

XII.B. EMERGENCY APPROACH & LANDING

OBJECTIVE & COMPLETION STANDARDS

To develop an understanding of the emergency approach & landing maneuver and the skills necessary for the task. The learner can apply these concepts in the plane.

The learner can simulate an emergency approach and landing, considering landing area and wind, accomplishing checklists, and landing safely on the desired spot, to ACS standards.

KEY POINTS

- Best Glide Airspeed
- ABCD Checklist
- Soft-Field Power-Off Approach & Landing

ELEMENTS

1. Best Glide Speed
 2. ABCD Checklist
 3. Emergency Approach
 4. Contacting ATC
 5. Landing
 6. Descent Factors
 7. Emergency Locating Devices
 8. Mental Attitude
 9. Common Errors
 10. Hazards
-

REFERENCES

- Airplane Flying Handbook
 - POH
-

SCHEDULE

- Introduction
- Development
- Conclusion

EQUIPMENT

- Board & Markers
- References
- Model airplane

INSTRUCTOR

- Present Content
- Ask/Answer Questions
- Assign Homework

STUDENT

- Participate in learning
 - Take notes
 - Ask/Answer Questions
-

LEGEND & ABBREVIATIONS

SECTION HEADER FOR EACH LESSON ELEMENT

Light blue for Main points and/or brief section summary

- **Orange** text is used for mnemonics or things to remember
- **RM**: Teal RM denotes an ACS Risk Management concept
- **CE**: Red CE shows an Airplane Flying Handbook listed Common Error

IA: Instructor Action (ex. hop out of the lesson & review a checklist) – Coming soon!

Light gray for notes, examples, extra details & explanations, etc.

INTRODUCTION

ATTENTION

Interesting fact or attention-grabbing story

Understanding the elements behind a properly executed emergency approach and landing could be the difference between a safe soft field landing and a dangerous, poorly performed crash.

OVERVIEW

Review Objectives, Elements, and Key Points

Every single Knowledge & Risk Management task is annotated!
Find whatever info you need.

WHAT

A simulated emergency landing occurs when the power is pulled, simulating a lost engine, and the pilot must run the checklist to attempt to restart the engine while properly configuring the airplane for an approach and landing usually in a nearby field.

WHY

To develop accuracy, judgment, planning, technique, and confidence when little or no power is available.

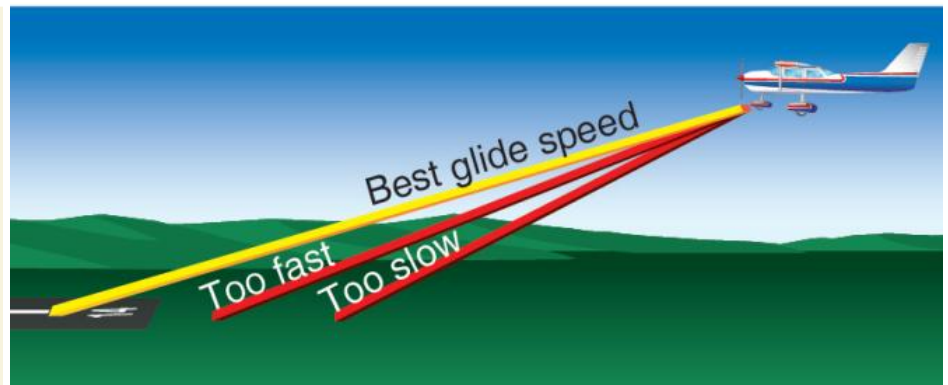
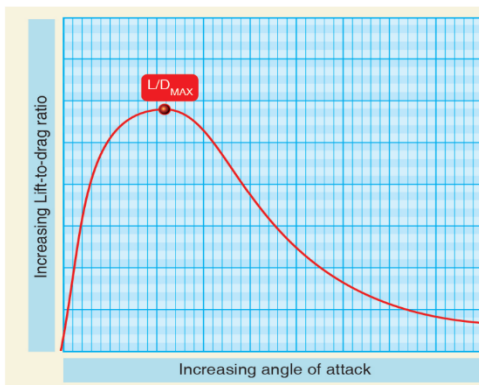
HOW

