Flapless Landings

This briefing and exercise is practiced before first solo (refer CFI) to prepare the student against the unlikely event of flap failure during early solo circuit consolidation. Therefore, it must be assumed that flap failure will not have been detected before starting the base turn, where flap is first selected.

What should the student do? Continue with the approach, by switching to a flapless approach or go around, re-circuit and prepare for the approach during the downwind leg? Clearly, if there are no other factors to be considered such as fuel or weather, the go around is the better option.

Objective

To carry out a flapless approach and landing.

Principles of Flight and Considerations

In all cases where a systems failure or unexpected deviation in procedures occurs –

Aviate – Navigate – Communicate

Aeroplane System

Although the possibility of failure is rare, the student needs to know how the aeroplane's flap system works and what can be done, not only to deal with any problems arising from its operation, but also how to prevent them occurring.

Describe the aeroplane's flap and electrical systems (even if the aeroplane has manual flap operation) with emphasis on their inter-relationships, through schematics, actual components, models and handouts (refer Flight Manual).

Detection

The risk of this failure going undetected can be minimised by a thorough preflight inspection, mitigated by sound aeroplane systems knowledge and possibly highlighted before flap selection by carrying out the SADIE checks (A = Amps or Alternator for electrically actuated flaps).

It is probable though that a flap failure will not be detected until flap is selected, usually in the base turn. This is no place to deal with a systems failure, so a go around is carried out. The climb to circuit altitude uses the full length of the climbout leg, giving a long downwind leg to consider options and plan for a flapless approach.

Causes

The most probable causes of flap failure are mechanical linkage failure (manual or electric flap), electric flap motor failure, or electrical current failure.

Another possible cause, that should never occur, is flap overspeed. If the flap has been extended or left extended at speeds in excess of the manufacturer's recommendation, the flap or linkages may be damaged. If this occurs, flap retraction may not be possible, with a consequent degradation in flight performance. Worse than this, is the possibility that the flap will retract unevenly, causing uncontrollable roll. A third possibility is that loads on the electric flap motor will cause it to burn out with the consequent risk of fire. This damage can go undetected, and may not result in an immediate flap failure, but may occur on later flights.

This malfunction is avoided by never exceeding the V_{FE} speed (Velocity for flap extension – white arc) with flap extended.

Figure 1

Diagnosis

Once the aeroplane is established in level flight at a safe altitude, the possible causes of the systems failure can be considered.

If electrically operated flaps fail, check the master switch is ON, the flap circuit breaker is set (or if popped reset only once), and the alternator or generator output and battery state tested (if applicable). In addition, a visual check of flap position is made to ensure that it is not the flap position indicator that has failed. The visual check can also look for any asymmetric condition.

Procedure

With flap up, the stalling speed is greater than with flap extended. To retain the same margin of airspeed over the stall speed, the approach and threshold speeds are increased by about the difference in the aeroplane's stall speed clean and the stall speed with full flap – commonly 5 knots for light aeroplanes.

This increase in threshold speed will result in a longer landing distance, and therefore the suitability of the runway should be considered. Neither the group rating system nor the P-Charts allow for a flapless landing.

Without the increased drag provided by flap, the power setting required to control the descent will be lower, the descent angle will be shallower, and forward visibility will be poorer.

Airmanship

Situational awareness is improved through systems knowledge and routine systems checks.

Revise the SADIE checks, as introduced in the *Circuit Introduction* lesson.

The higher approach speed can affect your judgment of the spacing between you and the aircraft in front.

Aeroplane Management

As a result of the decreased drag, only small power changes will be required to alter the rate of descent.

Human Factors

There is a tendency to accelerate as the student unconsciously seeks the lower nose attitude they are familiar with from a normal approach and landing.

The simplicity of the manual flap extension system requires minimal systems knowledge. Electrically operated flap requires more systems knowledge and provides the student with the opportunity to practice problem solving.

Air Exercise

A flap failure will be simulated at the base turn or when flap is first selected, and a go around carried out for the first occurrence.

For further simulated flapless landings the student should assume that the failure is identified downwind, and there is no need to complete the go around.

Downwind

The systems checks are carried out (if applicable) as well as the normal radio call and downwind prelanding checks.

The suitability of the runway in use is considered and a decision made on the appropriate approach speed to be used.

> If the runway in use is not suitable and a diversion to another aerodrome is preferred, practice in this procedure should be given before first solo (refer CFI).

Downwind spacing is assessed, and an appropriate power setting at the base turn point is selected. Because of the decreased drag without flap and the desirability of a powered approach, it is common practice to extend the downwind leg and set the same power setting as a normal circuit, so that some power will be used throughout the approach.

An alternative method to stretching the circuit out is to extend downwind only slightly and initially use a much lower power setting. As the aeroplane sinks onto the correct glide slope or approach path, power is slowly increased until the desired rate of descent is achieved. The aim point should not move up or down but remain steady in the windscreen.

Base

The base turn will have a lower power and higher nose attitude. Ensure the student trims the aeroplane for the descent. Because of the aeroplane's higher inertia, the turn onto final will need to be anticipated earlier than normal.

The Approach

The approach is flown as normal with the attitude selected to maintain the higher approach or threshold speed and trimmed. Only small adjustments in power should be required to control the rate of descent.

The noticeable differences in this approach are;

- the higher nose attitude required to maintain the desired airspeed, which results in reduced forward visibility (runway may be largely obscured), and
- the effect of power changes on the rate of descent.

As always, if attitude or power is altered some adjustment to the other component will be required to maintain the desired performance.

Power + Attitude = Performance

Landing

Because the aeroplane is already in a higher nose attitude than normal with a lower rate of descent than normal, the round-out is less pronounced and only a slight hold-off is used. The aeroplane is then allowed to sink in a slightly nose-high attitude to prevent the nosewheel taking the landing loads. The nosewheel is then lowered and brakes applied as required, aft elevator is used to keep the weight off the nosewheel.

As the student is familiar with holding off for the normal fully flared landing, resisting an over-flaring action and allowing the aeroplane to sink onto the runway may take some practice.

As with all powered approaches, runway length available and aim point notwithstanding, it is desirable to touch down just inside the threshold. If a prolonged float is permitted to develop, a go around may be appropriate.

Airborne Sequence

Before Flight

By this point the student should be able to do all of the radio work for the flight, with minimal input from you.

As discussed at the end of the last lesson the student will do their own takeoff safety brief.

The Exercise

Start with a normal takeoff and simulate flap failure on the base turn of the first circuit, by saying "assume you now have a flap failure."

After the simulation of flap failure, and the repositioning of the aeroplane downwind by the student, the circuit continues normally until the base turn.

Since the flapless landing will usually be a full stop, the next take-off may be a good opportunity to practice an EFATO. Be careful not to fill all of the circuit lessons with emergencies, the student still needs plenty of practice at normal landings.

After Flight

Mention in your debrief any go arounds that were carried out, and praise the student for taking the initiative – if that is what they did.

Next lesson will be crosswind circuits, so long as the conditions permit. If not, continue practicing circuits, reminding the student to expect the emergency procedures you have covered in all following lessons.