust power for flightpath
- Be prepared for go-around
- “Landing gear green, prop forward”

11. Flare / Touchdown
- Continuous x-wind corrections
- Transition eyes to end of runway
- Begin flare once in ground effect
- Apply continuous backpressure until plane settles on main gear
- Bounced landings require go-around

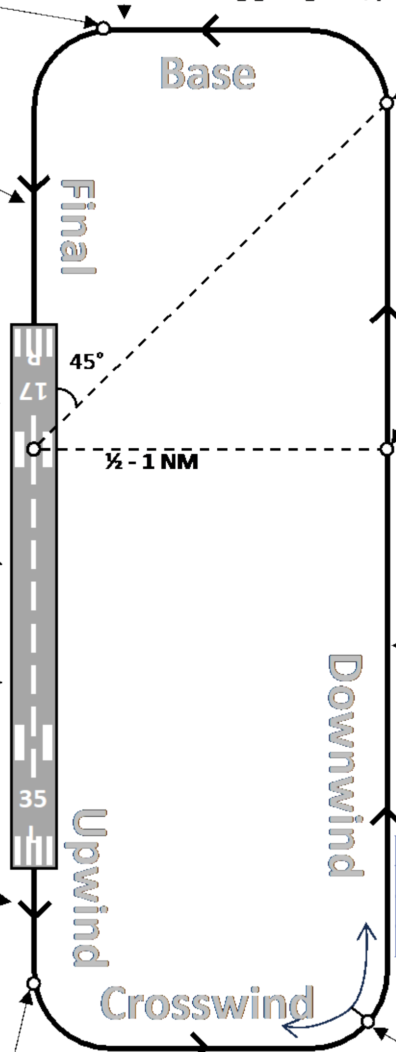
12. Rollout (Full Stop)
- Full aft yoke for aero. braking
- No configuration changes until off runway

12. Rollout (Touch-and-Go)
- Stabilize aircraft on centerline
- Carb heat – off
- Flaps to T/O position
- If sufficient runway: full power
- Rotate at V_R

1. On Upwind
- Climb at V_X or V_Y
- Maintain track with 3 aligned ground points or GPS TRK
- Be mentally prepared for engine failure
- Retract flaps once at a safe altitude and clear of obstacles

2. 300’ Below TPA
- Clear left or right (raise wing if Cessna)
- Turn 90 onto crosswind
- If following traffic, wait until they’re abeam before turning

8. On Base
- Flaps 2
- Pitch for V_{REF} + 10 KIAS
- Adjust power as necessary to maintain flight path: ”High or low, fast or slow”
- Verbalize: “Landing gear green, prop forward on final”



7. Touchdown Point 45° Behind
- Clear left/right (raise wing if Cessna)
- Turn base

6. Abeam Touchdown Point
- Reduce power to ~1500 RPM
- Flaps 1
- Pitch for V_{REF} + 20 KIAS and establish descent

5. Established on Downwind
- Landing configuration flow (no flaps yet)
- Before landing checklist (no flaps yet)

ACS Tolerances		
	Airspeed	Touchdown
PVT	V_{REF} +10/-5 KIAS	+400’/-0’
COM	V_{REF} ±5 KIAS	+200’/-0’

4. At TPA
- Reduce power to ~2200 RPM
- Maintain 90 KIAS

3. On Crosswind
- Count 3-5 seconds (depending on wind) to establish proper crosswind distance
- Clear left/right (raise wing if Cessna)
- Turn 90 onto downwind

Normal Landing Notes

- Increase V_{REF} by half of the gust factor when landing in gusty conditions.
- Only land with reduced flaps in emergencies, strong gusts, strong crosswind, or windshear consistent with airplane AFM (e.g. Cessna/Piper allows partial flap landings, Cirrus does not under most circumstances).
- (Retractable gear) Your hand must remain on the landing gear handle when extending landing gear until safe indication occurs.
- Overshooting final approach is unacceptable and requires an immediate go-around.
- Final approach should be no shallower than PAPI/VASI slope and should be steeper for most VFR landings to allow for power-off landings.
- Stabilized approach criteria: by 500' AGL, the airplane must be:
    - Landing checklist completed.
    - VREF +10/-5 KIAS.
    - On centerline (unless short approach).
    - Fully configured for landing.
    - No more than 0.25 degrees off glideslope (unless briefed).
    - Descent rate < 750 FPM (unless briefed).
- Non-stable final approach requires a go-around.
- Exit runway at the first taxiway you can reasonably make unless instructed otherwise.
- Clear runway past the first set of hold short lines.
- Complete the after-landing flow once clear of runway. Back up the flow with after landing checklist at parking spot or other long-term stop (don't block taxiway running checklist).

My Airplane Parameters
V_{REF}:

Soft-Field Approach and Landing — PVT, COM

Same as normal approach and landing except:

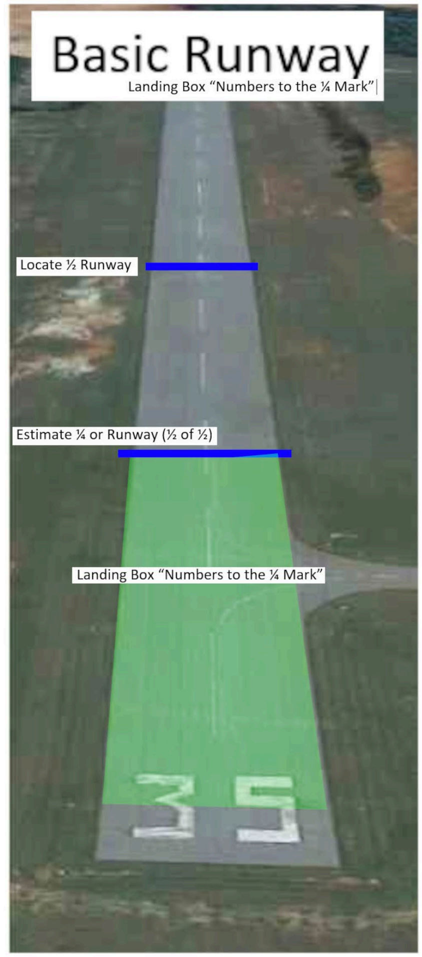
1. Use soft-field V_{REF}, as specified by POH.
    a. Apply standard gust correction, but do not use less than full flaps.
2. Keep 100-200 RPM of power through round-out into ground effect.
3. Slowly reduce the power to idle to manage smooth transfer of weight to main landing gear.
4. Landing attitude must be a full stall.
5. Use backpressure to keep nose wheel off the runway as long as possible (ending with full aft yoke).
6. Minimize use of wheel braking and do not stop when transitioning to taxi.

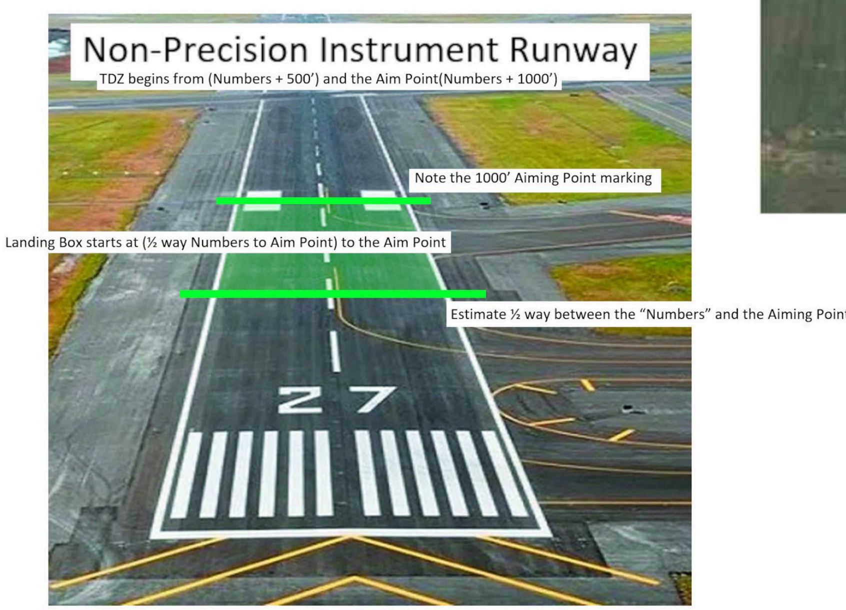
My Airplane Parameters
$V_{REF\ SOFT}$:

ACS Tolerances		
	Airspeed	Touchdown
PVT	V_{REF} +10/-5 KIAS	N/A
COM	V_{REF} ±5 KIAS	

Touchdown Zone / Landing Box

The goal of proper landings is to be completed from a stabilized approach into the touchdown zone box. If you’re not going to make the touchdown zone, go around.





Make it your Professional/Artistic GOAL to land in the “Box” and ON CENTERLINE on every landing. Manage your energy appropriately to land in the “box”. Make safe decisions: Unstable approaches, mis-managed energy on approach, windshear , something doesn’t feel just right, or LANDING OUTSIDE THE BOX - EXECUTE A GO-AROUND. Attempting to salvage a poor / un-stabilized approach is risky, often leading to “bent metal”

Short-Field Approach and Landing — PVT, COM

Same as normal approach and landing except:

1. Announce desired touchdown point while on downwind (recommend 1000 footers for training)
2. Adjust flight path on final to clear 50’ obstacle on final (steeper approach).
3. Use short-field V_{REF}, as specified in POH.
    a. Apply standard gust correction, but do not use less than full flaps.
4. Aim approximately 400’ (2 runway stripes) before touchdown point.
    a. Might need to adjust depending on wind or airplane performance.
5. Reduce throttle to idle when passing over aiming point.
6. Adjust flare to touch down on desired point and minimize floating.
    a. Go-around if you’re going to miss your point.
7. Retract flaps after touchdown (unless otherwise specified in POH).
8. Apply maximum braking (or say “simulated maximum braking”)
    a. Do not lock the brakes. Doing so will severely damage tires and increase stopping distance.
9. Hold yoke full aft for maximum aerodynamic braking.

My Airplane Parameters
$V_{REF\ SHORT}$:

ACS Tolerances		
	Airspeed	Touchdown
PVT	V_{REF} +10/-5 KIAS	+200’/-0’
COM	V_{REF} ±5 KIAS	+100’/-0’

No-Flaps Approach and Landing — PVT, COM

Same as normal approach and landing except:

1. A lower power setting will be needed when beginning descent to land because of reduced drag.
2. Use published no-flaps V_{REF}, applying standard gust correction.
    a. Add 10 KTS to V_{REF} if no speed is published.
3. Sight picture will be more nose-up than normal landing.

My Airplane Parameters
$V_{REF\ NO\ FLAPS}$:

Go-Around/Rejected Landing — PVT, IR, COM

1. Maximum power.
2. Carb heat – off (if applicable).
3. Retract flaps to recovery setting.
4. Hold forward pressure while trimming nose-down to prevent trim stall.
5. “Positive rate, gear up” (if applicable).
6. Accelerate to V_X or V_Y as appropriate.
7. Retract flaps in steps once reaching a safe altitude and speed.
8. Call tower.

Note: Mnemonic for go-around is 6 Cs: cram, climb, clean, cool, call, comply

My Airplane Parameters
Recovery Flaps:
Safe Retraction Speed:

ACS Tolerances	
	Airspeed
PVT	V_X/V_Y +10/-5 KIAS
COM	V_X/V_Y ±5 KIAS

Power-Off 180° Accuracy Approach and Landing — COM

Unlike other landings, there is no one-size-fit-all recipe for executing a power-off 180° accuracy approach and landing. Judging when to turn, when to configure, and how to configure will depend on wind, density altitude, and aircraft performance. Good judgement is paramount.

This is the only approach and landing where a go-around is considered unsatisfactory performance unless the reason for the go-around was outside the pilot's control. Per the ACS: "Initiating a go-around as a result of an applicant's inability to complete this Task within the tolerances specified in the skill elements is considered unsatisfactory. Runway safety concerns beyond the control of the applicant or evaluator that necessitate a go-around would not be considered unsatisfactory. The applicant and evaluator must not sacrifice the safety of flight and force a landing to complete this Task."

My Airplane Parameters
V_G:

1. Once established in the downwind, pick and call out a touchdown point on the runway. Consider using the 1000 footers or a specific runway centerline stripe.
2. Once abeam the touchdown point, reduce power to idle.
3. Pitch for an airspeed roughly 10 kts faster than V_G.
4. Wind speed and direction will dictate when you should turn base.
   a. When landing in a strong headwind, or if there's a crosswind pushing you away from the runway while in the downwind, turn base earlier.
   b. When landing with low wind/tailwind, or if there's a crosswind pushing you towards the runway while in the downwind, turn base later.
5. Once established on base, you have four tools at your disposal for adjusting your descent to hit your point.
   a. If you feel like you're high, square off the base to final turn, hold V_G+10, and add drag (in that order)
   b. If you feel low, turn direct to the runway, slow to V_G, and delay adding drag.
6. When adding drag, keep in mind that it's hard to take out flaps once you add them. Also, don't add a lot of drag at once. Make a configuration change, wait to see what it's effect on your descent rate is before making another change. Recommend adding drag in the following order:
   a. Landing gear (if applicable)
   b. 1st notch of flaps
   c. 2nd notch of flaps
   d. Forward slip (you can fine tune descent with partial slips)
   e. Last notch of flaps
7. Most of our single engine trainers float approximately 2 runway stripes (400') when landing with a normal approach speed and descent rate. If your approach speed is faster, you'll float longer and will need to shift your aiming point forward accordingly.

Emergency Approach and Landing — PVT, COM

Use the mnemonic A, B, C, D, E to remember the steps for an emergency approach and landing. The letters stand for airspeed, best place to land, checklists, declare, execute.

