CIRCUIT EMERGENCIES - (Long Brief)

Aim:

To understand the major principles, considerations and application of the glide approach, the safe procedures to follow after an EFATO, and to understand other important considerations relating to emergency procedures.

Objectives:

By the completion of this brief you will be able to recite the Take off safety considerations and state the actions you would take in the event of an EFATO. You will also be able to recall the best glide speed for C172 TUE and explain the effects on glide distance should this speed not be targeted and maintained.

Revision:

Normal circuit procedures.

Definitions:

Glide approach - an approach without the assistance of power.

EFATO - engine failure after take-off. EFATOs are practiced to instill you with the immediate actions to be taken in the event of an engine failure after take-off, with minimal time and terrain clearance available to you.

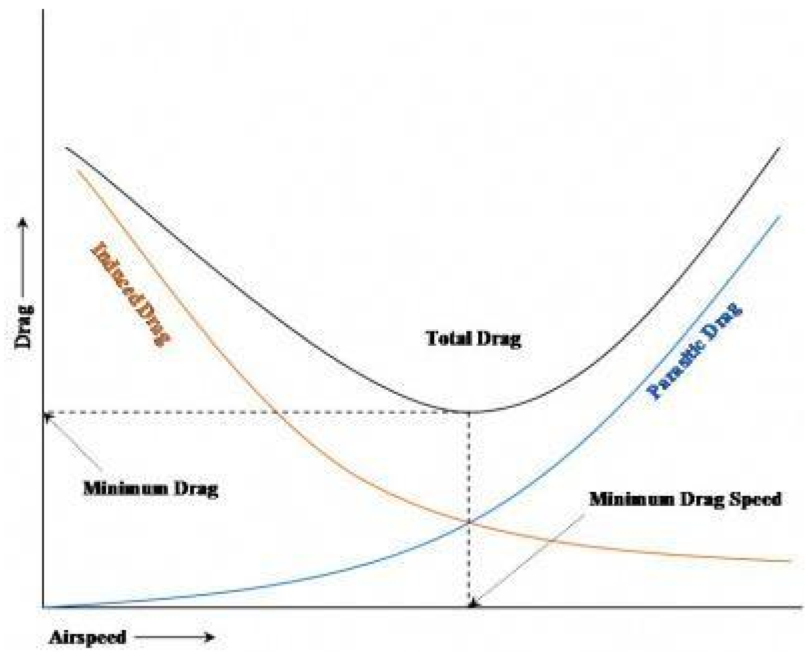
Fuel starvation - the state in which the fuel supply to the engine is interrupted, although there is adequate fuel on board the aircraft.

Fuel exhaustion - the state in which the aircraft has become devoid of usable fuel.

Principles:

Factors affecting glide performance:

Recall that the airspeed corresponding to minimum drag will provide the best lift/drag ratio. In nil wind, it is at this speed that we will glide the greatest horizontal distance over a given vertical height. Flying into a headwind, the best glide speed will be slightly faster and flying with a tailwind, it will be slightly slower.



For a glide approach in the C172, we will fly at 65kts to achieve the best lift/drag ratio.

Other factors affecting glide performance include:

- Weight - the weight of the aircraft actually has no effect on the maximum gliding distance achievable, with two important caveats. The first is that the best glide speed will be somewhat higher when the aircraft is heavier (in fact, the speed published in the AFM is usually for best glide at MTOW). The second is that because a heavier aircraft flies faster for best glide, it will reach the ground first, and will glide *further* in a headwind because it will spend *less time* being pushed back by the headwind.
- Flap - flaps add drag and reduce glide performance, and each application of flap will bring your eventual touchdown point closer toward you.

