5B – EFFECT OF CONTROLS - AIRBRAKES & SPOILERS

INTRODUCTION

The aim of this exercise is to demonstrate the effect of opening and closing the airbrakes on the rate of descent, the attitude and airspeed of the glider.

- Effect of opening and closing airbrakes/spoilers on air speed.
- Changing sink rates on opening brakes/spoilers.
- Forces required at different speeds.
- Selecting the right lever.

THEORY BRIEFING

Airbrakes

The primary effect of airbrakes is to increase the drag on the aircraft. The amount of drag can be varied by the pilot, by adjusting the extent to which the airbrakes are extended. The effect is two-fold by adding drag and reducing lift. As an example, a K13 at 55kts has a glide ratio of 25:1, and with full airbrake deployed, this becomes 6:1, giving good approach control, enabling steeper approaches and shorter landing runs.

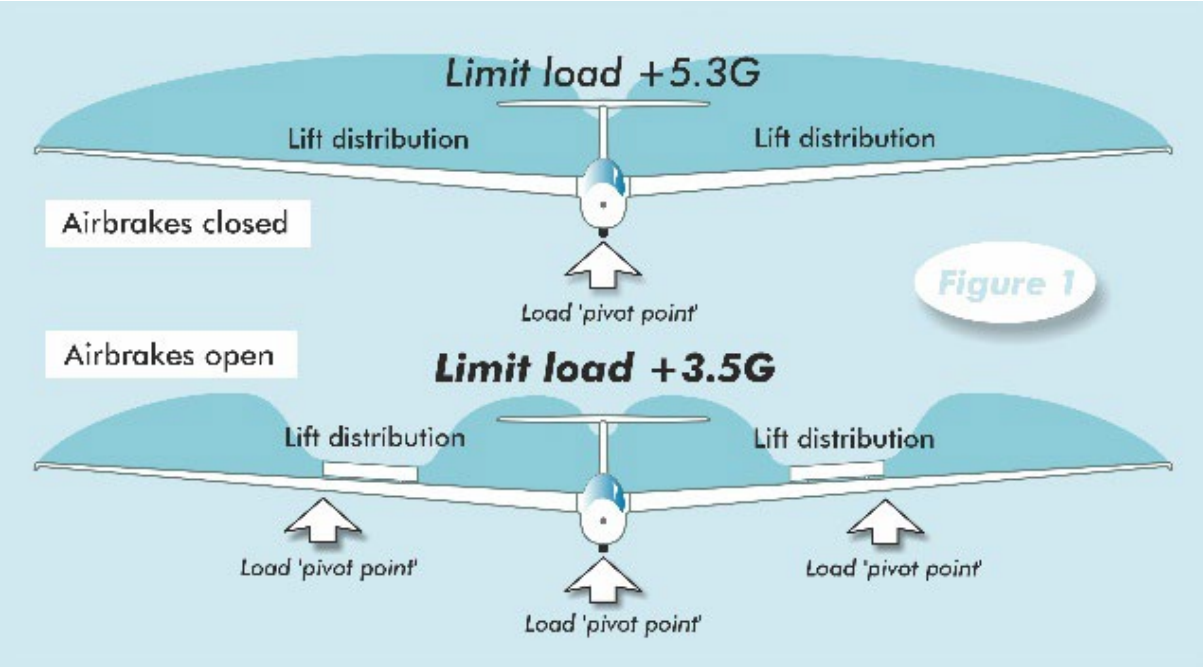
The drag is also speed sensitive, increasing as the square of the speed and this causes the glide angle to reduce considerably further with increased speed.

Trainees often mistakenly believe that you can control the speed on the approach by pulling more brake. It needs to be explained that the primary purpose of airbrakes is to control the rate of descent.

However, extending the airbrakes, spoilers or any other approach control device, will have the effect of changing the trim of the glider and the increase in drag will start reducing the airspeed. Therefore, the nose of the glider will need to be lowered to maintain speed, but the change of trim may be nose up or down. Therefore, any change in the airbrake setting will require a nose up or down adjustment to compensate.

