Airbus A380

The Airbus A380 is a double-deck, wide-body,four-engine jetairliner manufactured by the European corporation Airbus, a subsidiary of EADS. It is the world's largest passenger airliner and, due to its size, many airports have had to expand their facilities to properly accommodate it. Designed to challenge Boeing's monopoly in the large-aircraft market, the A380 made its initial flight on 27 April 2005 and entered initial commercial service in October 2007 with Singapore Airlines.The aircraft was known as the *Airbus A3XX*during much of its development, before receiving the A380 designation.

The A380's upper deck extends along the entire length of the fuselage, with a width equivalent to a wide-body aircraft. This allows for an A380-800's cabin with 478 square metres (5,145.1 sq ft) of floor space; 49% more floor space than the next-largest airliner, the Boeing 747-400 with 321 square metres (3,455.2 sq ft), and provides seating for 525 people in a typical three-class configuration or up to 853 people in all-economy class configurations. The A380-800 has a design range of 15,400 kilometres (8,300 nmi; 9,600 mi), sufficient to fly from New York to Hong Kong, and a cruising speed of Mach 0.85 (about 900 km/h or 560 mph at cruising altitude).

VMCG (Velocity of Minimum Control on Ground)

During the takeoff roll, it is of utmost importance to know the minimum speed at which the aircraft will remain controllable, in the event of an engine failure on ground. This is because, in such a case, and if the takeoff is continued, only the rudder will be able to counteract the yaw moment that is generated by symmetric engine(s) thrust.

Per regulations, the minimum speed at which an aircraft is defined to be "controllable"(lateral excursion lower than 30 feet) after an engine failure on ground, is referred to as VMCG (Velocity of Minimum Control on Ground). VMCG mainly depends on:

- **Engine(s) thrust**
- **Pressure altitude.**

If a failure occurs before reaching VMCG, the takeoff must be interrupted to maintain control of the aircraft.
Note: Steering is not used during certification flight tests. However, in real life operations, steering would be helpful in controlling the aircraft.

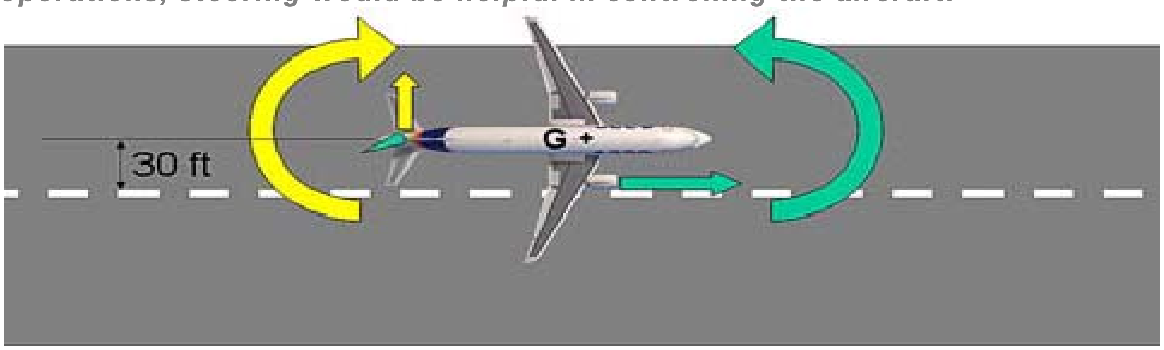

Figure 1
Ground Control after Engine Failure

V_1: Decision Speed

V_1 is the maximum speed at which a rejected takeoff can be initiated, in the event of an emergency. Additional information on this "Go / No-Go" decision can be found in the Flight Operations Briefing Note entitled: "Revisiting the Stop or Go Decision".
V_1 is also the minimum speed at which a pilot can continue a takeoff after an engine failure.
If an engine failure is detected after V_1, the takeoff must be continued. This implies that the aircraft must be controllable on ground. Therefore, V_1 is always greater than V_{MCG}.

V_R : Rotation speed

The rotation speed ensures that, in the case of an engine failure, lift-off is possible and V_2 is reached at 35 feet at the latest.
Note: Therefore, at 35 feet, the actual speed is usually greater than V_2.

