American operators

V speeds

V speeds are speeds that define certain performance and limiting characteristics of an aircraft and the **"V"** stands for velocity. They are established by the manufacturer during design and testing, and are specific to the aircraft model. Usually "V speeds" are relative to the air through which the aircraft is moving and are thus airspeeds. In many cases, they are defined by reference to the standard atmosphere or other specific conditions, and/or at the aircraft's maximum gross weight, and the pilot is responsible for calculating the effective value based on the actual weight and air density. In other cases the indicated airspeed, the value uncorrected for atmospheric pressure differences (height and temperature), is useful directly by the pilot. E.g. the indicated stall speed V_S remains essentially constant for all heights and temperatures while the true stall speed increases as pressure lessens.

In the U.S., V speeds are stated in knots or, for older aircraft models, miles per hour. For faster aircraft, some speeds are also defined by Mach number. Typically, V speeds are given for an aircraft at maximum gross weight, and should be adjusted accordingly for lighter weights.

Speeds frequently used in General Aviation

V_A
: design maneuvering speed (stalling speed at the maximum legal G-force, and hence the maximum speed at which abrupt, full deflection, control inputs will not cause the aircraft to exceed its G-force limit). Maneuvering speed is limited by aircraft structural characteristics. With the Cirrus SR20 and SR22, this speed is also known as V_O

V_{FE}
: maximum flap extended speed (a different maximum speed may be specified for partial flap extension).

V_{LE}
: maximum landing gear extended speed. The maximum speed at which the aircraft may be flown with the landing gear extended. V_{LE} is always higher than V_{LO}

V_{LO}
: maximum landing gear operating speed. The maximum speed at which the aircraft may be flying while raising or lowering the gear. V_{LO} is always lower than V_{LE}

V_{MC}
: minimum control speed with the critical engine inoperative.

V_{NE}
: The VNE , or the never exceed speed, of an aircraft is the V speed which refers to the velocity that should never be exceeded due to risk of structural failure, most commonly due to wing or tail deformation or failure and less commonly due to aeroelastic flutter (usually in faster aircraft). VNE is specified as a red line on many airspeed indicators. This speed is specific to the aircraft model, and represents the edge of its performance envelope.

V_R
: rotation speed. The speed of an aircraft at which the pilot initiates rotation to obtain the scheduled takeoff performance. It must be greater or equal to the V_1 speed.

V_{NO}

The V_{NO} of an aircraft is known as the maximum structural cruising speed (the maximum speed to be used in turbulent conditions) or can refer to the **velocity of normal operation**. V_{NO} is specified as the upper limit of the green arc on many airspeed indicators. This speed is specific to the aircraft model. The range above V_{NO} is marked on the airspeed indicator as a yellow arc from V_{NO} to the V_{NE}.

V_{REF}

reference landing approach speed; speed (in calm air) at the landing screen height of 50 ft. Often used by pilots as a base from which to calculate speeds to be used during landing, and calculated as a margin over the stall speed - usually $1.3 \times V_{S0}$.

V_S

the stalling speed or the minimum steady flight speed at which the airplane is controllable. Usually synonymous with V_{S1}. This speed is specific to the aircraft model and depends upon the weight and balance of the aircraft. The true stall speed increases as atmospheric pressure decreases. (I.e. as temperature increases and/or as altitude increases.) The indicated stall speed, i.e. the speed indicated by the airspeed indicator, remains essentially unchanged with air pressure.

V_{S0}

the stalling speed or the minimum steady flight speed in the landing configuration.

V_{S1}

the stalling speed or the minimum steady flight speed obtained in a specific configuration (usually a configuration "clean" of flaps, landing gear and other sources of drag).

V_X

speed for best angle of climb. This provides the best altitude gain per unit of horizontal distance, and is usually used for clearing obstacles during takeoff.

V_Y

speed for best rate of climb. This provides the best altitude gain per unit of time.

Speeds used in high performance aircraft and other reference speeds

V_B

design speed for maximum gust intensity.

V_C

The VC of an aircraft is the V speed which refers to the velocity of cruising. VC is within the green arc on many airspeed indicators. This speed varies is different for each aircraft model. VC is also called the design cruising speed or the optimum cruise speed – the latter being the speed giving the most velocity (i.e greatest distance/time) from a litre of fuel, usually utilising 75% power at Maximum Take-Off Weight (MTOW) and about 1.3 times the maximum lift-to-drag ratio (L/D) speed – Vbr above. The speed and power required decrease as the aircraft weight decreases from MTOW.

For normal category aircraft FAR Part 23 specifies a minimum design cruising speed (in knots) based on the wing loading of (weight in pounds divided by wing area in square feet). For the utility category, the minimum design cruising speed is . Many ultralight aeroplanes are unable to comply with the FAR part 23 requirement for a minimum design cruising speed.

V_D
: design diving speed. Usually $1.4 \times V_{NO}$.

V_{DF}/M_{DF}
: demonstrated flight diving speed.

V_{EF}
: the speed at which the critical engine is assumed to fail during takeoff.

V_F
: design flap speed.

V_{FC}/M_{FC}
: maximum speed for stability characteristics.