1. BEST GLIDE SPEED

AI.XII.B.K2, AI.XII.B.K2A

A. Airspeed at which the aircraft glides the furthest for the least altitude lost in non-powered flight

- i. Occurs at the highest lift-to-drag ratio (L/D_{MAX})



B. Glide Ratio: Distance the airplane travels in relation to the altitude it loses

- i. Provides an estimate of how far you can fly
- ii. Any increase or decrease from best glide reduces the glide ratio

C. Best Glide & Weight

- i. L/D determines the distance the airplane can glide, not weight
- ii. If the proper speed is maintained, changes in weight don't affect the best glide angle or distance flown

- iii. However, a heavier plane needs to fly at a higher airspeed to obtain the same glide ratio

D. Best Glide & Wind

AI.XII.B.K2c

- i. With a tailwind, the airplane glides farther because of the higher groundspeed
- ii. With a headwind, the airplane does not glide as far because of the lower groundspeed

E. Best Glide & Configuration

- i. When drag increases, the airplane must be pitched down to maintain airspeed (no longer at L/D max)
- ii. To maximize distance traveled, minimize drag-producing components

F. Minimum Sink Speed

AI.XII.B.K2b

- i. Airspeed used to maximize the time that the airplane remains in flight
 - Results in losing altitude at the lowest rate (lowest vertical speed)
- ii. Less distance traveled versus best glide airspeed
- iii. Not often published but generally a few knots less than best glide airspeed

G. Cardinal Rule: Do not attempt to “stretch” a glide by increasing back pressure/slowing below best glide

- i. Any speed other than best glide reduces distance traveled

2. ABCD CHECKLIST

AI.XII.B.K1

A. AVIATE: The first reaction should be to immediately establish the best glide airspeed and fly the airplane

- i. Flying the airplane is the most important priority
- ii. Variations in speed nullify accuracy in judgment of gliding distance / landing spot
- iii. Eagerness to get down is one of the most common faults during simulated emergency landings
 - Pilots neglect speed, arriving too fast for a safe landing – just as dangerous as too slow

B. BEST Landing Spot: Select the best landing spot and immediately turn toward it

- i. Check in front, behind and to both sides of the airplane
- ii. Landing sites are restricted by the route of flight, height above the ground, and excess airspeed
- iii. An airport is ideal. If there is no airport, select a field within glide distance:
 - Preferably hard packed, long, smooth, with no obstacles, especially at the approach end
 - As a general rule, the pilot should not change their mind more than once
- iv. Note wind direction / speed; land into the wind, if able (altitude, obstacles, etc. may prevent this)
 - Be aware of tailwind (longer landing distance) and crosswinds
- v. Always continue to clear for traffic

C. Emergency CHECKLISTs

- i. Restart Checklist
- ii. Troubleshoot (if the reason for failure can be determined, a restart becomes more likely)
 - Check the systems to decipher the problem

D. DISTRESS Call

- i. When able, inform ATC or Guard

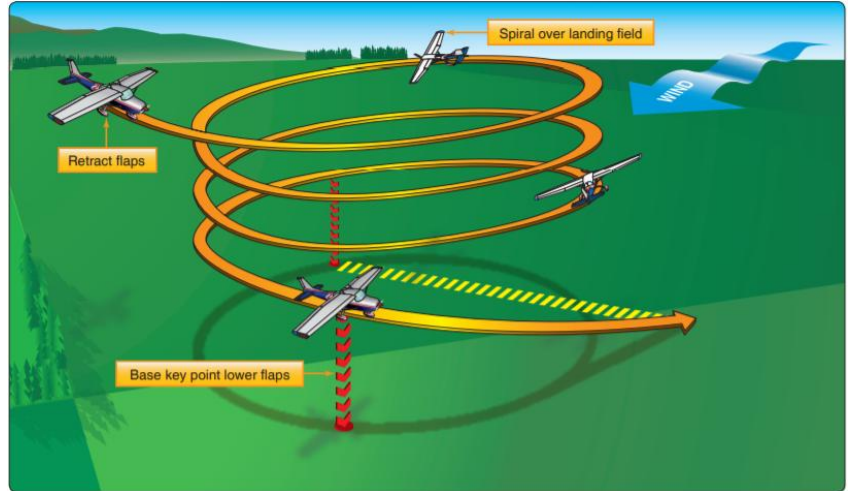
3. EMERGENCY APPROACH

A. Governed by:

- i. Wind direction and speed
- ii. Dimensions and slope of the field
- iii. Obstacles on final approach path

