Aircraft Velocity and Runway Operations

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SYST 460

Takeoff

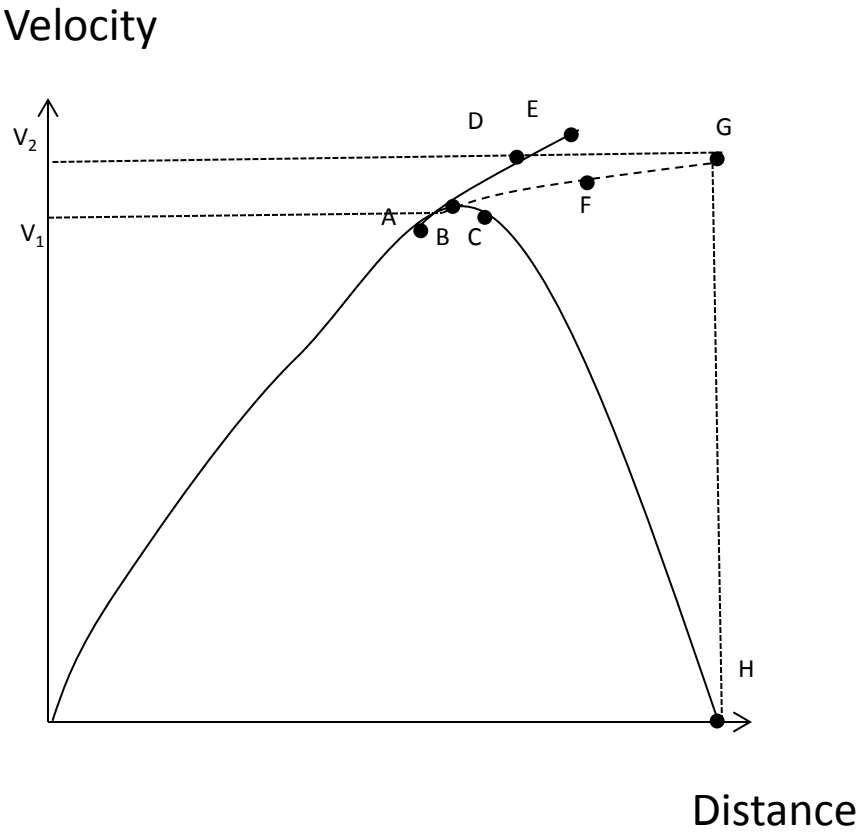
- Manuever from static condition to:
  - 1500 feet above field elevation
  - altitude at which transition to enroute configuration is completed

Runway Length Calculation

- Airplane must generate enough speed to produce Lift
- Accleration takes place with limited length of runway
  - Need stopping distance if anything goes wrong
- Below V1 takeoff safely aborted
- Above V1, takeoff must continue
- <u>Point A- B-C-H (last possible trajectory to stop on runway</u>
- Point A, engine failure and thrust spools down
- Point B crew recognizes problem and start stopping by retarding throttles
- Point C brakes are applied and spoilers deployed
- Point H, aircraft comes to complete stop

- Point D, no engine failures results in liftoff speed
- Point E, all engines, aircraft reaches safe speed V_2

- Point F, engine failure occurs beyond Point A. making it impossible to stop aircraft on remaining runway
- Point G, aircraft operating with one engine reaches safe speed V_2 at 35 ft.



Balanced Field Condition (BFC) :distance required to stop after engine failure = distance travelled to reach V_2 at 35ft

Takeoff Speed Profile

- V_1 – airspeed beyond which no stopping action be initiated: Decision speed
- V_R – airspeed at which rotation is initiated during takeoff to obtain V_2
- V_{MU} – minumum unstick speed = airspeed at which aircraft can be made to lift-off and continue to perform takeoff
- V_{LOF} airspeed when aircraft becomes airborne
- V_S – stall speed of airplane
- V_2 target airspeed for 35 feet above runway elevation to achieve climb gradient for airborne takeoff
- $V_1 < V_R$
- $1.1\ V_{MU} < V_{LOF}$
- $1.2\ V_S < V_2$