ATPL Performance – V Speeds

V Speeds

|  |  |
| --- | --- |
| ***V SPEED*** | Definition |
| **VEF** |  |
| **V1** |  |
| **VR** |  |
| **VLOF** |  |
| **V2** |  |
| **V1WET** |  |
| **V2MIN** |  |
| **VFE** |  |
| **VGO** |  |
| **VLO** |  |
| **VMAX TYRE** |  |
| **VMBE** |  |
| **VTOSS** |  |
| **VMC(A)** |  |
| **VMCG** |  |
| **VMCL** |  |
| **VMD** |  |
| **VMO** |  |
| **VMP** |  |
| **VMU** |  |
| **VP** |  |
| **VREF** |  |
| **VS0** |  |
| **VS1** |  |
| **VR0** |  |
| **VR1** |  |
| **VSTOP** |  |
| **VX** |  |
| **VY** |  |
| **VZF** |  |

ATPL Performance – Section 1

PoF Related

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | VMP | VMD | 1.32VMD | FASTER |
|  |  |  |  |  |
| CLIMB |  |  |  |  |
| ENROUTE |  |  |  |  |
| DESCENT |  |  |  |  |

|  |  |  |
| --- | --- | --- |
|  | Vx | Vy |
|  | Jet | Prop | Jet | Prop |
| Mass |  |  |  |  |
| Config |  |  |  |  |
| Alt/Temp |  |  |  |  |
| Eng Fail |  |  |  |  |

ATPL Performance – Class B

Class B

**Take-Off(T/O) Class B**

|  |  |
| --- | --- |
| No Stopway or Clearway |  |
| If Stopway or Clearway |  |
|  |  |
|  |  |

Note: clearway length limited of TORA.

**Surface Corrections**

|  |  |  |
| --- | --- | --- |
|  | **Takeoff** | **Landing** |
| Dry Paved |  |  |
| Wet Paved |  |  |
| Dry Grass |  |  |
| Wet Grass |  |  |
| Upslope |  |  |
| Downslope |  |  |
| Headwind |  |  |
| Tailwind |  |  |

**Class B Twin**

|  |  |
| --- | --- |
| VR | Is the faster of  |
| V2 (VTOSS) | Is the faster of  |

Contaminated Runways –

**Climb**

Class B

**MEP – Both Engines Operating**

|  |  |
| --- | --- |
| Gradient | After Takeoff ≥ |
| Speed | ≥ |

**MEP – One Engine Inop**

|  |  |
| --- | --- |
|  |  (assumes no fail prior to ) |
| Gradient | 400ft above  |
| At 1500ft  |
| Speed |  |

**Obstacle Clearance**

Must clear obstacles by or miss horizontally.

|  |  |
| --- | --- |
| Departure Sectors |  |
| Turn Limits | Above and o max AOB |

**Lateral Distances**

|  |  |  |
| --- | --- | --- |
|  | ≤ 15o Track Change | > 15o Track Change |
| VMC/Good Navigation |  |  |
| IMC/ Other Conditions |  |  |

**NTOFP (Assumes failure of critical engine when visual reference expected to be lost)**

|  |  |
| --- | --- |
| Twin Engine Gradient | From twin engine gross factored by  |
| One Engine Gradient | Use  |
| Wind correction |  |

EN-Route

Class B

SEP –

MEP –

 Planned gradients following an engine failure are: climb reduced by and descent increased by

SEP and MEP – Maximum planned altitude when climb rate

Landing

Full stop landing from above threshold ≤ 70% of LDA. (Divide by 0.7 or times by 1.43)

\*Authority may approve less that \_\_\_\_\_\_\_ft but no lower than 35ft.

ATPL Performance – Class A

Class A

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| V |  | V |  | V |  | V |
| VLOF |  | V |  | V2 |
| V |  | V |  | V |  | V and V |

V1, VR and V2 increase with increased T/O weight (assuming R/W not limiting).

