Flight Lesson: Engine Failure in the Pattern

Objectives:

1. for the student to exhibit knowledge relating to the elements of engine failure in the pattern
2. be able to perform emergency landings during various points in the traffic pattern
3. to develop student's judgement in landing points
4. to develop student's ability to make forced landings
5. to demonstrate that planes can sill fly without power

Justification:

1. engine failures could occur at any point in flight
2. in an emergency, knowledge of engine failures will assist the student in safe operations
3. when learning off-field landings, the pattern will be used to get to the landing point
4. simulated engine failures will be required for the private pilot checkride.

Schedule:

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

Recommended Readings:

AFH	Ch 16: 16-3 to 16-8

Elements Ground:

- engine failures overview
- engine failure in the pattern scenarios

Elements Air:

- engine failures in the pattern

Completion Standards:

1. when the student exhibits knowledge pertaining to engine failure in the pattern
2. when the student is able to properly react and safely address an engine failure in the pattern

Common Errors:

- student does not establish best glide speed
- student does not trim airplane
- student does not execute a plan and procedure in a controlled manner
- student does not judge landing point correctly

Presentation Ground:

Engine Failure Overview

1. some reasons an engine fails
   (1) fuel exhaustion/starvation
   (2) incorrect fuel grade or type of fuel
   (3) pilot error or misjudgment
      i. forgetting to switch tanks
      ii. incorrect use of mixture
      iii. failure to use carb heat
   (4) faults in magnetos, mechanical failure, etc.
   (5) bad luck (bird strike)
2. a well trained pilot is prepared for an engine failure at any time.
3. disciplined approach to flows, checklists, and sequence of events is important, because in an emergency, memory of procedures may be difficult
   (1) in an emergency, people usually react as they are trained or taught
   (2) Remember the Saying: “Aviate, Navigate, Investigate, Communicate, Terminate”
4. remember, a plane can fly without its engine. maintain positive control of the airplane and situation
5. since no power is available, controlling glide path and airspeed is essential to a safe landing
   (1) first thing to do is ***always*** establish best glide speed immediately.
   (2) then trim to be able to fly “***hands free***”!
6. flaps can be used to steepen the glide-path to the runway
   (1) once you commit your flaps, you cannot shallow out your glide path, thus NEVER commit flaps unless you know you have the field made
7. forward slip can steepen glide-path even more
8. airspeed is controlled by pitch attitude

Engine Failure Pattern procedures

PTS Standards			
initial airspeed	best glide	**Δ airspeed**	±10 kts

1. you can never predict when and how an engine failure is going to occur, but the following are most of the scenarios you may encounter in the pattern
2. on the runway
   (1) if still on the ground, apply maximum braking
   (2) shutdown procedure
      i.mixture - idle cutoff
      ii.fuel selector - off
      iii.ignition and master - off
3. upwind
   (1) critical location for an engine failure. decision has to be made whether or not to turn around
      i. turning around allows landing on a known surface
      ii. landing straight ahead allows headwind landing, and no turns

(2) if plane is below 700 ft
  i. land straight ahead (or minor deviations left and right)
  ii. mixture to idle cut-off
  iii. time and load permitting, make a call
  iv. flaps as necessary
  v. fuel selector valve, ignition, master - off
(3) if plane is above 700 feet a decision must be made
  i. depends on wind, pilot ability, airplane ability
  ii. a turn loses a significant amount of altitude
  iii. a pilot may fixate on turn, and forget about airspeed
  iv. even if turn is made, runway may be out of reach, and then one is landing with a tailwind
  v. when in doubt, land straight ahead
(4) follow shutdown procedure

4. crosswind
(1) a decision must be made whether the plane can make it to the runway heading into the wind, or whether to land with a tailwind
  i. advantages of a headwind is obvious, but landing point is further away
  ii. advantages of a tailwind landing is the landing point is closer
(2) once committed, follow shutdown procedure

5. downwind
(1) any point on downwind, the runway can usually be made.
(2) the idea is to maintain the normal traffic pattern, but vary each leg of it.
  i. keeps things as similar to normal patterns as possible
  ii. gets the airplane down to the landing point in a controlled and procedural way
  iii. (draw some examples)
(3) without power, the approach path will be steeper than usual, and the pitch of the airplane will be lower to maintain the proper airspeed.
(4) procedure
  i. establish best glide (C152 - 60kts, C172 - 65kts) and trim
  ii. “7-up” for attempted restart
    (i) fuel selector - both
    (ii) mixture - rich
    (iii) power - set
    (iv) carb heat - on
    (v) magnetos - check both
    (vi) master - on
    (vii) fuel primer - locked
  iii. communicate to tower
  iv. fly pattern
    (i) on base, change the length of it to compensate for judgement errors
  v. once runway is made, put in flaps
  vi. touchdown flare will need to be more pronounced since there is no power, and thus a steeper approach angle

vii. once committed, follow shutdown procedure
viii. brake as needed

(5) on base or final
i. at this point you may not make the runway
ii. only option is to try delaying flaps
iii. *continue to hold airspeed*
(i) pulling up only reduces your glide distance
iv. if not able to make the runway, select a field and make a full stall landing

Presentation Air:

1. multiple engine failures at various points in the pattern
2. throughout training, simulate engine failures to keep student “honest”