

## 11- AIRBRAKES AND SPOILERS

The aim of this exercise is to introduce the effects of the airbrakes or spoilers, and to practice coordinating them with the elevator.

Before introducing this exercise the trainee should have:

- reasonable elevator, aileron and rudder coordination
- good speed control.

### BRIEFING

#### Airbrakes

The airbrake's primary effect is to create variable amounts of extra drag, which comprises profile drag and induced drag in proportions dependent on the glider's speed.

The extra drag increases the vertical rate of descent and worsens the glide ratio. The more the airbrakes are extended, the greater the rate of descent and the steeper the glide. For example, the glide ratio of a K13 at 55kt, airbrakes closed, is about 25:1. If the same airspeed is maintained, full airbrake reduces this to approximately 6:1.

The airbrakes of most gliders are only speed limiting if the dive angle is 45° or less, but for some the angle may be only 30°. Very few gliders, have airbrakes which can limit the airspeed in a vertical dive to the never exceed speed ( $V_{NE}$ ), or lower.

Airbrakes can cause the glider's speed to decay very rapidly, an effect which is particularly marked when approaching through a wind gradient. Airbrake/elevator coordination, with good speed monitoring and control, are crucial in the airbrake exercises. To maintain a given speed when using the airbrakes, the attitude will need adjusting; nose-down when they're opened, and nose-up when they're being closed.

They can also cause pitch changes, nose up or nose down, usually small, but again type dependent.

Depending on whether you are either opening or closing the airbrakes, the operating forces may increase significantly with speed. At higher speeds they may suck out once unlocked, and on some gliders they can then deploy fully and violently. The airbrakes may also be much harder to close at higher speeds.

The small loss of lift airbrakes cause when deployed can increase the stalling speed by an amount which is type dependent; a relevant point when considering landing or ballooning.

Opening the airbrakes redistributes the lift loads on the wing by, in effect, dividing the wing into three sections; inboard section, airbrake section and outboard section. The lift contribution from the airbrake section is reduced, and result is an increase in the bending loads on the outboard sections; their 'pivot point' now being the outboard edge of the brake boxes. These changes typically reduce the glider's normal positive G limitations from +5.3 to +3.5, which is about 30% (figure 1).

#### Spoilers

Spoilers primarily spoil the lift, but produce little extra drag. As a result they are NOT speed limiting. They are usually much less effective than airbrakes and can cause significant trim changes when deployed. Spoilers are usually spring loaded to close when the operating lever is released.

If the glider has a wheel brake it may be connected to the airbrake/spoiler lever and adjusted to operate once the airbrakes/spoilers have been fully deployed.

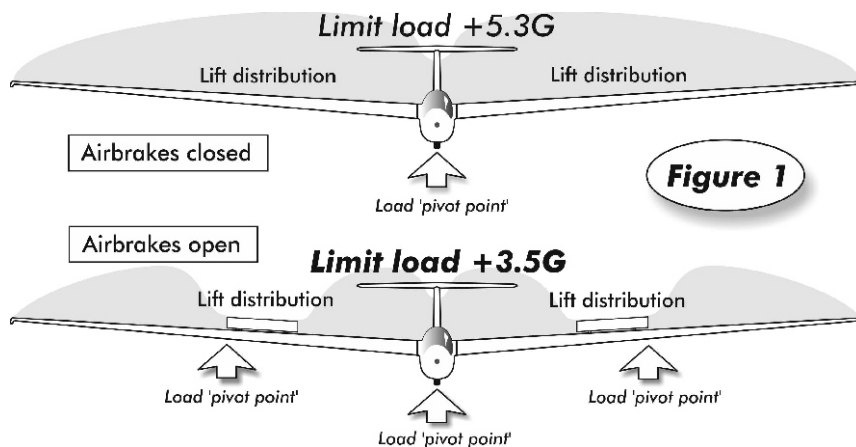


Figure 1

Airbrakes and spoilers may produce rudder and/or elevator buffet during use.

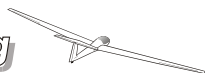
#### The right lever?

The way in which some GRP gliders have been designed means that the airbrake and undercarriage levers are on the same side of the fuselage, and sometimes close enough together to make it very easy to get hold of the wrong one. Over the years this has resulted in a number of accidents, some serious. These have usually involved single seaters, so the major implications are for going solo and type conversion.