Airspeed

- As soon as you lose your engine (or simulate an engine failure by reducing power to idle), immediately start pitching and trimming for best glide speed.
- Avoid getting fixated on attaining exactly V_G.
  - Start slowing down or speeding up towards V_G
  - Rough in some trim
  - Move on to other tasks
  - Periodically check airspeed and make pitch and trim adjustments as necessary.

- Do not add any flaps or put the landing gear down until you are 100% sure you've made your landing site. These configuration changes all add drag and shorten your glide range.

Best Place to Land

Spend some time, but not too much time, looking where you're going to land if you can't get the engine restarted.

- The best place to land is an airport
    - Spend a few seconds to look for an airport, keeping in mind it might be behind or directly underneath you
    - Quickly use the nearest function of your GPS to find the closest airports
    - In the absence of wind, most of our trainers glide approximately 1.5 NM for every 1000' of altitude loss. You can use this rule-of-thumb to decide if you have enough altitude to glide to the closest airport on the GPS.
- If there are no nearby suitable airports, select a suitable field, road, riverbank, or other landing site.

Once your landing site is selected, **turn and fly directly towards your site.**

Checklist

- Time and altitude permitting, run the "Engine Failure During Flight: Restart" checklist.
    - This can be run as a flow first (floor to door) but should be backed up with the checklist
- After declaring an emergency (the next step) also run the "Forced Landing Without Power" checklist

Declare an Emergency

- Contact ATC and make a concise mayday call describing your emergency, what if any assistance you need, and what your plan is
    - For example: "Mayday Mayday Mayday. Cessna 12345 is 10 miles northwest of Hooks airport. Had an engine failure and am landing at Skydive Houston."
- If you're not talking to anyone yet:
    - Use an ATC frequency you know works in the area (e.g. Hooks tower if you're close to Hooks).
    - Declare your emergency on guard: 121.5 if you don't know what frequency to use
    - Squawk 7700 so ATC can quickly locate you and dispatch help to your location
- If you're already talking to ATC (e.g. tower, approach, or center)
    - Declare an emergency with them, no need to switch to guard.
    - Don't need to say where you are, they already know.
    - Squawking 7700 is not necessary unless you can't talk on the radio (though it won't hurt).

Execute the Forced Landing

- Evaluate your glide performance to ensure your landing site can be reached
- Once you reach your site, spiral downwards at best glide. This is a good time to use the steep spiral maneuver if you know it (COM).
- Evaluate the wind direction to determine your best direction of landing. You want to land into the wind to minimize the amount of energy you need to dissipate.
- Roll out of your spiral at approximately pattern altitude on a downwind. Rolling out high is better than low.
- Execute a power off 180 approach and landing
- Once on final, complete the final items of the "Forced Landing Without Power" checklist

Obviously, this procedure will only work if you have sufficient altitude upon reaching your landing site. If you don't have sufficient altitude to spiral, do your best judging your descent rate and chose an appropriate flight path/configuration.

Do whatever you need to do to ensure a successful outcome, including changing landing sites if a better option presents itself along the way.

Maneuvers

Configuration Flows

Each maneuver is done in one of three configurations: takeoff, cruise, or landing. Every item in the configuration is included in the before landing checklist, which is placarded somewhere on the front panel. However, the setting of each item may or may not be different than the setting specified on the checklist depending on the configuration.

Please memorize and chair fly the three configurations for your aircraft. It will make executing each maneuver much easier. In flight, use the before landing checklist as a guide to make sure you included every item in the configuration.

	Takeoff Configuration	Cruise Configuration	Landing Configuration
C172 N/P	Fuel selector ...... both Mixture ...... rich Carb heat ...... off Flaps ...... 0°	Fuel selector ...... both Mixture ...... lean Carb heat ...... off Flaps ...... 0°	Fuel selector ...... both Mixture ...... rich Carb heat ...... on Flaps ...... full
C172 S	Fuel selector ...... both Mixture ...... rich Flaps ...... 0°	Fuel selector ...... both Mixture ...... lean Flaps ...... 0°	Fuel selector ...... both Mixture ...... rich Flaps ...... full
PA-28-1X1	Fuel selector ...... proper tank Mixture ...... rich Fuel pump ...... on Carb heat ...... off Flaps ...... 0°	Fuel selector ...... proper tank Mixture ...... lean Fuel pump ...... off Carb heat ...... off Flaps ...... 0°	Fuel selector ...... proper tank Mixture ...... rich Fuel pump ...... on Carb heat ...... on Flaps ...... full
C182	Fuel selector ...... both Mixture ...... rich Prop ...... full Flaps ...... 0°	Fuel selector ...... both Mixture ...... lean Prop ...... reduce Flaps ...... 0°	Fuel selector ...... both Mixture ...... rich Prop ...... full Flaps ...... full
PA-28R-180	Fuel selector ...... proper tank Mixture ...... rich Fuel pump ...... on Gear ...... up Flaps ...... 0°	Fuel selector ...... proper tank Mixture ...... lean Fuel pump ...... on Gear ...... up Flaps ...... 0°	Fuel selector ...... proper tank Mixture ...... rich Fuel pump ...... on Gear ...... down 3 green Flaps ...... full
SR20	Fuel selector ...... proper tank Fuel pump ...... boost Mixture ...... rich Flaps 50%	Fuel selector ...... proper tank Fuel pump ...... off Mixture ...... lean Flaps ...... up	Fuel selector ...... proper tank Fuel pump ...... boost Mixture ...... rich Flaps ...... full

Steep Turns — PVT, COM, CFII

Steep turns consist of two 360° turns, one in each direction, using a bank angle of 45° or 50°. They develop a pilot's skill in flight control smoothness and coordination; awareness of the airplane's orientation to outside references; ability to manage overbanking, adverse yaw, and induced drag; division of attention between flight control applications; and the constant need to scan for hazards and traffic in the area. Steep turns are to be completed **above 1,500' AGL.**

1. Clear the area ("clear left, center, right" or 90° clearing turns).
2. **Cruise configuration** flow.
3. Confirm airspeed below V_A at training weight (recommend ______ KIAS @ _________ RPM) and starting altitude.
4. Select reference point off the nose and bug/reference heading.
5. Roll into 45° (PVT) or 50° (COM) bank.
6. Once established in turn:
    a. Add 100-200 RPM or 2-3" MAP to maintain airspeed.
    b. Add backpressure to maintain altitude (or consider 2-3 swipes of nose-up trim to help).
7. Roll out 1⁄2 bank angle prior to entry heading (reference point).
8. After briefly stabilizing heading and altitude, roll into turn in opposite direction.
    a. Might have to hold forward pressure to keep from ballooning during course reversal.
9. Roll out 1⁄2 bank angle prior to entry heading (reference point).
10. Remove extra power/trim.
11. **Cruise configuration** flow/checklist.

My Airplane Parameters
V_A:

ACS Tolerances

	Airspeed	Altitude	Bank	Heading
PVT COM	±10 KIAS	±100'	45° ±5° 50° ±5°	±10°

Notes

- Keep eyes outside for reference and situational awareness (80% outside, 20% inside)
- Use section lines @ prominent landmarks to maintain orientation.
    - Easier to use section lines for reference if maneuver is started on a cardinal heading (N, S, E, W).

Maneuvering During Slow Flight PVT, COM

Slow flight develops a pilot's ability to maneuver and control the airplane at high angles of attack and low airspeeds, like approach, landing, and go-arounds. The goal is to establish and maintain an airspeed at which any further increase of angle of attack, increase in load factor, or reduction in power would result in a stall warning (stall horn or buffet). Slow flight must be accomplished **above 1,500 AGL.**

My Airplane Parameters
V_{FE}:
Target Airspeed:
Recovery Flaps:
Safe Retraction Speed:

1. Clear the area: "clear left, center, right" or 90° clearing turns.
2. Confirm and verbalize airspeed, altitude, and heading/forward reference.
3. **Landing configuration** flow
4. Reduce power to ~1500 RPM or ~15" MAP.
5. Decelerate to below V_{FE}, then extend flaps in increments.
6. Slow to target speed, approximately 5-10 knots above 1G stall speed.
7. Increase power to maintain altitude, pitch forward to hold airspeed.
8. Pitch for airspeed, power for altitude
    a. Level flight, climbs, turns, and descents as required without activating a stall warning (max 15° bank)
    b. Carb heat – off (if applicable) once power is in green arc.
9. Recover:
    a. Full power, hold altitude with forward pressure and nose to horizon.
    b. Carb heat – off (if applicable)
    c. Flaps to recovery position
10. Above safe retraction speed, retract flaps in steps.
    a. Back pressure required to keep nose on horizon as flaps retract.
11. **Cruise configuration** flow/checklist

ACS Tolerances				
	Airspeed	Altitude	Bank	Heading
PVT	+10/-0 KIAS	±100'	±10°	±10°
COM	+5/-0 KIAS	±50'	±5°	

Power-Off Stall — PVT, COM

Recognizing and recovering from power-off stalls prepares the pilot to recognize and avoid potential stalls in the realm of an approach to landing. The maneuver will be performed in the landing configuration. Stall recoveries must be completed **above 1,500 AGL.**

1. Clear the area: "clear left, center, right" or 90° clearing turns.
2. Confirm and verbalize airspeed, altitude, and heading/forward reference.
3. **Landing configuration** flow
4. Reduce power to ~1500 RPM or ~15" MAP.
5. Decelerate to below V_{FE}, then extend flaps in increments.
6. Establish stabilized descent at V_{REF}.
7. Throttle idle (slowly).
8. Wings level or up to 20° bank as assigned.
9. Maintain altitude to induce stall.
10. Verbally acknowledge cues of impending stall (horn, buffet).
11. At full stall (PVT) or first indication of stall (COM) recover:
    a. Nose down to reduce AOA.
    b. Full power.
    c. Carb heat – off (if applicable).
    d. Level wings with rudder, not ailerons.
    a. Flaps to recovery position.
    b. "Positive rate, gear up" (if applicable).
12. Establish climb at V_X or V_Y as appropriate.
13. Above safe retraction speed, retract flaps in steps while maintaining climb.
14. Level off at requested altitude, heading, and airspeed.
15. **Cruise configuration** flow/checklist

My Airplane Parameters
V_{FE}:
V_{REF}:
Recovery Flaps:
Safe Retraction Speed:

ACS Tolerances	Bank	Heading
PVT	±10° not to exceed 20°	±10°
COM	±5° not to exceed 20°	

Power-On Stall — PVT, COM

Power-on stalls train the pilot to recognize and recover from an accidental stall during takeoff, go-around, climb, or when trying to clear an obstacle. The airplane flying handbook recommends practicing them in both the takeoff and cruise configurations. Power-on stalls must be performed at an altitude that allows recovery to be completed **above 1,500 AGL**.

1. Clear the area ("clear left, center, right" or 90° clearing turns).
2. Confirm and verbalize airspeed, altitude, and heading/forward reference.
3. **Takeoff or cruise configuration** flow as specified by instructor/examiner.
4. Carb heat – on.
5. 1500 RPM or 15" MAP (maintain altitude) to slow down to near V_R.
6. At V_R, simultaneously:
    a. Increase pitch (slowly).
    b. Full power (or as requested, no less than 65%).
    c. Carb heat – off.
    d. Right rudder to stay coordinated.
7. Increase pitch attitude to induce stall.
8. Verbally acknowledge cues of impending stall (horn, buffet).
9. At full stall (PVT) or first indication of stall (COM) recover by simultaneously:
    a. Nose forward to reduce AOA.
    b. Full power.
    c. Level wings with rudder, not ailerons.
10. Establish climb at V_Y.
11. Above safe retraction speed, retract takeoff flaps (if applicable).
12. Level off at requested altitude, heading, and airspeed.
13. **Cruise configuration** flow/checklist

My Airplane Parameters
V_R:
Takeoff Flaps:
Safe Retraction Speed:

ACS Tolerances		
	Bank	Heading
PVT COM	±10° not to exceed 20°	±10°

Emergency Descent — PVT, COM

During a simulated emergency descent, you must be able to recognize situations requiring an emergency descent, such as cockpit smoke and/or fire, depressurization, or medical emergency. Situational awareness, appropriate division of attention, and positive load factors should be maintained during the maneuver and descent.

1. Clear the area ("clear left, center, right" or 90° clearing turns).
2. **Cruise configuration** flow.
3. Carb heat – on.
4. Power idle.
5. Bank 30°-45° and establish a spiraling descent.
6. Pitch for and maintain V_{NO} (training) or V_{NE} (real emergency).
7. Time permitting, run emergency checklist appropriate to scenario (e.g. engine fire, power off landing).
    a. At relatively low altitudes used for training, there probably won't be time. Rely on memory items instead.
8. 100' prior to desired level-off altitude, smoothly level the wings and apply backpressure to arrest descent.
9. Cruise power, then **cruise configuration** flow/checklist.