The loss of lift when deploying airbrakes will increase the stalling speed, a consideration when choosing the minimum approach speed, or in the case of a balloon landing when airspeed may be low. At increased speed when operating the airbrakes, the forces on the lever can be quite high, sometimes sucking out violently once they are unlocked. Due to the positioning of the airbrake lever, it may not be possible to exert enough force to close them, so speed may have to be reduced to do so (a problem when landing in rough air with a strong wind to contend with).

An important aspect of opening airbrakes when pulling G is that the limits reduce from 5.3G to 3.5G for most gliders (those in the Utility class) due to the lift distribution curve on the wing being disrupted. A greater proportion of the lift is developed outboard placing greater strain on the wing structure. See figure 1.



Spoilers

Spoilers, as the name implies reduce the lift, but do not produce as much drag as the usual airbrakes. They are definitely non speed limiting and the significant trim changes vary according to the design of the glider, some but not all, are spring loaded and close if the operating lever is released.

Other Approach Devices

Some gliders employ extreme flap deflection to increase drag. Some also have 'Top Spoilers' that are linked to the flap and lift ahead of the flap on the top surface when approach settings are used. This type of brake can be very powerful indeed. Many gliders have an approach setting for their flaps and also use conventional airbrakes. On some of these the flaps alone create considerable drag. An important point to remember if needing to reduce brake on approach, even with the brakes closed performance may be very poor.

They are very uncommon now, but many early glass gliders featured a tail parachute. Typically, these produce lots of drag, but as the only way to reduce that is to jettison the parachute, great care should be taken with their use.

Wheel brake

In some gliders, the wheel brake is operated by extending the airbrake fully, rather than having a separate control. In these cases, landing with full airbrake is not advised because if any yaw is present a ground loop may result.

AIR EXERCISE BRIEFINGS

The air exercise briefing should emphasise the safety requirements for the flight, as well as brief reminder of the main effect of airbrakes on rate of descent, as well as the effects on airspeed and trim.

TEM

Threat	**Mitigation**
Collision	Keep good lookout
Descending into traffic	Do not 'fall' into circuit
Error	
Running out of height	Monitor height & position

MANOEUVRE DEMONSTRATION

The demonstrations for this section are all upper air exercises. Approach control/reference point demonstrations are part of Chapter 12.

Trim the aircraft for the approach speed, relax on the stick and open the airbrakes, drawing the trainee's attention to any attitude/speed change, the increased sink (variometer) and any airframe buffet.

Then close the airbrakes and notice the attitude/speed change and reduced sink rate. Note that it takes time for the variometer to settle to the new value.

Next, demonstrate a simulated approach (trainee lightly on the stick) showing that a nose down attitude is necessary to maintain approach speed. And when closing the airbrakes show that a further adjustment is required to prevent speed increasing.

TRAINEE ATTEMPTS

Having demonstrated all the aspects above, whilst you maintain approach speed, get the trainee to open and close the airbrakes over the full range of movement and then lock them. This introduces the trainee to the need to maintain the attitude as the brakes are open or closed.

The trainee should then trim to approach speed, then open and close the airbrakes whilst maintaining the speed and finally locking the airbrakes closed. Encouraging progressive rather than sudden and large movements with the airbrake lever makes speed control easier to achieve. Draw attention to the changes of trim in addition to the changes in attitude.

A further exercise for the trainee is to open and close the airbrakes at higher speeds emphasising the need for care in opening them and the amount of force required to close them.

DE-BRIEFING

Highlight the parts of the exercise that went well and point out what should be included in their next flight, put an indication of that in their logbook and when appropriate an entry in the trainee's training record.

COMMON DIFFICULTIES

The main difficulty is that the Trainee will not be able to control the attitude as they open and close the brakes.

Considerable amounts of height can be lost demonstrating and practicing these exercises. An aerotow launch or thermals can be very helpful.

When operating the airbrakes, the glider will be out of trim making speed control more difficult. Some trainees require considerable practice before they are ready to use airbrakes on the approach.