Considerations:

EFATO - Common causes and prevention:

- Carburettor ice
  - Common during conditions of high humidity and can form on the ground during taxi. It can be difficult to detect at low power settings, and may only become apparent during the takeoff. There may be clues in the way the engine is running on the ground.
  - Risk of carburettor ice minimised by completion of the pre-flight engine run up. In conditions conducive to formation of carburettor ice and after prolonged periods of idling, it is advisable to cycle the carburettor heat to ON just before takeoff.
  - Be mindful of the surface the aircraft is on when using carburettor heat on the ground as the heated air is unfiltered, and there is a chance of sucking grass, dust etc. into the carburettor.
  - Particularly in the event of a partial EFATO or poor engine performance on takeoff, selecting carburettor heat to ON is among the first actions to be taken as soon as the nose is lowered for best glide.
- Air blockage:
  - A blockage in the carburettor air filter.
  - Selecting carburettor heat to ON also provides an immediate secondary source of air to the carburettor, should the air filter have become blocked during the take-off.
  - Risk minimised by careful inspection of the air intake as part of the preflight inspection.
- Fuel contamination:
  - This tends to be the most probable cause of an engine failure. Water in the fuel is typically the culprit.
  - Preflight fuel inspections are mandated before the first flight of every day, and subsequent to every refueling. A small sample of fuel is drained from the fuel tank drain points and checked for water.
  - Be aware that some water may remain in suspension immediately after refueling, and that it is therefore prudent to let it settle before conducting a fuel sample check.
  - If the aircraft is not on level ground, note all contamination present in the fuel may be captured. If this is suspected, a gentle rocking of the aircraft wings can help.
- Fuel starvation:
  - Fuel on board but not getting to the engine.
  - Can be the result of an incorrect fuel tank selection. Inadvertently placing the fuel selector in an intermediate position (for example, between L and R) can also cause fuel flow issues.
  - Less common causes are blocked fuel lines, injectors, fuel vents or a failure of the engine driven fuel pump.
  - Good familiarisation with the aircraft's systems and a pre-flight run up can mitigate against the threat of a fuel starvation issue.
- Fuel exhaustion:
  - No usable fuel on board the aircraft.
  - Less likely a factor for EFATOs than fuel starvation as typically some attempt will have been made to gauge the amount of fuel during the preflight.

Take-off Safety Brief:

The time available for decision making during the takeoff is short, and anticipated response to an engine failure is briefed before line up. The aim of the takeoff safety brief (whether it be briefed verbally or mentally) is to *visualise* the actions that will be taken in the event of an EFATO. This process of visualisation has been shown to greatly increase the chances of success.

The take-off safety brief is to include the intentions of the pilot in command in the event of an engine failure both in the take-off ground roll, and subsequent climb out.

The briefing should consider the conditions on the day, particularly wind speed and direction. If the wind is not straight down the runway, then a slight turn into wind following an EFATO would result in increased headwind and lower ground roll. The type of terrain on the departure end of the runway should be visualised, and suitable landing areas recalled from any previous flights.

Take-off Safety Brief example:

"In the event of Engine problem before becoming airborne, I will close the throttle and apply braking to come to a stop. Exit the runway (if possible) and shut down
Engine problem / failure after take-off with adequate runway remaining, I will close the throttle , use flap as requires and attempt to land on the runway or clear area ahead of the runway.
With no runway remaining, I will lower the nose and trim for 65kts, and select a landing area within 45 degrees either side of the nose using flap as require and unlock the door latches.

NOTE: you will be required to give this brief "out Loud" to your instructor whilst training however you would only go through it mentally once license with passengers on board so as not to unduly alarm them. I

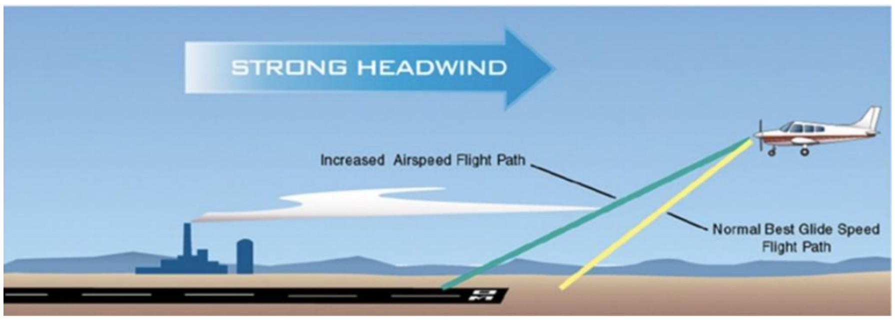
Engine Failure After Takeoff (EFATO):