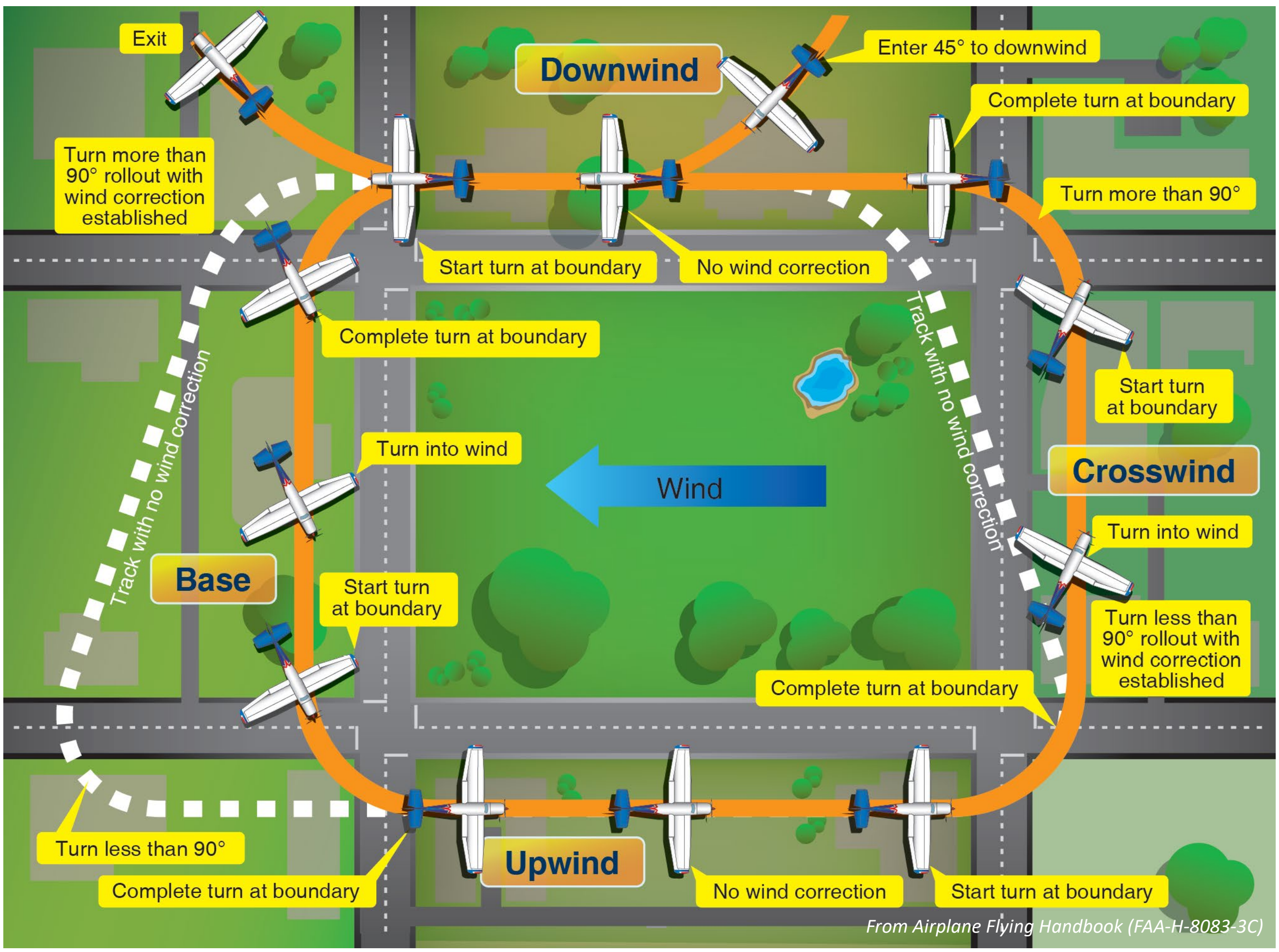
My Airplane Parameters
V_{NO}:
V_{NE}:

ACS Tolerances			
	Airspeed	Altitude	Bank
PVT COM	+0/-10 KIAS	±100' level off	30°-45°

The rectangular course ground reference maneuver maintains an equal distance from all sides of a rectangular reference (e.g., a field). The purpose of the maneuver is to replicate and practice a typical airport traffic pattern. Because of the low altitudes, ground reference maneuvers should only be performed over rural areas free of homes, occupied farm buildings, and obstacles. Rectangular course must be completed **between 600’ and 1,000’ AGL.**

1. Clear the area (“clear left, center, right” or 90° clearing turns).
2. Select a suitable ground-based reference (square or rectangular field, or area with 4 clear boundaries).
    a. Keep in mind obstacles and possible emergency landing sites.
3. Confirm stable airspeed (recommend ________ KIAS @ ________RPM) and altitude between 600’ and 1000’ AGL.
4. **Cruise configuration** flow.
5. Enter at a 45° angle to the downwind leg.
6. Apply wind drift corrections as necessary to maintain ½ to ¾ mile distance from the reference area boundary.
7. Maintain altitude and airspeed during the maneuver.
8. Exit rectangular course once reestablished on the downwind leg.
9. **Cruise configuration** flow/checklist.

ACS Tolerances		
	Airspeed	Altitude
PVT	±10 KIAS	±100’



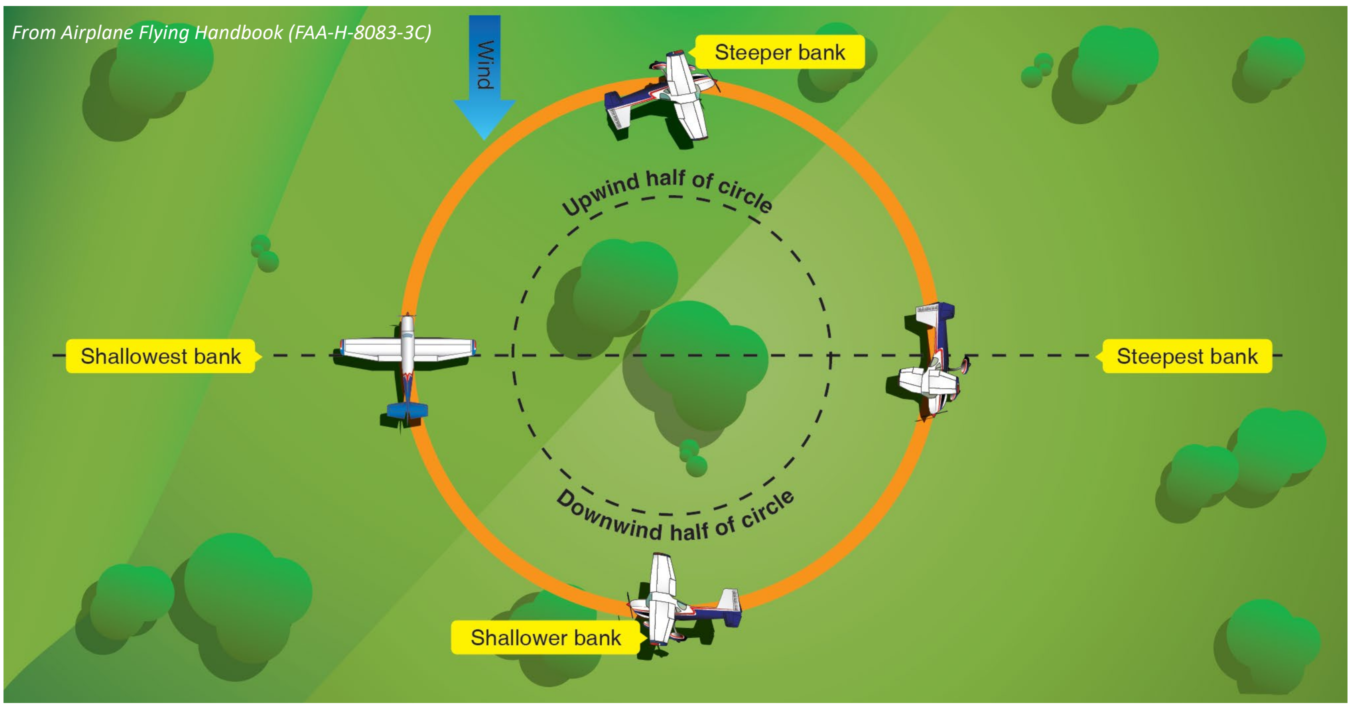
From Airplane Flying Handbook (FAA-H-8083-3C)

Turns Around a Point PVT

Turns around a point consists of a 360° constant radius turn around a single ground reference point. The pilot will need to constantly adjust the bank angle of the aircraft to maintain a constant turn radius as the airplane's ground speed varies due to wind. Because of the low altitudes, ground reference maneuvers should only be performed over rural areas free of homes, occupied farm buildings, and obstacles. The maneuver must be completed **between 600' and 1,000' AGL.**

1. Clear the area ("clear left, center, right" or 90° clearing turns).
2. Select a suitable ground-based reference point.
    a. Keep in mind obstacles and possible emergency landing sites.
3. Confirm stable airspeed (recommend _______ KIAS @ ~_______ RPM) and altitude between 600' and 1000' AGL.
4. **Cruise configuration** flow.
5. Enter on the downwind.
6. Adjust bank angle to maintain a constant radius turn.
    a. Will need to shallow the bank continuously during the 1st half, then steepen it during the 2nd.
7. Level the wings once a 360° turn is complete and exit on the entry heading.
8. **Cruise configuration** flow/checklist.

ACS Tolerances		
	Airspeed	Altitude
PVT	±10 KIAS	±100'



Methods for Determining Wind Direction:

- Airport ATIS/AWOS/ASOS.
- Smoke drift.
- Wind drift circle:
    - Abeam a ground reference, execute a constant 30° bank turn for 360°.
    - At original heading, new position relative to where you started provides wind direction.
    - Longest radius = downwind. Shortest radius = upwind.

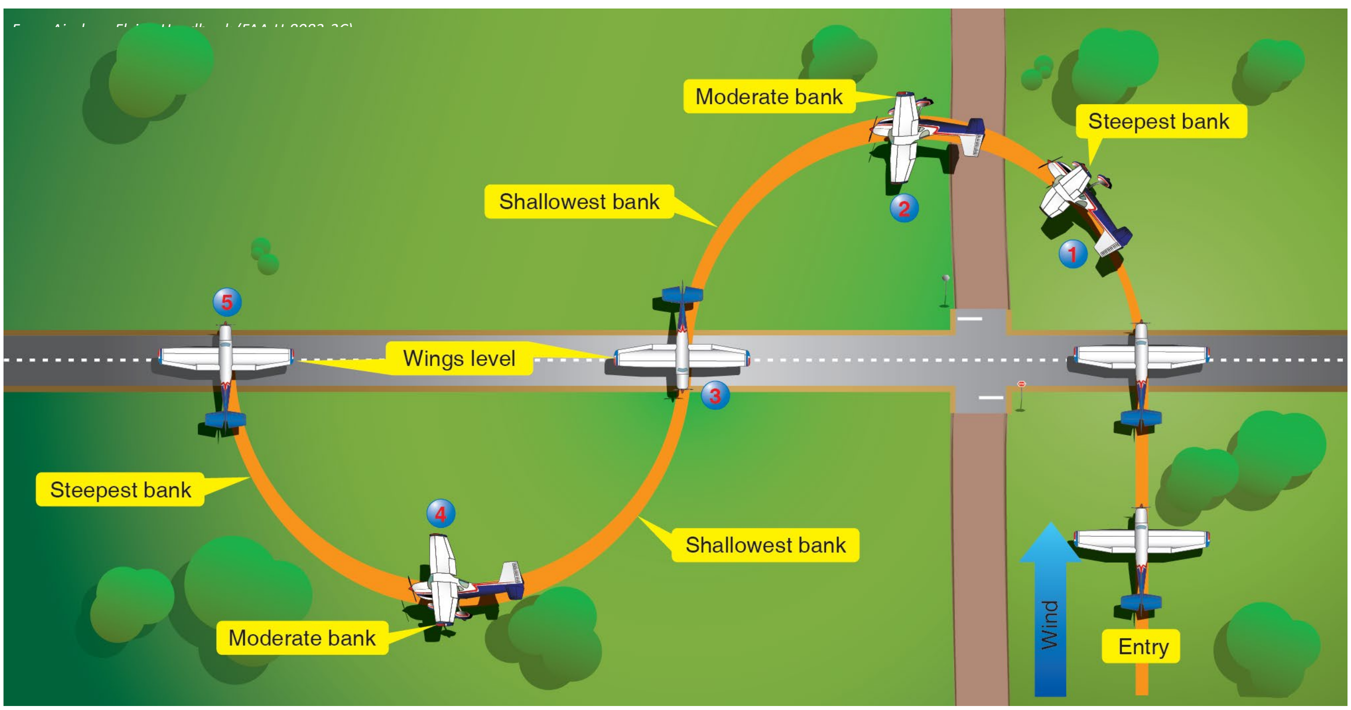
Note: always remain vigilant for an off-airport landing site should an engine failure occur.

S-Turns PVT

S-turns consist of two opposite but equal half-circles on each side of a selected ground-based straight-line reference. They demonstrate a pilot's ability apply wind-drift corrections to fly a constant radius turn as well as to develop the pilot's ability to divide their attention between flightpath, ground-based references, manipulating the flight controls, and scanning for outside hazards and instrument indications. Because of the low altitudes, ground reference maneuvers should only be performed over rural areas free of homes, occupied farm buildings, and obstacles. S-turns are flown at an altitude **between 600' AGL and 1,000' AGL.**

1. Clear the area ("clear left, center, right" or 90° clearing turns).
2. Select a suitable ground-based reference line perpendicular to the wind.
3. Confirm stable airspeed (recommend ______ KIAS @ ~______ RPM) and altitude between 600' and 1000' AGL.
4. **Cruise configuration** flow.
5. Enter on the downwind.
6. Adjust bank angle throughout the turn to fly a constant radius turn.
    a. Establish steepest bank initially (recommend 20°).
    b. Shallow the bank as turn progresses depending on wind strength.
    c. Maintain altitude and airspeed.
7. Roll wings level crossing over reference line, then repeat turn in opposite direction.
    a. Establish shallow bank at same angle required at the end of the first turn.
    b. Steepen bank as turn progresses to cross reference line perpendicular.
8. Level wings once across the reference line.
9. **Cruise configuration** flow/checklist.

