15
EMERGENCY AND SPECIAL PROCEDURES

AIM

To teach the student how to carry out a safe approach and landing following an emergency and to consider the action in event of fire.

INSTRUCTIONAL GUIDE

A forced landing due to mechanical malfunction occurs only very rarely with modern aeroplanes. A forced landing due to poor airmanship should in theory never occur. In practice it occasionally does. The pilot must have an understanding of how to cope with emergencies during which he or she may or may not have the use of engine power and during which the student may have to land the aeroplane away from a prepared aerodrome or even ditch it. The forced landing procedures to cover these contingencies will differ. If power is available there is time to act deliberately and think through the problem, perhaps even seeking assistance on the radio. If no power is available a quick decision and sound judgment are the essentials especially after take-off or during low level operations. If the aeroplane is to alight on land then the actual landing should have already been practiced. On water a different technique has to be applied. For these reasons the exercises are dealt with separately.

Before leaving the circuit on solo flights the student should have had some instruction in forced landings without power and should have grasped the basic requirements of the exercise. The student cannot of course, be expected to be fully proficient at this early stage.

The ultimate aim in practicing forced landings is to make the student so familiar with the procedure that, should he or she be faced with such an emergency, no time will be wasted on what to do and how to plan an approach.

In the early attempts the instructor should carefully point out the field to be used, should allow the student to practice several approaches from the same height and should place the aeroplane in an ideal position relative to the field. As training progresses the task should be made progressively more difficult. Heights and positions should be varied and different fields chosen. When the student has reached a suitable basic standard the practice can be made more realistic by closing the throttle without warning at various heights and under various conditions.

Given the relative complexity of a forced landing due to the number of expected actions, a GFPT or PPL applicant should be able to complete all the checklist actions from about 2,000 feet AGL and a CPL applicant from about 1,000 feet AGL.

Note: Whilst the thrust of this manual is towards simple fixed undercarriage training aeroplanes it does no harm to mention the following undercarriage considerations to a student.

When forced to carry out a landing away from a prepared surface the position of the undercarriage, if retractable, must be considered. If the aeroplane has a tricycle undercarriage it is generally advisable to land with it in the locked down position. By doing so the risk of injury is minimized, since the initial impact is cushioned by the undercarriage and the fuselage may be held clear of smaller obstructions. Full brake can be applied immediately after touchdown.

In the case of an aeroplane fitted with a tail wheel the undercarriage should be retracted if possible. If this is not done there is a risk of the aeroplane nosing over and coming to rest in the inverted position. If the pilot is certain that the surface is good and the length adequate it may be possible to land with this type of undercarriage locked down.

When forced to ditch an aeroplane the undercarriage should invariably be retracted if possible.

PRE-FLIGHT BRIEFING CONSIDERATIONS

COMPLETE ENGINE FAILURE

When a complete engine failure occurs the fundamental considerations are those of time and height. However, the immediate actions are normally to close the throttle, speed to height (or for distance), check for fire, trim for the glide and conduct initial trouble checks.

The next action must be to choose a suitable landing area bearing in mind the wind speed and direction (which should be known at all times) and the student must be briefed on how to make the most of the restricted choices available. Figure 15-1 shows the descent profile to the intended landing area and suggested procedures. Figure 15-2 shows a method of selecting a landing area. The field must be within easy gliding distance. Ideally it should have a long run into wind, a good surface, and no obstructions particularly on the approach, and be near where assistance is available. The best indications of wind direction are obtained from a windsock and smoke or dust. The movement of cloud shadows is a good indication, particularly if the clouds are not very high. Wind lanes on water are useful. Failing any of these indications the take-off direction and forecast winds should be used as a guide. When low down, the drift of the aeroplane may also give a good indication of wind speed and direction.

The student should be briefed that whilst a landing into wind is normally preferable, it might on occasions be advantageous to land across the wind. It may be that a long run with an acceptable cross wind component would provide a safer landing area than a short run into wind. If the wind is very strong the long run could not be used and the short one might be adequate. It is usually preferable to land uphill but down wind rather than downhill but into wind.

Figure 15-1: Engine failure descent profile and procedures.