V1 and VMBE with downslope and tailwind.

|  |  |  |  |
| --- | --- | --- | --- |
| **Requirement** | **VR** | **V2MIN** | **VREF** |
| **VMC** | VMC | VMC | VMC |
| **Stall** | Class A (all engine)\\\ VMU at VLOF (aero limit)\* 1. VMU at VLOF (geo limit)

1 Eng Fail\\\\1.05 VMU at VLOF (aero limit)1.04 VMU at VLOF (geo limit) | \\\Class A 1.13 VSR1Class A (4 engine turboprops and some 4 engine turbojets) =   VSR1 \ | Class A \1.23 VSR0 |

\\\

Screen Height – Dry

Screen Height – Wet

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**Take Off Distance and Run**

|  |  |
| --- | --- |
| T/O Distance Dry (TODdry)  | Greater of or\\ |
| T/O Distance Wet | Greater of \\ |
| T/O Run Dry | Greater of \\ |
| T/O Run Wet | Greater of \\ |

Note: TOR is generally measured from start of T/O to a point equidistant between VLOF and the point at which the a/c is 35ft above T/O surface; exception TORN-1wet which is between start of T/O and the point at which the a/c is 15ft above T/O surface.

**Accelerate Stop Distance (ASD)**

Class A

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ASD must be considered for both and the case.

ASD on dry runway: greater of ASDN and ASDN-1 - no account for reverse thrust can be applied.

ASD on wet runway: greater of ASD on a dry runway (as above) and the ASDN and ASDN-1 for a wet runway (using the wet values for VEF and V1) - the effects of reverse thrust can be applied to the wet runway ASDN and ASDN-1.

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In calculating distances, the speed at which the pilot takes the first action to reject is at V1. In all cases, there is a distance equal to the distance covered in seconds at added to the acceleration and deceleration distances.

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**RLTOM increases when:**

Decreases

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\Wind

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\Is longer

Decreases

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\Runway Slopes

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Flap Setting

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A/C Packs

Engine anti-Ice

CLTOM is also known as

PLTOM is lowest of

RTOM is lowest of ; whichever is greatest Mass for T/O.

**Obstacle Clearance**

|  |  |
| --- | --- |
| Departure Sectors | = 60m + ½ WS + (0.125 x D) (until specified Domain Width) Unless a/c wingspan > than 60m in which case = 90m + (0.125 x D) |
| Turn Limits | Above and o max AOB |

* Turns in the NTOFP reduce climb performance and increase the stall speed, so there are additional requirements:

Class A

* + The turn must not be commenced below , or of the wingspan of the aircraft, whichever is greater
	+ The angle of bank must not exceed below 400ft, and above this not exceed
	+ If > 15º AOB then obstacle clearance increases to 50ft.
	+ Allowance must be made for effect on gradient and speed. – flight manual gives decrement for 15º AOB at V2.
		- For 20º, use 2 x decrement and V2 + kts
		- For 25º, use 3 x decrement and V2 + kts

CAT.POL.A.210 permits greater AOB with authority approval. Max angles 20º (200-400’) 30º (400-1500’); 50ft min clearance once greater than 15o AOB.

**Lateral Distances**

|  |  |  |
| --- | --- | --- |
|  | ≤ o Track Change | > o Track Change |
| VMC/Good Navigation |  |  |
| IMC/ Other Conditions |  |  |

Reduced Thrust/Flex T/O (TOGA

Restrictions:

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Derate (TOGA no longer available)

Gain a commercial advantage of slower VMCG and VMCA speeds.

Enables slower V1, VR and V2  speeds. Used when and pressure alt and/or low/low medium T/O weight.

Increased V2

Class A

Used on long runways to increase through higher speeds (move closer to VMDand therefore increase excess thrust). Threats (hot brakes/fire, burst tyres) fast

 (high speed reject).

Contaminated runway

 Drag increases to Vp then decreases

NTOFP

Safety Factors\*

|  |  |  |
| --- | --- | --- |
| 1 Eng | 2 Eng | 3 Eng |
|  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Segment** | **1st** | **2nd** | **3rd** | **4th** |
| **Start** |  |  |  |  |
| **End** |  |  |  |  |
| **Twin Eng Min %** |  |  |  |  |
| **Three Engine %** |  |  |  |  |
| **Four Eng Min %** |  |  |  |  |
| **Gear Position** |  |  |  |  |
| **Flap Position** |  |  |  |  |
| **Thrust** |  |  |  |  |
| **Speed** |  |  |  |  |

Notes: 1) Min Eng gradients are gross, therefore, for twin net is 1.6% (2.4%-0.8%).