ACS Tolerances		
	Airspeed	Altitude
PVT	±10 KIAS	±100'

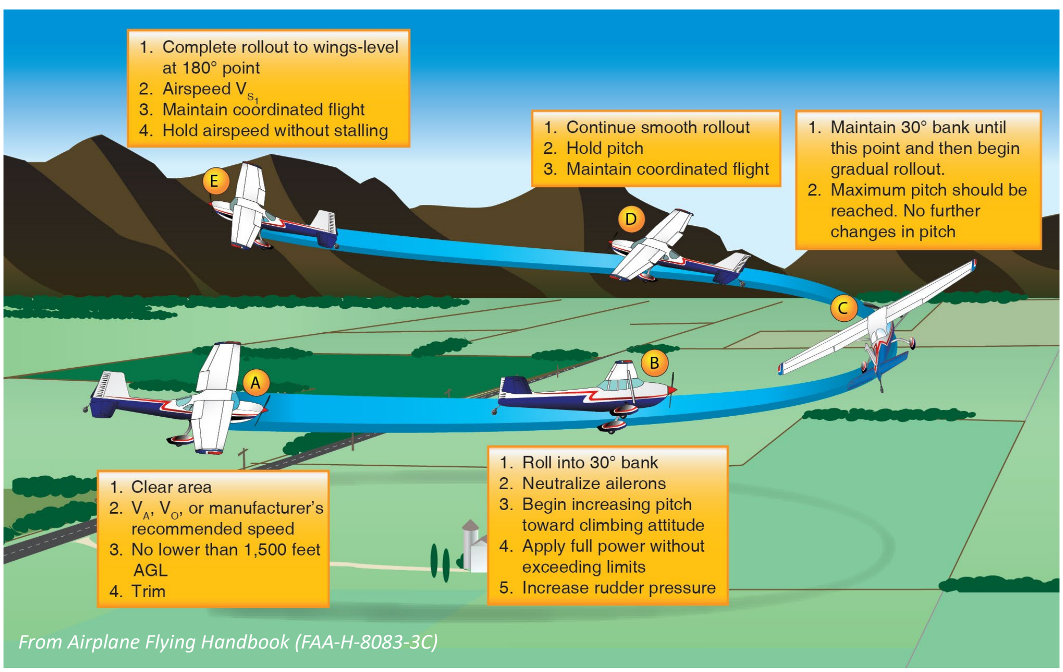


Chandelles COM

A chandelle is a maximum performance, 180° climbing turn that concludes with the airplane in a wings-level, nose-high attitude just above stall speed. The goal is to reverse course while gaining the most altitude possible. The first half of the turn consists of a constant bank angle and changing pitch. The second half consists of a constant pitch and changing bank. Chandelles must be performed **above 1,500 AGL.**

1. Clear the area (“clear left, center, right” or 90° clearing turns).
2. Choose a reference point off the wing in the direction the maneuver is to be performed.
    a. Recommend a road or section line perpendicular to aircraft path.
3. Confirm and verbalize airspeed (~V_A), altitude, and heading/reference.
4. **Cruise configuration** flow.
5. Mixture – rich.
6. Roll into a 30° bank.
7. Full power.
8. First 90° of turn (ends when nose is parallel with reference line).
    a. Maintain a constant 30° bank.
    b. Gradually add backpressure to increase pitch attitude to highest pitch (~12° nose up) at 90° point.
9. Second 90° of turn (ends with reference line off opposite wing).
    a. Maintain a constant pitch attitude (will require more backpressure as speed decreases).
    b. Gradually reduce bank angle to achieve wings level at 180° point.
    c. Apply more and more right rudder to maintain coordination as speed decreases.
10. Momentarily maintain airspeed just above stall (~$1.15V_{S1}$, okay if stall horn sounds intermittently).
11. Slowly lower the nose to accelerate without losing altitude.
12. **Cruise configuration** flow/checklist.

ACS Tolerances	
	Heading
COM	±10°



From Airplane Flying Handbook (FAA-H-8083-3C)

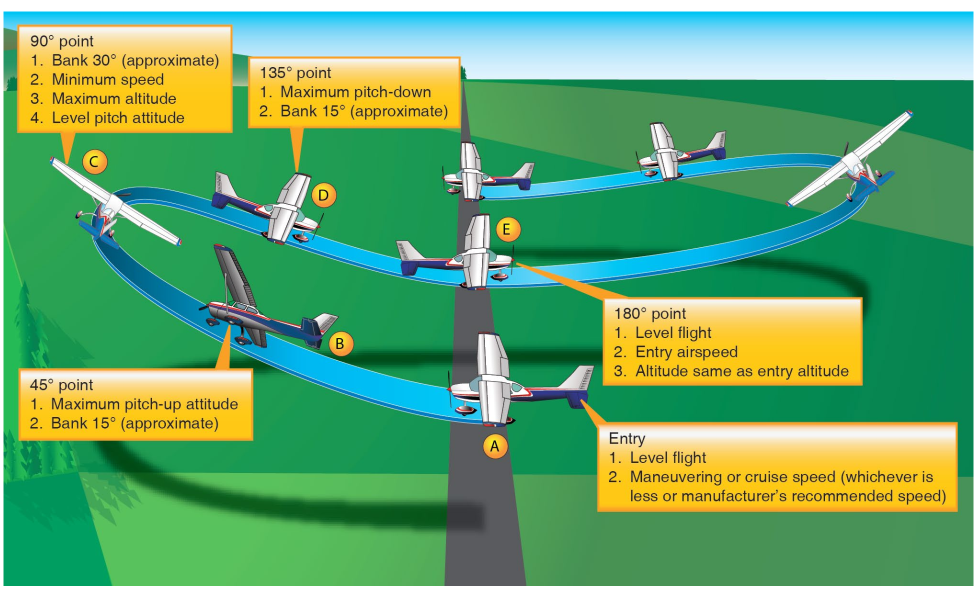
Note: if airspeed at end of maneuver consistently exceeds V_{S1} + 10, increase maximum pitch angle

Lazy Eights — COM

Lazy eights are similar to S-turns with a climb and descent added to each half-turn. The purpose of the maneuver is to develop proper coordination of flight controls across a wide range of airspeeds and altitudes. In fact, it is the only flighty training maneuver in which flight control pressures are constantly changing. Unlike S-turns, lazy eights are not ground reference maneuvers. There is no requirement to correct for wind to stay over a reference point. The Lazy 8 name derives from the 8 sliced on the horizon by the nose of the aircraft. Lazy eights are to be performed **above 1,500 AGL.**

1. Clear the area ("clear left, center, right" or 90° clearing turns).
2. **Cruise configuration** flow
3. Choose a reference point off the wing in the direction the maneuver is to be performed.
    a. Recommend a road or section line perpendicular to aircraft path.
4. Confirm and verbalize airspeed (~V_A), altitude, and heading/reference.
5. Bank slightly (~5°) and slowly pitch up, allowing airplane to overbank.
6. 0° – 45°:
    a. Target 15° bank by 45° reference.
    b. Target maximum nose-up pitch attitude (~15°) by 45° reference.
    c. Airspeed decaying to just above stall.
7. 45° – 90°:
    a. Target 30° bank by 90° reference.
    b. Relax backpressure to allow nose to slice through horizon at 90° reference.
8. 90° – 135°:
    a. Gradually start reducing bank. Target 15° by 135° reference.
    b. Allow nose to keep falling and attain maximum nose-down attitude (~15°) by at 135° reference.
    c. Airspeed is increasing.
9. 135° – 180°:
    a. Continue to reduce bank. Target wings-level at 180° reference.
    b. Increase backpressure to attain level pitch attitude at 180° reference.
10. Confirm airspeed, altitude, and heading are close to original.
11. Repeat maneuver in opposite direction.
12. **Cruise configuration** flow/checklist.

ACS Tolerances			
	Airspeed	Altitude	Heading
COM	±10 KIAS	±100'	±10°



Steep Spirals — COM

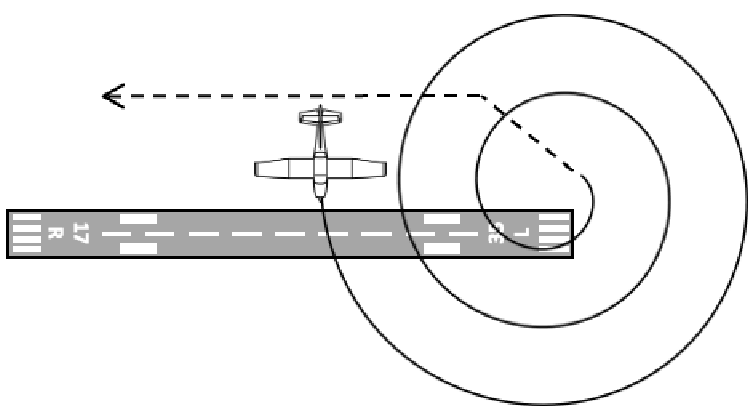
A steep spiral is designed to dissipate substantial amounts of altitude while keeping the airplane over a selected spot—useful for setting up a power-off emergency landing. The goal is to maintain a constant radius turn around a surface-based reference point like turns around a point but with a descent. For training and evaluation, the maneuver must be started at an altitude that allows for three complete turns and concludes **above 1,500 AGL**.

ACS Tolerances			
	Airspeed	Heading	Bank
COM	±10 KIAS	±10°	<60°

1. Climb to an altitude that will allow 3 full turns (recommend 4,500 AGL).
2. Clear the area (“clear left, center, right” or 90° clearing turns).
3. **Cruise configuration** flow
4. Note/bug initial heading.
5. Select a reference point very close to the left side of the aircraft inboard of the main gear.
6. Carb heat – on (if applicable).
7. Power idle.
8. Slow to V_G or V_A (as appropriate for airplane), then bank ~45° to begin spiral.
9. Use full nose-up trim to help maintain airspeed during maneuver.
10. Adjust bank as necessary maintain radius from reference not to exceed 60°.
11. Every 360°, clear engine by advancing and retracting throttle.
12. Upon completion of 3rd spiral, roll out on initial heading.
13. Advance throttle to resume cruise and hold forward pressure until excess nose-up trim is removed.
14. **Cruise configuration** flow/checklist.

Notes:

- Best glide descent vs. maneuvering speed descent.
  - Technique difference is contingent upon scenario presented to the pilot and the aircraft glide characteristics.
- Left or right turns?
  - Pilot flying in the left seat – make spiral turns to the left and fly left traffic into the landing airport.
  - Pilot flying in the right seat – make spiral turns to the right and fly right traffic into the landing airport.
- If transitioning directly into an emergency landing:
  - Spiral over departure end of runway
  - 1,500 – 1,700 AGL is a good altitude to depart the spiral into a downwind entry for the intended runway



Accelerated Stall — COM

Accelerated stalls demonstrate that an aircraft can stall at airspeeds above V_{S0}/V_{S1} when load factors above +1G. They should be completed at an altitude that allows recovery to be completed above 3,000 AGL and should never be practiced with flaps deployed.

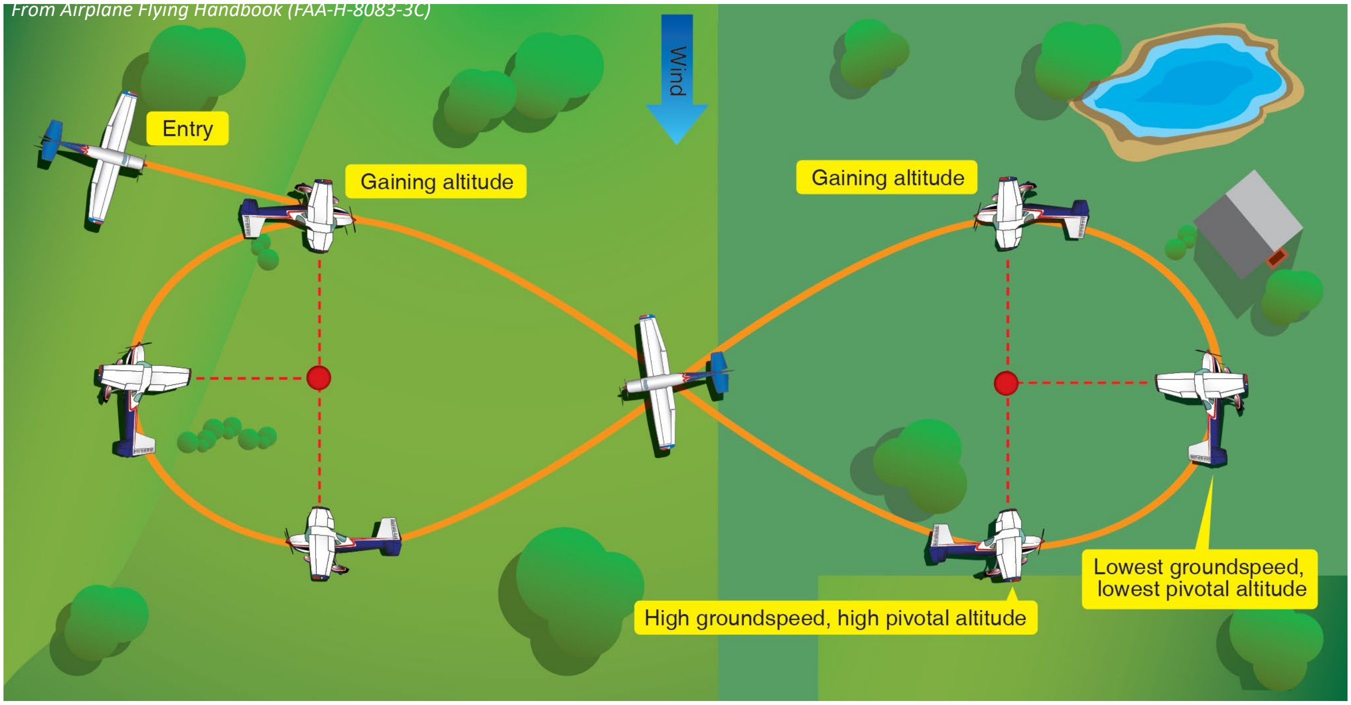
1. Clear the area ("clear left, center, right" or 90° clearing turns).
2. **Cruise configuration** flow.
3. Mixture – rich.
4. Low-end cruise power setting (recommend _______ RPM).
5. Maintain altitude and slow below V_A.
6. Bank 45° and allow the nose to fall below the horizon to establish a slight descent.
7. Smoothly but definitively increase backpressure until the first indication of a stall.
   a. The aircraft nose should pull across the horizon more so than up above it.
8. Acknowledge the first indication of a stall, recover – simultaneously:
   a. Relax backpressure to reduce AOA.
   b. Level the wings.
   c. Full power.
9. Establish climb at V_Y or V_X as requested.
10. Level off at requested altitude, heading, and airspeed.
11. **Cruise configuration** flow/checklist.