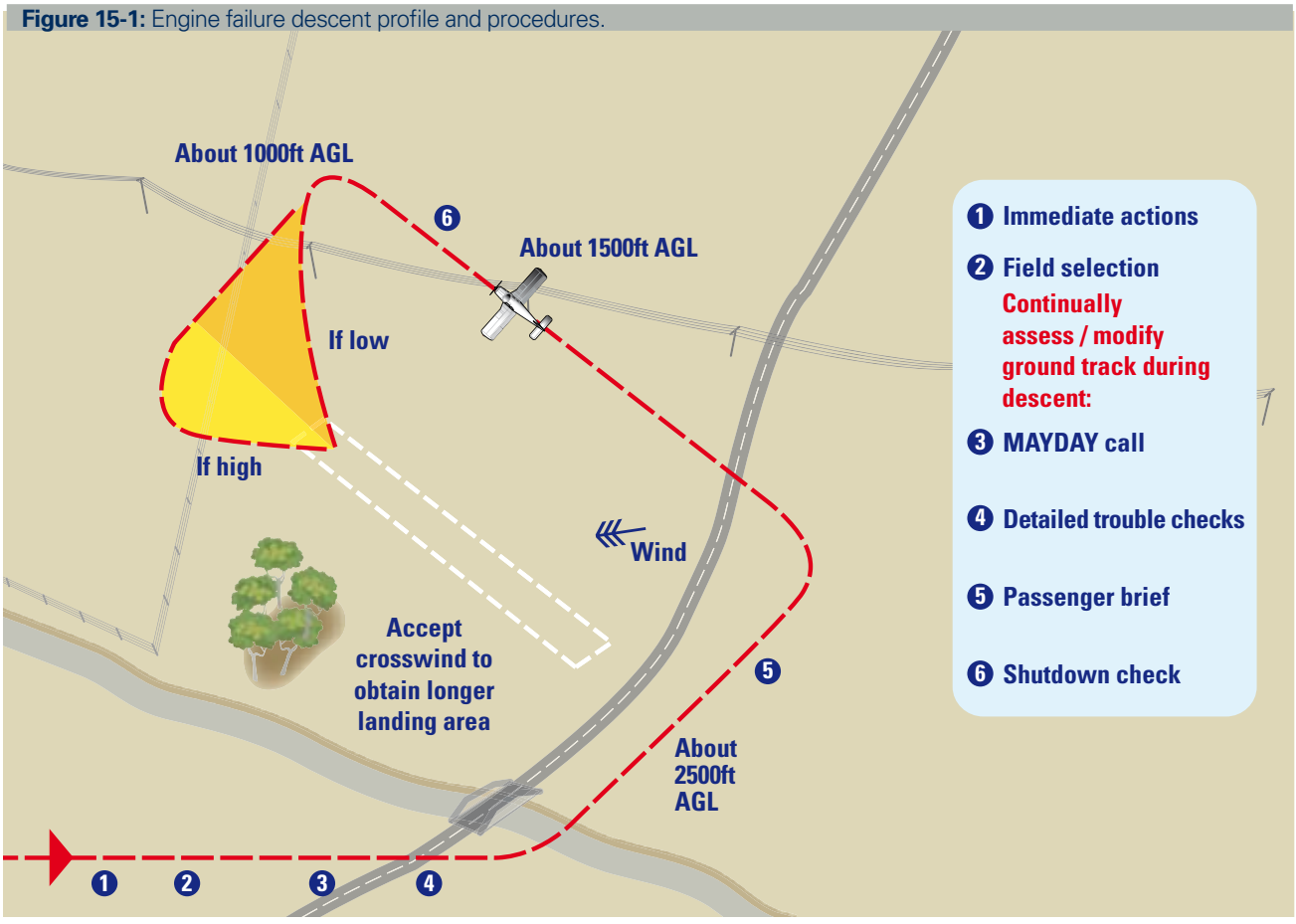

Figure 15-2: Mnemonic for selecting a landing area.

MNEMONIC FOR SELECTING A LANDING AREA

Wind – speed & direction
Obstacles – above ground
Size – in relation to wind
Surface – condition/type
Slope – may land uphill downwind
Shoots – undershoot & overshoot
Sun – if possible do not land looking into the sun
Civilization – near to a homestead if possible

Some indication must be given to the student as to the relative merits of various surfaces.

