FORCED LANDINGS - (Long Brief)

Aim:

To learn the major principles, considerations and application of executing a forced landing in the event of a full or partial engine failure.

Objective: By the completion of this brief you will be able to recite the considerations, procedures and immediate actions required for forced landings.

Revision:

Best L/D speed.

Definitions:

Full engine failure - any engine condition that necessitates a descent and landing in the immediate area.

Partial engine failure - any engine condition which may allow the aircraft to maintain height for a short time until a landing position can be achieved at a suitable field.

Considerations:

The most common causes of engine failures in single engine piston aeroplanes are as follows:

a. <u>Fuel exhaustion and or fuel starvation.</u>

i) Improper fuel management (running a tank dry despite having fuel in other tank)

Ii) Improper planning for Trip fuel/reserves and weather conditions.

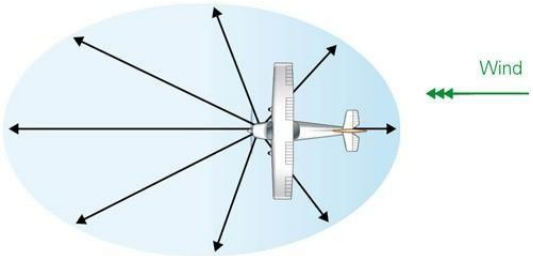
iii) Pilot lack of design familiarity with aircraft fuel system operation

b. Carburettor ice
c. Major mechanical failure - beyod pilot control
    i. Broken connecting rod, valve, crank, camshaft
    ii. Oil system failure

2. Wind assessment:

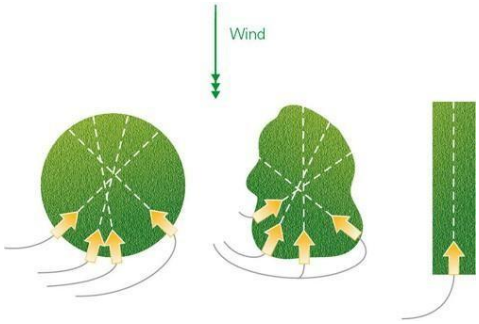
a. Smoke
b. Wind vanes on water
c. Cloud shadows - use caution as winds aloft can differ significantly from winds on the ground
d. Trees, dust, grass, crop movement
e. Forecast winds and wind at departure aerodrome

Consider the effect of wind on landing distance required and on the aircraft's gliding range. Landing into wind is generally preferable, but other factors including field orientation and surface slope will need to be considered. Gliding distances will be reduced into a headwind, and increased into a tailwind.



3. Field selection:

a. **Size:** as large as possible
b. **Shape:** consider all types of landing sites. Do not limit yourself to fields that resemble a runway. Any shape will suffice if of suitable size and locally we have beaches which are preferable to rough terrain.



c. **Slope:** an uphill slope is preferred over level ground. A downhill slope should be avoided as it would take a very strong headwind to override the disadvantages of a downhill slope. Surface slope can be difficult to ascertain from the air unless very steep.

d. **Surface**: a firm surface is preferred to prevent the nosewheel digging in (to a soft surface) and somersaulting the aeroplane. Surface type can be ascertained by runway texture, and by comparing it to the surface texture at a known local aerodrome with a grass runway. A very green surface could indicate that the field is wet and soft. A dark brown field is likely freshly ploughed. If a landing must be made on a ploughed surface, land along (not across) the furrows.

Surface also includes anything on the surface including crops, stock, fences, stumps, animal holes, wet patches, surface undulations etc.

e. **Surroundings**: where possible, a landing area with a clear field in the approach and upwind areas should be chosen to provide for undershoot and overrun during forcedlandings.

Check for proximity of powerlines, especially when making an approach over a road. All of the previous factors are a priority, but landing near to habitation/civilisation will put you closer to help.

Other factors to consider in field selection

Sun: the sun is mostly a factor around sunrise or sunset, and more so in winter where the sun spends more time lower in the sky. Accepting some crosswind may be preferable to an approach directly into the sun.

