

Speeds: Various Aviation Authorities

This document is designed to be a compilation of V-speeds used by any agency/military/company of the world, including outdated speeds no longer used, to act as a general reference for anyone who is looking for a brief definition of an unfamiliar speed. 1999.

VA - design maneuvering speed. This is the recommended indicated speed in moderate turbulence or when throwing the aircraft about. At or below this speed the aircraft will stall, and thus reduce the aerodynamic force on the wings, before it encounters a vertical current imparting enough energy to exceed the design wing loading. VA is the maximum speed at which full control deflections can be made safely.

VAT - threshold crossing speed, usually 1.3 VS0

VAT0 - threshold crossing speed with all engines operating

VAT1 - threshold crossing speed with the critical engine inop

VAT max - maximum threshold crossing speed, above which a go-around should be initiated to prevent exceeding the scheduled landing distance (VAT0 + 15kts)

VAPP - target approach airspeed

VB - the design speed for maximum gust intensity. Whereas VA is a fixed calculation relative to VS1 for all aircraft within the same category, VB is developed as a recommended turbulence penetration speed for a light aircraft in severe turbulence with vertical gust components up to 50 feet/second.

VBR - best range - the speed that provides (L/D)max, thus minimum drag and minimum power required and consequently greatest distance per liter of fuel. Usually utilizes about 55% power and decreases as the aircraft weight decreases from MTOW. Rather boring to fly at that speed, wind conditions have to be taken into account and the fuel saving may not be that significant compared to say 60% power.

VBE - best endurance - the speed which gives the greatest airborne time per liter, usually around 75% of the speed for range and decreases as the aircraft weight decreases from MTOW. Might utilize about 40% power at MTOW. The speed that might be used when flying a search pattern allowing a proper area survey, but it is generally uncomfortable to fly at such a low speed. Also the low power setting may not be consistent with good engine handling.

VBG - best power-off glide - the speed that provides (L/D)MAX, or maximum glide ratio, consequently greatest flight distance available from the potential energy of height in a specified configuration. It is the same speed as that for best range and decreases as the aircraft weight decreases from MTOW.

VC - the design cruising speed or optimum cruise speed - the speed giving the most velocity (i.e. greatest distance/time) from a liter of fuel, usually utilizing 75% power at MTOW. The speed and power required decrease as the aircraft weight decreases from MTOW. VC is sometimes indicated to be the normal level flight speed range for the aircraft as shown by the AS/ green band.

VCL - clean configuration safety speed

VD - design diving speed

VDF - demonstrated flight diving speed (MDF)

VEF - the speed at which a critical engine is assumed to fail during takeoff for V1 calculations (assumes acceleration after the critical engine fails) >105% of VMC

VF - design flap speed

VF1 - design flap speed for procedure flight conditions

VFC - maximum speed for stability (flight controllability) characteristics (or: final climb speed**)

VFE - maximum flaps extended speed. The top end of the white arc on the ASI. Flight with flaps extended, or extending flaps, above this speed may result in distortion of the flaps or the extension mechanism. (MFC)

VFR - flap retraction safety speed, the lowest airspeed at which the flaps should be retracted during climbout

VFTO - final take-off speed

VGA - go-around target airspeed

VH - the maximum level flight indicated speed attainable utilizing maximum continuous engine power -which, for some engines, may be less than full throttle power.

VHOLD - holding airspeed which gives best endurance for a specified configuration and altitude

VK - target velocity

VL/D max – speed which produces the greatest glide distance (max lift to drag ratio)

VLE - retractable undercarriage aircraft - the maximum indicated speed at which the landing-gear can remain extended without risking gear door damage.

VLO - the maximum indicated speed at which the landing gear system can be operated. Different limits may exist for extension and retraction

VLL - the maximum indicated speed for extending the landing lights

VLLO - the maximum indicated speed at which the landing gear can be extended (assigned only when extension and retraction speeds are different)

VLOF - maximum lift off speed - for normal take-off (about 10% above VMU).

VLS - minimum selectable airspeed (VMIN)

VMAX - maximum attainable airspeed in level flight at a specified altitude, or maximum selectable airspeed

VMBE - maximum speed for brake energy absorption capability

VMC - minimum control speed with critical engine inoperative

VMCA - Minimum control speed in flight at which the a/c can be controlled with 5° of bank, in the case of failure of the critical engine with the other engine at takeoff power (takeoff flaps setting and gear retracted).

VMCG - Minimum control speed on the ground at which the a/c can be controlled with critical

engine inop and the other engine at rated takeoff power.

VMCL - Minimum flight speed at which the a/c can be controlled after failure of the critical engine, in the landing configuration (landing flaps setting, gear extended) with go-around power set on the operating engine

VMD - minimum descent - the speed that results in the lowest sink rate in a power-off glide, providing the longest duration of flight from the potential energy of height; but less than maximum gliding range. Probably about 90% of the power-off glide speed - VBG.

VMIN - minimum selectable airspeed

VMO - maximum operating limit speed (MMO)

VMS - minimum speed in a stall

VMT - minimum threshold crossing speed (see VAT)

VMU - minimum unstick speed. An indicated speed used in take-off conditions where it is advisable to lift off at the lowest possible airspeed to get the tires off the surface (e.g. soft field, wet grass, asphalt w/ potholes) and safely fly in ground effect until VTOS is attained to allow climb away. Acceleration after lift off at VMU is slow, due to the drag at the high AOA, and should not be used as an obstacle clearance technique.

