USE OF AIRBRAKES

Aim: To learn how and when to use the airbrakes in a glider.

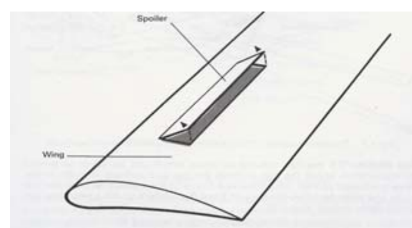
Gliders are extremely efficient machines that are designed to glide at a shallow angle over long distances. Manufacturers achieve this by using aerofoils (wings) that provide best lift for least drag so that for any given height, the glider glides the furthest possible distance… that is, it has the highest possible L/D ratio. Max L/D is great for soaring, but what about when it comes to descending for any reason or steepening our glide path as desired when coming in to land. We can steepen our glide by flying faster; this is converting our potential energy of height to kinetic energy of speed; diving our height off. However, we still have to slow down to land, so we need a way of increasing our drag to steepen our glide for a given speed. So, we want anything that increases drag, reduces our glide performance and reduces our L/D ratio. Manufacturers achieve this by designing pilot controlled drag devices. These include:

- Spoilers
- Airbrakes
- Trailing edge brakes
- Tail chutes

While some of these reduce lift, they all increase drag, thereby reducing the glider's energy and steepening it's glide. When considering the performance of the modern glider, say 40:1 at a speed of 50 knots, it is so flat that it would take a very long, flat approach to make a landing. This is hard to judge and requires obstacle free approach areas; a luxury not often available. Having made our approach to the landing area, we would be left trying to dissipate the energy of the glider decelerating from 50 knots. Any drag device therefore helps reduce the glide ratio, steepen the approach and dissipate the energy of the glider so we can approach over obstacles and land and stop in shorter distances. Another effect of the change in lift and drag is the stall characteristics will be altered. In general, all will cause the glider to stall at a slightly higher speed. This will be covered during the stalling exercises.

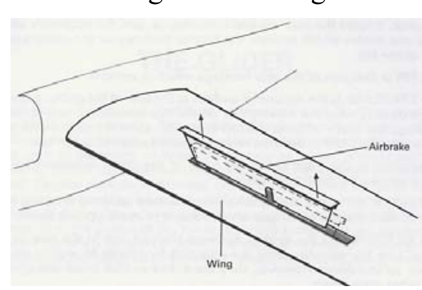
Spoilers:

Spoilers were used on early model gliders as they provided a simple means of spoiling the lift and increasing the drag by extending a hinged surface on the wing out into the airflow. They usually require holding open as the airflow tends to blow them closed. They become less efficient at higher speed compared to airbrakes and are not capable of limiting the speed of the glider in a dive.



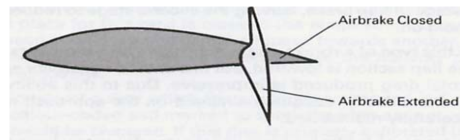
Airbrakes:

Airbrakes are large flat plates, sometimes perforated, that extend perpindicular to the wing's surface and create a large increase in drag as well as spoiling the lift generated by that area of the wing. Some designs have airbrakes extending above and below the wing. The position of the airbrakes determines their effectiveness and handling; ie. Does the glider pitch up or down when the brakes are extended. Airbrakes have a tendency to stay open or extend by themselves if allowed to so it is important that when using the airbrakes, the pilot maintains a firm grip on the brake lever to hold them at the desired position. Airbrakes have a positive lock to ensure they stay closed when not being used. Some airbrakes, called TV or Terminal Velocity Dive Brakes are powerful enough to provide sufficient drag to stop the glider exceeding its maximum speed in a vertical dive. Higher performance modern gliders are too efficient by comparison to the older designs so now manufacturers only achieve this speed limiting capability in up to 45° dives. Still, this is a very useful safety feature.



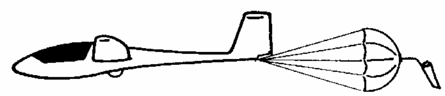
Trailing edge brakes:

This design is usually part of a combined trailing edge flap system which offers flap for improved performance and brake for steepening the glide for approach and landing. In its simplest form, the trailing edge is hinged to protrude both above and below the wing. On initial deployment / opening, the flap moving down may create additional lift but the airbrake portion above the wing will create sufficient drag to far outweigh the flaps effect. The drag increase can be quite dramatic which will cause a quicker deceleration when deployed so the nose attitude must be lowered to maintain the desired speed. This in turn offers steep approach angles. The design looks like this:



Tail chutes:

Any feature that interrupts the smooth laminar flow of air over the wing creates drag. To minimize this, some designers elected to do away with airbrakes and spoilers and turned to using tail chutes, deployed out of the rear of the fuselage, usually from a stowage compartment in the bottom of the rudder, to create a large amount of drag and thereby allowing for steepening of the approach. The tail chute can be deployed when needed and jettisoned when no longer needed. This feature is perhaps the tailchute's greatest weakness. Once out, their effectiveness varies with speed but if you get slow and need to shallow out the approach, you can only jettison the tailchute. You are then left with clean glide performance and the problems this creates. Having jettisoned the tail chute, you could be left with quite a search to recover it… or worse, if lost, the cost of a new one! Further considerations and training on their use will be covered later.



Air Exercise:

We start on the ground by taking a look at the airbrake system in our glider and discussing the likely handling and performance features of it. Your Instructor will then sit you in the glider and have you strap in before practicing the opening and closing of the brakes. Check out the load required to unlock and relock the brakes and check that full brake extension is available without any awkward contortions in the cockpit space available. Check whether the wheel brake is actuated in any way by the airbrake system. Can you see the brakes from the cockpit?

Once off tow, your Instructor will set the glider in a steady glide at 50 knots. Note the attitude, then follow through on the controls and the airbrake lever. They will open the airbrakes fully; watch for any pitch change; note any change in speed and check the rate of descent… you will probably feel the sink, but it can be seen as an increase in the rate of descent indicated on the vario and a more rapid loss of height on the altimeter. The brakes will then be closed; again note how the glider returns to the normal glide. You will then be given control and asked to try the same exercise but with the added requirement of maintaining the desired airspeed of 50 knots throughout. This will require you to lower the nose slightly as the brakes are deployed and raising it again as they are retracted. Also note the load required to extend and retract the brakes in flight. Consider retrimming to maintain a steady glide with the brakes extended, and retrimming when the brakes are retracted.

Now try extending and retracting the brakes at different speeds while maintaining the desired speed. Note the higher rates of descent and steeper glide angle and the higher physical loads as speed increases. When fully open, they can be quite hard to close. You need to be able to operate the brakes throughout the glider's speed range and control the rate of opening if extended at higher speeds. More on this later when we cover flight at higher speeds.

Tips:

Avoid levering brake against the control column, particularly when operating the brakes at higher speeds.

Need To Know:

- What type of airbrake system is fitted to your glider and how to look, identify and then operate the airbrakes.
- How to maintain our desired speed when changing our brake setting.

Further Reading:

- The Glider Pilot's Manual; by Ken Stewart. Page 78 – 83 and 189 – 191. Good all round info on airbrakes.