Elevation: based on local knowledge, charts or by comparing the altimeter to terrain perspective, the height above mean sea level of the selected landing site needs to be estimated. This is because the forced landing procedure is based on planned heights above ground level, but flown at heights above sea level with reference to the altimeter.

Application:

Engine Failure (Simulated)

1. Immediate actions:

Convert excess speed to height / obtain best glide speed (65kts in the C172.). Trim.

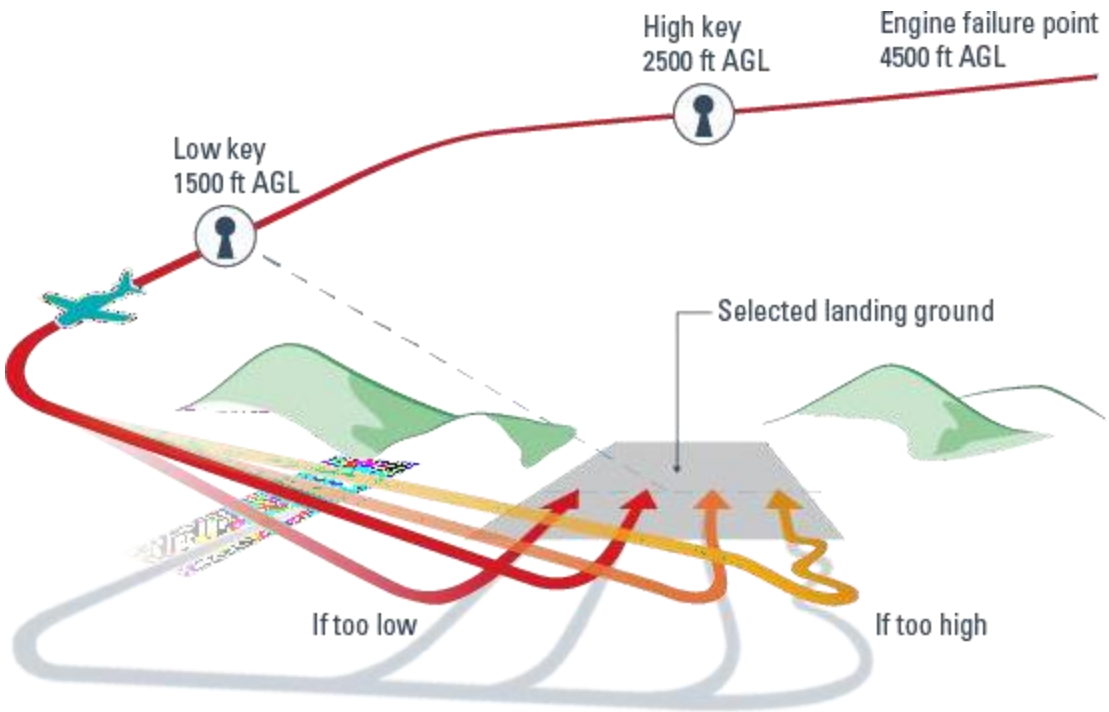
F - confirm Fuel selector valve BOTH. Fuel pump on if applicable

M - Mixture RICH

C - Carburettor Heat ON

2. Assess wind and select paddock.

3. Plan approach:



Refer to the diagram above. When we have selected our field, we want to maneuver the aircraft to fly a descending pattern that reaches a set of designated reference points at pre nominated heights above ground level (AGL). Flying a pattern into a landing field is preferable to picking a field in the distance and gliding toward it in the hope of making it, because a pattern grants us a much better perspective of whether or not we are on profile for a successful landing at any specific point, and gives us the opportunity to correct.

We will nominate a set of low key and high key points to provide some reference of the required height at any point in the pattern.

The 2500ft AGL high key point is located on the upwind end of the selected field, and the 1500ft AGL low key point is located on the downwind leg of the pattern; abeam the aiming point on the selected landing ground. We will aim to touch down roughly ⅓ of the way into the field. This mitigates against the risk of finding ourselves too low and without options late in the approach phase.