Eights on Pylons — COM

Eights on pylons are a ground reference maneuver in which the pilot selects two ground reference points and traces a figure eight pattern around them. During the maneuver, the pilot must keep the extended lateral axis of the airplane on the selected fixed on each pylon (airplane on a stick). This is done by keeping the airplane at the pivotal altitude, which will change as groundspeed varies due to wind.

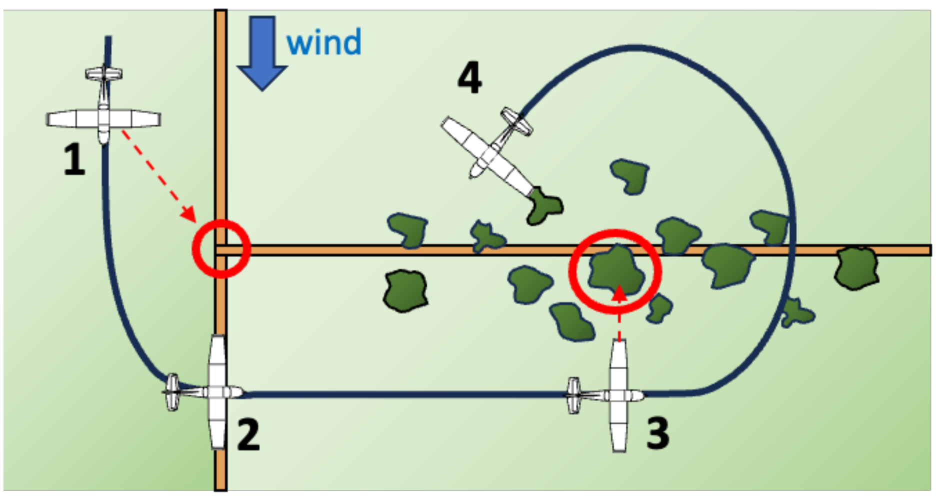
1. Determine the pivotal altitude given the current ground speed and climb/descend to it.
2. Clear the area ("clear left, center, right" or 90° clearing turns).
3. **Cruise configuration** flow
4. Establish a cruise airspeed near the maximum allowable continuous power setting.
   a. A low airspeed combined with a high headwind might result in a pivotal altitude below 500 AGL and cause a violation of §91.119.
   b. The maneuver should not require bank angles greater than 45. Therefore, overstressing the airframe is not a factor and maneuvering speed can be exceeded.
5. Use expanded procedure (see below) to determine two appropriate pylons.
6. Enter the maneuver at a 45° angle to the downwind at the midpoint between the pylons.
7. Once abeam 1st pylon, bank to put the extended lateral axis on the pylon (just above or below midpoint of wing)
8. Climb/descend as necessary to stay at the pivotal altitude during the pylon turn.
   a. If the pylon moves forward, move the yoke forward to dive and catch it.
   b. If the pylon moves backward, move the yoke back to let it catch up to you.
   c. Do not cheat and use rudder to slip/skid to keep the pylon centered on the wing.
   d. Expect to descend during the 1st half of the turn and climb during the 2nd half.
9. Roll wings level once at a 45° angle to the line between the pylons.
10. Execute another pylon turn once abeam the 2nd pylon.
11. Exit maneuver on entry heading.
12. **Cruise configuration** flow/checklist

ACS Tolerances	
	Bank
COM	<40°



Method for selecting pylons:

1. Select a prominent pylon with a road, fence line, or other reference line coming off it perpendicular to the wind.
2. Maneuver downwind of the 1st pylon slightly above the estimated pivotal altitude and start a timer.
3. After 20 seconds, whatever prominent feature on the reference line abeam your aircraft is the 2nd pylon.
4. Loop around the 2nd pylon, descend to the pivotal altitude, and begin the maneuver.



Groundspeed (kts)	Pivotal Altitude (feet AGL)
70	430
75	500
80	570
85	640
90	720
95	800
100	880
105	980
110	1070
115	1170
120	1270

Pivotal Altitude:

The formula for pivotal altitude is ground speed squared divided by 11.3, or use the above table:

Secondary Stall CFI

A secondary stall occurs after recovery from a preceding stall if the recovery is too abrupt. It emphasizes the importance of reducing angle of attack and gaining speed, rather than attempting to minimize altitude loss. The maneuver should be completed at an altitude that allows **recovery above 1,500 AGL**.

1. Clear the area (“clear left, center, right” or 90° clearing turns).
2. Set up and perform either a power-off or power-on stall to a full stall.
1. During recovery, pitch up abruptly before allowing airspeed to build sufficiently to induce secondary stall.
2. Acknowledge the stall indication (for the second time) and execute proper stall recovery.
3. **Cruise configuration** flow/checklist.

Elevator Trim Stall CFI

The elevator trim stall demonstrates the effects when a pilot applies full power for a go-around without maintaining positive control of the airplane. It shows the importance of using strong control pressures to overcome strong trim forces. It should be completed at an altitude that allows **recovery above 1,500 AGL**.

1. Clear the area (“clear left, center, right” or 90° clearing turns).
2. Execute a power-off stall profile up through the establish a stabilized descent at V_{REF} step.
3. Trim aircraft for a hands-off descent at V_{REF} at an idle power setting.
4. Verbalize “go-around.” Smoothly apply full power to simulate a go-around.
5. Carb heat – off.
6. Allow nose to rise (do not hold any elevator pressure).
7. Control the yaw with rudder to maintain heading.
8. Acknowledge first indication of stall, push yoke forward to reduce AOA, and execute power-off stall recovery.
9. **Cruise configuration** flow/checklist

Cross-Control Stall CFI

The cross-control stall demonstrates the effects of uncoordinated flight on stall behavior and emphasizes the importance of maintaining coordinated flight, especially in the base-to-final turn. The airplane is placed in a skidding turn before increasing the AOA to induce a stall. Because of the intentional skid, the cross-control stall should always be recovered at the first indication of stall. The cross-control stall should be completed at an altitude that allows **recovery above 3,000’ AGL.**

1. Clear the area (“clear left, center, right” or 90° clearing turns).
2. Execute a power-off stall profile up through the establish a stabilized descent at V_{REF} step but do not use flaps.
3. Bank 30° to simulate the base-to-final turn.
4. Smoothly apply excess rudder pressure in direction of turn.
5. Apply opposite ailerons to prevent overbanking and maintain constant bank angle.
6. Increase backpressure to induce stall.
7. Acknowledge first indication of stall and recover by simultaneously:
    a. Nose down to reduce AOA.
    b. Remove skidding rudder input.
    c. Full power.
    d. Carb heat – off (if applicable).
    e. Level wings.
8. Execute power-off stall recovery.
9. **Cruise configuration** flow/checklist.

Instrument Flying and Procedures

Basic Attitude Instrument Flying for Non-Instrument Pilots — PVT, COM

Flying without reference to the outside (visual) horizon is an **EMERGENCY** for a non-instrument rated pilot. You **MUST** get back to visual conditions!

Scan

- Scan, interpret & control solely by the instruments.
- Do NOT trust your body's sensations.
- Look at all instruments with a systematic movement of your eyes (scan)
- Do not fixate on any instruments.

Control Inputs

- Do not use large control inputs.
- Use 15° or less in bank (half standard-rate turns).
- Use +/- 7° pitch control: 3 bar widths of the attitude indicator's aircraft's wings.
- USE FINESE
- Overcontrolling (large control inputs) will easily leads to vertigo and spatial disorientation.

180° Turn

- Typically, the quickest maneuver to exit IFR conditions is a 180° turn.
- Hopefully VFR conditions are behind you, where you came from.
- **Scan, interpret & control SOLELY by the instruments.**
- Look at bottom of Heading Indicator for the best exit heading.
- Verbalize the new heading.
- Scan, interpret & control SOLELY by the instruments initiate a turn to the new exit heading.
- Use no more than 15° of bank.
- Roll out on the new exit heading and hold this heading you re-encounter VFR conditions.

Declaring An Emergency

- If unable to locate VFR conditions with the 180° turn, you are now well established in an **EMERGENCY**!
- Scan, interpret & control SOLELY by the instruments.
- Fly the aircraft first and foremost.

Climb	• Improved obstacle clearance • Improved radio & radar coverage for ATC or FSS
Confess	• Tell yourself that you are in danger.
Communicate	• Dial in 121.5 & 7700 • Contact any FSS or ATC for help • "May Day, May Day, May Day" • Non-instrument pilot in IFR conditions • Request assistance for VFR conditions
Comply	• Follow ATC instructions and scan instruments
Conserve	• Set power & mixture for cruise

This is a fundamental skill for instrument rated pilots.

- Scan (cross check)
  - No one procedure works for all pilots.
  - Centralized scan based on the attitude indicator.
- Interpretation of instruments
  - Watch the needles and understand what the instruments are revealing.
  - Is the aircraft flying in a condition desired by the pilot?
- Control of aircraft
  - Scan, interpret & control solely by the instruments.
  - Positively control the aircraft’s pitch, roll, and yaw from scan and interpreting the instruments.
- Maneuvers Building BAI Skills
  - Patterns A, B, C in the Instrument Flying Handbook
  - Vertical S maneuver

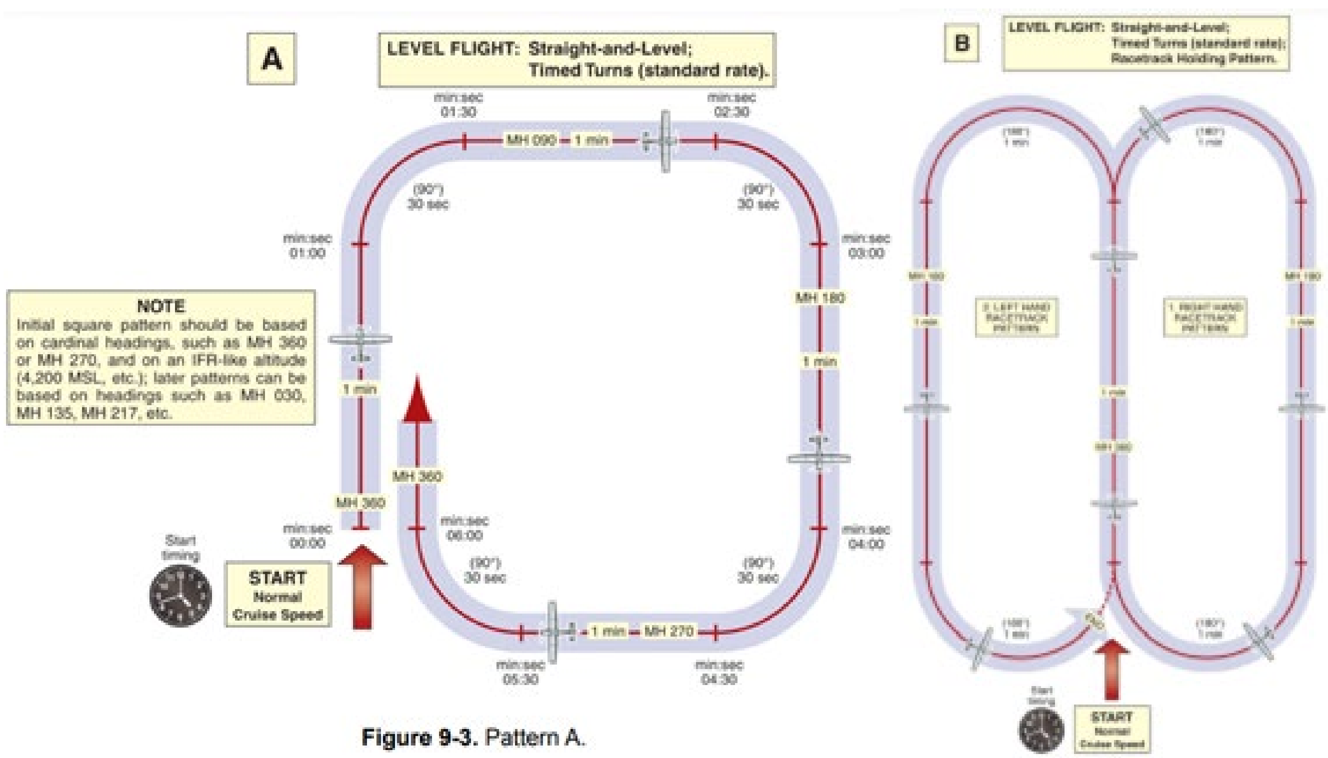


Figure 9-3. Pattern A.