Obviously an aerodrome or prepared airstrip is the best choice. A disused aerodrome is usually satisfactory. Pasture will probably be the next best choice and stubble usually provides a fairly good surface. If ploughed land has to be used land along the furrows if possible. Standing crops should be used only as a last resort and beaches should be treated with caution though they may, in fact, be very good. Local knowledge is invaluable and practice at choosing fields should be continued right through the student's training.

Having selected the field and landing direction a plan must be formulated. This depends principally on the height available and distance to the field. If the aeroplane is say, 5,000FT above the field it will probably be advantageous to fly around the field. In any case the aeroplane must be flown to a position some 1,000FT above ground level which is, in effect, on the base leg relative to the chosen field and from which a comfortable glide into the field can be made. Explain that the altimeter does not necessarily give an accurate indication of the aeroplane height above the ground.

Demonstrate the procedure to the student on a whiteboard, on paper or by electronic means. Draw a plan of a field and mark the areas at which the aeroplane should arrive in order to carry out a glide approach, aiming to land well inside the field. Discuss the methods of arriving at this point, assuming engine failure at various positions relative to the field and at various heights. Explain that it is really a question of getting there in the simplest way.

Brief the student that having chosen the landing area and planned the descent on the assumption that the cause of the engine failure cannot be rectified, it is now necessary to look for the cause of failure. Re-check the fuel, ensuring that a tank containing fuel is selected.

Check that ignition switches, mixture control, carburettor air, and other engine controls are set for operation. If the engine has stopped rotating set the controls and try the starter unless there are obvious symptoms of mechanical failure. As soon as a forced landing becomes inevitable the student should be briefed concerning the contents of a distress call. It should be stressed that this call be broadcast as soon as possible as the greater the height of the aeroplane the better the chance of the call being heard. The student should be briefed that if the engine cannot be re-started the fuel and ignition switches should be turned off at or before reaching the 1,000FT area. Point out that in some aeroplanes the master switch must remain on until the final flap selection is made. All seat belts should be tightened by this time and a simulated passenger brief given.

Explain how you intend to demonstrate the approach, emphasizing the way to adjust the base leg by either turning slightly away from the field if too high or turning in early if rather low. Explain the use of flap, pointing out that this should be restricted initially to leave as much variation of control as possible over the angle and rate of descent. The considerations are the same as for a glide approach except that when absolutely sure of getting into the field full flap should be used unless some aeroplane peculiarity makes this inadvisable.

The subsequent actions after landing will depend on the location of the aeroplane. If the landing has been made in desolate country the question of survival is the dominant one and this is outside the scope of the pre-flight briefing for this exercise. Generally some form of habitation should be sought and the appropriate authorities should be notified. The student should be reminded that search and rescue signals and information are contained in the Aeronautical Information Publication.

AIRMANSHIP

This exercise is practiced only in an approved area or at special ALAs approved for the purpose. Since several aeroplanes may be practicing at these fields a good lookout is essential at all times.

During dual exercises the descent should be continued down to a position from which it is possible to determine without doubt the success, or otherwise, of the exercise. At certain suitable locations a touchdown might even be possible. Instructors must brief students on the minimum height to which they may descend whilst solo. This height will normally be not below 500FT AGL

To reduce the incidents of spark plug fouling plug briefly increase power to the cruise setting every 1,000FT or use other specified procedures.

In a real emergency the decision as to whether or not to switch off the engine is governed largely by the following two considerations:

(i) If the failure is definitely mechanical it should be switched off immediately

(ii) If the failure is partial, resulting in reduced or intermittent running, the engine may be used at the pilot's discretion, remembering that it may pick up temporarily or fail again at a critical stage. In such a case it is probably best not to rely on the faulty engine and to assume a total failure.

Note: The engine failure should be simulated only by closing the throttle. Ignition switches and fuel tank selectors should not be moved during practices.

PRECAUTIONARY SEARCH AND LANDING

For a variety of reasons other than engine failure a pilot may be faced with the decision to land away from a prepared surface. These reasons are nearly always due to faulty navigation, poor planning (running out of fuel or daylight) or encountering bad weather and this cause is also often due to poor planning.

