Short-Field Takeoff and Landing

ADVANCED MANOEUVRES

Objectives

To ensure by calculation that there is adequate runway length for takeoff and landing in accordance with the aeroplane's performance data.

To apply sound decision making principles before adopting the recommended procedure for takeoff or approach for a runway of minimal length.

To operate the aeroplane in accordance with the manufacturer's recommended short-field techniques in order to obtain the best possible performance.

1. Takeoff Considerations

Temperature	• Changes density. ↑ temperature → ↓ in density. Correction needed • OAT gauge or METAR
Density	• As density ↓ , IAS ↓ ∴ as the density ↓ , TAS will need to be ↑ to achieve same IAS for any given rotate IAS • ↑ takeoff roll, but effects of density on engine performance far more critical
Pressure Altitude	• Corrects airfield elevation under the existing conditions, to an elevation within the *standard atmosphere* • Set 1013 hPa on sub-scale and read off the pressure altitude • Or QNH and elevation required for calculation
Aeroplane Weight	• Directly affects takeoff and climb performance
Runway Surface	• Takeoff roll is reduced on a firm or sealed surface compared to a soft or grass surface • Grass surface is defined as short dry grass
Slope	• Up-slope ↑ the TODR • Down-slope ↓ TODR
HWC	• When the wind is at angle to runway, need to calculate headwind component
Wind	• With strong or gusty winds, always possibility of windshear in the climb-out • V_R and V_{TOSS} increased to counter the possible effects of windshear

Calculation

- Information from Flight Manual and AC 91-3
- Takeoff performance figures based on new engines and propellers – how does this aeroplane compare?
- Is the surface short dry grass or a long and wet?
- How important is it that a takeoff be conducted now – under these conditions – and how will the conditions be affected by a delay?
- Calculated takeoff distance to 50 ft assumes full power is applied before brake release and that stated flap setting is used
- TODR includes ground roll and distance travelled over the ground to reach 50 ft at V_{TOSS}
- No rounding of takeoff speeds – fly them accurately

2. Landing Considerations

Elevation or PA	• Aerodrome elevation is used when calculating landing distance and effects of pressure altitude ignored • Aerodrome height AMSL will affect LDR and PA may be used for more accurate calculations
Weight	• Affects inertia and ∴ stopping distance
Runway Surface	• Landing roll is ↓ on a firm dry surface compared with a grass or wet surface due improved braking action
Slope	• Up-slope ↓ LDR, and down-slope ↑ LDR
HWC	• When wind at an angle to runway, the HWC needs to be calculated
Wind	• If strong or gusty winds, always possibility of windshear on the approach • Approach and V_{TT} speeds are increased to counter the possible effects of windshear

Calculation

- Information from Flight Manual and AC 91-3
- Calculated landing distance from 50 ft assumes correct speed at 50 ft and stated flap setting is used
- LDR includes distance to touch down from 50 ft over the threshold and the ground roll to a full stop
- Crossing the threshold higher than 50 ft, using less than full flap, or crossing the threshold at a higher airspeed, will increase the landing distance

3. Airmanship

- Additional decision making required in relation to strong/gusty wind and EFATO – immediately and positively lower the nose

4. Aeroplane Management

- Full power before brake release – check static rpm
- If static rpm not achieved could be due
  - Icing
  - Instrument error
  - Propeller damage
- Get problem checked

5. Human Factors

- Vision affected by high nose attitude
- During approach perception may be influenced by visual cues of surrounding terrain, a false horizon, or runway length and width
- Cross-reference instruments regularly

6. Air Exercise

Takeoff

- Hold brakes on (nosewheel straight), elevator neutral, apply full power. Static rpm, Ts and Ps checked
- Clean brake release, take the weight off nosewheel – check for normal acceleration
- Hold nosewheel on ground until V_R
- At V_R smoothly rotate and lift off. Lower nose and accelerate to V_{TOSS}
- Reaching V_{TOSS} adjust attitude and hold, keep straight on reference point
- At safe height accelerate to best RoC (V_Y) or normal recommended climb speed. Check balance
- Before raising flap,
  - safe height,
  - safe airspeed, and
  - a positive rate of climb
- When these conditions have been met, raise flap and counter the pitch change. Allow acceleration to continue, and upon reaching the climb speed required (best rate or normal), trim to maintain the appropriate attitude

Landing

- Downwind, confirm approach and threshold speeds and choose aim point
- Slightly delay turn onto base to ensure some power must be used throughout approach
- Monitor approach path by reference to the aiming point and adjust power to maintain a steady rate of descent – power controls RoD
- Established on final, select full flap and decrease airspeed by adjusting attitude
- Achieve nominated V_{TT} by 200 ft agl
- It is important to carry some power into the flare
- If the aeroplane is not properly configured by 200 ft agl – go around!
- The round-out and the hold-off are combined into the flare
- Aim to reduce the rate of sink to zero at the same time as the main wheels touch the ground and the throttle is closed
- Lower the nosewheel, brake immediately, keep weight off the nosewheel with elevator backpressure
- Raise flap on completion of the landing roll