Aircraft Systems Field Exam – 2017

1. Sketch the block diagrams for a very simple pitch autopilot and a separate simple autothrottle for a transport category jet aircraft designed to fly a 3 degree ILS glideslope. Show the states that would be fed back into the autopilot and the control outputs (i.e. actuation paths) from the autopilot to the aircraft. You can assume that the landing weight is 130,000 lbs and the approach reference speed is 140 kts.

2. How would you modify the feedback states of autopilot and autothrottle in problem 1 if the aircraft were a small piston engine aircraft with a landing weight of 1500 lbs and an approach reference speed of 80 kts.

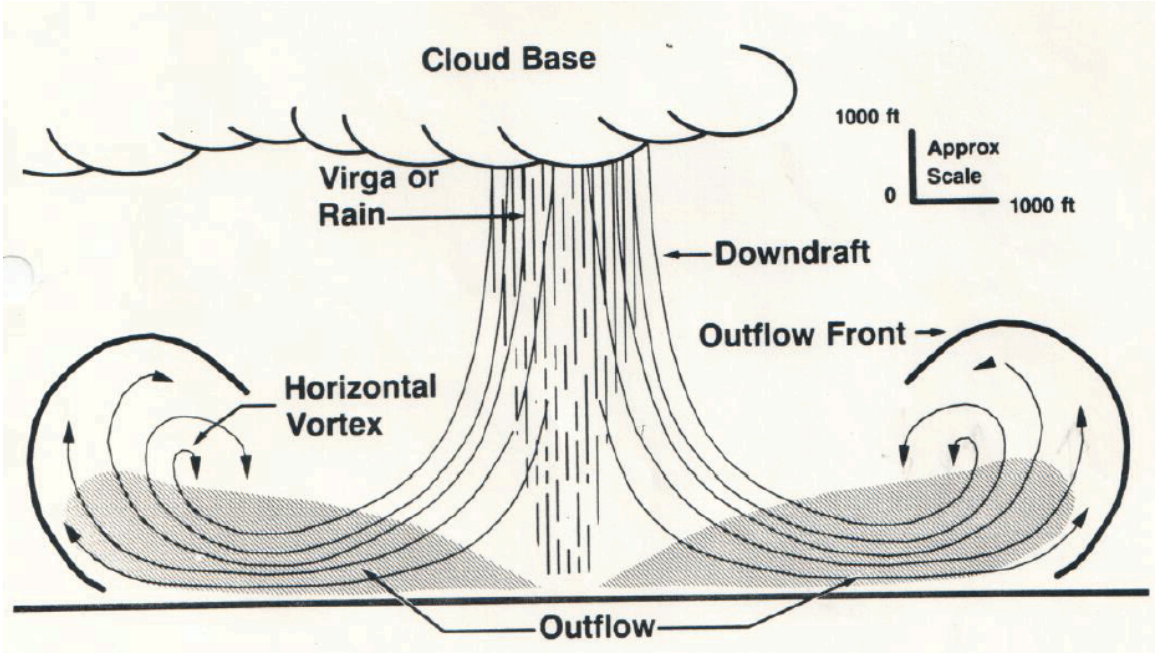

Figure 1 Schematic of Symmetric Wet Microburst

3. Discuss the flight trajectory (path and airspeed) you would expect if the aircraft in problem 1 were to encounter a severe microburst (shown schematically in Figure 1) during the final approach segment of an ILS approach (inside the outer marker). For purposes of discussion, you can assume that the maximum outflow velocity is 60 kts and the maximum downdraft velocity is 6000 fpm.

Include a discussion of how the scale length of the microburst encounter (ie total distance across the microburst) interacts with the aircraft response time constants. For example, how would the aircraft response vary if the scale length was much shorter or much longer.

4. What would you recommend as a control strategy for an escape maneuver from the microburst.

5. (extra credit) In a wet microburst (shown in Figure 1) it can be expected to encounter heavy rain when crossing the downdraft region. How is the heavy rain likely to influence the aerodynamic performance of the aircraft (eg C_L and C_D vs α).