From the outset the student must understand that should any doubt exist as to the advisability of continuing the flight the decision to land must be made whilst there is still time to do so with the aeroplane under full control and before conditions deteriorate to a dangerous level.

For the purpose of the exercise it is as well to brief the student that conditions of poor visibility with a low cloud base and limited fuel will be simulated.

Once the decision to land has been taken a suitable landing area must be sought immediately. The considerations regarding size, surface, freedom from obstructions and wind direction are essentially the same as those for the exercise involving complete engine failure. As soon as a likely area has been sighted it should be inspected thoroughly.

Draw a plan of a field for the student and brief on how to fly parallel to and normally to the right of the proposed landing path. This run should be made with the optimum flap setting at slow cruising speed. This preliminary inspection should be sufficiently low for the surface to be inspected but not so low that it is necessary to avoid obstacles. Another point to impress on the student is that the inspection runs should be made at a constant height whilst safely avoiding upwind obstacles. If not satisfied with the surface complete at least one other inspection run at a lower height if necessary.

When satisfied with the area, complete a circuit keeping the field in sight. Position the aeroplane for a short field landing.

When the surface wind is other than light and variable, flying into wind will produce a noticeable reduction in ground speed. When flying down wind the increase in ground speed may be so noticeable that under extreme conditions a student may be tempted to reduce airspeed, which is dangerous.

Brief the student that when the wind is strong enough to produce drift, this makes turns deceptive. When turning down wind from into wind the aeroplane gives the impression of slipping in. The converse applies when turning from down wind to the into wind position, in this case the aeroplane appears to skid out. These impressions are optical illusions and rudder must not be used to correct this apparent unbalance without confirmation from the balance indicator that the application of rudder is necessary.

Although these are optical illusions the drift is real. Care must therefore be taken to ensure that the student allows plenty of room when turning from down wind into wind inside a confined area.

AIRMANSHIP

With good airmanship the student should rarely be forced into a position to have to carry out this procedure.

The decision to land must be made in ample time before fuel runs out, before it becomes too dark or before the weather deteriorates to a dangerous level.

The need for a really good lookout whilst carrying out this low flying exercise cannot be over-emphasized.

Turns must be accurate in spite of the deceptive appearance of the ground.

This exercise must be practiced only in approved areas or at approved fields and even then all effort should be made to avoid frightening livestock and annoying people. Point out to the student that it is good airmanship to apply the inspection technique to a landing ground, other than a recognized aerodrome, with which you are not familiar. It may not be necessary to carry out a short landing in all cases though of course no harm will be done by adopting this technique.

ACTION IN THE EVENT OF FIRE

Fires in the air and on the ground are both rare occurrences. Nevertheless, the student must receive a briefing on how to cope with these emergencies. One of the main points to cover is to ensure that the student is conversant with the position and method of use of every fire appliance in the aeroplane.

FIRE ON THE GROUND

The most common causes of fires on the ground are fractures allowing leakage of oil or fuel under pressure. These causes are associated with rotation of the engine. It follows that the student must be briefed that to close the throttle is invariably the first action to be taken should fire occur. Fuel and ignition switches must be turned off. Fire extinguishers should be operated if the fire shows no sign of abating.

Fire may also be caused in some engines by over-priming or even by facing the wrong direction in a strong wind thus allowing excess fuel to accumulate in exhaust systems.

If fire, other than fire associated with the engine, is detected, electrical systems should be switched off and the appropriate fire extinguishers used. Engines should be stopped and passengers and crew should disembark. Remind the student of the very toxic effects of some types of extinguishing fluids.

FIRE IN THE AIR

Fire in the air, though a most infrequent occurrence, is primarily caused by leakage of oil or fuel under pressure. The student must be briefed to stop this leakage by closing the throttle and turning off fuel and ignition switches. The most appropriate fire extinguishers should be used if possible.

A slide slip may be useful in directing smoke and flames away from the cabin area and may even put the fire out. In any case the student must be briefed that a forced landing will almost invariably follow as it is most inadvisable to attempt to re-start the engine.

If a fire other than an engine fire occurs in the air any associated electrical circuits should be turned off. Extinguishers should be used bearing in mind the specific uses for each type. Cabin ventilators and windows should be opened to get rid of smoke and toxic fumes and the aeroplane landed as soon as possible.