B. Proceed directly to the landing area

- i. **Goal:** Be on downwind, abeam the landing point at normal pattern altitude
- ii. If above pattern altitude, circle over the approach end while descending (steep spiral)
 - Turn in the same direction you intend to fly the pattern
- iii. **RM:** Following or changing the flight path to the landing area



AI.XII.B.R2

- Adjust as conditions change
- Best practice is to go directly to the landing area & circle overhead, with a plan to enter the pattern

C. Divide attention between flying / checklists

- i. Constantly assess the approach

D. Adjust the pattern based on altitude, wind, etc. to safely reach the landing area

AI.XII.B.K3

- i. Make the approach as normal as possible
- ii. Base & final turns are positioned based on altitude, wind, obstructions, etc.

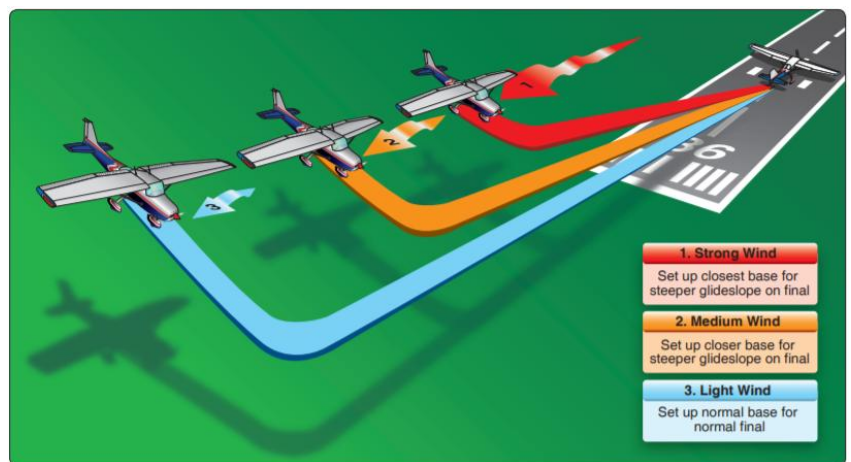
- Strong headwind = closer base Tailwind = farther out base
- If high, delay base leg; if low, turn early, or go direct to landing area

iii. If too high, consider:

- Extending the pattern
- S-turns
- Configuring early
- Slipping

iv. If too low, consider:

- Tightening the pattern



XII.B. Emergency Approach & Landing

- Proceeding directly to the landing area
- Delaying configuration
- Maintaining best glide

E. Stable Approach

AI.XII.B.K4

- i. The more stable the approach, the more predictable the approach
 - Maintain best glide, and attempt to make the approach as normal as possible
- ii. Flying the airplane is the highest priority
- iii. Energy Management
 - Reference [Appendix A. Energy Management](#) for more detailed energy management concepts - Corresponding slides can be found in the slide's appendix

F. Configuration

AI.XII.B.R4

- i. Intent is to touchdown in a normal landing configuration (emergency permitting)
- ii. Flaps will be gradually lowered based on the conditions, situation, airplane performance, etc.
 - Have a standard position to lower the flaps and adjust based on the situation
 - Too high: Configure earlier (or delay configuration and slip, vary the base leg, etc.)
 - Too low: Delay configuration (tighten the base leg and/or turn to final)
 - Once flaps are lowered, they should not be retracted
 - Landing flaps should only be lowered once the landing area is assured

4. CONTACTING ATC

A. If on frequency with ATC, transmit “Mayday, mayday, mayday.” If not on frequency, use guard 121.5

- i. Let them know who you are, where you are, and what you're doing
- ii. The radios will likely be kept on until just before landing. Keep ATC apprised of the situation / plan
- iii. If time and conditions permit, squawk emergency - 7700

B. ATC Emergency Services

AI.XII.B.K6

- i. **Priority:** The frequency is basically yours, whatever you need
- ii. **Aircraft Separation:** Any other potentially hazardous aircraft will be moved out of your way
- iii. **Advice:** Nearby airports, etc.
- iv. **Emergency Response:** ATC will coordinate with the tower or local emergency response

5. LANDING

A. If a restart is not an option, complete the Emergency Landing Checklist

- i. Keep the electrical equipment on as long as practical to make radio calls, use the flaps, etc.