VNE - never exceed speed. The speed which must not be exceeded in a glide or dive or other maneuvers in smooth air. The red line at the top end of the AS/ yellow arc, usually 90% of the 'design diving speed' - VD - which latter is usually 1.4 times VNO.

VNO - maximum structural cruise speed. The top end of the AS/ green arc. When cruising at, and

below, VNO the aircraft should not be damaged by a 35-knot vertical gust; which is at the bottom end of the severe turbulence scale. Flight above VNO should only be conducted cautiously and in smooth air.

VP – pull-up speed. The maximum airspeed at which the aircraft may be pulled out of a dive with instantaneous full control deflection (or: hydroplaning speed**)

VR - rotation speed

VRA - rough air speed, must be less than *VMO* - 35kts (TAS) and less than or equal to *VB*

VREF - the reference indicated approach speed, usually 1.3 times *VS0* plus 50% of the wind gust speed in excess of the mean wind speed.

VS - stalling speed or the minimum steady flight speed at which the aircraft is controllable

VS0 - stalling speed, or the minimum steady flight speed, in the landing configuration, (at MTOW and 1G wing loading with the cg at the most extreme position allowed, usually the most forward where backward movement of the control column may be limited). The bottom end of the *AS/* white arc, but it may be documented as IAS or CAS. *VS0* decreases as the aircraft weight decreases from MTOW.

VS1 - stalling speed, or the minimum steady flight speed, in a specified flight configuration. For a simple aircraft usually just flaps up, MTOW and 1G wing loading, engine idling and a slow deceleration to the minimum flight speed. The bottom end of the *AS/* green arc, but it may be documented as IAS or CAS. *VS1* decreases as the aircraft weight decreases from MTOW, which also means that if the pilot can reduce the wing loading below 1G - by an 'unloading' maneuver - *VS1* is decreased.

VS2g - stalling speed in a specified flight configuration under a 2G vertical load.

VS15 - stalling speed in the specified flap configuration (flaps xx°)

VSR - slat retraction safety speed, the lowest airspeed at which the slats should be retracted during climbout

VSS - stick shaker activation speed (notwithstanding AOA probe)

VSSE - safe single engine speed (about 10% above VMC).

VSW - stall warning airspeed

VT - threshold crossing speed; target speed (after V2 has been reached); maximum aerotow speed (gliders) **

VTmax - maximum threshold crossing speed

VTD - touchdown speed

VTOSS - minimum take-off safety speed. An indicated speed chosen to ensure that adequate control will still exist during initial climb after take-off under conditions of turbulence - or even engine failure. After lift off the aircraft should not be allowed to climb away until VTOSS is attained. (rotorcraft)

VU - utility speed (military equivalent to VA?)

VX - indicated speed for best angle of climb. i.e. To attain height over the shortest ground distance. The initial climb speed used when there are obstructions off the runway end. VX decreases as the aircraft weight decreases from MTOW, refer rule of thumb 3 above, but the angle of attack is maintained at around 12°. VX stated in an operating handbook also has to be at least equal to VTOSS. However be aware that the angle of climb will also depend on the low level wind conditions at the airfield.

VXSE - best angle of climb with single engine operative (or asymmetric power condition)

VY - indicated speed for best rate of climb. i.e. To attain height in the shortest time. VY decreases as the aircraft weight decreases from MTOW, but the angle of attack is maintained at around 8°. After reaching a safe height airspeed is usually increased to an appropriate 'en-route climb' speed. VY also decreases with altitude i.e. as TAS increases.

VYSE - best rate of climb with single engine operative (or asymmetric power condition)

VW - maximum speed for winch launch (glider)

VWW - windshield wiper operation speed

VZF - minimum zero flaps speed

V1 - Decision speed. The maximum speed in the takeoff at which the pilot must take the first action to stop the aircraft within the accelerate-stop distance. This speed is adjustable based on many factors included ambient conditions and takeoff thrust used.

V1MIN - The slowest decision speed at which the takeoff may be continued and which will allow the aircraft to reach V2 (and 35ft) over the runway. (Accelerate - Go)

V1BAL - The decision speed which allows the Accelerate - Stop distance to equal the Accelerate - Go distance

V1MAX - The fastest decision speed which will allow the aircraft to stop on the runway.
(Accelerate - Stop)

V2 - Take-Off safety speed. The lowest speed at which the a/c complies with the handling criteria associated with the climb after T.O. following an engine failure.

V2MIN - minimum takeoff safety speed, not less than 1.2 VS1

V3 - initial steady climb speed at which the a/c is assumed to pass through the 35 ft screen height with all engines operating on takeoff (or: minimum flap retraction speed**)

V4 -all engines operating take-off climb speed with undercarriage up and flaps at t/o configuration; used to the point where acceleration to the flap retraction speed is initiated; it should be attained by 400 ft above field elevation (or: minimum slat retraction speed**)

** : not in conjunction with other given definition, usually the result of two authorities choosing different speeds for the same letter or my own lack of a definitive answer