Darling Downs Soaring Club Inc

Training Supplement – Use of Flaps

Flaps

This is a general briefing on flaps in gliders and should be read in conjunction with the aircraft flight manual for the type you are intending to fly.

Why flaps are fitted?

Flaps enable the camber of the wing to be changed so the wing will be at its optimum for the speed being flown.

Correct use of flaps will keep the wing operating near its optimum angle of attack and will result in the fuselage meeting the airflow at the angle which causes the least drag.

Flap settings

The flaps normally found on gliders will allow the trailing edge of the wing to be lowered through typically two stages (pre-set angles). This is *positive flap*.

The first stage will be about 8 degrees for flight at slow speeds (thermalling) and the second stage will be about 30 degrees for landing.

On high performance gliders the flaps can also be raised above the neutral (or 0 degree setting) to reduce the camber of the wing. These settings are for flight at high speeds. There are usually 2 or 3 high speed settings available. These flap settings are *negative* flap.

The flaps may be linked to the ailerons , so that as flap is raised or lowered both ailerons rise or lower in unison, making sure that as much of the wing as possible has the best camber for the phase of flight.

The flaps are normally controlled by a single lever in the cockpit which is moved aft to lower them, and forward to raise them.

Generally, positive flap lowers the stall speed; negative flap raises the stall speed (check your flight manual)

It is worth noting that lowering ('drooping') the ailerons reduces the roll rate of the glider and thus selecting full landing flap in such gliders may need to wait until after the turn on to final is complete.

Use of flaps on take off

For take off, the flaps should be set to give the wing enough camber to produce the maximum amount of lift as early as possible without creating too much drag. This would normally be at the *thermalling* setting.

Some gliders may begin the take off with flaps set at zero to ensure adequate aileron control during the ground run, others may use a negative (upward) setting such as -7 degrees. This will raise the ailerons and give the maximum aileron control at low speeds, which may be necessary in light or cross wind conditions to prevent wing dropping during the early part of the ground roll.
As soon as good aileron and directional control is achieved (before the glider reaches flying speed), the flaps can then be lowered. If this technique is used it is essential that:

1. Your hand is on the release not flap lever until aileron and directional control is gained and
2. When you change the flap setting you must positively identify the control prior to operating it.

As, changing the flap setting at this stage of the flight may cause the glider to become airborne suddenly, be prepared for this to prevent the glider getting to high.

For gliders that can take on large water ballast loads (eg Nimbus), you will probably need to use at least the first positive flap setting to get the glider airborne before the tug.

Use of flaps in flight

The large airspeed ranges used by modern gliders means that if flaps are fitted they should be adjusted as the airspeed is changed. This will keep the gliders wing flying at the optimum angle of attack and give it the best camber for the phase of the flight at any one time.

When a glider is thermalling or flying slowly in rising air the flaps should be lowered to the first positive setting (about 8 degrees). To lower them any more will incur a large drag penalty and cancel out the extra lift gained.

Zero flap setting (0 degrees) is used to achieve the best glide angle.

Once the glider accelerates to fly at speeds of over 60 knots then a thinner less cambered wing is an advantage, with less drag as the lift increases with speed.

Typical flap settings and speeds are shown in the table below:

FLAP SETTING	SPEED
+8 degrees	Up to 55knots
Zero	55-65 knots
-4 degrees	60-85 knots
-7 degrees	85 knots and above

The glider must be flown within the speed/flap range or performance will suffer.

You should keep your hand on the flap lever when in flight smoothly easing the flaps up or down as the airspeed is increased or decreased. Try and avoid jerky flap movements and unnecessary changes of flap.

When rolling into thermals it may be best to leave the flap extension until the aircraft is established in the thermal.

The flap/speed combinations will change if the wing loading is varied by carriage of water ballast.

Use of flaps during approach and landing

NOTE: Use of positive flap gives a lower nose attitude for a given speed. It is important to ensure you establish the correct speed on final and verify it on the airspeed indicator.

For normal landings the flap should be set at the first stage of positive flap (+8 degrees) and airbrake used to control the rate of descent. This will enable a lower approach speed due to the lower stall speed with flaps deployed.

The landing flap position lowers the flap beyond the point where a useful amount of extra lift is produced to a setting where a large amount of drag is produced. This setting should not be used unless you are on finals and can safely reach the landing area. It is only for short landings over obstacles where a steep descent is required.

Flap **should not** be raised once on final as it will cause a loss of lift (and hence, height) and increase the stalling speed.

After touchdown selecting negative flap on the ground run may give better aileron control, however if it may cause a distraction do not do this giving full concentration on the ground roll.

Limiting flap speeds

The maximum speed permitted will vary according to the flap setting. Exceeding the maximum speed for a given flap setting could cause damage to the aircraft.

The following table is an example of flap limiting speeds:

Flap setting	Maximum Airspeed
Landing flap	70 knots
+8 degrees	70 knots
Zero	120 knots
-4 degrees	130 knots
-8 degrees	145 knots (VNE)

When changing flaps in flight, you want to avoid putting loads on the flap settings at higher speeds, and carefully observe the maximum speeds for various flap setting. The technique is:

- When increasing speed – change the flap setting first and then increase speed.
- When decreasing speed – reduce the speed and then change the flap setting.

Flap/airbrake systems (as per the Ventus and Nimbus and Mosquito)

A more complex system of trailing edge airbrakes and flaps exists in some gliders. With this system, the glider possesses conventional flaps for performance flying but also has a landing flap setting. In addition a trailing edge airbrake is linked to the flap.

When the airbrake lever is operated, a portion of the upper surface of the wing, just in front of the flaps rotates upwards to cause extra drag.

Once this airbrake section has reached a certain extension, further aft movement of the airbrake lever will, as well as extending the airbrake section further, lower the flaps to a large angle (around 80 degrees) to increase the drag and rate of descent.

Due to this ability to increase the drag adequate airspeed must be adopted and maintained.

The characteristic of reducing lift when flap is raised at slow airspeeds is something that you should be aware of when using this type of flap/airbrake.

In some aircraft, the use of full landing flap may reduce the responsiveness of the aircraft and in gusty conditions, it may be advisable to use less landing flap.

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Hints

- Know your airspeed limits for the appropriate flap settings
- Be aware of the dangers of raising the flaps when on final, resulting in loss of height and increase in stalling speed.
- Know the flap setting for each speed to be flown to ensure that the correct flap setting is used for the appropriate speed.
- Check the flight manual for the aircraft you are flying. In strong winds, flaps for takeoff and landing may not be recommended.