2) Second segment ends at a minimum of 400’ above the T/O surface but many operators use a higher figure such as 800’. Additionally, if there is a high obstacle in the 3rd segment the 2nd segment will be extended to achieve greater height before the level off.

3) \*Gradients in the 3rd segment are ‘equivalent gradients’, which are used to produce a minimum acceleration during flap/slat retraction.

**En-Route –One Engine Inoperative (OEI)**

Class A

In assessing en-route obstacle clearance gradients are based on net performance. For one engine inoperative gross gradients are reduced by the following:

* for 2-engine aircraft.
* for 3-engine aircraft.
* for 4-engine aircraft.

**Obstacle Clearance:**

* Have a (possible) positive net flight path gradient at least above all terrain

and obstacles along route; either in the climb or having stabilised in level flight (Net level-off altitude) following a ‘drift down’.
* ‘Drift Down’ obstacle clearance: minimum of clear of all terrain and obstacles along route during the ‘drift down’.

Route considerations (CAT.POL.A.215): all terrain and obstructions along the route within on either side of the intended track in accordance with the following:

* The engine is assumed to fail at most critical point;
* Account is taken of the effects of wind;
* Fuel jettisoning is permitted (subject to maintaining required fuel reserves)
* The aerodrome meets the performance and weather requirements at estimated time of landing.
* If the navigational accuracy does not meet at least navigation performance 5 (RNP5) then the route width margins are increased to 18.5 km (10 NM).

Destination/Alternate: the net flight path shall have a positive gradient at above the aerodrome where landing is assumed to be made in the event of engine failure.

 **Landing**

Maximum landing mass is the lowest of:

**Baulked Climb**

Class A

Maximum mass at which a gradient can be achieved given the following conditions:

* All engines operating at the power available seconds after selecting TOGA from the flight idle setting.
* Aircraft in the landing configuration.
* Expected air density for the destination aerodrome, given forecast temperature and airfield elevation at time of landing.
* Climb speed ≥ or , or ≤ VSRO.

**Discontinued Approach**

Maximum mass at which the following gradients can be achieved:

* Twin
* 3-Engine
* 4-Engine

With the following conditions:

* engine inoperative and remaining engine/s at
* Normal approach speed but ≤
* Gear retracted and flaps in configuration.
* Expected air density for the destination aerodrome, given forecast temperature and airfield elevation at time of landing.

**Discontinued Instrument Approach Climb**

For instrument approaches with DH below the expected approach mass that allows a

missed approach climb gradient, with critical engine failed, of the greater of or the published gradient.

**Landing Distance Requirements**

Class A

 Full stop landing from at the estimated landing mass:

* Within of the LDA for a turbojet
* Within of the LDA for a turboprop

The following conditions must be met / taken into account:

* VREF must not be less than VSRO.
* Aircraft in the configuration.
* Corrected for the airfield and
* Factored for not more than of the headwind and not less than of the tailwind.
* The runway slope in the direction of landing if greater than ±

Note: Authority may approve the use of landing distances using a screen height of less than 50’ but not below

**Runway Selection**

Landing must be considered for both the forecast wind and in still air:

* In still air, the aircraft uses the most favourable (normally longest) runway.
* Using forecast winds, planning should be based on the runway most likely to be in use; considering wind direction, approach aids, terrain etc.

**Wet Runways**

If runway is forecast to be wet then landing distances must be increased by unless a lower factor is specified in the aeroplane flight manual.

**Contaminated Runways**

Class A

Contaminated = > coverage:

1. surface water more than deep, or by slush, or loose snow, equivalent

to more than 3 mm (0,125 in) of water;
2. snow which has been compressed into a solid mass which resists further compression and will hold together or break into lumps if picked up (compacted snow); or
3. ice, including wet ice, with more than of water, slush or wet snow or compacted snow or ice.

If runway is forecast to be contaminated, the LDA must be the greater of:

* of the required dry landing distance, or
* of the landing distance determined in accordance with approved contaminated landing distance data or equivalent, accepted by the Authority.