In the event of an EFATO, we need to lower the aircraft's nose immediately to prevent an inadvertent stall. Maintaining a high nose climb attitude with little or no thrust will result in a fairly rapid reduction in indicated airspeed. Our subsequent actions will be largely dependent on our height above the runway surface.
Below 1000ft AGL, a successful return to the field can be either very unlikely or impossible, particularly if the aircraft has not yet turned onto crosswind. Remember that turning the aircraft will increase the induced drag because more lift will be required from the wings. The increased drag will necessitate lowering the nose to maintain our glide speed, which will increase the rate of descent and reduce the aircraft's gliding distance. Therefore, in situations where we are quite close to the ground, the safest option will typically be to establish best glide speed and attempt a landing in an area that doesn't require a significant amount of turning (i.e. 45 degrees either side of the nose, or anything in the windscreen).

Glide approaches:

Glide approaches from circuit altitude will be practiced extensively in the Circuit Emergencies lesson. The objective of a simulated glide approach will be to maneuver the aircraft with idle power from downwind to land at a point approximately ⅓ of the way down the runway, or at some point designated by your instructor.

Wind: A headwind will adversely affect the ability to reach the intended landing site, sometimes drastically. An *undershoot* is likely to occur when the aiming point begins moving up in the windscreen. When flying into a headwind, increasing our airspeed above the published best glide speed will give us better wind penetration and give a better overall gliding range.



Windshear on final: The only method available to deal with windshear is to increase airspeed.

Moving the aiming point:

Assuming the ⅓ aim point can be reached, we can move the touchdown point toward us by use of the following:

- **Flap**
  - Increases drag
  - Decreases L/D ratio
- **Airspeed control**
  - Flying faster or slower than the best glide speed (adjusted for wind conditions) will result in a shorter gliding distance. Be mindful that reducing our airspeed could put us at or near a stall, and that increasing our airspeed late in the approach can lead to excess energy and float at round out
- **S Turns**
  - Increases distance
  - Decreases L/D ratio
- **Sideslip**
  - Aileron and rudder used in opposite directions
  - Some aircraft are not permitted to be sideslipped, or cannot be sideslipped with flaps. Check with your instructor, or the aircraft POH/AFM.
  - Caution - maintain airspeed

Application:

EFATO:

- Immediately check forward to lower the nose and adopt the aircraft's best glide speed.
- Select a landing area within 45 degrees either side of the nose.
- If above approximately 300' AGL, perform initial action checks. FMC:
  - F - Fuel selector BOTH, fuel pump on (if applicable to aircraft)
  - M - Mixture RICH
  - C - Carburettor Heat ON
- If time permits and prior to touching down - consider unlatching doors and advising passengers to brace. Fuel selector to OFF position, electrics OFF.
- Decide on use of flap to make your chosen landing area.

Glide approach:

Circuit will initially be flown as normal. Late downwind your instructor will call "simulated engine failure", and they will reduce power to idle.

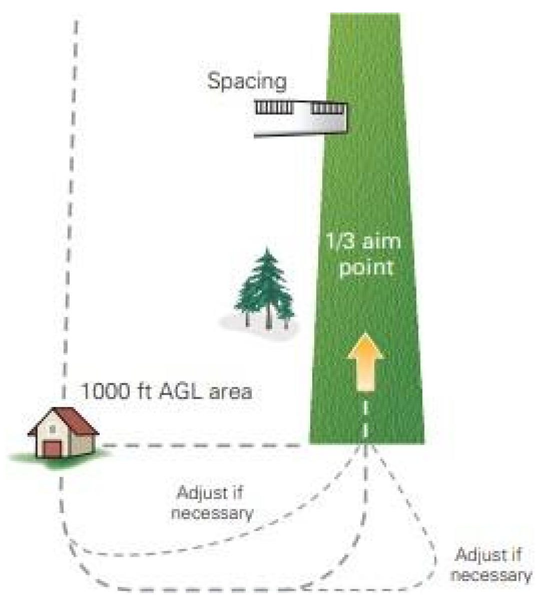
Initial actions will be:

- Apply back pressure and trim the aircraft for 65kts.
- Turn 45° to the field and select an aiming point ⅓ down the runway.
- FMC checks (see above)

Note: The FMC checks are to be conducted *simultaneously* with the trimming and positioning of the aircraft.