V_{FTO}
: final takeoff speed

V_H
: maximum speed in level flight with maximum continuous power.

V_{LOF}
: lift-off speed.

V_{MO}/M_{MO}
: maximum operating limit speed.

V_{MU}
: minimum unstick speed.

V_{SR}
: reference stall speed.

V_{SR0}
: reference stall speed in the landing configuration.

V_{SR1}
: reference stall speed in a specific configuration.

V_{SW}
: speed at which onset of natural or artificial stall warning occurs.

V_{TOSS}
: takeoff safety speed for Category A rotorcraft.

V_1
: critical engine failure recognition speed. V_1 is the minimum speed in the takeoff, following a failure of the critical engine at V_{EF}, at which the pilot can continue the takeoff with only the remaining engines. Any problems after V_1 are treated as inflight emergencies. In the case of a balanced field takeoff, V_1 is the maximum speed in the takeoff at which the pilot must take the first action (e.g., apply brakes, reduce thrust, deploy speed brakes) to stop the airplane within the accelerate-stop distance and the minimum speed at which the takeoff can be continued and achieve the required height above the takeoff surface within the takeoff distance. In this context, V_1 is the takeoff decision speed.

V_2
: takeoff safety speed. Also called takeoff screen speed, the minimum speed in the second segment of a climb following an engine failure.

V_{2min}
: minimum takeoff safety speed.

Non-regulatory speeds

These values are not defined by FAA regulations.

V_{BE}
: best endurance speed; the speed that gives the greatest airborne time for fuel consumed. This may be used when there is reason to remain aloft for an extended period, such as waiting for a forecast improvement in weather on the ground.

V_{BG}
: best power-off glide speed; the speed that provides maximum lift-to-drag ratio and thus the greatest gliding distance available.

V_{XSE}
: speed for best angle climb with the critical engine inoperative.

V_{YSE}
: speed for best rate of climb with the critical engine inoperative.

V_2
: t/o safety speed

V_3
: steady initial climb speed with all engines operating

V_4
: steady climb speed with all engines operating to be achieved by 400 ft gross height

V_a
: design maneuvering speed

V_c
: design cruising speed.

V_{clmax}
: max coefficient of lift speed.

V_d
: design diving speed

V_{dmin}
: minimum drag

V_{df}
: demonstrated flight diving speed

V_{ef}
: the CAS at which the critical engine is assumed to fail

V_f
: design flap speed

V_{fe}
: max flap extended speed

V_{fto}
: final t/o speed

V_{imd}
: minimum drag

V_{imp}

minimum power

V_h
max speed in level flight with max continuous power.

V_{le}
max landing gear extended speed

V_{lo}
max landing gear operating speed

V_{lof}
lift-off speed

V_{mbe}
max brake energy speed

V_{md}
minimum drag

V_{mc}
minimum control speed with critical engine inoperative

V_{mca}
minimum control speed, air
Air minium control speed is the minimum flight speed at which the airplane is directionally controllable as determined in accordance with Federal Aviation Regulations. Airplane certification conditions include one engine becoming inoperative and windmilling, not more than a 5 degree bacnk towards the operative engine, takeoff power on the operative engine, landing gear up, flaps in takeoff position, and most rearward C of G.

V_{mcg}
minimum control speed, ground

V_{mcl}
minimum control speed, approach and landing

V_{me}
max endurance

V_{mo}
max operating limit speed

V_{mp}
minimum power

V_{mr}
max range

V_{mu}
minimum unstick speed

V_{nd}
max structural cruising speed

V_p
aquaplaning speed.

V_{ra}
rough air speed

V_{ref}
reference landing speed

V_s
: V-stall

V_{so}
: stall speed in landing configuration

V_{s1}
: stall speed in a specified configuration

V_{s1g}
: one g stall speed

V_{sr}
: reference stall speed

V_{sse}
: safe single engine speed

V_t
: threshold speed

V_{tmax}
: max threshold speed

V_x
: best angle of climb

V_{xe}
: best angle of climb, single engine

V_y
: best rate of climb

V_{yse}
: best rate of climb single engine

Speeds indicated on Airspeed Indicator

Airspeed Indicator

V speeds are nearly always given as Indicated Airspeed (IAS), so that pilots can read them directly off the airspeed indicator (ASI). ASIs carry color-coded markings that give the pilot an immediate reference, as follows:

- **V_{S0}**

  bottom of white arc.

- **V_S**

  bottom of green arc.

- **V_{FE}**

  top of white arc.

- **V_{NO}**

  top of green and bottom of yellow arcs. The yellow arc is a caution, as speeds in this region may add dangerous stress to the aircraft, and are only to be used in smooth air when no turbulence or abrupt control inputs are expected.

- **V_{NE}**

  red line and top of yellow arc.

- In addition, on a light multi-engine aircraft, **V_{YSE}** is indicated by a blue line, and **V_{MC}** is indicated by a red line near the bottom of the green arc.

http://www.nationalgeographic.com/adventure/0511/features/learning_to_fly.html

http://www.bestaviation.net/australia/schools/western_australia.asp

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FAA knowledege test

http://www.dauntless-soft.com/PRODUCTS/GroundSchool/private.asp

http://www.aopa.org/flight_planner/intro.html

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