B. Gear & Flaps

- i. Gear and flaps should only be lowered after landing is assured
 - Gear can provide better protection in the case of stumps, rocks, or other obstacles
 - If the field is excessively soft, wet, short, or snow covered, a gear up landing may be safer

C. If practical, hold the wheels off to allow for a gentle touchdown, like a soft field landing

- i. At this point, the safety of the passengers is the only concern, the airplane does not matter

6. RM: DESCENT FACTORS

AI.XII.B.R1

A. Altitude

- i. Dictates the distance the aircraft can travel (use AGL, not MSL)
 - Know approximate distance traveled at best glide per 1,000' – apply to the situation
- ii. The goal is to put the aircraft at a normal pattern altitude at a normal key position

B. Wind

- i. During the approach
 - It can influence glide distance (headwind vs tailwind vs crosswind)
 - The stronger the wind on final, the closer the base leg needs to be to make a normal approach
- ii. Tailwind
 - A tailwind increases the runway required for landing
- iii. Maximum Demonstrated Crosswind Component
 - If possible, don't exceed it as the aircraft may not be able to remain within the confines of the runway

C. Terrain & Obstructions

- i. Be especially cautious of terrain/obstructions during an emergency approach & landing
- ii. Without an engine, there may not be enough energy to clear the terrain

D. Available Landing Distance

- i. Be familiar with the landing distance needed for an emergency approach & pick a suitable landing area
- ii. Landing distance at off airport landing areas will have to be estimated from the air

7. EMERGENCY LOCATING DEVICES (ELT)

AI.XII.B.K5

A. ELT: Small, self-contained transmitter that will automatically, upon impact, transmit an emergency signal

- i. Transmits the emergency signal on 121.5, 243, and/or 406 MHz

B. Numerous private companies produce emergency locating devices that can be carried on oneself

- i. Basic Personal Locator Beacons (PLBs)
- ii. Satellite Messengers

8. MENTAL ATTITUDE

- A. The survival records favor pilots who maintain their composure and know how to apply the concepts and procedures developed through the years. Success is as much a matter of the mind as of skills
- B. “We don’t rise to the level of our expectations; we fall to the level of our training”

9. COMMON ERRORS

AI.XII.B.K7

- A. Improper airspeed control
- B. Poor judgment in the selection of an emergency landing area
- C. Failure to estimate the approximate wind speed and direction
- D. Failure to fly the most suitable pattern for existing situation
- E. Failure to accomplish the emergency checklist
- F. Undershooting or overshooting selected emergency landing area

10. RM: HAZARDS

A. Low Altitude Maneuvering

AI.XII.B.R5

- i. A small problem at high altitude can quickly become a big problem at a low altitude
- ii. Quick, panicked maneuvers can result in a stall or loss of control close to the ground
 - Especially important in engine failure emergencies
 - Be aware of, and avoid, obstructions, towers, etc.
- iii. **Low Altitude Stall/Spin**
 - A low altitude stall or spin can leave little to no recovery time
 - ALWAYS maintain coordination, and airspeed at low altitudes
 - During engine failures, maintain best glide – Stalls could be catastrophic low/without power
 - At low level, recover at any indication of a stall then adjust to make the emergency landing
 - Spin (*Different aircraft respond differently to spins and spin recoveries - follow POH procedures*)
 - A spin is a result of a stall + yaw
 - Prevention
 - Maintain coordination – don’t cross the controls especially during an emergency landing
 - Do not use abrupt, excessive pressure inputs (especially back elevator pressure)
 - Stop whatever you’re doing and recover at the first sign of a stall
 - Recovery (**PARE**)
 - **P**ower - Idle
 - **A**ilerons - Neutral
 - **R**udder - Full rudder opposite the spin direction
 - **E**levator - Brisk, positive forward pressure (nose down)