It is worth pointing out to trainees that the problem exists, and that it's more likely in some gliders than others - the ASW series seems particularly prone to this type of mistake. Landing tends to be a stressful time, relatively speaking, so checking that you've actually done what you thought you did already may not be the most obvious action. It may also be that you're new to retractable undercarriages, so that in terms of what you've previously flown, the lever you're holding onto just 'has' to be the airbrake!

In general, if you 'open the airbrakes' and nothing happens to the descent rate, then it is quite likely you're cycling the undercarriage up and down instead. The least complicated way to avoid this potentially costly mistake is to look briefly at the lever before you take hold of it.

In the ASW series the airbrake lever hangs down and the undercarriage lever sticks up. In addition, unlike the undercarriage lever - which can only be moved sideways in or out of the detents at the end of its travel - the airbrake lever can be swivelled away from the cockpit side at any point, through at least 90°, and can't be locked in the most rearward position.



## UPPER AIR EXERCISE

### Effects of Airbrakes

Rapid height losses will occur during these exercises, so precede them with a lookout at least as thorough as the one before spinning.

- the instructor sets up and trims for the approach speed, then releases (but guards) the stick, and opens the airbrakes. He draws attention to:
  - any changes in speed or attitude that occur
  - increased rate of descent indicated on the variometer
  - any elevator and/or rudder buffet
- he closes the airbrakes, still not holding (but guarding) the stick, and draws attention to:
  - any changes in speed or attitude
  - the reduced rate of sink indicated by the variometer
- the instructor then demonstrates flying at the approach speed and operates the airbrakes, this time maintaining a constant airspeed. He draws attention to:
  - the need to change the glider's attitude using the elevator to maintain speed when the brakes are open
  - the need to change the glider's attitude again to maintain a constant speed when the brakes are closed
- the instructor then flies the glider at the approach speed with the trainee opening and operating the brakes over their entire range, and closing and locking them. Draw attention to:
  - any tendency for the brakes to suck out
  - the force required to move the airbrake lever - comparing the air loads to those on the ground
  - the force required to close and lock the airbrakes.
- the trainee should then practice maintaining an approach speed while unlocking the airbrakes and operating them smoothly over the full range, including locking them closed again.

**Note:** if the forces required vary significantly within the normal range of approach speeds, the exercise should be repeated at different speeds. Some mention should be made of the fact that these loads vary from glider to glider.

- the trainee should dive the glider towards maximum manoeuvring speed ( $V_A$ ), and then smoothly and fully open the airbrakes to check the operating forces when they are used for speed limiting.

- during subsequent approaches prompt the use and adjustment of the airbrakes.

### DE-BRIEFING

- the effect of the glider's speed on the airbrake operating forces and the need to keep one's hand on the airbrake lever to prevent the airbrakes sucking out beyond the desired position.
- the effect of the airbrakes on the glider's speed and the need to coordinate them with the elevator.
- the need for more frequent speed monitoring when using airbrakes.
- the need to use the airbrakes if the speed is accelerating unintentionally through maximum manoeuvre speed.

### ADVICE TO INSTRUCTORS

**Allow the trainee sufficient practice to be able to manage the basic coordination of elevator and airbrakes. It is an essential lead-in to learning judgement using the Reference Point.** [See Reference Point (RP), chapter 12].

The large sink rates involved in this exercise inevitably cost height, so plan the flight with care. Make sure that there is no possibility of descending onto any other aircraft during the exercise.

The trainee needs to experience the airbrake control forces at speeds well in excess of the approach speed in preparation for either:

- opening them in an uncontrolled dive situation
- after failing to control the speed during an approach, which may lead to difficulties in closing the brakes. This is a potentially critical safety point that might become relevant only later, when converting to a new type.

### Spoilers

The differences between airbrakes and spoilers are identified in the briefing, and the flying exercises will need modifying to emphasize these points. The speed limiting dive is inappropriate because spoilers are not speed limiting.

After the airbrake exercise and before teaching the approach reference point technique, allow the trainee to practice airbrake/elevator coordination and speed control. This should be during the approach and landing. Prompt for their use, if required.

Trainees converting from gliders with spring loaded spoilers to one with airbrakes must be reminded not to let go of the airbrake lever unless it is locked closed.

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## COMMON DIFFICULTIES

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When converting aeroplane pilots to gliding, be aware that they:

- may treat the airbrake lever like a throttle and automatically move it back (closing the throttle) for landing

- are used to far longer and shallower approaches than are safe for gliders, and consequently won't be concerned about them
- may associate closing the airbrakes with opening the throttle and maintaining height or climbing. In gliders this usually leads to disaster.