DITCHING

The possibility of being faced with the decision to ditch an aeroplane is remote. Even so an instructor should spend a few minutes briefing the student on the best way to tackle this problem, should it arise.

The aeroplane should always be ditched into wind if the surface of the water is smooth, or if the water is smooth with a very long swell. In a very pronounced swell or rough sea the best plan would be to land along the swell, accepting if necessary, the cross wind and higher touchdown speed. The danger of nosing into large waves during an into-wind ditching is very great and should be avoided.

If faced with a ditching the pilot should already have a good idea of surface wind direction. In general, waves move down wind except when very close to the shoreline, or in fast moving estuaries. Remind the student that swell does not necessarily bear any relation to the surface wind direction.

Wind lanes may be apparent, the streaked effect being more pronounced when looking down wind. When the surface is unbroken, gusts may sometimes ripple the surface in great sweeps which indicate the direction of the wind. As the aeroplane nears the water the drift will give a good indication of wind direction.

Water always appears from the air to be calmer that it is. If possible fly low over the water and study its surface before ditching.

Brief the student that the speed and rate of descent should be as low as possible consistent with safe handling. A tail-down attitude should be adopted when touching down by holding off until excess speed is lost so that the speed at the instant of impact is as low as possible.

The value of power during ditching is so great that if a pilot realizes a ditching is inevitable and still has engine power available, the ditching should be conducted prior to running out of fuel If power is available the water surface can be inspected to decide upon the best landing direction and the slowest touchdown made.

Flaps should be used, though in general should not be lowered beyond the optimum setting. To lower them further will increase the rate of descent and may well impair the ditching characteristics of the aeroplane.

The undercarriage should be retracted if possible.

Pilots must be briefed to warn passengers and crew not to relax or move until the aeroplane has come to rest. They should be prepared for a double impact, the first when the tail strikes and then a second and greater shock as the nose hits the water. They should also be prepared for the aeroplane to slew to one side.

Action after ditching will depend on the amount of lifesaving equipment available. However, all persons should wear life jackets when flying over water, except if the over water operations only involve take-off or landing.

AIR EXERCISE

(a) Forced landing—complete engine failure

(b) Precautionary search and landing

FORCED LANDING—COMPLETE ENGINE FAILURE

The following sequence of events is one way of conducting a forced landing following a complete engine failure:

- Initial actions
- Throttle closed
- Speed to height or distance
- Check for fire
- Trim for glide
- Brief check of fuel management plus Temps & Pressures
- Select general area for landing
- Mayday call
- Detailed trouble check & possible engine restart attempt
- Detailed landing area selection & associated letdown profile
- Passenger brief
- Shutdown checks

As it is a practice forced landing open throttle to cruise setting at least every 1,000FT of descent.

At the 1,000FT area carry out a normal glide approach using full flap when sure of getting into the field.

Point out how to adjust this final approach by either turning away from or towards the field, by using a longer base leg, by judicious use of flap, or by sideslipping as applicable to the type of aeroplane.

When sure of the outcome of the exercise point out the height to which the student may descend whilst solo and then carry out the procedure for going around.

Give the student plenty of practice, varying the height and distance from various fields when simulating failure of the engine.

PRECAUTIONARY SEARCH AND LANDING

When in a suitable area descend to about 500FT above the ground and tell the student to assume poor weather conditions with a cloud base of about 600FT and poor visibility.

Choose a suitable airstrip and demonstrate how to inspect the surface. Fly at low safe cruising speed with the optimum flap setting. Fly over the field slightly to the right of the intended landing path at about 100FT to make the first check. On this run check the surface and drift and note any high ground and obstacles in the overshoot area. Climb up to about 500FT and make a circuit keeping the field in sight and placing the aeroplane in a favourable position to make a dummy approach, again to the right of the landing path. On this approach re-check the surface and drift. Repeat the circuit and if quite satisfied with the surface carry out a short field landing procedure or go around procedure.

Give the student plenty of practice at this exercise. During the initial attempts point out the effects of drift near the ground which give rise to optical illusions.

Practice at various fields assuming different weather conditions and ensure that the student is competent at this exercise before authorizing solo practice.