The rotation of the aircraft begins at V_R, which makes lift-off possible, at the end of the maneuver.The V_R must be such that the lift-off speed is greater than V_{MU}.

V_{MCA} (Velocity of Minimum Control in the Air)

The rudder is used to compensate for the yaw moment caused by thrust asymmetry.There is a minimum speed at which full rudder will be necessary, in order to fly a constant heading with level wings.

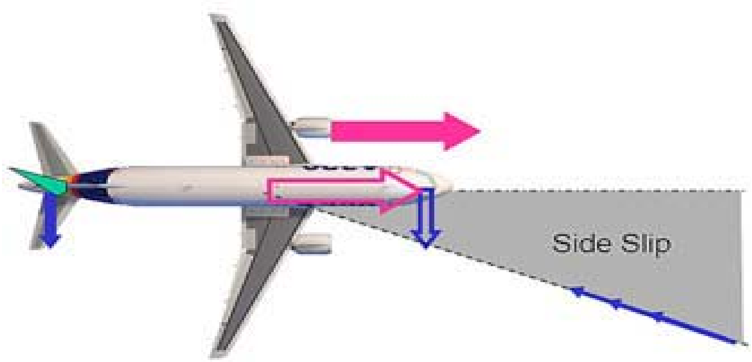

Figure 2
Sideslip Angle in a One Engine-out Condition

To reduce sideslip, this speed can be reduced even more, if the aircraft is banked on the live engine's side.The lower the speed, the greater the necessary bank angle. The speed that corresponds to a 5-degree bank angle is defined, by regulations, as the minimum control speed and is referred to as V_{MCA} (Velocity of Minimum Control in the Air).

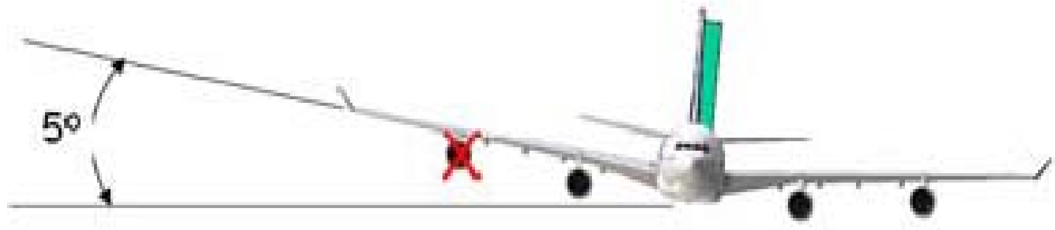

Figure 3
Roll Angle at VMCA

V_2: Takeoff Safety Speed

V_2 is the minimum speed that needs to be maintained up to acceleration altitude, in theevent of an engine failure after V_1. Flight at V_2 ensures that the minimum required climb gradient is achieved, and that the aircraft is controllable. V_2 speed is always greater than V_{MCA}, and facilitates control of the aircraft in flight.
In an all-engines operative takeoff, V_2+10 provides a better climb performance than V_2 (Refer to Figure 5 below

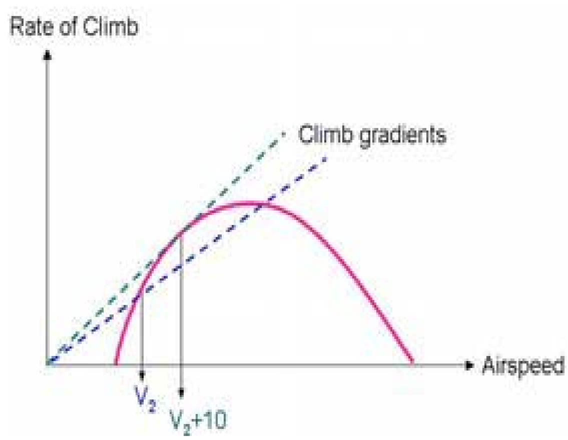

Figure 4
Climb Gradient Relative to Speed in a Specific Flaps' Configuration

If one engine is lost before reaching V_2, then the initial climb is flown at V_2. If thrust is lost at a speed between V_2 and V_2+10, then the current speed is maintained ,to ensure the most efficient climb speed.
It is not necessary to increase pitch, in order to reduce the speed to V_2, when a higher speed has already been reached.