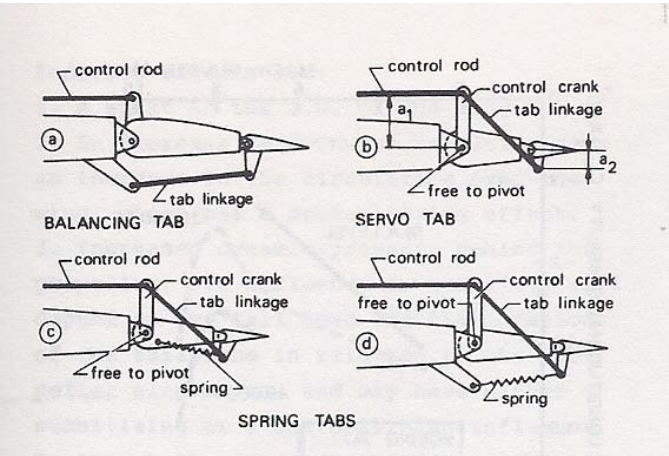
Schaufele Annotations
Chapter 4 Preliminary Wing Design

Lateral Control Devices

In Fig. 4-16, you can see that the DC-9 aileron has two tabs (small aerodynamic control surfaces) on the trailing edge of the port (LHS looking forward) aileron. The outer tab is a trim tab and is usually operated by a transverse wheel in the cockpit for trimming the aircraft in roll. This requirement might occur if more fuel is burned from the fuel tanks on one side than on the other.

The inner tab is the control tab (also called a servo tab), as shown in sketch 'b' in Fig. 4.1. On the DC-9 the flight controls do not move the ailerons directly. The controls move the control tab, but in a direction opposite to the required direction of the aileron itself. The aileron is freely pivoted on its hinge. Because of the greater moment arm of the control tab, it will apply a moment to the aileron which will move the aileron in the opposite direction. The aileron has a much larger area than the control tab and therefore applies a much larger force on the wing, and consequently a larger rolling moment on the airplane than that applied by the tab. The benefit is that the required actuation forces are much smaller, such that the control cables are connected directly to the control tabs with no hydraulic boost. The force on the control column required to move the ailerons turned out to be so small that on the DC-9-40 springs were added to the control system to provide additional feel for the pilot.



Source: Torenbeek

Fig. 4.1 Tab Mechanisms

A balance tab (sketch 'a') is not the same as a control (or servo) tab. A balance tab also operates in the opposite direction to the main control surface. For a control system with balance tabs, the control system actuates the main control surface, and the balance tab is mechanically linked to the control surface such that it moves in the opposite direction. This serves to reduce the hinge moments on the control surface, and thus the required actuator size. Balance tabs are on many other airplanes. Spring tabs are variations on the control tab. At high q the tab carries a large control force in relation to the spring force. The action of the spring tab is then comparable to the servo tab. At low q the spring force is large in relation to the force on the tab and system 'c' behaves like a plain control, whereas system 'd' acts more or less like a balance tab.

Another variant is the anti-balance tab, in which the tab operates in the same direction as the control surface. This results in a somewhat greater control power, and much greater moment on the control surface hinge. This requires a much greater applied control force by the pilot. This system may be used if the required control forces are deemed to be too small.