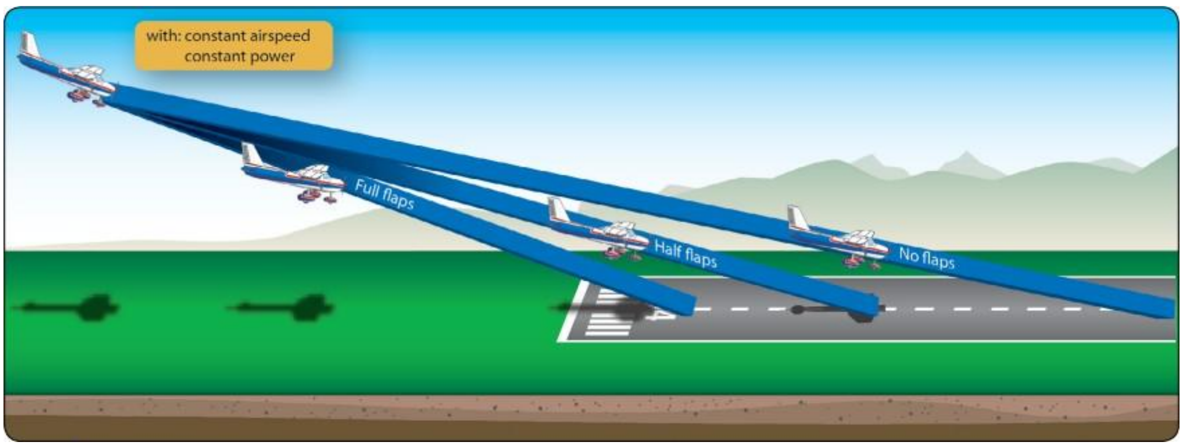
We will continue to descend on a base leg for the runway. We can pay particular attention to where our aiming point sits relative to both our wing strut and its position in the windscreen. In the C172, keeping the aiming point at the point approximately ⅓ of the way down from the top of the wing strut will provide a viable glide path in instances where the headwind is light or negligible. In stronger wings, it will be necessary to position the aircraft closer to the intended landing area, and the aiming point will sit further down the wing strut.

An upward movement of our aiming point relative to our wing strut or a position in the windscreen can be a sign that we are becoming too low. Conversely, if the aiming point begins moving toward the bottom of the wing strut or down in the windscreen, we may be getting too high.



We have several remedies available to us to correct being high, including a slight overshoot of the centreline (see diagram above), flaps, S-turns, sideslipping, and use of an airspeed slightly higher than best glide. Being low can only be remedied by diligently maintaining best glide speed, ensuring flaps are UP, and turning directly toward the landing area.

Use of flaps should be delayed until we can be absolutely assured of making the field. Flaps will have the effect of bringing the landing point closer toward the threshold.



With each stage of flap extension, we must lower the nose to maintain best glide speed. Assess the new glide profile with each stage of flap, and if a landing would still be assured, consider the use of additional flap. Flaps will reduce our landing speed and landing distance required. Anticipate that a large amount of flap will result in a steep approach path, which will subsequently require a much more prominent round out.

Normal landing and braking procedures apply after touchdown.

Airmanship:

- Monitor pressures and temperatures
- Diligent exercise of handing over / taking over procedure
- Be aware of other traffic in the circuit, clearly state pracise GLIDE APPROACH when you give your base call and be sure not to cut anyone else in the circuit.
- Aeroplane safety in doubt - go around.