High Time to Redefine V_1

The current 72-word definition is unwieldy and causes a dangerous default to 'takeoff decision speed.'

BY MARK LACAGNINA

The training session on regulations had numbed our senses, so the chief pilot posed a question to get us thinking. I don't remember the exact wording, but it was something like: "Is it ever legal to descend below decision height without the required visual references in sight?"

The answer is yes: If you decide to go around upon reaching decision height because you don't see what you need to see, the airplane most likely will descend below DH while you're cobbing the power, cleaning up and otherwise getting out of Dodge.

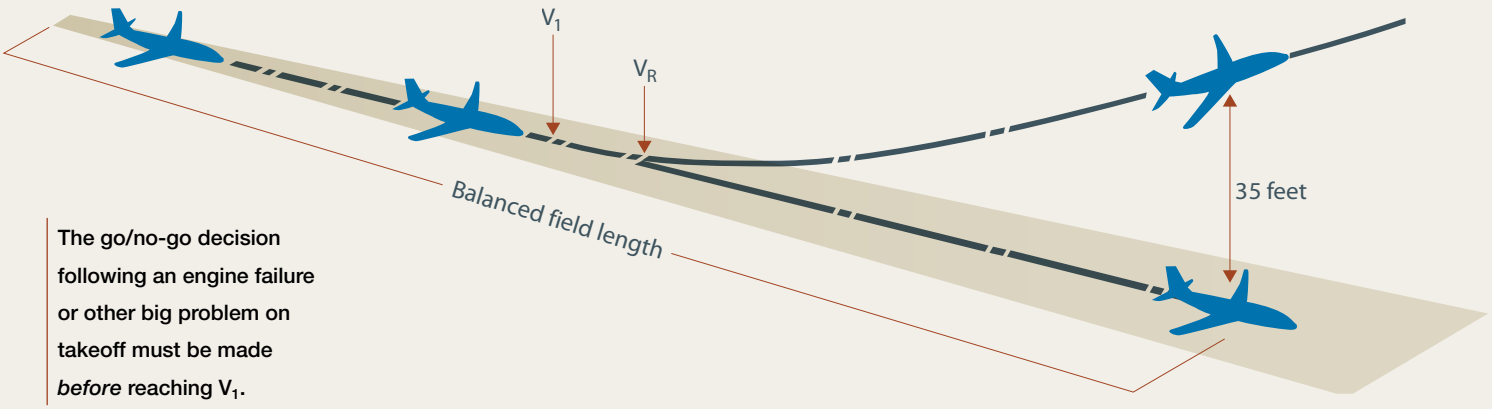
Perfectly legal. That's why it's called *decision* height.

Here's a question for you: What is takeoff decision speed?

If you responded that it's an old, discarded definition of V_1, you're right.

If, however, you said that it *is* V_1, put on the dunce cap and go to the corner with the U.S. Federal Aviation Administration (FAA), the U.S. National Transportation Safety Board, the Transportation Safety Board of Canada, the Australian Transport Safety Bureau, the New Zealand Transport Accident Investigation Commission, and probably many others (you know who you are). All have defined V_1 in recent publications as *takeoff decision speed*.

Even the Dutch Safety Board, which recently published a probing report on a high-speed rejected takeoff (RTO), used "takeoff decision speed" in the title (see p. 18, this issue). Inside the



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report, where there was plenty of room, the board did publish the current definition:

> *V_1 means 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. V_1 also means the minimum speed in the takeoff, following a failure of the critical engine at V_{EF}, at which the pilot can continue the takeoff and achieve the required height above the takeoff surface within the takeoff distance.*

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Whew. That is a great explanation of the V_1 concept, but as a V-speed definition, it is downright obese.

It replaced *takeoff decision speed* 13 years ago, when the FAA, followed closely by the Joint Aviation Authorities, precursor of the European Aviation Safety Agency, overhauled the transport category airplane takeoff performance certification standards (*Flight Safety Digest*, 10/98). Among the changes were requirements to account for worn brakes and wet runways in establishing accelerate-stop performance.

The old definition of V_1 was officially scrapped because it created "a great deal of misunderstanding and disagreement" by insinuating that it is the speed at which the go/no-go decision is made, according to the FAA.

Unlike *decision height* on approach, the go/no-go decision following an engine failure or other big problem on takeoff must be made *before* reaching V_1. This is critical to takeoff safety.

Regulations require transport category airplane pilots to ensure that the departure runway is long enough to allow the takeoff to be safely continued or rejected from a predetermined go/no-go point on the runway. That point is where the airplane reaches V_1 while accelerating for takeoff.

During certification, manufacturers designate V_1 speeds for various airplane configurations and takeoff weights, and for the temperatures and field elevations at which the airplane is expected to operate. Typical practice is to establish V_1 speeds that result in equal accelerate-stop and accelerate-go distances. This "balanced field length" ends at a point where the airplane, with one engine inoperative, will be either stopped on the runway or at a specific height — 35 ft over a dry runway or 15 ft over a wet runway.

The accelerate-stop distances or balanced field lengths published in airplane flight manuals are based on the assumption that the first *action* to reject the takeoff is made at V_1.

Although the current "definition" of V_1 nicely encapsulates the overall concept, it is an unwieldy, writer's-cramp-inducing monster that has spooked folks who should know better into conjuring *takeoff decision speed* from the ashes because it's … wieldy.

I have long suspected that the continued use of the discarded definition by authoritative sources might have something to do with the continuing prevalence of accidents and incidents involving high-speed RTOs.

This creeping malaise prompted me, on my own, to petition the FAA to take another shot at redefining V_1. The current definition, I said, "is too long to be conveniently used in publications and presentations, thus the persistent use of the confusing and inaccurate — and abandoned — definition: *takeoff decision speed*." I asked the agency to change the definition to *takeoff action speed* or a "similar term that reflects the V_1 concept and ends the confusing connotation that V_1 is the airspeed at which the decision must be made to reject or continue the takeoff."

The FAA duly stamped "FAA-2009-0562" on my petition and posted it on a Web site, <regulations.gov>, where it has languished for two years with nary a comment.

Recently, I came across this statement: "One common and misleading way to think of V_1 is to say, 'V_1 is the decision speed.' This is misleading because V_1 is not the point to begin making the operational go/no-go decision. The decision must have been made by the time the airplane reaches V_1."

That is from the *Takeoff Safety Training Aid*, an excellent product of a joint effort by the industry and the FAA that was published *18 years ago*. I'd say it is high time for action.

InSight is a forum for expressing personal opinions about issues of importance to aviation safety and for stimulating constructive discussion, pro and con, about the expressed opinions. Send your comments to J.A. Donoghue, director of publications, Flight Safety Foundation, 801 N. Fairfax St., Suite 400, Alexandria VA 22314-1774 USA or donoghue@flightsafety.org.