Autobrake Systems

Hydro-Aire has been developing and manufacturing autobrake systems for manned and unmanned aircraft since 1968 and has accumulated a significant experience base.

Hydro-Aire developed Autobrake systems for conventional manned aircraft have two modes of operation: Landing mode and Refused (or Rejected) Take-Off (RTO) mode. An Autobrake Selector Switch allows the pilot to arm the RTO feature prior to takeoff (Takeoff Mode) or to select from several deceleration levels for landing (Landing Mode). A typical Hydro-Aire cockpit mounted autobrake selector panel is illustrated in **Figure 1**.

Unmanned UAV Autobrake systems do not have a pilot arming feature, they provide the Autobrake features upon command from the Vehicle Management Computer (VMC), usually in Landing Mode only, and at a preestablished deceleration level. UAV Autobrakes are designed to provide autonomous operation of the vehicle through the entire landing roll.

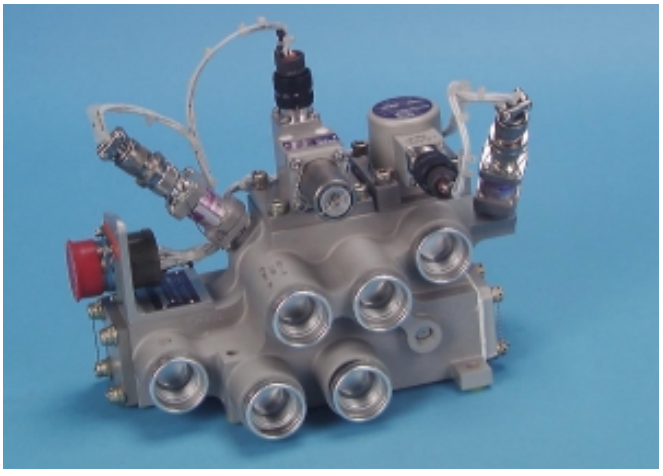
Autobrake systems can be implemented using a card in the Antiskid Control Unit, or in a separate container. A typical separate autobrake control unit is illustrated in **Figure 2**. A typical autobrake control valve (which includes a solenoid shut-off valve, servo control valve, check valves, and pressure switches) is illustrated in **Figure 3**. A typical four wheeled aircraft autobrake system implementation is illustrated in **Figure 4**.

In Landing mode operation, a controlled level of pressure is automatically applied to the brakes after touchdown, independent of the pilot's brake pedals. The system regulates brake pressure to maintain the selected deceleration level, and compensates for the effects of aircraft drag, flaps, thrust reversers, and spoilers. Under dry pavement conditions, the deceleration level can

Figure 1, A Typical Autobrake Selector Panel (717)