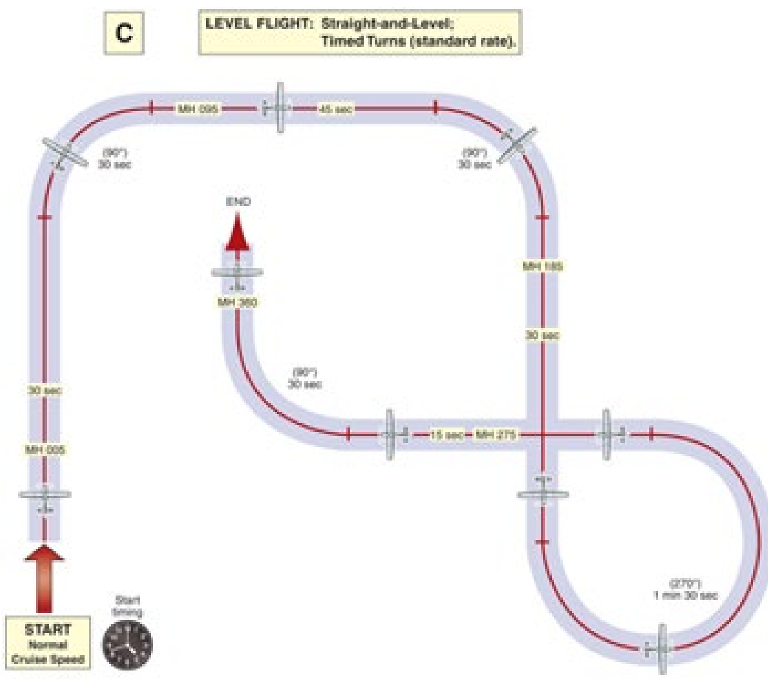
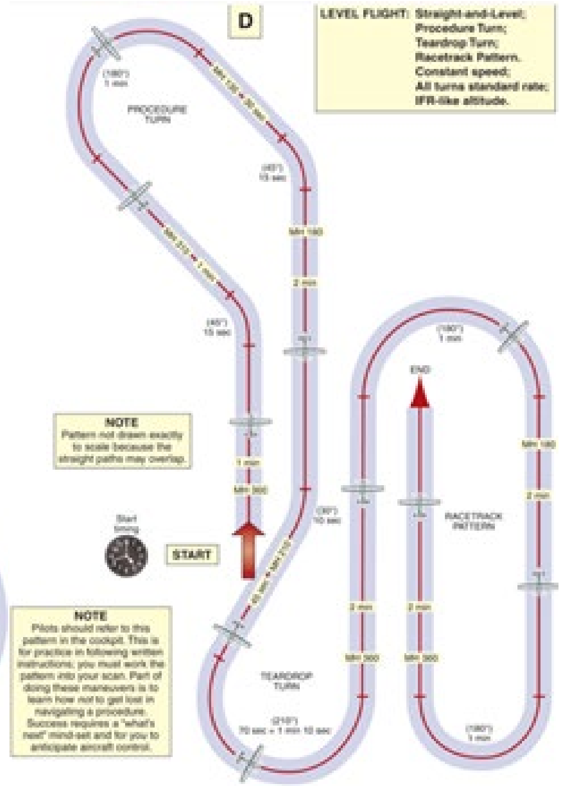
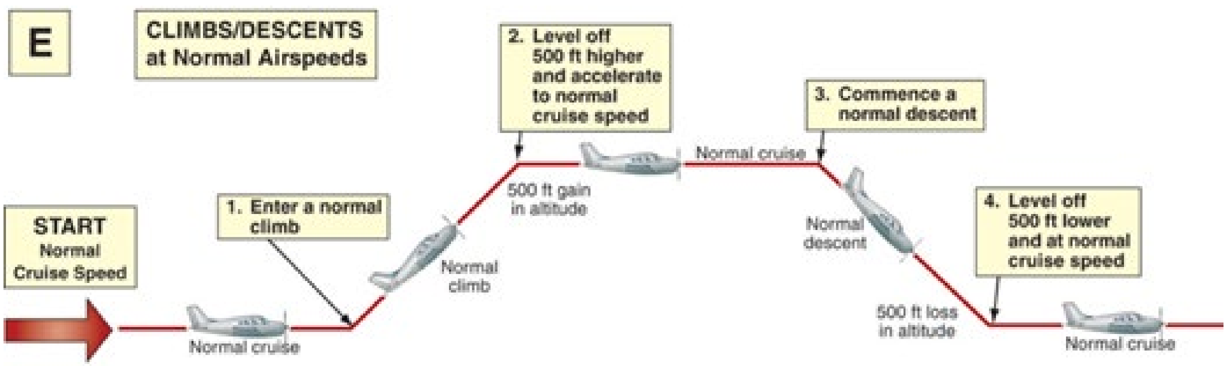
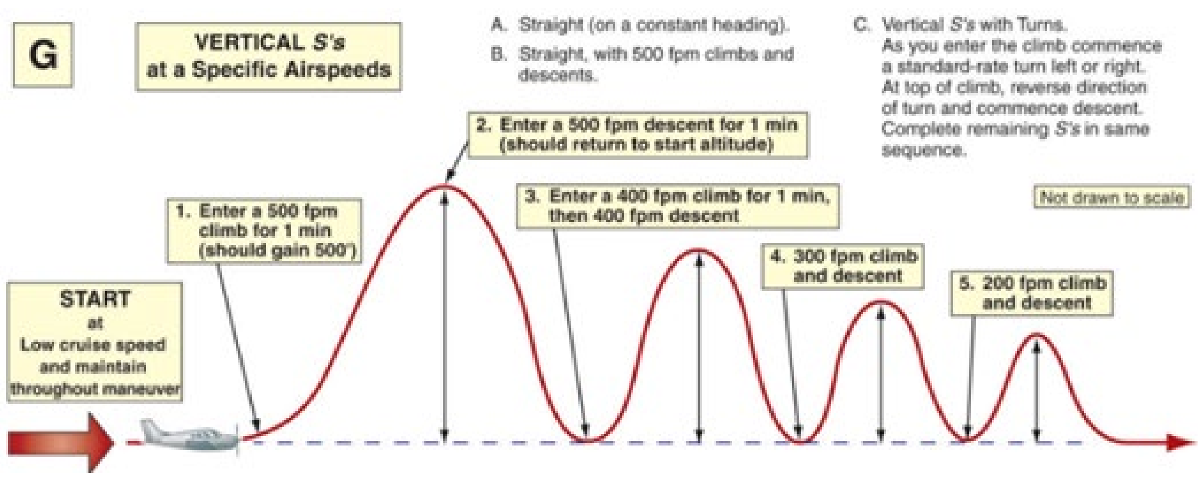


Figure 9-5. Pattern C.







Interpreting the Instruments

Attitude Indicator

- This is the most important instrument for setting any attitude or transitioning to a new flight attitude.
- Bank information referenced for 10°, 20°, 30°, 60°, and 90°
- Pitch information referenced in 5° graduations for + and - pitch attitudes.
- Changing attitude by one width of the reference aircraft's wings = 2° of pitch change. This is an extremely important reference to understand & use wisely.
- ½ width of wings = 1° pitch change.

Pitch Information

- Altimeter (primary), airspeed indicator (supporting), and VSI (supporting).
- Attitude indicator used solely as a transition to pitch attitudes instrument only.

Bank (Roll) Information

- Heading indicator (primary), compass (supporting), and turn coordinator (supporting).
- Attitude Indicator is solely used as a transition to bank attitudes instrument only.

Yaw Information

- The ball of the Inclinometer (slab on the PFD) is primary for yaw information.
- Step on the ball to coordinate.

Performance information

- A key concept to understand is ***angle of attack (pitch) + power = performance***
- Pitch and power are inter-related in getting the desired performance from the aircraft.
- Airspeed Indicator and Tachometer/Manifold Pressure are performance indicators.

BAI Rules of Thumb

- Finesse is paramount. Scan and control to catch any problem ASAP and make the smallest control inputs required.
- Lead altitude level offs by 10% of VSI rate (e.g., 500 FPM becomes a 50' lead factor).
- Lead heading roll outs by ½ of the bank angle (e.g., 30° of bank becomes a 15° lead factor).
- For altitude deviation within 100', use 1° or less of pitch change for corrections.
- Any heading deviation within 10°, use the rudder to correct (very useful on a localizer approach).
- For heading deviation more than 10°, use a bank angle less than ½ of the deviation up to standard rate (e.g., 20° off heading is corrected with a 10° bank).

Unusual Attitude Recoveries — PVT, IR

Scan the instruments to spot excessive attitude, airspeed, or other undesired states. Recovering from an unusual attitude is broken down into two phases: identification and recovery.

1. Identifying the Unusual Attitude

Nose High Indications

- Attitude Indicator well into blue sky.
- Airspeed decaying rapidly.
- Altitude possibly climbing.
- Heading Indicator possibly turning.

Nose Low Indications

- Attitude Indicator well into the black (brown) area.
- Airspeed increasing rapidly.
- Altitude decaying rapidly.
- Heading Indicator possibly turning.

2. Recovery

Nose High Recovery

1. Full power.
2. Push to reduce pitch attitude to reverse slow airspeed trend.
3. Level wings with attitude indicator turn-coordinator to stop heading Indicator trend.
4. Stabilize back to cruise airspeed and control altitude.
5. Reduce power to cruise setting and complete cruise checklist.

Nose Low Recovery

1. Power idle
2. Level wings with attitude indicator to stop heading Indicator trend.
    a. Must be done before increasing pitch to prevent accelerated stall.
3. Smoothly pull to Increase pitch attitude to reverse high airspeed trend.
4. Stabilize back to cruise airspeed and control altitude.
5. Increase power to cruise setting and complete cruise checklist.

Note: If attitude indicator is tumbling, use turn coordinator to level wings and altimeter trend to determine pitch.

VOR Navigation — PVT, IR

To successfully navigate using VORs, it is very helpful to know what heading each cardinal direction corresponds to:

- North ....360°
- Northeast.....045°
- East ....090°
- Southeast.....135°
- South ....180°
- Southwest....225°
- West............270°
- Northwest....315°

VOR Orientation

- Tune & identify the nav aid for the proper Morse code Identifier.
- Rotate the OBS knob until the CDI centers with a FROM flag.
- Read the aircraft's current radial at the top of the OBS compass card.
- Mentally correspond the radial to the 8 cardinal compass points for orientation.

VOR Cross Check for Positional Awareness

- Locate yourself on the chart using two VORs.
- Simply use the Orientation procedure using 2 VORs.
- Where the radials intersect = your position

VOR Radial Interception & Tracking

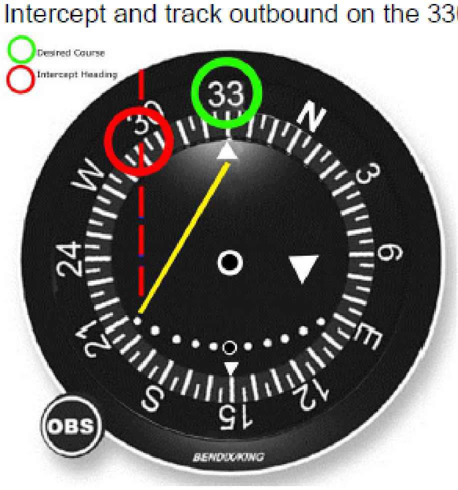
The most important concept to understand is when tracking ***inbound*** on a radial, your desired course is 180° opposite of the radial you're on. When tracking ***outbound*** on a radial, your desired course is the same as the radial.

For example, to track inbound on 180° radial, the desired course is 360°. To track outbound on the 315° radial, the desired course is 315°.VOR Intercept Procedures

1. Tune & identify the nav aid for the proper Morse code identifier.
2. Rotate the OBS knob to set the ***desired course*** (THE MOST IMPORTANT STEP)
3. Note needle deflection, mentally follow the bottom of the CDI needle up to where it intersects the OBS compass card. This deduced heading is the intercept heading.
4. Turn the shortest direction to the intercept heading.
5. Hold the intercept heading, as CDI needle centers, turn back to desired course.
6. Hold constant headings and repeat steps 3 - 5, if necessary for wind correction angles.

Example:

Intercept and track outbound on the 330 Radial.



1. Twist the OBS to Desire Course of 330
2. Note the CDI Needle deflection, follow bottom of needle up to the Compass Card.
3. The intercept heading is 290
4. Turn the aircraft to Compass Heading 290
5. Hold the heading 290 until the CDI Needle starts to center
6. As needle centers, turn the aircraft back to 330
7. If/When the winds at altitude blows you off of center course, Bracket using this technique to establish a Wind Correction Angle that keeps the CDI centered.

Orientation procedures

- Tune & ID the navigational signal or verify the GPS waypoint.
- Look at the needle's position on the heading indicator.
- Locate needle tail's position on the heading indicator.
- The tail of the needle equals the orientation.
- 

Intercepting a Bearing "TO" the Station

DHI Desired to the Head + Intercept.

1. Tune and ID the navigational signal or verify GPS waypoint.
2. Look at the RMI needle position on the heading indicator.
3. Locate the **D**esired bearing on DG.
4. Move from desired bearing to the **H**ead of the needle.
5. Continue in same direction past the head the same number of degrees to an **I**ntercept heading.
6. Turn the aircraft to the intercept heading.
7. As Head of needle falls on the heading indicator to the desired bearing, turn the aircraft to the desired bearing hold constant headings.
8. Hold constant headings, watch for the wind to move to A/C off the desired bearing, then do the DHI method on a small scale to obtain the wind correction angle.