If we find ourselves reaching our high key point *below* 2500ft AGL, it is an indication that we are too low in the pattern and we should shortcut our track to the low key point, which we intend to reach at 1500ft AGL. If we find ourselves reaching our high key point *above* 2500ft AGL, we may need to consider options of altering our flight path to ensure we don't reach the low key point with too much height. We can do this by widening our pattern slightly, or by increasing our airspeed to something measurably above best glide. In any case, having visualised where our low key point is, we will maneuver the aircraft to arrive there at approximately 1500ft AGL. We can ascertain correct spacing from the landing area with reference to the wing (low-wing aircraft) or wing strut (high-wing aircraft) just as was practiced during the Circuit Emergencies lesson.

Continually ask yourself, "will I make the ⅓ aiming point". We will use our base leg to make further adjustments to our altitude. If high, consider the use of flaps, of S-Turns, and overshooting final before coming back in toward the field. Remember, if we are high we also have the option of flying faster to reduce our gliding range. If low, turn toward the aiming point and ensure we are maintaining our best glide speed. In high wind conditions, we may need to sacrifice a base leg and track directly to the aiming point. Note that with every application of flaps, our touchdown point will move closer and closer toward us. Do not extend flaps if it is likely to create a risk of undershooting.

4. Trouble checks (not below 1500ft AGL):

C - Carburettor Heat confirm ON
F - Fuel selector valve BOTH, check fuel quantity
M - Mixture RICH, then slowly CYCLE lean and back to RICH. (TOUCH DRILL)*
O - Oil temps and pressures - discontinue checks if excessive oil temp with low pressure
S - Switches - if the engine failure is partial, try switching to LEFT and RIGHT magnetos to see if any improvement. If not, back to BOTH. (TOUCH DRILL)
T - CYCLE Throttle through its range to check for any improvement. For a simulated engine failure, bring power to 1800RPM for a few seconds every 500ft to mitigate against plug fouling and to ensure that ice hasn't started forming in the carburettor.

*Where a checklist item has been noted as a touch drill, we will only *simulate* performing the action.

5. Reassess our plan and approach

6. MAYDAY Call:

We would now tune the local MELBOURNE CENTRE FREQUENCY (120.75) and make a distress call:

- ➔ "MAYDAY, MAYDAY, MAYDAY"
- ➔ ACFT call sign (3 times)
- ➔ Aircraft type
- ➔ Position
- ➔ Nature of distress
- ➔ Pilot in command's intentions
- ➔ Any other information that may facilitate the rescue

7. Squawk 7700 on transponder.

8. Reassess our plan and approach.

9. Passenger brief:

Valuable time can be saved here if the passengers have been provided an emergency brief before the flight. You will still be required to brief the passengers and explain clearly and succinctly what they will need to do. Advise passengers to check for loose objects, to ensure harnesses are tight, and on how to adopt the brace position. Request that the front seat passenger unlatches their door and holds it ajar prior to touchdown, to prevent it from jamming closed in the event of the airframe deforming. Provide passengers with a meeting point once on the ground - normally ahead of the aircraft if landing into wind - to minimise the risk of burns in the event of a fire breaking out.

10. Safety checks (prior to touchdown):

B - Brakes OFF
U - Undercarriage (fixed down)
S - Shutdown: Fuel selector valve OFF, Mixture OFF, Magnetos OFF, Master OFF (if aircraft has electric flaps eg. C172, MASTER OFF once flaps are set and landing is assured)
H - Harnesses SECURE, Hatches UNLATCHED and kept ajar before touchdown.

The priorities during a forced landing without power are always in the order of

AVIATE, NAVIGATE, COMMUNICATE.

Aviate - Fly the aircraft accurately and carry out the checks thoroughly.
Navigate - Maintain situational awareness. Keep the landing site in view at all times. Fly the pattern as necessary to achieve this, and adjust as necessary.
Communicate - Carry out a simulated MAYDAY call. Communicate with others on board to reassure and assist.

Airmanship:

- Maintain a good lookout during practice
- Know the necessary checks so they can be performed without detracting from the safety of the flight.
- Be flexible and exercise Command Judgement.
- Engine warms every 500 feet during practice.