

Flight Lesson: Engine Failure

Objectives:

1. make the student aware of the need to be prepared for emergencies at any time, including engine failures
2. make clear the importance of procedures, in and out of emergencies
3. let student gain simulated experience in engine failures

Justification:

1. develops students judgement when making off-field emergency landings
2. engine failures may occur at any point in any flight, and the pilot must learn to cope with the situation
3. simulated engine failure will be required during the private pilot checkride

Schedule:

Activity	Est. Time
Ground	1.0
Preflight/Taxi	0.25
Flight	1.0
Debrief	0.25
Total	2.50

Elements Ground:

- emergency fundamentals
- procedures
- items to note

Recommended Readings:

AFH	Ch 16: 16-1 to 16-2
AOPA	AOPA Flight Training - ASF Safety Spotlight: The impossible turn

Elements Air:

- landing field observation
- simulated engine failures

Completion Standards:

1. student makes proper decisions and decisive action in a simulated engine failure situation
2. student has developed satisfactory judgement, technique, and procedure for making off-field landings

Common Errors:

- does not establish best glide speed immediately
- does not trim airplane immediately after establishing best glide
- does not turn toward a field immediately
- does not execute plan and procedure in a controlled manner
- does not complete procedures properly
- increases pitch and slows when approaching ground

Presentation Ground:

emergency fundamentals

1. there are 6 basic items to take care in an engine failure emergency
 - (1) 3 are essential
 - i. control the airplane
 - (i) establish best glide and trim
 - ii. select a field that is into the wind, and turn toward it
 - iii. perform shutdown and land
 - (2) 3 are completed time permitting
 - i. investigate the problem, attempt to troubleshoot
 - ii. communicate on active frequency or 121.5 and squawk 7700
 - iii. brief passengers
 - (3) The saying is “Aviate, Navigate, Investigate, Communicate, Terminate”
2. Step 1: AVIATE - Control the airplane - establish best glide & trim
 - (1) what is best glide?
 - i. airplane has best lift to drag ratio at this speed
 - ii. airplane can glide the farthest distance
 - iii. airplane will stay in the air the longest time
 - (2) by trimming, the plane will fly “hands free”
 - (3) remember priorities - Aviate, Navigate, Communicate
 - i. in an emergency, the most important thing is to maintain positive control of the aircraft.
3. Step 2: NAVIGATE - select a field and turn toward it
 - (1) what is an ideal off-field landing area?
 - i. long, smooth, level open fields
 - ii. flat land, hard packed surface
 - iii. upwind landing
 - iv. fields without obstacles at the end
 - v. non-public roads
 - vi. uphill landing
 - (2) what is not ideal?
 - i. roads or freeways with power lines, traffic, and bridges
 - ii. mountainous areas
 - iii. water
 - iv. plowed fields
 - v. wooded areas
 - (3) determining wind direction
 - i. note departure and destination winds (and possibly winds aloft) to get an idea for wind directions
 - ii. grass fields, water, or smoke to determine wind
 - (4) turn toward the field
 - i. turn away from mountains, water, populated areas
 - ii. know the general area, and select a more specific field later (if altitude permits)
 - iii. be sure to check underneath and behind you

(i) you may be over a good field or even an airport

(5) remember, Aviate is still the #1 priority

4. Step 3: INVESTIGATE - Restart/troubleshooting procedure

(1) 7-up procedure - flow procedure for restarting

i. fuel selector - both

ii. mixture - rich

iii. power - set

iv. carb heat - on

v. magnetos - both (to start if propeller has stopped turning)

vi. master - on

vii. fuel primer - locked

(2) 7-up procedures are different for each aircraft - make sure to use checklist to verify appropriate steps have been taken

(3) remember - Aviate and Navigate are still higher priority

5. Step 4 - COMMUNICATE

(1) this is done time permitting - it is more important to fly the plane safely than communicate with the controllers

(2) declare an emergency if on an active frequency, or switch to 121.5

i. 121.5 is monitored by flight service, most towers, most airliners

(3) report the following:

i. aircraft id

ii. position

iii. number aboard aircraft

iv. nature of problem

v. proposed landing site or intentions

vi. "Mayday, Mayday, this is cessna xxx over san antonio reservoir. 3 souls on board. we have an engine failure and will be landing on the north side of the reservoir"

(4) squawk 7700 - it means emergency

(5) optionally, turn off your radio. at this point, you've communicated all that you need to. the radio may just provide distraction if it is left on.

(6) Brief Passengers

(1) "we've had an engine failure and are going to land off-field over there"

(2) "be sure to listen and do as I say"

(3) "make sure your seatbelts are on tight, and remove any sharp objects from your pockets"

(4) "I've been trained for this situation, I know what I'm doing"

(5) "help me look for other planes"

i. this may just be to keep passengers busy

6. Step 5: TERMINATE - Secure plane for landing

(1) complete before keypoint - 7-up shutdown flow

i. fuel shutoff valve - off

(i) to prevent leaks or fires

ii. mixture - idle cutoff

(i) so engine doesn't restart on touchdown

- iii. throttle - close
- iv. ignition switch - off
- v. wing flaps - as required
- vi. master switch - off
 - (i) only turn off after you have all the flaps you want in.
- vii. doors - unlatch prior to touchdown
- viii. on touchdown - brake as necessary

7. the key point concept

- (1) the key point concept consists of picking a point approximately 1000' above the field elevation
- (2) the point should be downwind abeam the touchdown point
- (3) fly to the key point, and circle over it to lose altitude
 - i. may have to change bank angle to correct for wind drift
 - ii. rollout on downwind as close to 1000' as possible
- (4) this applies for all emergency descents (pattern and off-field)
 - i. by making this point, you are going to make the field
 - ii. helps in consistency of procedures since it will be practiced this way. consistent outcome, judgement easier
- (5) continue approach with a shortened downwind
- (6) add flaps if making touchdown point is assured
 - i. helps lower nose to a more normal looking descent attitude
- (7) turn base as necessary and vary the length of base to assure making the touchdown point
- (8) have full flaps in by short final if able
- (9) make full stall landing

8. things to note

- (1) if gliding into the wind, the distance traveled will be shorter
- (2) try not to land downwind if the wind is more than 10 kts.
- (3) never try to extend your glide by increasing your pitch. this will only slow the airplane down, and increase the descent rate. *always* maintain best glide speed
- (4) common factors that can interfere with a pilot's ability to act quickly and properly when emergencies occur:
 - i. reluctance to accept the situation. the pilot freezes and delays action.

PTS Standards			
initial airspeed	best glide	Δ airspeed	± 10 kts

Presentation Air:

- 1. check where students WOULD land throughout training
- 2. Simulated Engine Failures throughout training
 - (1) allow students to pick fields and see how it would have turned out