Intercepting a Bearing "from" the Station

TDI Tail to Desired + Intercept

1. Tune & ID the navigational signal or verify GPS waypoint.
2. Look at the needle's position on the heading indicator.
3. Locate the **T**ail of needle on the DG.
4. Move from the tail of needle to the **D**esired bearing.
5. Continue in the same direction past the desired bearing the same number of degrees to the **I**ntercept heading.
6. Turn the aircraft to the intercept heading.
7. As tail of needle rises to the desired bearing, turn the aircraft to the desired bearing.
8. Hold constant headings, watch for the wind to move to aircraft off the desired bearing, then do the TDI method on a small scale to obtain the wind correction angle.

Copying ATC Clearances — PVT, IR, COM

VFR pilots departing an airport within class B or class C will obtain a departure clearance from clearance delivery. The format is easy to remember by the following acronym RAFT.

- R - Route of Flight
- A - Altitude to climb to
- F - Frequency for ATC
- T - Transponder code

IFR pilots will always receive a clearance from clearance delivery (where available), ground control, or ATC / FSS by phone. It always comes in a standard format. An easy memory aid (acronym) for an IFR clearance is CRAFT.

- C - Clearance limit
- R - Route (including SIDs, STARs, preferred routes, after takeoff instructions)
- A - Altitude (initial and expected)
- F - Frequency for ATC
- T - Transponder code

Read back clearance for confirmation or inquire about any questions or problems with the clearance.

Hold / Void Times

If clearance is obtained via telephone from ATC or FSS, understand and comply with any hold for release and void times.

Pilot in Command Authority

- The pilot in command is the ultimate authority of the aircraft.
- Any problems with an ATC clearance should be amended and obtained by the PIC (e.g., vectors toward hazardous weather, requests exceeding aircraft's parameters)

Compass Turns — IR

Compass Errors

Memory Aid – **D.V.M.O.N.A.**

- **D**eviation
- **V**ariation
- **M**agnetic Dip
- **O**scillation Error
- **N**orthern turning errors
- **A**cceleration errors

Reading & Interpreting a Magnetic Compass (Non-Vertical Card)

- Typical aviation compasses can be confusing as the pilot is essentially looking at the back side of the compass.
- As an aid to orientation, set a moveable OBS card to the compass heading then interpret the data.
- Turn to drag the desired heading to the compass lubber line (e.g., if desired heading is right of lubber line, turn to the left)

Compass Turn Compensation Aids

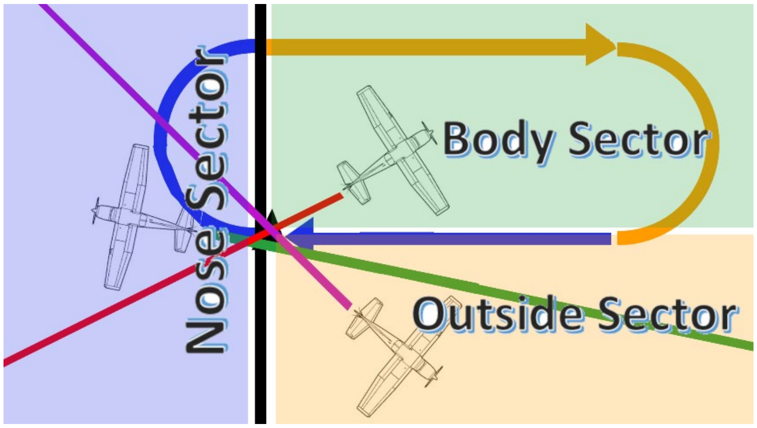
- Memory Aid - U.N.O.S.
- **U**ndershoot **N**orth headings.
- **O**vershoot **S**outh headings.
- Due to magnetic dip, the compass will lag turning north and lead turning south, no error east or west.
- Magnetic dip is a function of the aircraft's latitude.
- Latitude = Undershoot/overshoot factor for north or south.
- Houston is 29 deg North, Correction Factor is approximately 25 -30 deg.

Use the GPS "TRK" data indication as a help in making compass turns and compass tracking when partial panel.

Holding Patterns and Entries IR

Before working on entries, be familiar with the AIM's description and requirements for holding patterns, IFR position reporting requirements, orientation relating to fixes (VOR, RMI, intersections), and hold entries (direct, teardrop, parallel).

There are three hold entry sectors: nose, body, and outside sectors.



Entry Orientation

- The type of entry is contingent upon the sector into which the aircraft enters after crossing the fix (this concept differs from the FAA Recommendation)
- Cross into the Nose = Direct entry
- Cross into the Body = Teardrop entry
- Cross into the Outside = Parallel entry

Cockpit Hold Entry Determination

1. Tune and ID the fix.
2. Go direct to the fix.
3. On heading indicator, locate the outbound holding direction.
    a. The cardinal direction or holding radial in the clearance = outbound direction.
4. Put finger on the outbound direction and move it to the center of the heading indicator creating your inbound leg for visualization.
5. Draw a hook at the center of the DG left or right (with your finger) appropriate to the holding clearance (left turns or right turns).
6. Visualize the holding pattern on the DG.
7. Ask yourself, what entry sector will the aircraft cross into.
    a. Nose = Direct entry, body = teardrop, outside = parallel

Rules of Thumb

- The cardinal direction (N, S, E, W, etc.) In the ATC holding clearance always indicates the outbound direction
- If the outbound direction is in the bottom ½ of the DG, it will be a direct entry; if it is in the top ½ of the DG it is either a teardrop or a parallel entry.
- Wise pilots will request leg lengths (NM) from ATC when issued a holding clearance. This makes flying holds much easier as it removes the requirement for adjustments to make the inbound leg meeting the timing requirements.

DME Arcs — IR

Prior to flying DME arcs in an airplane, you should be familiar with VOR concepts, DME concepts, orientation and intercepts, wind correction factors, and ATC phraseology.

When turning onto a DME arc, use a lead factor of 1% of the ground speed. For example, if flying with a 99 KT ground speed, use a .99 or 1.0 NM lead factor. If inside the 10 DME arc, turn at 9.0 DME. If outside the 10 DME arc, turn at 11.0 DME.

Orientation Tricks

- If confused, simply turn 90° to reference radial then determine left or right correction for wind.
- Use nav 1 for inbound approach course and use nav 2 to fly the arc.
- Radial = orientation.

Flying the Arc (Using the Keep Centering the CDI Method)

1. Tune and ID the VOR and DME (glass cockpit aircraft: set an RMI needle to the VOR fix)
2. Intercept the specified course towards the DME fix (this might be inbound towards the VOR or outbound from the VOR).
3. At a lead distance factor (1% of GS) turn 90° into direction of arc.
4. Aircraft should be approximately 90° to the original radial.
5. Repeat the following steps:
    a. Hold heading until CDI moves ½ to ¾ scale deflection.
    b. Twist OBS to re-center the CDI. This reflects the new reference radial.
    c. Turn the aircraft to be 90° to the new reference radial.
6. Watch DME to compensate for wind. WCA will vary throughout the arc. If distance is less than desired turn away from arc (10° - 15°).
7. Continuously orient yourself (reference radial = position).
8. Watch for inbound course (nav 1) CDI to come alive and turn to intercept this course.

IFR Approach Procedures — IR

Assumes knowledge of Jeppesen and/or NAS approach plates, aircraft power settings and profiles, use of flows and checklists, use of memory aids, and orientation skills.

Orientation Skills

- Be proficient at knowing your location at all times.
- Knowing position allows you to think and prepare ahead of the aircraft.
- VOR orientation (radial = location).
- GPS orientation.
- RMI orientation (tail on heading indicator = location).

The 5 Ts

Use and verbalize the 5 Ts at all fixes: turn, time, twist, throttle, talk.

- Turn - Do you turn? To what heading?
- Time - Do you start clock or note crossing time?
- Twist - Do you twist OBS to a new course?
- Throttle - Do you slow down or go down?
- Talk - Do you make an ATC report?

Approach Briefing

Use a standardized, consistent procedure for organizing and setting up the aircraft for an approach. This briefing must be accomplished correctly prior to being established on any published segment of an approach. W.I.R.E.S. is an excellent aid.

Weather
- obtain local weather, appropriate altimeter setting, the approach in use, NOTAMs

Instruments
- Set heading indicator to compass, attitude indicator altimeter setting.
- Verify no red Xs on the PFD and MFD.

Radios
- Use an organized flow, setting all comms, navs, and GPS based on the designated approach plate.
- Comm 1, Nav 1, Comm 2, Nav 2, GPS, DME, Transponder
- Set frequencies and courses.
- Identify frequencies.

Environment
- Where are you?
- What does ATC expect (vectors or full procedure?)
- Brief the entire approach plate systematically top to bottom.
- **CAT**: Identify each Approach Segment's **C**ourses, **A**ltitudes, **T**imes
- Missed: Identify missed approach fix and procedure
- Landing TDZ plan and taxi plan

Speed
- Slow the aircraft and set aircraft configuration for the airport and landing.
- Know and apply specific aircraft traffic pattern profiles.

Approach Segments Procedures

Enroute/ Transition
- WIRES briefing
- Approach checklist

Initial
- 5 Ts, 2 minutes outbound for procedure turn

Intermediate
- 5 Ts, before landing flows and checklist

Final
- 3 Gs, 5 Ts: gear down, go down, GUMPS, turn, time, twist, throttle, talk
- Descend to minimums (add buffer to MDA).

Missed
- 6 Cs
- Cram, climb, clean, cool, call, comply

Abnormal Procedures

Emergency Procedures and Equipment Malfunctions — PVT, IR, COM

To best prepare yourself to handle the unexpected:

- Be thoroughly knowledgeable about all the systems and components of each system of your aircraft.
- System knowledge improves your ability to handle equipment/system malfunctions.
- Commit to memory all boldfaced procedures specified for emergencies.
- Utilize the checklists for all other emergency or abnormal procedures.
- Exhibit complete procedures on all emergencies and/or equipment malfunctions.

Flow Checks / Patterns

- Boldfaced emergency procedures can be accomplished by flows.
- Flows aid the pilot in stressful situations.
- If time and circumstances permit, a published checklist will be used to confirm a flow is complete.
- In most training aircraft, a flow starting at the fuel selectors moving towards the power quadrant along the instrument panel to the left (side panel) will cover all required controls and panels to meet the extent of an engine related emergency.

Prioritizing Pilot Actions

- First and foremost, fly the aircraft. Maintain control!
- Positional awareness: know your location and know where to land at all times.
- Abnormal problem vs. Life threatening problem
- Safety window?

Safety Window

- Statistically, most aircraft accidents occur during takeoff, initial climb, approach & landing.
- Area of highest workload and numerous diversions of attention.
- General dimensions of safety window:
    - Size is dependent on aircraft speed, pilot's familiarity with area, etc.
    - ≈ 5nm radius below 3000 ft AGL of the airport
- Any problem or emergency within the safety window needs to be dealt with on its severity. Prioritize: what risk level is the event?
- If not a life-threatening event, leave the safety window to get away from the traffic and terrain risks.

Equipment malfunction that can be troubleshot:

- Depart the safety window.
- Fix or troubleshoot the problem.
- Confirm with checklist.
- Return for landing.
- Advise ATC/FSS if problem remains.
- Prepare and brief passengers for possible abnormal / emergency landing.

Simulated Emergencies / Simulated Engine Failures

- Practiced on all flights.
- Will not be practiced below 500' AGL to non-paved runways or off field approaches.
- If advising ATC, use "simulated" in phraseology.
- Practiced to full landing at approved airports paved runways only!

Examples of Simulated Emergencies to practice

- Engine failures (on takeoff, climb, cruise, decent in the traffic pattern)
- Engine fires & electrical fires
- Landing gear failures
- Flat tires
- Flap failures (up or stuck in position)
- Control cable (pitch & bank) failure or binding
- Throttle cable failure (stuck at full power)
- Electrical failures
- Radio failures
- Fuel low scenarios
- Lost procedures
- Pilot or passenger illness
- All emergency / abnormal procedures listed in Section 3 of the AFM (Emergency Procedures)

Lost Communications — PVT, IR, COM

The first step in a lost communications situation is to determine if the problem is real. As with any abnormal problem, first priority is to fly the aircraft. Then troubleshoot by checking:

- radio volume,
- headset jacks,
- audio panel selector switch positions,
- other radios,
- hand microphone,
- change frequencies, and
- utilize Guard Frequency 121.5.

Use backup hand-held transceiver if available. Also monitor VOR audio function for possible blind ATC radio calls. Once you have determined the lost communications is permanent, broadcast in the blind and squawk 7600 code in transponder.

Uncontrolled Airport (VFR)

- Overfly the airport at a minimum of traffic pattern altitude plus 1000 feet.
- Determine wind direction & appropriate runway to use.
- Note the traffic pattern for any other aircraft!
- Maneuver to enter the appropriate downwind on the standard 45° entry.
- Be vigilant for aircraft.
- Fly the pattern and land.

Controlled Airport (VFR)

- Broadcast blind and squawk 7600.
- Climb to 2500’ AGL above Class D airspace to circle above the airport.
- Note runway in use and traffic in the pattern.
- Maneuver to enter the appropriate downwind on the standard 45° entry.
- Rock wings and flash lights to draw the control tower’s attention.
- Use vigilance for aircraft.
- Comply with light gun signals (see FARs).

Lost Comms while IFR

If visual conditions are encountered, remain VFR & land. Do Not enter IFR conditions!

If in instrument meteorological conditions, or if you are in VMC but cannot maintain VMC to land:

1. Fly the aircraft.
2. Maintain positional awareness.
3. Ask yourself the "***ARC***" questions.

    A - What altitude do you fly?
    R - What route do you fly?
    C - What do you do at your clearance limit?