Figure 2, A Typical Autobrake Control Unit

Figure 3, A Typical Autobrake Control Valve



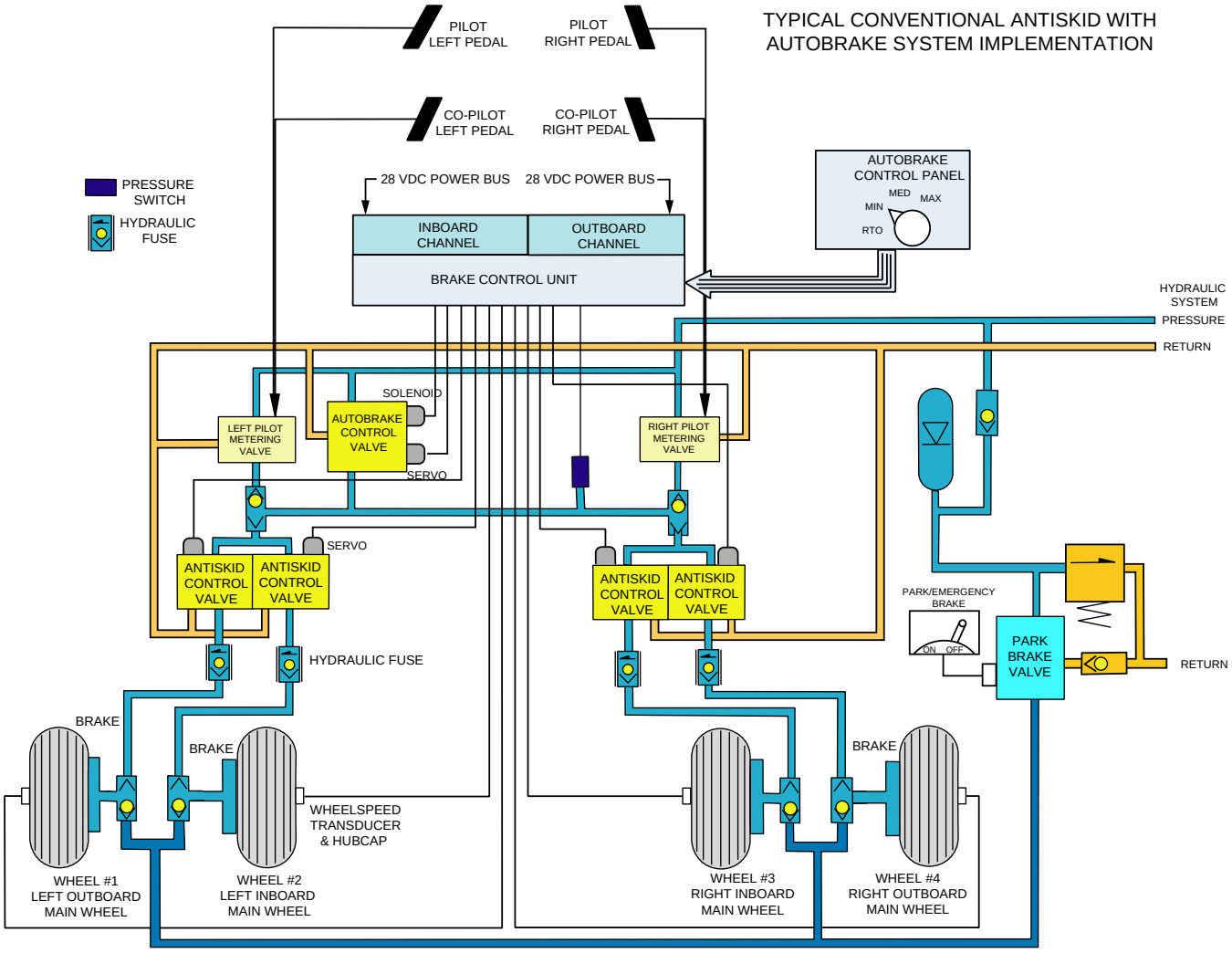


Figure 4, A Typical Autobrake System Implementation

be held constant to within 0.25 ft/sec^2. Aircraft manufactures usually request a system with three levels of deceleration (MIN, MED, and MAX) although five levels (1, 2, 3, 4, and MAX) can be provided.

The lower settings produce moderate braking levels from 2 to 8 ft/sec^2 which can provide optimum braking performance on wet pavements. The maximum settings are more aggressive and can be arranged to use all the available runway friction provided by the antiskid system. The pilot can select a different deceleration level during the landing roll-out if so desired. At the end of the roll out, application of pedal braking transfers control back to the pilot. An advanced feature is available that compensates for pilot braking technique and makes the transfer exceptionally smooth. A Landing autobrake system has significant advantages compared to standard manual pedal braking.

The smooth and steady application of brakes to both sides of the aircraft improves lateral stability and ensures a constant deceleration rate. This greatly enhances passenger ride comfort or load stability during the landing and can reduce wear on carbon brakes. The brakes are always applied at the same point in the touchdown sequence and the deceleration rate is constant which makes stopping distances consistent and predictable. The pilot can choose a runway

turnoff with a high degree of confidence and operation under Cat IIIb auto-land conditions is enabled. Some studies suggest that carbon brake life can be extended by the use of autobrakes.

RTO autobrakes have been certified as the primary means of stopping the aircraft during a rejected takeoff. With the system armed during takeoff, movement of the thrust levers back to the fully retarded position or operation of the thrust reversers will initiate full brake application. This automatic feature reduces crew workload during an emergency and frees resource for dealing with cause of the rejection. The prompt, sustained application of full system pressure to the brakes minimizes stopping distance and reduces the probability of runway excursion. As with the Landing mode, application of pedal braking transfers control back to the pilot.