- Once the spin has stopped, neutralize the rudders and raise the nose - be careful not to stall
- iv. **CFIT** (Controlled Flight into Terrain): [AC 61-134](#): General Aviation CFIT Awareness
- The solution to combating CFIT accidents starts on the ground
 - Common themes include proper planning, good decision making, and being able to safely operate the aircraft throughout its entire operating range
 - Recommendations:
 - Non-instrument rated VFR pilots should not attempt to fly in IMC
 - Know and fly above minimum published safe altitudes
 - If IFR, fly published procedures
 - Verify proper altitude, especially at night or overwater, through use of a correctly set altimeter
 - Verify all ATC clearances. Question potentially hazardous clearances
 - Maintain situational awareness both vertically and horizontally
 - Comply with appropriate regulations for your specific operation
 - Don't operate below minimum safe altitudes if uncertain of position or ATC clearance
 - Be extra careful when operating in an area which you are not familiar
 - Use current charts, appropriate checklists & know your aircraft and equipment

B. Collision Hazards

AI.XII.B.R3

i. Collision Avoidance

- Scanning
 - Short, regularly spaced eye movements bringing successive areas into the central visual field
 - Each movement should not exceed 10°, each area should be observed for at least one second
- Clearing Procedures
 - Climb/Descent: Use gentle banks to scan above/below the wings as well as other blind spots
 - Prior to any turn: Clear in the direction of the turn
 - Pre-Maneuver: Clearing turns – clear above/below, in front/behind
- Operation Lights On (voluntary FAA safety program)
 - Turn on landing lights during takeoff and when operating below 10,000', day or night
- Right-of-Way Rules ([FAR 91.113](#))
 - Pertinent to emergencies: An aircraft in distress has the right-of-way over all other traffic
 - Be cautious, other aircraft may not know you're in distress

ii. Terrain

- Study terminal charts and IFR/VFR chart altitudes, use Max Elevation Figures (MEFs)
- Be extra vigilant at night, when terrain may be impossible to see until it is too late
- Minimum Safe Altitudes ([FAR 91.119](#))
 - Anywhere: Altitude allowing an emergency landing without undue hazard to persons or property
 - Congested Areas: 1,000' above the highest obstacle within 2,000'

- Other than Congested Areas: 500' above the surface, except when over open water/sparsely populated areas, then no closer than 500' to any person, vessel, vehicle, or structure

iii. **Obstacles & Wire Strike**

- Research obstacles in the area - Charts, NOTAMs, Terminal procedures, etc.
- Antenna Towers can reach > 1,000-2,000' AGL and support guy wires can extend 1,500' horizontally
- Overhead wires (may not be lit) span departures & landmarks pilots frequently follow
 - Lakes, highways, railroad tracks, etc.

C. Distractions, SA & Disorientation, Task Prioritization

AI.XII.B.R6

i. **Distractions**

- They're dangerous - Remove them from view or, if a person, explain the situation & ask them to stop
- Focus on aircraft performance & clear for traffic - If distracted, recognize the problem and fix it
- Especially important to avoid distractions in an emergency with numerous tasks to manage

ii. **Situational Awareness (SA) & Disorientation**

- Extremely important, lost SA has led to unsafe situations, mishaps, and incursions
- High task load during an emergency can lead to a loss of SA
- Maintain SA
 - Starts with preflight planning - Know what's coming next and stay ahead of the airplane
 - Divide attention between inside and outside references
 - If SA is lost, admit it, and fix the problem
 - Emergency Descent: Maintain SA in relation to the level-off altitude, emergency & associated procedures, airplane configuration, and the plan (diversion)
- Disorientation can be caused by, or lead to, an upset
 - **Push:** Apply forward pressure to unload the plane
 - **Roll:** Roll aggressively to the nearest horizon
 - **Thrust:** Adjust as required
 - **Stabilize:** Return to a safe flight condition

iii. **Task Prioritization**

- Divide attention between the aircraft, scanning, and communicating (ATC or CTAF)
 - No one responsibility should take your full attention for more than a short period
- Understand what tasks need to be accomplished and when
 - Organization is especially important in situations like this – many tasks, little time
- “Attack the closest alligator”
 - When tasks are piling up, handle the most threatening problem
- Proper task management can help prevent distractions, loss of SA, and disorientation
- Safety is the number one priority – Aviate, Navigate, Communicate

Conclusion: Brief review of the main points