A: Altitude – Know the appropriate altitude to fly (aid: **M E A**)
Fly the highest of

- **M**inimum Enroute Altitude or
- **E**xpected Altitude or
- **A**ssigned Altitude

R: Route – Know the appropriate route to fly (**A V E F**)
In order of expected routing compliance

- Last **A**ssigned or
- Route being **V**ectored to or
- **E**xpected route or
- the **F**iled route or

C: Clearance limit – What to do when you arrive at Clearance Limit or IAF

- If CL is destination airport: Begin your approach at filed ETA, or
- If CL is any fix prior to destination: hold and leave hold at EFC, continue to destination.

Emergency Pilot in Command authorization (FAR 91.3) allows: "In an in-flight emergency requiring immediate action, the pilot in command may deviate from any rule of this part to the extent required to meet that emergency."

Choosing not to comply with standard lost communication procedures to navigate to better weather conditions could be considered emergency pilot in command authorization. Be prepared to address the aeronautical decision making with the FAA upon safe completion of the flight.

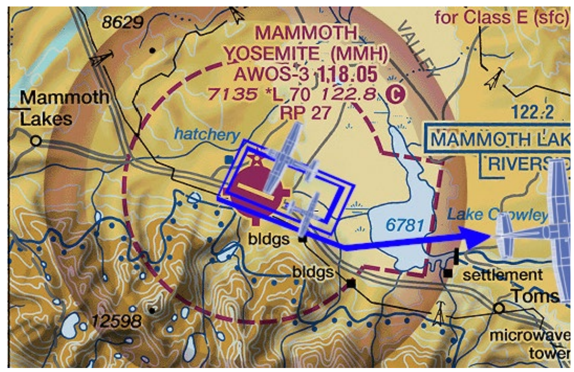
Make sure you have a headlamp or flashlight with backup batteries as required equipment on all night flights. We always use aircraft lighting in accordance with operation lights on but be especially vigilant about proper usage at night.

Landing Light & Electrical System Malfunctions

- Be proficient at handling landing light failures in safe manner with the outcome of the landing never in doubt.
- Use your flashlight!
- Soft field landing technique for a landing light failure landing is quite useful.

Radio Navigation / Instrument Proficiency

- Proficiency using the radio nav aids (VOR, GPS, ATC) and Instrument scan and control for all night operations is required.
- Increased risks to safety exist at night. Risk mitigation and hazard avoidance requires the pilot to have exceptional instrument flying skills to fly at night.
- IFR flying techniques should be incorporated for night flights.



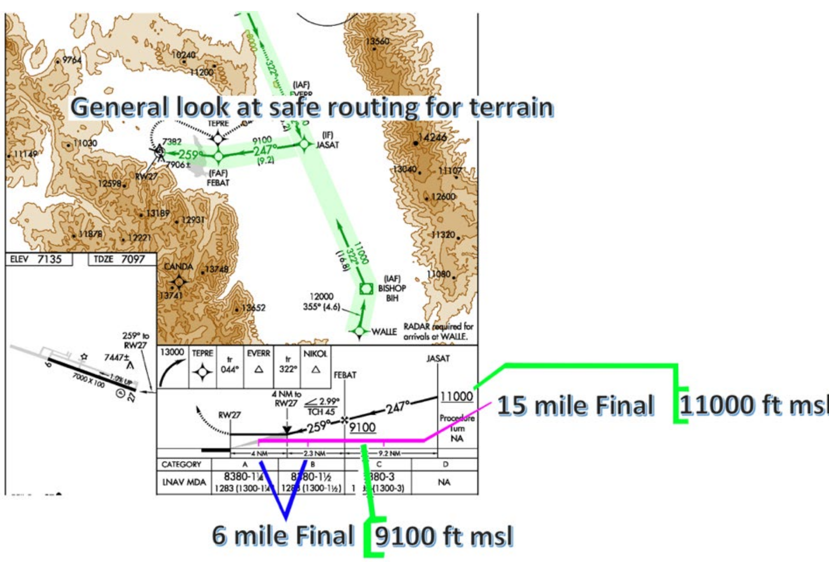
VFR Departures

A good practice is to climb in the traffic pattern, known as a ***Visual Climb Over the Airport***, to the pre-determined cruising altitude that will provide safe avoidance of terrain and obstacles. A simple request to the control tower to visually climb over the airport to “X” altitude is usually accommodated. Non-towered airport departures can climb in the traffic pattern until a safe altitude is attained.

VFR Arrivals

A good practice is to review the arrival airport’s instrument approaches for the intended runway. Multiple free sources of these approach plates can be obtained via the internet. Foreflight has IFR approach plates. The approach plates that serve the intended runway will display minimum safe altitudes and the distances appropriate to those distances. This practice in no way shall be used in any weather conditions less than safe VFR conditions.

PAPI or other Visual Approach Path Indicator Light Systems will be utilized and respected. Maintain at or above the glide path all times until a normal position to land.



Appendix

Aircraft Speeds and Parameters

Section	Parameter	C172 N N1966F N369RJ N5310D	C172 P N64556 N9568L‡ N99508† N13CB	C172 S N494JB N919TC	C182 T* N1492U	PA-28-151 N41535 N5415F**	PA-28-161 N6199B N30117 N9040K N810DA	PA-28-181 N21489	PA-28R-180 N7530J	SR-20 N2706E
Engine	Max HP	160 @ 2700	160 @ 2700	180 @ 2700	230 @ 2400	150 @ 2700	160 @ 2700	180 @ 2700	180 @ 2700	200 @ 2700
	Static RPM	2280-2400	2300-2420	2300-2400	N/A	2330-2430	2330-2430	2325-2425	N/A	N/A
	Max GTW Norm.	2300	2400	2550	3100 / 2950	2325	2325	2550	2500	3000 / 2900
	Max GTW Util.	2000	2100	2200	N/A	1950	2020	1950	N/A	N/A
	Fuel Delivery	Carb.	Carb.	Fuel Inj.	Fuel Inj.	Carb.	Carb.	Carb.	Fuel Inj.	Fuel Inj.
Fuel	All Fuel	43	43	56	92	50	50	50	50	60.5
	Usable Fuel	40	40	53	87	48	48	48	??	56
	Use. Fuel Tabs	N/A	N/A	35	74 / 64	34	34	34	??	
	Aux Pump Use	N/A	N/A	Prime, Emerg, Vpr Supp	Prime, Emerg, Vpr Supp	Prime, T/O, Ldg, Tnk Swtch, Emerg, Climb	Prime, T/O, Ldg, Tnk Swtch, Emerg, Climb	Prime, T/O, Ldg, Tnk Swtch, Emerg, Climb	Prime, T/O, Ldg, Tnk Swtch, Emerg, Climb	BOOST for T/O, Ldg, Tnk. Swtch, Emerg. Use for climb/cruise as necessary for vapor suppression. Prime for prime
Oil	Max Oil (Sump)	7	7	8	8	8	8	8	8	8
	Min Oil (Sump)	5	5	5	4	2	2	2	2	6
Stall	Vs0	41	33	40	41	44	44	53	69 mph	56
	Vs1	47	44	48	51	50	50	59	63 mph	65
Takeoff / Climb	Vr	55	55	55	50-60	45-55	60	60	60-80 mph	65-70
	Vx	59	60	62	65	63	63	64	90 mph	81
	Vy	73	76	74	80	75	79	76	100 mph	96
	Vr Short	50	50	51	58	50	52	49	60-70 mph	65
	Vx Short	55	56	56	58	52	52	54		75
	Flaps Normal	0	0	0	0-10	0	0	0	0	50% (Retract at 85 kts)
	Flaps Short	10	10	10	20	25	25	25	25	50%
Cruise	Cruise Clmb Spd.	75-85	75-85	75-85	85-95	87	87	87	110 mph	95-105
	Cruise Clmb Pwr	Full	Full	Full	2400 / 23"	Full	Full	Full	2500 / 25"	Full
	Va	97 / 80	99 / 82	105 / 90	110 / 91	111 / 88	111 / 88	108	134 mph	131 / 114
	Vno	128	127	129	140	126	126	121	170 mph	165
	Vne	160	158	163	175	160	160	148	214 mph	200
	Vg	65	65	68	75	73	73	76	105 mph	96-87
	Glide Rat (nm/kft)	1.5	1.5	1.5	1.4		1.9	1.5	??	1.8
Land	Vfe	110 / 85	110 / 85	110 / 85	140 / 120 / 100	103	103	100	125 mph	120 / 100
	Vlo	N/A	N/A	N/A	N/A	N/A	N/A	N/A	150 down / 125 up	N/A
	Vle	N/A	N/A	N/A	N/A	N/A	N/A	N/A	150 mph	N/A
	Vref	65	65	65	60-70 (FF)	63 (FF)	63 (FF)	66 (FF)	90-100 mph	80 (50%) / 75 (FF)
	Vref Short	60 (FF)	61 (FF)	61 (FF)	60 (FF)	63 (FF)	63 (FF)	66 (FF)	90 mph (FF)	75 (FF)
	Vref No Flaps	70	70	70	70-80	70				80
	Max Xwind	15	15	15	15	17	17	17	20 mph	21

*The "T" in C182T does NOT stand for turbo. It is a naturally aspirated engine
**N5415F has an STC for a O-360-A4M, 180hp engine. The POH supplement says to increase fuel consumption by 17% and use all the same speeds
†N99508 has an STC for a O-360-A4M, 180hp engine. The MGTOW is 2550 and Va is 105 at that weight. Performance data is in POH supplement.
‡N9568L has 54 gallon long range fuel tanks (50 gal usable)

Aircraft ICAO Equipment Codes

		ICAO Equipment					ICAO Surveillance									ICAO PBN			
		B	D	G	R	S	B1	B2	U1	U2	C	E	S	SUR	CODE	B2	C2	D2	S1
C172N	N1966F			G	R	S			U1		C			282B	A181A5	B2	C2	D2	S1
	N369RJ					S			U1		C			282B	A42F3B				
	N5310D	B		G	R	S	B1				C			260B	A6B680	B2	C2	D2	S1
C172P	N64556	B		G	R	S			U1		C			282B	A87AF4	B2	C2	D2	S1
	N9568L			G	R	S			U1		C			282B	AD4E6C	B2	C2	D2	S1
	N13CB	B								U2			S	282B	A0790C	B2	C2	D2	S1
	N99508	B		G	R	S		B2				E		260B	ADE7AF	B2	C2	D2	S1
C172S	N494JB	B		G	R	S			U1		C			282B	A61FBE	B2	C2	D2	S1
	N919TC			G	R	S			U1				S	282B	ACB9C6	B2	C2	D2	S1
P28A	N21489	B	D	G	R	S			U1		C			282B	A1CBF0	B2	C2	D2	S1
	N5415F	B		G	R	S	B1				C			260B	A6DEB0	B2	C2	D2	S1
	N6199B	B		G	R	S			U1		C			282B	A813C2	B2	C2	D2	S1
	N30117	B		G	R	S			U1		C			282B	A325A4	B2	C2	D2	S1
	N9040K	B		G	R	S			U1		C			282B	AC806A	B2	C2	D2	S1
	N41535			G	R	S			U1		C			282B	A4E992	B2	C2	D2	S1
	N810DA	B		G	R	S	B1				C			260B	AB09A8	B2	C2	D2	S1
P28R	N7530J	B		G	R	S		B2				E		260B	AA278F	B2	C2	D2	S1
C182	N1492U	B		G	R	S				U2			S	282B	A0C6D0	B2	C2	D2	S1
	N908VA			G	R	S			U1				S	282B	AC8EC0	B2	C2	D2	S1
SR20	N2706E	B		G	R	S	B1					E		260B	A2A9AB	B2	C2	D2	S1
BE95	N998DM	B		G	R	S		B2				E		260B	ADF0B2	B2	C2	D2	S1

ICAO Equipment	B	LPV (APV with SBAS)
	D	DME
	G	GNSS
	R	PBN Approved
	S	Standard (V,O,L… VHF radio, VOR, ILS)
ICAO Surveillance	B1	ADSB with dedicated 1090 MHz ADS-B out
	B2	ADSB with dedicated 1090 MHz ADS-B out and in
	U1	ADS-B out capability using UAT
	U2	ADS-B out and in capability using UAT
	C	Mode A/C transponder
	E	Mode S, including aircraft identification, pressure altitude, and extended squitter (ADS-B)
	S	Mode S, including both pressure altitude and aircraft identification capability
	SUR	Used to indicate that the ADS-B Out is of the variety that is 2020 compliant
	CODE	The assigned hexadecimal value found in the FAA registry. It is uniquely associated with the registration value (N number) and is always broadcast by ADS-B Out systems
PBN	B2	RNAV 5 GNSS
	C2	RNAV 2 GNSS
	D2	RNAV 1 GNSS
	S1	RNP APCH

0° ... 45° ... 90° ... 135° ... 180° Point Orientation

During Flight Maneuvers, Maintaining Orientation and Situational Awareness (SA), aka Positional Awareness, is PARAMOUNT. Keep your head up and look outside the cockpit to maintain SA.

Visually comparing the Lateral Axis and its relationship to *section lines* (ie Long roads, agricultural field lines on the surface) will help maintain SA. Simply extend a straight line off your shoulder, out along the center of the wing, out to infinity. This line represents the Lateral Axis.

The Commercial Pilot Training Maneuvers of the Chandelle and the Lazy 8 require rapid and accurate determination of SA for the 0° ... 45° ... 90° ... 135° ... 180° points.

This is a top-down representation for determining these points.....